

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Increase in Assisted Suicide in Switzerland: Did the socio-economic predictors change? Results from the Swiss National Cohort

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-020992
Article Type:	Research
Date Submitted by the Author:	05-Dec-2017
Complete List of Authors:	Steck, Nicole; Universitat Bern, Institute of Social and Preventive Medicine (ISPM) Junker, Christoph; Federal Statistical Office, Medical Statistics Zwahlen, Marcel; University of Bern, Institute of Social and Preventive Medicine
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Palliative care
Keywords:	Assisted Suicide, End of Life Care, Cohort Study, Switzerland

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8 **Increase in Assisted Suicide in Switzerland:**  
9 **Did the socio-economic predictors change?**  
10 **Results from the Swiss National Cohort**  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21

22 Nicole Steck<sup>1</sup>, PhD, Christoph Junker<sup>2</sup>, MD, and Marcel Zwahlen<sup>1</sup>, PhD, for the Swiss National Cohort  
23

24 <sup>1</sup> Institute of Social and Preventive Medicine (ISPM), University of Bern,  
25 Switzerland

26 <sup>2</sup> Federal Statistical Office, Neuchatel, Switzerland  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43

44 Correspondence:  
45 Nicole Steck  
46 Institute of Social and Preventive Medicine  
47 University of Bern  
48 Switzerland  
49 [Nicole.steck@ispm.unibe.ch](mailto:Nicole.steck@ispm.unibe.ch)  
50 Tel: +41 31 631 56 75  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Abstract

**Objective** To determine whether the strong increase in assisted suicides in Switzerland since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide and the diagnoses related thereto.

**Methods** Assisted suicides from 2003 to 2014 in Switzerland were investigated in a census-based longitudinal study of the whole Swiss population. Younger (25 to 64 years) and older (65 to 94 years) people were analysed separately. We calculated crude rates and used Cox proportional hazard and logistic regression models to examine associations with gender, marital status, education, religion, neighbourhood socio-economic position and other variables and to investigate time effects.

**Results** The analyses were based on 6,237,997 Swiss residents. Overall 3,941 assisted suicides were identified, 80 % thereof in the older age group. Crude rates of assisted suicide more than tripled during study period, with a more pronounced increase in the older age group. Cancer was the most common underlying diagnosis, but the percentage dying assisted was much higher among patients with diseases of the nervous system. The factors associated with assisted suicide did not change during the study period: Female gender, higher education, having no religious affiliation, no children and no Swiss passport, living in a neighborhood with a higher socio-economic index and in the French speaking part of Switzerland were associated with a higher rate.

**Conclusions** The study results do not indicate any shift in socio-economic factors associated with assisted suicide, but a more pronounced increase in incidence in the elderly. Vulnerability for assisted suicide may not be limited to socio-economic factors. Therefore a register-based, sensitive monitoring of characteristics of assisted deaths and diagnoses involved should be implemented.

**Strengths and limitations of this study:**

- The nationwide cohort study with a virtually complete coverage and data on individual, household and building level allows investigating time trends in the associations of assisted dying and detailed socio-economic characteristics in Switzerland, one of few countries with long-term experience in assisted dying.
- In Switzerland there is no obligation to report assisted suicides to a central registry, so the cases may not be fully complete. However, the Federal statistical office makes a great effort to identify assisted suicides, in cooperation with right-to-die organisations, the institutes of Forensic Medicine and the physicians.
- Most socio-economic variables come from census 2000 and may not be completely up to date in 2014 for all individuals. However, particularly in the older age group characteristics as education, religion or language region are quite stable.
- For information on the underlying disease the study relies on the diagnoses given on the death certificate. Besides the issue of the reliability of these diagnoses, no information is available on the disease stage or severity.

## Introduction

Switzerland is one of few countries worldwide that allow assisted suicide [1-3]. In general a right-to-die organisation is involved in the process in Switzerland [4]. The organisations assist their members in dying, when a physician assessed the decisional capacity and confirmed that the person requesting assistance does either suffer from a terminal illness, an unendurable incapacitating disability or unbearable and uncontrollable pain [3]. According to article 115 of the Swiss penal code assistance in suicide is only considered a crime and open to prosecution if selfish interests are involved [5].

Euthanasia, on the other hand, is prohibited. Though the lawmakers were not thinking of a medical perspective when article 115 was created in 1918, the judgments by the Tribunal Federal supported the activities of the right-to-die organisations [6].

In an earlier study over the years 2003 to 2008, we described a higher rate of assisted suicide in Switzerland for female gender, people living alone or being divorced, but also for people with higher education and higher socio-economic position [7]. Cancer was the most common diagnosis, though the percentage dying assisted among all deaths was much higher among patients with diseases of the nervous system. In the last 15 years the numbers of assisted suicides reported by right-to-die-organizations increased substantially in Switzerland [8 9]. While the three main right-to-die organisations reported less than 200 assisted suicides of Swiss residents yearly at the beginning of the century, in 2014 the number reached more than 760 ([supplementary table 1](#)). This increase is in line with the development in other European countries and US states that allow assisted suicide or euthanasia [10-17]. This intensified the debate about ethics and prohibition or controlled regulation of assisted death in Europe and worldwide. One main concern about assisted dying is the so called 'slippery slope', a shift from exceptional to routine practice, putting pressure particularly on patients who are chronically ill and socioeconomically vulnerable [2 18-20].

The aim of this study was to analyse, whether the increase in numbers of assisted suicide since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide. We wanted to identify groups with a disproportional increase in the rate of assisted dying and investigate possible shifts in diagnoses.

## Methods

### *The Swiss National Cohort*

The Swiss National Cohort (SNC) is a longitudinal study of the Swiss Population, the core SNC is described in detail elsewhere [21 22]. The current version of the SNC is based on census data from 1990 and 2000 that were linked to mortality and emigration records until 2014 and to the newly introduced Registry Based Census (RBC) 2011, using deterministic and probabilistic linkage procedures. Participation in the Swiss census is mandatory, resulting in a coverage of 99% in the

1  
2  
3 census 2000 [23]. The present analysis is based on the census 2000 and we included people who  
4 were between 25 and 95 years old in the study period 2003 to 2014. For exposing variables  
5 (education, religion, etc.) information from the census 2000 was used, as the RBC does not content  
6 the same detailed information. An exception is marital status, where we had information on the last  
7 change before RBC 2011 respectively before death and used the relevant information. All individuals  
8 were followed from 1 January 2003 until death, emigration or the end of the study period on 31  
9 December 2014. The SNC was approved by the Cantonal Ethics Committees of Bern and Zurich, with  
10 approval covering this study.  
11  
12  
13  
14

### 15 16 *Identification of assisted suicides*

17  
18 During study period, mainly three right-to-die associations were active in assisting Swiss residents in  
19 dying: Exit in the German speaking part, Exit in the French speaking part and Dignitas. The  
20 organisations have been described in detail elsewhere [1 24]. The Federal Statistical Office (FSO)  
21 identifies the assisted deaths based on information given by the physician respectively the institutes  
22 of Forensic Medicine on the death certificate, using code X61.8, as there is no official code for  
23 assisted deaths in the International Classification of Diseases (ICD) [9]. For the years 2003 to 2012 the  
24 right-to-die associations provided in addition anonymous data on all deaths of Swiss residents they  
25 assisted to the Federal statistical office.  
26  
27  
28  
29  
30

### 31 32 *Determination of underlying diseases*

33 For the determination of the underlying diseases we used the ICD-10 codes on the death certificates.  
34 Until 2008 suicide by poisoning was indicated as primary cause of death for assisted suicides in the  
35 Swiss mortality statistics. Therefore we used the first concomitant diseases as underlying cause for  
36 assisted suicides from 2003 until 2008. In 2009 the FSO changed the practice in coding assisted  
37 suicides based on the ICD-definition of the primary cause of death as “the disease or injury which  
38 initiated the train of morbid events leading directly to death, or the circumstances of the accident or  
39 violence which produced the fatal injury” [9 25]. Since 2009 the underlying disease is therefore  
40 labeled as primary cause and assisted suicide as concomitant circumstance. For 2009 to 2014 we  
41 used hence the primary cause to determine the underlying disease of assisted suicides. For all other  
42 deaths the primary cause of death was used during the whole study period.  
43  
44  
45  
46  
47  
48

49 We created broad categories of *all-cancer, mental and behavioural disorders, diseases of the nervous*  
50 *system, diseases of the circulatory system, diseases of the respiratory system, diseases of the*  
51 *musculoskeletal system and other diseases* and more detailed categories for the most common  
52 diagnoses (Supplementary table 2). We excluded all deaths with external causes as accident,  
53 unassisted suicide, assault (V, W, X and Y, except X61.8).  
54  
55  
56  
57  
58  
59  
60

### *Statistical analysis*

Within the SNC we performed a survival analysis with age as time scale, observation time starting at 1 January 2003 and ending on the earliest of the date of death, emigration or on 31 December 2014. We calculated crude rates of assisted suicide and estimated hazard ratios using Cox proportional hazard regression. The multivariable model included gender, religion (Protestant, Catholic, no affiliation and other/unknown), education (compulsory, secondary and tertiary), marital status (single, married, widowed and divorced), type of household (single person, two or more persons, institution), having children, urbanicity (urban, peri-urban or rural), the Swiss neighborhood index of socioeconomic position (in quintiles)[26], language region (German, French or Italian speaking) and Nationality (Swiss or Foreigner). To identify determinants of assisted suicide among all deaths we performed a logistic regression, including the same variables as in the Cox analysis but also age at death (10 year bands) and underlying diagnosis (broad categories, see above). The multivariable analyses were stratified by age-group (25 to 64 and 65 to 94) and by time period (2003-2008 and 2009-2014). In multivariable analyses we tested for interaction between variables and time period by including appropriately constructed interaction terms and performing likelihood ratio tests. In addition, for potentially fatal diseases we calculated the percentage of assisted deaths with a certain underlying cause among all deaths with the same condition.

Statistical analyses were done in Stata version 14 (Stata Corporation, College Station, TX, USA). Results are given as rates per 100,000 person years, hazard ratios (HR), odds ratios (OR) and  $\chi^2$  and p-values from Wald tests for overall model significance. In addition percentages of assisted suicides among all deaths across underlying causes are reported, with 95% confidence intervals (Cis).

## **Results**

### *Study population*

6,237,997 individuals who filled in the census 2000 and were between 25 and 95 years old in the study period 2003 to 2014 were included. 5,102,268 contributed to the cohort of the 25-64 years old, 2,139,152 to the cohort of the 65-94 years old, whereby 1,003,423 individuals contributed to both ([table 1a and 1b](#) and [supplementary table 3](#)).

We identified 3,941 assisted suicides, with an increasing number from 180 assisted suicides in 2003 (0.32% of all deaths) to 688 in 2014 (1.30 % of all deaths). This corresponds to 95.2 % of the number of assisted suicides of Swiss residents officially reported by the three main right-to-die-organisations in their annual reports ([supplementary table 1](#)). While a quarter of assisted suicides was in people younger than 65 in 2003/2004, the proportion decreased to 15% in 2013/2014. Crude rates more



1  
2  
3 than tripled from the two-year-period 2003/2004 to 2013/2014, from 3.60 to 11.21 per 100.000  
4 person years. The rates increased in both age groups, but more pronounced (from 12.23 to 35.35) in  
5 the group 65 to 94 years old than in the 25 to 64 years old (from 1.17 to 2.34) ([table 1a and 1b](#),  
6 [Figure 1](#)). Rates increased exponentially with age from 0.14 (95% CI 0.063-0.314) per 100,000 person-  
7 years at age 25 to 56.25 (95% CI 49.76- 63.58) per 100,000 at age 90. Overall crude rates were higher  
8 in women (6.81, 95% CI 6.54-7.10) than in men (5.37, 95% CI 5.12-5.63), but stratified by age women  
9 have a higher rate until the age of 69, from the age of 70 on men had a higher rate ([Figure 1](#)).  
10  
11  
12  
13

#### 14 *Diagnoses*

15  
16 In the younger age group more than half of the 771 people who died assisted had a cancer diagnosis  
17 and every fifth person was diagnosed with a disease of the nervous system, mainly multiple sclerosis  
18 (MS) or motor neuron diseases as ALS ([Table 2](#)). Mental and behavioural disorders accounted for 45  
19 or 5.8% of all assisted suicides, more than half thereof were assigned to mood disorders. The  
20 percentage of people who died assisted among all deaths with the same potentially fatal underlying  
21 cause varied from 0.073 % for diseases of the circulatory system to 5.25 % for diseases of the  
22 nervous system ([Supplementary table 4a](#)). Looking at the diagnoses more detailed, the percentage of  
23 assisted death was highest among MS patients (11.1 %) and people suffering from Huntington  
24 diseases (9.90 %).  
25  
26  
27  
28  
29

30  
31 In the age group 65 to 94 years the percentage of assisted suicides with cancer was lower (39.3 %)  
32 ([Table 2](#)). Diseases of the nervous (11.8 %) and the circulatory system (12.0 %) accounted each for  
33 hardly one eighth of assisted deaths. Among the 373 assisted deaths with diseases of the nervous  
34 system patients with Parkinson's disease (106) and motor neuron diseases as ALS (74) contributed  
35 most. 10.0 % of all assisted suicides were patients with diseases of the musculoskeletal system,  
36 mainly arthropathies and dorsopathies, 4.7 % with diseases of the respiratory system, from which  
37 three quarter were suffering from COPD. On 7.8 % percent of the certificates of assisted deaths  
38 there was no underlying cause reported. The percentage of assisted deaths among all deaths  
39 ([Supplementary table 4b](#)) with the same underlying disease was highest in diseases of the nervous  
40 system (1.2 %). Subdivided by diagnosis patients dying from motor neuron diseases as ALS had the  
41 highest percentage of assisted suicides (5.5 %), followed by multiple sclerosis (4.1%) and Huntington  
42 disease (3.4 %).  
43  
44  
45  
46  
47  
48  
49

#### 50 *Multivariable Cox regression analysis*

51  
52 The observed associations in the multivariable proportional hazard Cox models were very similar in  
53 the two time periods ([Figure 2](#) and [supplementary tables 5 and 7](#)), but some differed by age group:  
54 In the younger age group men had a lower rate than women in both periods (HR of 0.78 in early and  
55  
56  
57  
58  
59  
60

0.77 in late period), but not in the older age group (HR 1.12 respectively 1.01). Having no affiliation to religion and being protestant were associated with a higher rate of assisted suicide than being catholic, with the effect being stronger in the older age group. Also the association between a higher education level and assisted suicide was stronger in the older age group, while in the younger age group only in the second period people with compulsory education had a 32% lower rate than people with secondary education. Concerning the marital status, in the younger age group the divorced had a 70% higher rate in the second period compared to married people. In the older age group widowed people had a 33 to 40% higher rate, the rate of the divorced was around twice as high as in married people. Living in a neighborhood with a higher socioeconomic index was associated with a higher hazard of assisted suicide. People living in the French speaking area had a higher rate than people living in the German speaking area, although the effect was not statistically significant in younger people in the first time period. In the second time period younger (HR 0.35) and older people (HR 0.48) living in the Italian speaking part had a lower rate than people living in the German speaking part. Compared to Swiss citizens' foreigners living in Switzerland were less likely to die with a right-to-die organisation.

#### *Multivariable logistic regression analysis*

We further analysed the odds of assisted suicides among all deaths with a multivariable logistic regression model (Figure 2 and supplementary tables 6 and 7). The associations were mostly the same as in the Cox proportional hazard model, with mainly one exception: In the logistic regression models men had not only a lower odds than women in the younger (OR of 0.52 in the early, of 0.54 in the late period), but also in the older age group (OR of 0.64 in the early, of 0.65 in the late period). To analyse differences in time trends between age groups 25 to 64 and 65 to 94 years, we additionally calculated a multivariable logistic regression overall. The model showed a significant interaction between age group and time period ( $\chi^2=10.4$ , 1 df,  $p=0.0013$ ) with a larger increase in the older than in the younger age group over time (OR of 2.25 compared to 1.72).

Compared to people who died with cancer during study period, descendants with a disease of the nervous system on the death certificate were more likely to have died assisted (OR of 6.91 respectively 6.76 in the younger age group, 1.53 respectively 1.47 in the older age group). In the older age group the odds for *diseases of the circulatory system*, for *diseases of the respiratory system* and for *other diseases* were substantially lower. As *diseases of the musculoskeletal system* are in itself rarely fatal, the odds for dying assisted were high in all analyses. The associations between diagnoses and time periods were statistically significant in the likelihood ratio test for interactions ( $p=0.0018$  in the younger age group and  $p<0.001$  in the older age group) (supplementary table 7). In both age groups the odds of having no diagnoses on the deaths certificate decreased clearly from the

1  
2  
3 early to the late period ([supplementary table 8](#)). Furthermore, in the older age group the odds for  
4 people dying with diseases of the respiratory or the musculoskeletal system increased  
5  
6 ([supplementary table 8](#)).  
7

## 8 **Discussion**

9  
10 Crude rates of assisted suicide in Switzerland more than tripled from 2003 to 2014 and assisted  
11 suicides accounted for 1.3% of all deaths in 2014. The increase was stronger in the age group 65 to  
12 94 than in those younger than 65, but has been shown independently of socioeconomic factors as  
13 gender and characteristics of the individual and the household. In consequence, factors associated  
14 with assisted suicide from 2003 to 2008 were also associated with assisted suicide from 2009 to  
15 2014: Female gender, higher education, having no religious affiliation, no children and no Swiss  
16 passport, living in a neighborhood with a higher area-based socio-economic index and in the French  
17 speaking part of Switzerland were associated with a higher rate of assisted suicides. In the younger  
18 age group people living alone were more likely to die assisted, in the older age group the widowed  
19 and the divorced. Cancer, diseases of the nervous system and – in the older age group – of the  
20 circulatory and the respiratory system were the most common diagnoses on death certificates of  
21 people who died assisted. There was a shift in the diagnoses between time periods with less death  
22 certificates with no first underlying diseases in the second period, while in the older age group  
23 diseases of the respiratory and the musculoskeletal system increased. Percentages of assisted  
24 suicides among all deaths were highest in diseases of the nervous system.  
25  
26  
27  
28  
29  
30  
31  
32  
33

34 The strong increase in incidence of assisted suicide in Switzerland is based on a broad acceptance in  
35 the Swiss population, also confirmed by votations and surveys. The citizens of the canton of Zurich  
36 voted in 2011 clearly against the ban of assistance in suicide including a ban for non-residents to be  
37 assisted[27 28], and one year later the inhabitants of the canton of Vaud voted for the approval of  
38 assisted suicide in publicly funded institutions as hospitals or elderly homes [29]. The strong increase  
39 is also in line with the development in other European countries with a long-term experience in  
40 assisted dying [10-14]. In Belgium the number of reported cases increased more than sevenfold since  
41 2003. In 2013 more than 1'800 people died by euthanasia, corresponding to 1.7 % of all deaths [11].  
42 As in our study the increase was among both sexes and all age groups, and the proportion of older  
43 patients extended. In the Netherlands the number of reported assisted deaths reached 5,500 in 2015  
44 [12], three times higher than in 2003 and corresponding to almost four percent of all deaths. In the  
45 US states with long-term experience the numbers of assisted suicides also increase [13 14 17], but  
46 the numbers are with roughly 130 in Oregon (2016) and 200 in Washington (2015) significantly lower  
47 than in Europe.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

### *Strengths and limitations*

The study is based on data on individual, household and building level from the census 2000 with a virtually complete coverage. Selection or response biases are therefore unlikely. To our knowledge, this is the first study looking at time trends over more than 10 years in the associations of assisted dying and detailed socio-economic characteristics. Although information given in the census 2000 is not completely up to date in 2014 for all individuals, misclassification is a minor issue as in the older age group characteristics as highest achieved education, religion or language region hardly change over time. We were able to account for the fact that marital status might change, and more accurately analyse the association of widowhood or divorce with assisted suicide.

An increasing number of countries and US-states [2] have legalized assisted suicide in the past years or are in the respective process. Switzerland is one of the few countries with long-term experience which allows to study time trends and the possible change of predictors. The Federal statistical office makes a great effort to identify assisted suicides in the mortality statistics, in cooperation with right-to-die organisations, the institutes of Forensic Medicine and the physicians. However, as there is no obligation to report the assisted suicides to a central registry, identification of assisted deaths is likely not complete. In particular suicides assisted without the involvement of one of the three main organisations may be missed. In recent years smaller right-to-organisations got active, LifeCircle in the region of Basel and LLExit in the Italian speaking part of Switzerland. It is possible that differences in the process and reporting may increase the proportion of assisted suicides that are not identified by the FSO and therefore at least partly explain the lower increase of assisted suicides in the Italian speaking region of Switzerland. A Belgian study showed that differences found in end-of-life-practices between the language regions Flanders and Wallonia were not only caused by differences in acceptance, but also by differences in the process and the reporting compliance [30].

Another limitation of our study is the fact, that death certificates were the only source for information about the underlying disease. We did not have any information of the stage of the disease, the treatment and the alternative options, when the patient decided to die assisted. Also the comparability of the percentage of assisted deaths among all deaths between diseases is limited: In not or rarely fatal diseases as mental disorders or diseases of the musculoskeletal system the denominator does not reflect the number of people concerned and percentages of assisted deaths can therefore not be compared to fatal diseases. Another issue is the reliability of the death certificates. While studies report a high reliability for major groups such as cancer and for well-defined rare conditions such as ALS [31 32], the reliability is low for chronic conditions such as diabetes and renal insufficiency [31]. In Switzerland assisted suicides are treated as unnatural deaths

1  
2  
3 and investigated by a forensic team, which relies on documents of the right-to-die organisations [33].  
4 This might lead to a more accurate diagnosis on the death certificate than for natural deaths.  
5

6 The shift in diagnoses observed in our study may at least partially be explained by the change in the  
7 coding system of the Federal Statistical Office (FSO). The fact that assisted suicide was not “primary  
8 cause of death” from 2009 onwards may have increased the coding of underlying diseases. However,  
9 further studies are needed to monitor the development of diagnoses associated with assisted  
10 suicide. These studies should ideally not only base on death certificates to include also stage and  
11 severity of a disease as well as treatment undergone.  
12  
13  
14  
15

16 In summary, our study results show that the increase in assisted suicides in Switzerland was more  
17 pronounced in the older age group, but not associated with changing association with socio-  
18 economic and other factors. However, in context of assisted suicide vulnerability may not be limited  
19 factors such as living alone, being widowed or divorced. Serious illness, possibly accompanied by  
20 heavy pain, without perspective for improvement, but also old age may make any individual  
21 vulnerable. A register-based, sensitive monitoring of characteristics of assisted deaths and diagnoses  
22 involved should be implemented to identify trends and possible gaps in the health management of  
23 specific groups by the right-to-die organisations.  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **Funding:** This work was supported by the Swiss National Science Foundation (grant numbers:  
4 325130\_160171 and 33CS30\_148415).  
5

6 **Conflict of interest:** We have read and understood BMJ policy on declaration of interests and  
7 declare that we have no competing interests.  
8  
9

10 **Ethical approval:** Approval for the Swiss National Cohort study was obtained from the Ethics  
11 Committees of the Cantons of Zurich and Bern and a data centre was established at ISPM Bern. For  
12 this type of study formal consent is not required.  
13  
14

15 **Author's contribution:** Nicole Steck, Christoph Junker and Marcel Zwahlen developed the study  
16 design. Christoph Junker did the identification of the assisted suicides and the data preparation.  
17 Nicole Steck conducted the data processing, the analyses and wrote the first draft of the paper.  
18 Marcel Zwahlen supervised the statistical analyses. All authors critically revised the first draft and  
19 approved the final manuscript submitted for publication.  
20  
21  
22

23 **Data sharing statement:** Individual data from different data sets were used for the construction of  
24 the SNC. All these data are the property of the Swiss Federal Statistical Office (SFSO) and can only be  
25 made available by legal agreements with the SFSO. This also applies to derivatives such as the  
26 analysis files used for this study. However, after approval of the SNC Scientific Board, a specific SNC  
27 module contract with SFSO would allow researchers to receive analysis files for replication of the  
28 analysis. Data requests should be sent to Prof. Milo Puhan (chairman of the SNC Scientific Board,  
29 miloalan.puhan@uzh.ch).  
30  
31  
32  
33  
34

35 **Acknowledgements:** We thank the Swiss Federal Statistical Office for providing mortality and  
36 census data and for the support which made the Swiss National Cohort and this study possible. The  
37 members of the Swiss National Cohort Study Group are Matthias Egger (Chairman of the Executive  
38 Board), Adrian Spoerri and Marcel Zwahlen (all Bern), Milo Puhan (Chairman of the Scientific Board),  
39 Matthias Bopp (both Zurich), Nino Kunzli (Basel), Fred Paccaud (Lausanne) and Michel Oris (Geneva).  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

1. Steck N, Egger M, Maessen M, et al. Euthanasia and Assisted Suicide in Selected European Countries and US States: Systematic Literature Review. *Med Care* 2013;**51**(10):938-44 doi: 10.1097/MLR.0b013e3182a0f427[published Online First: Epub Date]].
2. Emanuel EJ, Onwuteaka-Philipsen BD, Urwin JW, et al. Attitudes and Practices of Euthanasia and Physician-Assisted Suicide in the United States, Canada, and Europe. *JAMA* 2016;**316**(1):79-90 doi: 10.1001/jama.2016.8499[published Online First: Epub Date]].
3. Burkhardt S, La HR. Debates About Assisted Suicide in Switzerland. *Am J Forensic Med Pathol*. 2012
4. Bosshard G, Fischer S, Bar W. Open regulation and practice in assisted dying. *Swiss Med Wkly*. 2002;**132**(37-38):527-34
5. Schweizerisches Strafgesetzbuch, 1937.
6. Judgements 2A.48/2006 and 2A.66/2006, 2006.
7. Steck N, Junker C, Maessen M, et al. Suicide assisted by right-to-die associations: a population based cohort study. *International journal of epidemiology* 2014;**43**(2):614-22 doi: 10.1093/ije/dyu010[published Online First: Epub Date]].
8. Bosshard G, Zellweger U, Bopp M, et al. Medical End-of-Life Practices in Switzerland: A Comparison of 2001 and 2013. *JAMA internal medicine* 2016;**176**(4):555-6 doi: 10.1001/jamainternmed.2015.7676[published Online First: Epub Date]].
9. FSO. Assistierter Suizid (Sterbehilfe) und Suizid in der Schweiz. BFS Aktuell: Federal Statistical Office, 2016:1-4.
10. Dyer O, White C, Garcia Rada A. Assisted dying: law and practice around the world. *BMJ* 2015;**351**:h4481 doi: 10.1136/bmj.h4481[published Online First: Epub Date]].
11. Dierickx S, Deliens L, Cohen J, et al. Euthanasia in Belgium: trends in reported cases between 2003 and 2013. *CMAJ* 2016;**188**(16):E407-E14 doi: 10.1503/cmaj.160202[published Online First: Epub Date]].
12. Regional euthanasia review c. JAARVERSLAG 2015, 2016.
13. Authority OH. Oregon Death with Dignity Act: Data summary 2016. In: 8579 O, ed., 2017:12.
14. Washington State Department of H. Death with Dignity Act Report 2015. 2016
15. Onwuteaka-Philipsen BD, Brinkman-Stoppelenburg A, Penning C, et al. 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**(9845):908-15 doi: 10.1016/S0140-6736(12)61034-4[published Online First: Epub Date]].
16. Chambaere K, Bilsen J, Cohen J, et al. Trends in medical end-of-life decision making in Flanders, Belgium 1998-2001-2007. *Med Decis Making* 2011;**31**(3):500-10
17. Hedberg K, New C. Oregon's Death With Dignity Act: 20 Years of Experience to Inform the Debate. *Annals of internal medicine* 2017;**167**(8):579-83 doi: 10.7326/m17-2300[published Online First: Epub Date]].
18. Lerner BH, Caplan AL. Euthanasia in Belgium and the Netherlands: On a Slippery Slope? *JAMA internal medicine* 2015 doi: 10.1001/jamainternmed.2015.4086[published Online First: Epub Date]].
19. Lewis P. The empirical slippery slope from voluntary to non-voluntary euthanasia. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics* 2007;**35**(1):197-210 doi: 10.1111/j.1748-720X.2007.00124.x[published Online First: Epub Date]].
20. Calabro RS, Naro A, De Luca R, et al. The Right to Die in Chronic Disorders of Consciousness: Can We Avoid the Slippery Slope Argument? *Innovations in clinical neuroscience* 2016;**13**(11-12):12-24
21. 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**(2):379-84
22. Spoerri A, Zwahlen M, Egger M, et al. The Swiss National Cohort: a unique database for national and international researchers. *Int J Public Health* 2010;**55**(4):239-42

- 1
- 2
- 3 23. Renaud A. Methodology Report - Coverage Estimation for the Swiss Population Census 2000:  
4 Swiss Federal Statistical Office, 2004.
- 5 24. Andorno R. Nonphysician-assisted suicide in Switzerland. *Camb.Q.Healthc.Ethics* 2013;**22**(3):246-  
6 53
- 7 25. WHO. International Statistical Classification of Diseases and Related Health Problems: Instruction  
8 manual, 2010:1-201.
- 9 26. Panczak R, Galobardes B, Voorpostel M, et al. A Swiss neighbourhood index of socioeconomic  
10 position: development and association with mortality. *J.Epidemiol.Community Health* 2012
- 11 27. Zürich K. Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der Suizidhilfe!".  
12 Secondary Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der  
13 Suizidhilfe!" 2011. Available at: [http://www.wahlen-  
14 abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
15 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 16 28. Zürich K. Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" Secondary  
17 Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" 2011. Available at:  
18 [http://www.wahlen-abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
19 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 20 29. Vaud K. Assistance au suicide. Secondary Assistance au suicide 2012. Available at:  
21 <http://www.elections.vd.ch/votelec/results.html?scrutin=VDVO20120617> (accessed  
22 22.03.2017).
- 23 30. Cohen J, Van WY, Smets T, et al. Cultural differences affecting euthanasia practice in Belgium: one  
24 law but different attitudes and practices in Flanders and Wallonia. *Soc.Sci.Med.*  
25 2012;**75**(5):845-53
- 26 31. Harteloh P, de BK, Kardaun J. The reliability of cause-of-death coding in The Netherlands.  
27 *Eur.J.Epidemiol.* 2010;**25**(8):531-38
- 28 32. Chio A, Magnani C, Oddenino E, et al. Accuracy of death certificate diagnosis of amyotrophic  
29 lateral sclerosis. *J.Epidemiol.Community Health* 1992;**46**(5):517-18
- 30 33. Bartsch C. Praxis und Probleme des assistierten Suizids in der Schweiz aus rechtsmedizinischer  
31 Sicht. In: Welsch CO, Ch; Frewer, A; Bielefeld H, ed. *Autonomie und Menschenrechte am  
32 Lebensende*. Boston: Transcript Verlag, 2016:203-20.  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



**Table 1a Study population 25-64 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)	
		Number	%	Number	%	Estimate	95% CI
All		5,102,268	100	771	100	1.58	1.47-1.70
Gender	Male	2,568,557	50.3	343	44.5	1.40	1.26-1.56
	Female	2,533,711	49.7	428	55.5	1.76	1.60-1.94
Calendar years	2003/2004	4,045,063	79.3	96	12.4	1.17	0.96-1.43
	2005/2006	242,768**	4.8	101	13.1	1.23	1.01-1.50
	2007/2008	246,252**	4.8	113	14.7	1.38	1.15-1.66
	2009/2010	206,220**	4.0	134	17.4	1.65	1.39-1.95
	2011/2012	188,818**	3.7	140	18.2	1.73	1.47-2.05
	2013/2014	173,147**	3.4	187	24.2	2.34	2.03-2.70
Religious affiliation	Protestant	1,702,781	33.4	275	35.7	1.74	1.54-1.96
	Catholic	2,158,382	42.3	205	26.6	0.99	0.87-1.14
	No Affiliation	628,032	12.3	245	31.8	3.91	3.45-4.23
	Other/unknown	613,073	12.0	46	6.0	0.76	0.57-1.02
Education	Compulsory	1,137,885	22.3	88	11.4	0.87	0.71-1.07
	Secondary	2,420,063	47.4	449	58.2	1.77	1.62-1.95
	Tertiary	977,528	19.2	221	28.7	2.13	1.87-2.43
	Unknown	566,792	11.1	13	1.7	0.43	0.25-0.75
Marital status	Single	1,715,805	33.6	176	22.8	1.25	1.08-1.45
	Married	2,831,208	55.5	383	49.7	1.31	1.19-1.45
	Widowed	99,092	1.9	29	3.76	3.83	2.66-5.51
	Divorced	456,163	9.0	183	23.74	3.85	3.33-4.45
Type of household	1 person	772,331	15.1	255	33.1	3.20	2.83-3.62
	≥ 2 persons	4,183,879	82.0	498	64.6	1.26	1.16-1.38
	Institutions	146,058	2.9	18	2.3	1.25	0.79-1.99
Children	No	2,226,028	43.6	318	41.2	1.57	1.41-1.75
	Yes	2,566,001	50.3	414	53.7	1.61	1.46-1.77
	Unknown	310,239	6.1	39	5.1	1.42	1.03-1.94
Urbanicity	Urban	1,445,955	28.3	265	34.4	1.88	1.66-2.12
	Peri-urban	2,321,284	45.5	370	48.0	1.68	1.51-1.86
	Rural	1,335,029	26.2	136	17.6	1.08	0.91-1.28
Neighborhood index of SEP	Lowest quartile	1,242,745	24.4	111	14.4	0.94	0.78-1.13
	Second quartile	1,220,105	23.9	156	20.2	1.34	1.14-1.56
	Third quartile	1,225,580	24.0	196	25.4	1.67	1.45-1.92
	Fourth quartile	1,222,208	23.9	284	36.8	2.45	2.18-2.75
	Unknown	191,630	3.8	24	3.1	1.27	0.85- 1.89
Language	German	3,666,753	71.87	548	71.1	1.56	1.44-1.70
Region	French	1,199,458	23.51	209	27.1	1.82	1.59-2.08
	Italian	219,002	4.29	14	1.8	0.67	0.40-1.13
	Rhaeto-Roman	17,055	0.33	-	-	-	-
	Nationality	Swiss	3,928,264	77.0	699	90.7	1.89
	Foreigner	1,174,004	23.0	72	9.3	0.61	0.49-0.77

\*at entry in study

\*\* People who entered the study at their 25th birthday

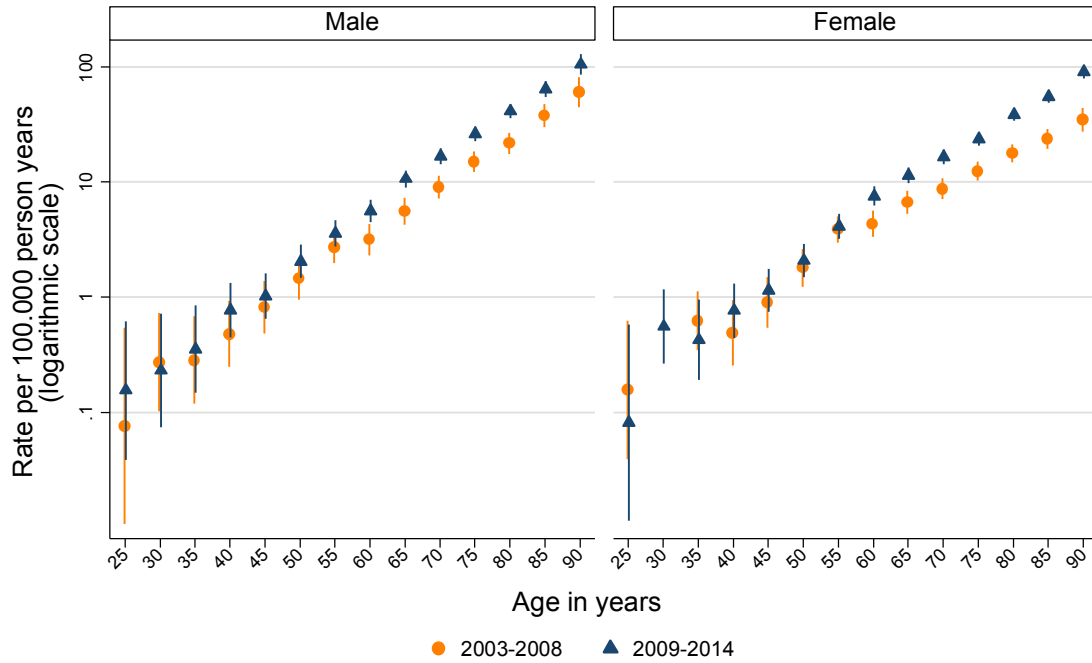
**Table 1b Study population 65-94 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)	
		Number	%	Number	%	Estimate	95% CI
All		2,139,152	100	3,170	100	20.40	19.70-21.12
Gender	Male	959,044	44.8	1,336	42.2	19.97	18.93-21.07
	Female	1,180,108	55.2	1,834	57.9	20.72	19.79-21.69
Calendar years	2003/2004	1,227,529	57.4	282	8.9	12.24	10.89-13.76
	2005/2006	161,701**	7.6	326	10.3	13.67	12.2-15.24
	2007/2008	184,728**	8.6	357	11.3	14.30	12.89-15.86
	2009/2010	187,522**	8.8	474	15.0	18.00	16.45-19.70
	2011/2012	191,358**	8.9	692	21.8	24.85	23.06-26.77
	2013/2014	186,314**	8.7	1039	32.8	35.35	33.27-37.57
Religious affiliation	Protestant	908,928	42.5	1,521	48.0	22.83	21.71-24.00
	Catholic	897,292	41.9	609	19.2	9.18	8.48-9.94
	No Affiliation	191,779	9.0	844	26.6	64.78	60.55-69.30
	Other/unknown	141,153	6.6	196	6.2	20.82	18.11-23.95
Education	Compulsory	689,219	32.2	600	18.9	11.61	10.72- 12.58
	Secondary	1,043,833	48.8	1,688	53.3	22.41	21.36-23.50
	Tertiary	377,305	17.6	850	26.8	32.15	30.06-34.38
	Unknown	28,795	1.4	32	1.0	16.24	11.49-22.97
Marital status	Single	171,876	8.0	259	8.2	22.03	19.50-24.88
	Married	1,274,969	59.6	1,301	41.0	14.20	13.45-14.99
	Widowed	480,234	22.5	1,105	34.9	28.98	27.32-30.74
	Divorced	212,073	9.9	505	15.9	36.26	33.24-39.57
Type of household	1 person	518,958	24.3	1,211	38.2	31.29	29.58-33.11
	≥ 2 persons	1,546,029	72.3	1,878	59.2	16.62	15.88-17.39
	Institutions	74,165	3.4	81	2.6	21.86	17.58-27.17
Children	No	339,093	15.9	713	22.5	30.75	28.57-33.09
	Yes	1,698,737	79.4	2,316	73.1	18.49	17.75-19.26
	Unknown	101,322	4.7	141	4.4	20.16	17.10-23.78
Urbanicity	Urban	640,844	29.9	1,306	41.2	27.79	26.33-29.34
	Peri-urban	955,312	44.7	1,472	46.4	21.25	20.20-22.37
	Rural	542,996	25.4	392	12.4	10.00	9.06-11.05
Neighborhood index of SEP	Lowest quartile	475,150	22.2	383	12.1	11.11	10.05-12.28
	Second quartile	509,464	23.8	537	16.9	14.42	13.25-15.69
	Third quartile	517,807	24.2	778	24.5	20.54	19.15-22.04
	Fourth quartile	557,424	26.1	1,384	43.7	33.74	32.01-35.57
	Unknown	79,307	3.7	88	2.8	18.23	14.80-22.47
Language Region	German	1,524,965	71.3	2,288	72.2	20.68	19.85-21.54
	French	497,621	23.3	814	25.7	22.57	21.07-24.17
	Italian	108,006	5.0	64	2.0	7.92	6.20-10.12
	Rhaeto-Roman	8,560	0.4	4	0.1	6.37	2.39-16.96
Nationality	Swiss	1,881,034	87.9	2,961	93.4	21.57	20.80-22.36
	Foreigner	258,118	12.1	209	6.6	11.53	10.07-13.21

\*at entry in study

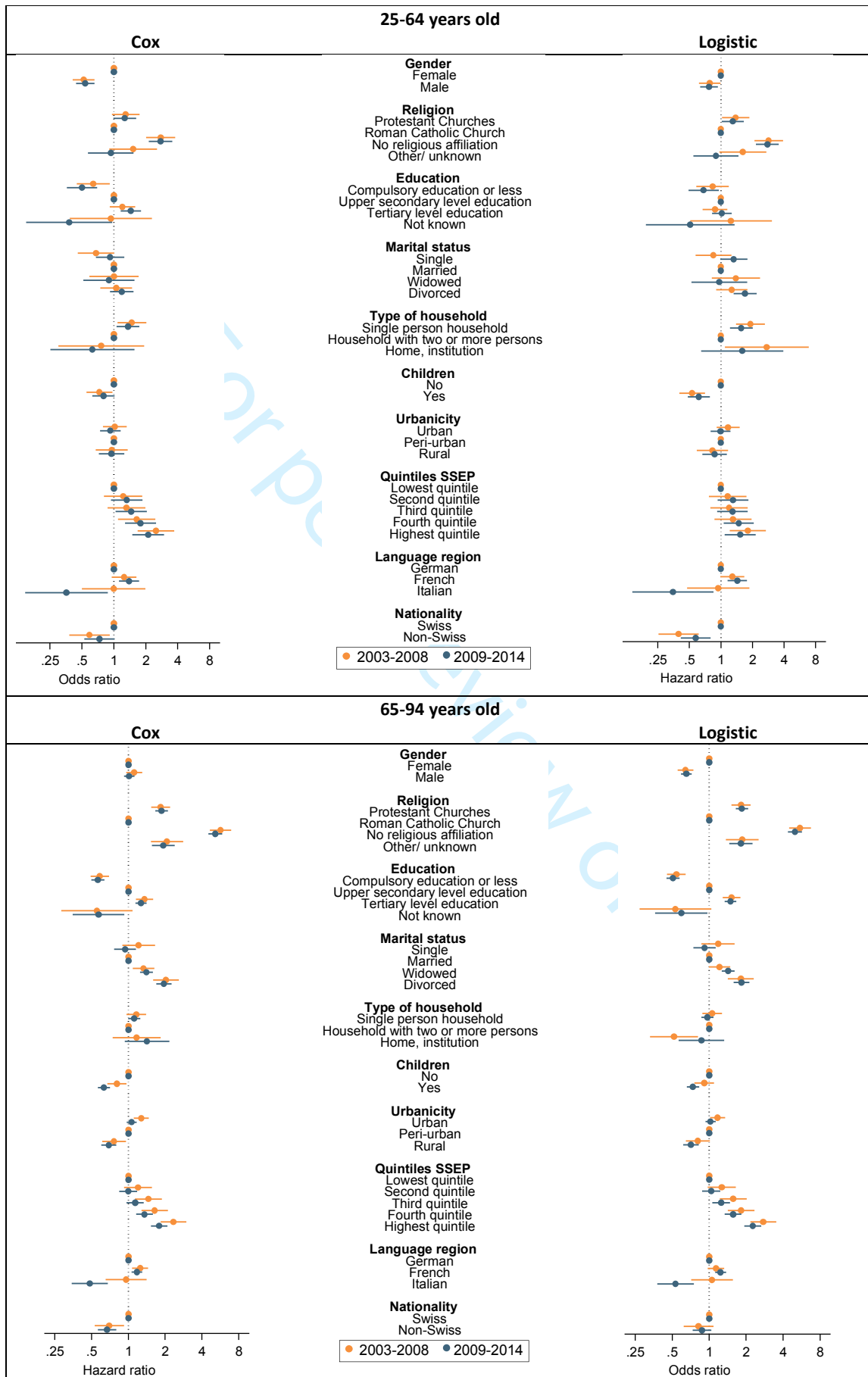
\*\* People who entered the study at their 25th birthday

Figure 1 Crude rate of assisted suicide by age and time period (2003-2008 and 2009-2014) for men and women



\*No events in women 30 to 35 years old in the time period 2003-2008

Figure 2 Results of multivariable Cox and Logistic regressions, by age group and time period (2003-2008 and 2009-2014)



**Table 2 Underlying diagnoses: Number and percentage of assisted suicides, per age group and time period**

Diagnosis	25-64 years old						65-94 years old					
	2003-2008		2009-2014		Total		2003-2008		2009-2014		Total	
	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%
<b>Cancer</b>	<b>159</b>	<b>51.3</b>	<b>243</b>	<b>52.7</b>	<b>402</b>	<b>52.1</b>	<b>385</b>	<b>39.9</b>	<b>862</b>	<b>39.1</b>	<b>1,247</b>	<b>39.3</b>
<i>Colon and other digestive organs</i>	44	14.2	73	15.9	117	15.1	104	10.8	236	10.7	340	10.7
<i>Lung and other respiratory organs</i>	28	9.0	40	8.7	68	8.9	43	4.5	135	6.1	178	5.6
<i>Breast</i>	21	6.8	32	6.9	53	6.9	47	4.9	90	4.1	137	4.3
<i>Prostate and other male genital</i>	6	1.9	8	1.7	14	1.8	57	5.9	102	4.6	159	5.0
<i>Others</i>	60	19.4	90	19.5	150	19.4	134	13.9	299	13.6	433	13.7
<b>Mental and behavioural</b>	<b>14</b>	<b>4.5</b>	<b>31</b>	<b>6.7</b>	<b>45</b>	<b>5.8</b>	<b>36</b>	<b>3.7</b>	<b>98</b>	<b>4.44</b>	<b>134</b>	<b>4.23</b>
<i>Mood disorders</i>	11	3.5	12	2.6	23	2.9	28	2.9	64	2.9	92	2.9
<i>Dementia</i>	0		2	0.4	2	0.2	5	0.5	22	1.0	27	0.8
<i>Other</i>	3	1.0	17	3.7	20	2.6	3	0.3	12	0.5	15	0.5
<b>Nervous system</b>	<b>62</b>	<b>20.0</b>	<b>110</b>	<b>23.9</b>	<b>172</b>	<b>22.3</b>	<b>105</b>	<b>10.9</b>	<b>268</b>	<b>12.2</b>	<b>373</b>	<b>11.8</b>
<i>Motor neuron disease</i>	17	5.5	18	3.9	35	4.5	27	2.8	47	2.1	74	2.3
<i>Parkinson's</i>	1	0.3	3	0.7	4	0.5	32	3.3	74	3.4	106	3.3
<i>Multiple sclerosis</i>	29	9.4	43	9.3	72	9.4	13	1.4	22	1.0	35	1.1
<i>Huntington</i>	1	0.3	9	1.9	10	1.3	0	0	3	0.1	3	0.1
<i>Paralytic syndromes</i>	3	1.0	10	2.2	13	1.7	8	0.8	12	0.6	20	0.6
<i>Alzheimer</i>	0	0	3	0.7	3	0.4	5	0.5	20	0.9	25	0.8
<i>Other</i>	11	3.5	24	5.2	35	4.5	20	2.1	90	4.1	110	3.5
<b>Circulatory system</b>	<b>2</b>	<b>0.7</b>	<b>12</b>	<b>2.6</b>	<b>14</b>	<b>1.8</b>	<b>112</b>	<b>11.6</b>	<b>268</b>	<b>12.2</b>	<b>380</b>	<b>12.0</b>
<i>Ischaemic</i>	0	0	1	0.2	1	0.1	2	0.2	61	2.8	63	2.0
<i>Heart failure</i>							1	0.1	26	1.2	27	0.8
<i>Cerebrovascular</i>	2	0.7	7	1.5	9	1.2	109	11.3	99	4.5	208	6.6
<i>Other</i>	-		4	0.8	4	0.5	0	0	82	3.7	219	2.6
<b>Respiratory system</b>	<b>10</b>	<b>3.2</b>	<b>16</b>	<b>3.5</b>	<b>26</b>	<b>3.4</b>	<b>31</b>	<b>3.2</b>	<b>118</b>	<b>5.4</b>	<b>149</b>	<b>4.7</b>
<i>COPD</i>	9	2.9	10	2.2	19	2.5	27	2.8	87	4.0	114	3.6
<i>Other</i>	1	0.3	6	1.3	7	0.9	4	0.4	31	1.4	35	1.1
<b>Musculoskeletal</b>	<b>6</b>	<b>1.9</b>	<b>13</b>	<b>2.8</b>	<b>19</b>	<b>2.5</b>	<b>62</b>	<b>6.4</b>	<b>255</b>	<b>11.6</b>	<b>317</b>	<b>10.0</b>
<i>Arthropathies</i>	2	0.6	-	-	2	0.3	16	1.7	88	4.0	104	3.3
<i>Dorsopathies</i>	1	0.3	6	1.3	7	0.9	23	2.3	90	4.1	113	3.5
<i>Osteoporosis</i>	-	-	1	0.2	1	0.1	17	1.8	46	2.1	63	2.0
<i>Other</i>	3	1.0	6	1.3	9	1.2	6	0.6	31	1.4	37	1.2
<b>Other</b>	<b>32</b>	<b>10.3</b>	<b>24</b>	<b>5.2</b>	<b>56</b>	<b>7.3</b>	<b>83</b>	<b>8.6</b>	<b>239</b>	<b>10.8</b>	<b>322</b>	<b>10.2</b>
<b>No</b>	<b>25</b>	<b>8.1</b>	<b>12</b>	<b>2.6</b>	<b>37</b>	<b>4.8</b>	<b>151</b>	<b>15.7</b>	<b>97</b>	<b>4.4</b>	<b>248</b>	<b>7.8</b>
<b>Total</b>	<b>310</b>		<b>461</b>		<b>771</b>		<b>965</b>		<b>2,205</b>		<b>3,170</b>	

**Supplementary table 1 Number of assisted suicides of Swiss residents in the annual reports of the right-to-die organisations Exit Deutschschweiz (Exit\_DS), Exit Suisse Romande (Exit\_SR) and Dignitas and number of assisted suicides identified in the SNC by year**

Year	Annual Reports of Right-to-Die Organisations			Total	Identified in SNC	%
	Exit_DS	Exit_SR	Dignitas			
<b>2003</b>	131	48	9	<b>188</b>	180	95.7
<b>2004</b>	154	42	14	<b>210</b>	198	94.3
<b>2005</b>	162	54	12	<b>228</b>	209	91.7
<b>2006</b>	150	65	15	<b>230</b>	218	94.8
<b>2007</b>	179	66	6	<b>251</b>	231	92.0
<b>2008</b>	167	75	10	<b>252</b>	239	94.8
<b>2009</b>	217	69	4	<b>290</b>	278	95.9
<b>2010</b>	257	91	6	<b>354</b>	330	93.2
<b>2011</b>	305	111	11	<b>427</b>	386	90.4
<b>2012</b>	356	144	13	<b>513</b>	446	86.9
<b>2013</b>	459	155	8	<b>622</b>	538	86.5
<b>2014</b>	583	175	6	<b>764</b>	688	90.1
<b>Total</b>	<b>3120</b>	<b>1095</b>	<b>114</b>	<b>4329</b>	<b>3941</b>	91.0

**Supplementary table 2 Categories of underlying diseases and corresponding ICD-10 codes**

Category	ICD-10 codes
<b>All cancer</b>	C00-C97
<i>Colon and other digestive organs</i>	C15-C26
<i>Lung and other respiratory organs</i>	C30-C39
<i>Breast</i>	C50
<i>Prostate and other male genital</i>	C60-C63
<i>Others</i>	C00-C14, C40-C49, C51-C58, C64-C97
<b>Mental and behavioural disorders</b>	F00-F99
<i>Dementia</i>	F00-F03
<i>Mood disorders</i>	F30-F39
<i>Other mental and behave. disorders</i>	F04-F29, F40-F99
<b>Diseases of the nervous system</b>	G00-G99
<i>Huntington disease</i>	G10
<i>Motor neuron disease (incl. ALS)</i>	G12.2
<i>Parkinson's disease</i>	G20
<i>Alzheimer</i>	G30
<i>Multiple sclerosis</i>	G35
<i>Paralytic syndromes</i>	G80-G83
<i>Other diseases of the nervous system</i>	G00-G09, G11-G12.1, G12.8-G14, G21-G26, G31-G32, G36-G73, G90-G99
<b>Diseases of the circulatory system</b>	I00-I99
<i>Ischaemic heart diseases</i>	I20-I25
<i>Heart failure</i>	I50
<i>Cerebrovascular disease</i>	I60-I69
<i>Other diseases of the circulatory system</i>	I00-I15, I26-I49, I51-I52, I70-I99
<b>Diseases of the respiratory system</b>	J00-J99
<i>Chronic obstructive pulmonary disease (COPD)</i>	J44
<i>Other diseases of the respiratory system</i>	J00-J43, J45-J99
<b>Diseases of the musculoskeletal system</b>	M00-M99
<i>Arthropathies</i>	M00-M25
<i>Dorsopathies</i>	M40-M54
<i>Osteoporosis</i>	M80-M82
<i>Other diseases of the musculoskeletal system</i>	M30-M36, M60-M79, M83-M99
<b>Other diseases</b>	A00-B99, D00-D89, E00-E90, H00-H95, K00-K93, L00-L99, N00-N99, O00-O99, P00-P96, Q00-Q99, R00-R68, R70-R98
<b>No/Unknown cause of death</b>	R69, R99

**Supplementary table 3**

Study population 25-94 years old

Characteristics	Study population		Assisted suicides		Crude rate per 100 000		
	Number	%	Number	%	Estimate	95% CI	
All	6,237,997	100	3,941	100	6.13	5.94-6.32	
Gender	Male	3,035,954	48.7	1,679	42.6	5.38	5.13-5.65
	Female	3,202,043	51.3	2,262	57.4	6.83	6.55-7.12
Calendar period	2003/2004	5,125,151	82.1	378	9.6	3.60	3.26-3.98
	2005/2006	260,552	4.2	427	10.8	4.03	3.26-3.98
	2007/2008	266,315	4.3	470	11.9	4.40	4.02-4.82
	2009/2010	217,785	3.5	608	15.4	5.65	5.21-6.11
	2011/2012	195,047	3.1	832	21.1	7.66	7.16-8.20
	2013/2014	173,147	2.8	1,226	31.1	11.21	10.60-11.86
Religious affiliation	Protestant	2,220,728	35.6	1,796	45.6	7.97	7.61-8.35
	Catholic	2,631,593	42.2	814	20.7	2.98	2.78-3.19
	No Affiliation	701,843	11.2	1,089	27.6	14.33	13.51-15.21
	Other/unknown	683,833	11.0	242	6.1	3.47	3.06-3.93
Education	Compulsory	1,591,996	25.5	688	17.5	4.50	4.17-4.85
	Secondary	2,931,137	47.0	2,137	54.2	6.49	6.22-6.77
	Tertiary	1,129,274	18.1	1,071	27.2	8.21	7.73-8.72
	Unknown	585,590	9.4	45	1.1	1.41	1.05-1.86
Marital status	Single	2,134,254*	34.2	435	11.04	2.85	2.60-3.13
	Married	3,334,767*	53.5	1,684	42.73	4.39	4.19-4.61
	Widowed	360,464*	5.8	1,134	28.77	24.81	23.41-26.30
	Divorced	408,512*	6.5	688	17.46	11.19	10.38-12.05
Type of household	1 person	1,121,885	18.0	1,466	37.2	12.34	11.73-12.99
	≥ 2 persons	4,912,145	78.7	2,376	60.3	4.68	4.49-4.87
	Institutions	203,967	3.3	99	2.5	5.47	4.49-6.66
Children	No	2,401,889	38.5	1,031	26.1	4.55	4.28-4.83
	Yes	3,458,728	55.4	2,730	69.3	7.12	6.86-7.39
	Unknown	377,380	6.1	180	4.6	5.20	4.50-6.02
Urbanicity	Urban	1,813,089	29.1	1,571	39.9	8.32	7.92-8.75
	Peri-urban	2,794,883	44.8	1,842	46.7	6.34	6.05- 6.63
	Rural	1,630,025	26.1	528	13.4	3.19	2.93-3.48
Neighbourhood index of SEP	Lowest quartile	1,498,623	24.0	494	12.5	3.22	2.95-3.52
	Second quartile	1,498,727	24.0	693	17.6	4.49	4.17-4.84
	Third quartile	1,498,726	24.0	974	24.7	6.26	5.88-6.66
	Fourth quartile	1,498,821	24.1	1,668	42.3	10.60	10.10-11.12
	Unknown	243,100	3.9	112	2.9		
Language Region	German	4,476,490	71.7	2,836	72.0	6.14	5.91-6.37
	French	1,461,343	23.4	1,023	25.9	6.76	6.36-7.19
	Italian	278,011	4.5	78	2.0	2.69	2.15-3.35
	Rhaeto-Roman	22,153	0.4	4	0.1	1.81	0.68-4.82
Nationality	Swiss	4,970,429	79.7	3,660	92.9	7.19	6.96-7.42
	Foreigner	1,267,568	20.3	281	7.1	2.07	1.84-2.33



**Supplementary table 4a Percentage of assisted suicides among all deaths with the same, potentially fatal, underlying disease, age group 25-64 years, by gender and time period and in total**

	2003-2008		2009-2014		Total
	Male	Female	Male	Female	
<b>Cancer</b>	<b>0.53 (0.41-0.67)</b>	<b>0.81 (0.65-1.00)</b>	<b>0.99 (0.82-1.19)</b>	<b>1.31 (1.10-1.56)</b>	<b>0.88 (0.80-0.97)</b>
<i>Digestive</i>	0.52 (0.33-0.78)	1.01 (0.64-1.53)	1.22 (0.90-1.62)	1.15 (0.74-1.69)	0.93 (0.77-1.12)
<i>Respiratory</i>	0.35 (0.19-0.59)	0.67 (0.37-1.12)	0.47 (0.26-0.77)	1.19 (0.77-1.76)	0.60 (0.47-0.76)
<i>Breast</i>	-	0.75 (0.47-1.15)	-	1.37 (0.94-1.93)	1.03 (0.77-1.34)
<i>Male genital</i>	1.14 (0.42-2.47)	-	1.68 (0.73-3.28)	-	1.40 (0.77-2.33)
<i>Other</i>	0.62 (0.42-0.89)	0.82 (0.56-1.17)	1.10 (0.80-1.48)	1.47 (1.08-1.95)	0.96 (0.82-1.13)
<b>Nervous system</b>	<b>2.83 (1.82-4.19)</b>	<b>4.84 (3.44-6.58)</b>	<b>5.79 (4.36-7.50)</b>	<b>7.81 (5.97-10.0)</b>	<b>5.25 (4.51-6.07)</b>
<i>Motor neuron disease</i>	5.14 (2.38-9.54)	6.84 (2.92-10.80)	9.76 (4.30-18.3)	4.17 (0.11-21.1)	6.48 (4.56-8.90)
<i>Parkinson</i>	-	4.76 (0.12-23.8)	8.33 (1.03-27.0)	4.20 (1.38-9.53)	4.60 (1.27-11.36)
<i>MS</i>	4.20 (1.38-9.53)	11.06 (7.22-16.0)	14.5 (8.70-22.2)	13.2 (8.81-18.7)	11.08 (8.77-13.75)
<i>Huntington</i>	-	4.17 (0.11-21.1)	22.72 (7.82-45.4)	13.3 (3.76-30.7)	9.90 (4.85-17.46)
<i>Paralytic syndromes</i>	4.35 (0.91-12.2)	-	7.79 (2.91-16.2)	7.55 (2.09-18.2)	5.49 (2.95-9.20)
<i>Alzheimer</i>	-	-	4.26 (0.52-14.5)	1.75 (0.044-9.39)	1.55 (0.32-4.45)
<i>Other</i>	1.53 (0.56-3.30)	1.54 (0.50-3.56)	2.58 (1.34-4.45)	4.18 (2.18-7.19)	2.38 (1.67-3.30)
<b>Circulatory system</b>	-	<b>0.079 (0.0095-0.28)</b>	<b>0.11 (0.043-0.22)</b>	<b>0.23 (0.075-0.54)</b>	<b>0.073 (0.040-0.12)</b>
<i>Ischaemic</i>	-	-	0.030 (0.000-0.166)	-	0.011 (0.000-0.061)
<i>Cerebro-vascular</i>	-	0.32 (0.038-1.14)	0.46 (0.094-1.33)	0.75 (0.20-1.91)	0.34 (0.155-0.642)
<i>Other</i>	-	-	0.122 (0.025-0.357)	0.106 (0.002-0.589)	0.057 (0.016-0.146)
<b>Respiratory system</b>	<b>0.38 (0.10-0.97)</b>	<b>0.95 (0.35-2.06)</b>	<b>0.75 (0.30-1.54)</b>	<b>1.49 (0.68-2.81)</b>	<b>0.81 (0.53-1.18)</b>
<i>COPD</i>	0.780 (0.213-1.98)	1.55 (0.504-3.58)	0.637 (0.132-1.85)	2.13 (0.860-4.33)	1.16 (0.70-1.81)
<i>Other</i>	-	0.327 (0.0083-1.81)	0.862 (0.235-2.19)	0.730 (0.089-2.61)	0.44 (0.18-0.91)
<b>All deaths*</b>	0.44 (0.37-0.52)	0.95 (0.82-1.10)	0.80 (0.69-0.91)	1.53 (1.35-1.73)	0.84 (0.78-0.90)
	0.63 (0.56-0.70)		1.08 (0.99-1.18)		

\* external causes excluded in the denominator

**Supplementary table 4b Percentage of assisted suicides among all deaths with the same, potentially fatal, underlying disease, age group 65-94 years, by gender and time period and in total**

	2003-2008		2009-2014		Total
	Male	Female	Male	Female	
<b>Cancer</b>	<b>0.50 (0.43-0.57)</b>	<b>0.64 (0.56-0.74)</b>	<b>1.13 (1.03-1.23)</b>	<b>1.27 (1.15-1.39)</b>	<b>0.88 (0.84-0.93)</b>
<i>Digestive</i>	0.476 (0.355-0.625)	0.563 (0.422-0.736)	1.12 (0.945-1.33)	1.03 (0.835-1.25)	0.81 (0.73-0.90)
<i>Respiratory</i>	0.207 (0.123-0.327)	0.696 (0.451-1.026)	0.707 (0.544-0.904)	1.55 (1.22-1.95)	0.69 (0.59-0.80)
<i>Breast</i>	-	0.909 (0.669-1.21)	-	1.65 (1.33-2.02)	1.28 (1.08-1.51)
<i>Male genital</i>	0.785 (0.595-1.02)	-	1.40 (1.14-1.69)	-	1.09 (0.929-1.27)
<i>Other</i>	0.554 (0.426-0.708)	0.576 (0.450-0.726)	1.28 (1.09-1.50)	1.18 (0.992-1.38)	0.90 (0.818-0.989)
<b>Nervous system</b>	<b>0.74 (0.54-1.00)</b>	<b>0.73 (0.56-0.93)</b>	<b>1.57 (1.29-1.90)</b>	<b>1.73 (1.48-2.01)</b>	<b>1.23 (1.11-1.36)</b>
<i>Motor neuron disease</i>	3.96 (2.13-6.68)	4.06 (2.24-6.71)	6.94 (4.49-10.1)	6.80 (4.36-10.0)	5.45 (4.31-6.80)
<i>Parkinson</i>	0.791 (0.433-1.32)	1.17 (0.697-1.85)	1.32 (0.881-1.91)	2.77 (2.04-3.68)	1.50 (1.23-1.81)
<i>MS</i>	1.92 (0.234-6.77)	3.64 (1.83-6.42)	5.41 (2.36-10.4)	4.55 (2.51-7.51)	4.06 (2.84-5.60)
<i>Huntington</i>	-	-	11.8 (1.46-36.4)	2.94 (0.074-15.3)	3.41 (0.709-9.64)
<i>Paralytic syndromes</i>	2.65 (0.726-6.64)	2.47 (0.677-6.20)	3.87 (1.43-8.23)	3.49 (1.29-7.44)	3.13 (1.92-4.79)
<i>Alzheimer</i>	0.043 (0.001-0.238)	0.080 (0.022-0.204)	0.237 (0.087-0.515)	0.258 (0.141-0.433)	0.163 (0.106-0.241)
<i>Other</i>	0.834 (0.382-1.58)	0.973 (0.486-1.73)	2.23 (1.53-3.13)	4.04 (3.08-5.19)	2.16 (1.78-2.60)
<b>Circulatory system</b>	<b>0.097 (0.072-0.13)</b>	<b>0.098 (0.076-0.13)</b>	<b>0.25 (0.21-0.30)</b>	<b>0.26 (0.22-0.30)</b>	<b>0.17 (0.16-0.19)</b>
<i>Ischaemic</i>	0.004 (0.000-0.024)	0.004 (0.000-0.024)	0.168 (0.117-0.235)	0.146 (0.097-0.213)	0.074 (0.006-0.095)
<i>Heart failure</i>	0.025 (0.000-0.014)	-	0.192 (0.070-0.417)	0.392 (0.240-0.605)	0.144 (0.095-0.210)
<i>Cerebro-vascular</i>	0.548 (0.403-0.728)	0.464 (0.356-0.594)	0.639 (0.471-0.846)	0.456 (0.339-0.598)	0.512 (0.445-0.586)
<i>Other</i>	-	-	0.196 (0.134-0.277)	0.216 (0.160-0.284)	0.109 (0.087-0.136)
<b>Respiratory system</b>	<b>0.15 (0.084-0.24)</b>	<b>0.17 (0.093-0.27)</b>	<b>0.55 (0.42-0.72)</b>	<b>0.67 (0.51-0.86)</b>	<b>0.38 (0.32-0.44)</b>
<i>COPD</i>	0.256 (0.141-0.430)	0.420 (0.224-0.717)	0.836 (0.613-1.11)	1.07 (0.768-1.45)	0.637 (0.523-0.765)
<i>Other</i>	0.037 (0.005-0.134)	0.034 (0.004-0.122)	0.241 (0.125-0.420)	0.367 (0.221-0.573)	0.163 (0.114-0.227)
<b>All deaths*</b>	0.33 (0.30-0.36)	0.38 (0.35-0.41)	0.70 (0.65-0.74)	0.88 (0.83-0.93)	0.57 (0.56-0.60)
	0.35 (0.33-0.38)		0.79 (0.76-0.83)		

\* external causes excluded in the denominator

Supplementary table 5 Results of the Cox regression models by age group and time period

Characteristics		Age group 25-64 years				Age group 65-94 years			
		2003-2008		2009-2014		2003-2008		2009-2014	
		HR	95%CI	HR	95%CI	HR	95% CI	HR	95% CI
Gender	Male	0.78	0.62-0.99	0.77	0.64-0.93	1.12	0.96-1.29	1.01	0.92-1.12
	<b>Female</b>	1		1		1		1	
	Wald test, 1df	$\chi^2=4.20, p=0.04$		$\chi^2=7.08, p=0.008$		$\chi^2=2.10, p=0.15$		$\chi^2=0.08, p=0.7751$	
Religious affiliation	Protestant	1.38	1.03-1.86	1.30	1.02-1.65	1.83	1.54-2.49	1.87	1.66-2.10
	<b>Catholic</b>	1		1		1		1	
	No Affiliation	2.86	2.08-3.90	2.77	2.16-3.56	5.68	4.64-6.94	5.12	4.49-5.83
Education	Other/unknown	1.61	0.96-2.71	0.90	0.55-1.47	2.07	1.53-2.80	1.93	1.56-2.39
	Compulsory	0.83	0.58-1.19	0.68	0.49-0.95	0.58	0.49-0.69	0.56	0.50-0.64
	<b>Secondary</b>	1		1		1		1	
Marital status	Tertiary	0.88	0.67-1.16	1.02	0.82-1.27	1.36	1.15-1.60	1.27	1.14-1.41
	Unknown	1.25	0.51-3.07	0.51	0.19-1.35	0.55	0.28-1.08	0.57	0.35-0.93
	Wald test, 3 df	$\chi^2=2.03, p=0.57$		$\chi^2=6.70, p=0.08$		$\chi^2=64.07, p<0.001$		$\chi^2=126.96, p<0.001$	
Type of household	Single	0.85	0.57-1.26	1.33	0.99-1.79	1.21	0.89-1.65	0.94	0.77-1.15
	<b>Married</b>	1		1		1		1	
	Widowed	1.39	0.82-2.36	0.96	0.52-1.79	1.33	1.09-1.62	1.40	1.24-1.58
Children	Divorced	1.27	0.90-1.79	1.70	1.32-2.19	2.03	1.59-2.58	1.95	1.69-2.26
	1 person	1.91	1.40-2.62	1.56	1.22-2.00	1.16	0.97-1.40	1.11	0.99-1.24
	<b>≥ 2 persons</b>	1		1		1		1	
Urbanicity	Institutions	2.74	1.09-6.86	1.59	0.65-3.92	1.17	0.74-1.84	1.42	0.93-2.16
	Wald test, 2 df	$\chi^2=18.20, p<0.001$		$\chi^2=12.74, p=0.002$		$\chi^2=2.57, p=0.28$		$\chi^2=5.33, p=0.07$	
	<b>No</b>	1		1		1		1	
Neighbourhood index of SEP	Yes	0.53	0.40-0.71	0.61	0.48-0.78	0.81	0.67-0.97	0.63	0.56-0.71
	Unknown	0.84	0.46-1.53	1.09	0.66-1.79	0.64	0.45-0.91	0.70	0.55-0.89
	Wald test, 1 df	$\chi^2=18.94, p<0.001$		$\chi^2=15.51, p<0.001$		$\chi^2=5.45, p=0.02$		$\chi^2=63.09, p<0.001$	
Language Region	Urban	1.17	0.90-1.51	0.99	0.80-1.23	1.28	1.11-1.47	1.06	0.97-1.17
	<b>Peri-urban</b>	1		1		1		1	
	Rural	0.8	0.59-1.17	0.87	0.66-1.14	0.76	0.61-0.95	0.69	0.60-0.80
Nationality	Wald test, 2 df	$\chi^2=18.94, p<0.001$		$\chi^2=1.10, p=0.58$		$\chi^2=25.72, p<0.001$		$\chi^2=34.26, p<0.001$	
	<b>Swiss</b>	1		1		1		1	
	Foreigner	0.39	0.25-0.62	0.57	0.41-0.80	0.70	0.53-0.92	0.67	0.56-0.80
Neighbourhood index of SEP	Second quintile	1.16	0.77-1.75	1.30	0.93-1.82	1.20	0.92-1.55	1.00	0.84-1.18
	Third quintile	1.20	0.79-1.80	1.29	0.92-1.81	1.46	1.13-1.87	1.12	0.96-1.34
	Fourth quintile	1.30	0.87-1.95	1.48	1.06-2.06	1.64	1.28-2.10	1.35	1.16-1.58
Language Region	Highest quintile	1.81	1.21-2.69	1.53	1.09-2.15	2.34	1.83-2.98	1.79	1.53-2.08
	Wald test, 4 df	$\chi^2=18.94, p<0.001$		$\chi^2=6.95, p=0.14$		$\chi^2=65.39, p<0.001$		$\chi^2=97.24, p<0.001$	
	<b>German</b>	1		1		1		1	
Nationality	French	1.28	0.99-1.67	1.43	1.16-1.77	1.25	1.07-1.45	1.18	1.06-1.30
	Italian	0.94	0.47-1.86	0.35	0.14-0.85	0.96	0.65-1.41	0.48	0.34-0.68
	Wald test, 2 df	$\chi^2=3.61, p=0.16$		$\chi^2=17.72, p<0.001$		$\chi^2=8.46, p=0.01$		$\chi^2=30.58, p<0.001$	
Nationality	Swiss	1		1		1		1	
	Foreigner	0.39	0.25-0.62	0.57	0.41-0.80	0.70	0.53-0.92	0.67	0.56-0.80
	Wald test, 1 df	$\chi^2=16.81, p<0.001$		$\chi^2=10.93, p<0.001$		$\chi^2=6.58, p=0.01$		$\chi^2=20.54, p<0.001$	

Supplementary table 6 Results of the logistic regression models by age group and time period

Characteristics		Age group 25-64 years				Age group 65-94 years				
		2003-2008		2009-2014		2003-2008		2009-2014		
		OR	95%CI	OR	95%CI	OR	95% CI	OR	95% CI	
Gender	Male	0.52	0.41-0.66	0.54	0.44-0.65	0.64	0.55-0.75	0.65	0.59-0.72	
	<b>Female</b>	1		1		1		1		
	Wald test, 1 df	$\chi^2=28.80, p<0.01$		$\chi^2=37.92, p<0.01$		$\chi^2=33.65, p<0.01$		$\chi^2=69.95, p<0.01$		
Age at death	<b>25-34</b>	1		1				1		
	35-44	1.36	0.59-3.12	0.66	0.33-1.332					
	45-54	1.25	0.56-2.78	0.55	0.29-1.07					
	55-64	1.33	0.60-2.94	0.67	0.35-1.28					
	<b>65-74</b>					1		1		
	75-84					0.94	0.80-1.10	0.92	0.82-1.03	
	85-94					0.77	0.64-0.94	0.73	0.64-0.83	
	Wald test	3df: $\chi^2=0.72, p=0.87$		$\chi^2=4.74, p=0.19$		2df: $\chi^2=7.74, p=0.02$		$\chi^2=27.07, p<0.01$		
Underlying disease	<b>Cancer</b>	1		1		1		1		
	Mental	1.38	0.78-2.44	2.19	1.45-3.30	0.61	0.43-0.87	0.42	0.34-0.53	
	Nervous system	6.91	5.06-9.42	6.76	5.29-8.65	1.53	1.23-1.92	1.47	1.27-1.60	
	Circulatory	0.04	0.01-0.14	0.13	0.07-0.25	0.21	0.17-0.27	0.26	0.22-0.30	
	Respiratory	1.08	0.57-2.06	1.06	0.63-1.77	0.35	0.24-0.51	0.57	0.47-0.70	
	Musculoskeletal	3.81	1.64-8.84	4.63	2.51-8.52	4.92	3.70-6.54	9.45	8.08-11.06	
	Other diseases	0.79	0.53-1.18	0.44	0.29-0.68	0.52	0.41-0.66	0.68	0.58-0.78	
	No disease	1.57	1.01-2.43	0.45	0.25-0.81	4.05	3.32-4.95	1.06	0.85-1.32	
		Wald test, 7 df	$\chi^2=198.53, p<0.01$		$\chi^2=374.96, p<0.01$		$\chi^2=741.59, p<0.01$		$\chi^2=1684.34, p<0.01$	
	Religious affiliation	Protestant	1.29	0.96-1.74	1.27	0.99-1.62	1.81	1.52-2.17	1.85	1.64-2.08
<b>Catholic</b>		1		1		1		1		
No Affiliation		2.76	2.01-3.79	2.75	2.14-3.55	5.49	4.48-6.72	5.00	4.37-5.70	
Other/unknown		1.52	0.91-2.55	0.94	0.57-1.54	1.86	1.37-2.53	1.81	1.46-2.25	
		Wald test, 3 df	$\chi^2=44.75, p<0.01$		$\chi^2=73.00, p<0.01$		$\chi^2=294.46, p<0.01$		$\chi^2=600.21, p<0.01$	
Education	Compulsory	0.64	0.45-0.91	0.50	0.36-0.70	0.54	0.45-0.64	0.51	0.45-0.57	
	<b>Secondary</b>	1		1		1		1		
	Tertiary	1.20	0.91-1.59	1.45	1.16-1.81	1.52	1.29-1.80	1.49	1.34-1.66	
	Unknown	0.94	0.38-2.29	0.38	0.15-0.97	0.53	0.27-1.04	0.59	0.36-0.97	
		Wald test, 3 df	$\chi^2=9.36, p=0.02$		$\chi^2=36.32, p<0.01$		$\chi^2=94.71, p<0.01$		$\chi^2=210.35, p<0.01$	
Marital status	Single	0.68	0.46-1.01	0.92	0.68-1.26	1.18	0.87-1.61	0.92	0.75-1.13	
	<b>Married</b>	1		1		1		1		
	Widowed	1.00	0.59-1.71	0.90	0.52-1.56	1.22	0.99-1.49	1.43	1.26-1.61	
	Divorced	1.06	0.75-1.49	1.19	0.92-1.53	1.81	1.42-2.31	1.83	1.58-2.13	
		Wald test, 3 df	$\chi^2=5.27, p=0.15$		$\chi^2=3.39, p=0.34$		$\chi^2=23.72, p<0.01$		$\chi^2=92.22, p<0.01$	
Type of household	1 person	1.48	1.08-2.02	1.36	1.06-1.74	1.06	0.88-1.27	0.97	0.86-1.08	
	<b>≥ 2 persons</b>	1		1		1		1		
	Institutions	0.76	0.30-1.93	0.63	0.25-1.57	0.52	0.33-0.81	0.86	0.56-1.33	
		Wald test, 2 df	$\chi^2=7.15, p=0.03$		$\chi^2=7.48, p=0.02$		$\chi^2=10.35, p<0.01$		$\chi^2=0.66, p=0.72$	
Children	<b>No</b>	1		1		1		1		
	Yes	0.73	0.55-0.97	0.80	0.63-1.02	0.91	0.76-1.09	0.74	0.66-0.83	
	Unknown	0.75	0.41-1.38	0.95	0.57-1.57	0.60	0.42-0.85	0.70	0.55-0.89	
		Wald test, 1 df	$\chi^2=4.62, p=0.03$		$\chi^2=3.28, p=0.07$		$\chi^2=12.37, p<0.01$		$\chi^2=25.85, p<0.01$	
Urbanicity	Urban	1.02	0.79-1.32	0.93	0.74-1.16	1.17	1.02-1.35	1.02	0.93-1.13	
	<b>Peri-urban</b>	1		1		1		1		
	Rural	0.96	0.68-1.35	0.95	0.72-1.25	0.81	0.65-1.01	0.71	0.61-0.82	
		Wald test, 2 df	$\chi^2=0.13, p=0.94$		$\chi^2=0.46, p=0.80$		$\chi^2=0.99, p=0.32$		$\chi^2=25.27, p<0.01$	
Neighbourhood index of SEP	<b>Lowest quintile</b>	1		1		1		1		
	Second quintile	1.22	0.81-1.86	1.32	0.94-1.86	1.27	0.97-1.65	1.04	0.88-1.23	
	Third quintile	1.32	0.87-1.98	1.46	1.03-2.05	1.57	1.22-2.02	1.25	1.06-1.48	
	Fourth quintile	1.64	1.09-2.47	1.78	1.27-2.50	1.82	1.42-2.33	1.56	1.33-1.84	
	Highest quintile	2.49	1.67-3.72	2.11	1.49-2.98	2.75	2.16-3.52	2.26	1.93-2.65	
		Wald test, 4 df	$\chi^2=26.13, p<0.01$		$\chi^2=20.65, p<0.01$		$\chi^2=89.86, p<0.01$		$\chi^2=170.28, p<0.01$	
Language Region	<b>German</b>	1		1		1		1		
	French	1.25	0.96-1.63	1.39	1.12-1.73	1.14	0.97-1.33	1.24	1.12-1.37	
	Italian	1.00	0.50-1.99	0.36	0.15-0.88	1.05	0.71-1.56	0.53	0.38-0.75	
		Wald test, 2 df	$\chi^2=2.72, p=0.26$		$\chi^2=15.20, p<0.01$		$\chi^2=0.07, p=0.79$		$\chi^2=12.83, p<0.01$	
	<b>Swiss</b>	1		1		1		1		
Nationality	Foreigner	0.59	0.38-0.91	0.73	0.53-1.02	0.82	0.62-1.08	0.88	0.73-1.04	
		Wald test, 1 df	$\chi^2=5.60, p=0.02$		$\chi^2=3.40, p=0.07$		$\chi^2=1.98, p=0.16$		$\chi^2=2.18, p=0.14$	

**Supplementary table 7 Degrees of freedom (df), chi square (chi2) and p-values for likelihood ratio tests for interactions with time period (2003-2008 vs 2009-2014) in multivariable Cox respectively logistic regression models**

Variable	df	Cox regression		Logistic regression	
		chi2	p-value	chi2	p-value
<b>Age group 25-64 years</b>					
Sex	1	0.07	0.7922	0.26	0.6124
Diagnosis	7			22.92	0.0018
Religion	3	3.71	0.2949	3.08	0.3790
Education	3	3.78	0.2868	3.66	0.3001
Marital status	3	2.45	0.4837	2.61	0.4555
Household	2	0.88	0.6454	0.08	0.9629
Parenthood	1	0.50	0.4785	0.00	0.9578
Urbanicity	2	1.31	0.5205	0.38	0.8276
SSEP	4	2.10	0.7169	1.58	0.8120
Language region	2	0.98	0.6133	3.79	0.1505
Nationality	1	0.32	0.5721	0.11	0.7387
<b>Age group 65-94 years</b>					
Sex	1	0.10	0.7524	0.44	0.5060
Diagnosis	7			134.80	<0.001
Religion	3	3.42	0.3308	3.23	0.3581
Education	3	1.33	0.7220	1.52	0.6776
Marital status	3	2.13	0.5453	3.86	0.2768
Household	2	1.27	0.5292	4.66	0.0972
Parenthood	1	1.67	0.1959	0.45	0.5015
Urbanicity	2	3.16	0.2055	3.30	0.1923
SSEP	4	3.29	0.5100	2.27	0.6854
Language region	2	5.39	0.0676	5.58	0.0613
Nationality	1	0.94	0.3310	0.01	0.9200

**Supplementary table 8** Odds ratios and 95% Confidence Intervals (CI) for interactions between time period and diagnosis in multivariable logistic regression models (corrected for sex, age, religion, education, marital status, type of household, urbanization, the neighborhood index of socioeconomic position, language region and nationality)

	Age group 25-64		Age group 65-94	
	OR	95%CI	OR	95%CI
<b>Diagnosis</b>				
Cancer	1 (Ref)		1 (Ref)	
Mental and behavioural	1.67	0.84-3.31	0.71	0.48-1.07
Nervous System	0.98	0.66-1.45	0.99	0.76-1.29
Circulatory System	3.92	0.86-17.93	1.22	0.94-1.57
Respiratory System	0.99	0.43-2.25	1.67	1.10-2.53
Musculoskeletal System	1.19	0.42-3.37	1.97	1.43-2.71
Other diseases	0.56	0.32-1.00	1.32	0.99-1.76
No disease	0.30	0.15-0.62	0.27	0.20-0.36

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	page in the manuscript
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	4/5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4/5
4/5Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4/5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5, suppl. table 2
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	n.a.
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	n.a.
		(d) If applicable, explain how loss to follow-up was addressed	n.a.
		(e) Describe any sensitivity analyses	n.a.
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	n.a.
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, table 1
		(b) Indicate number of participants with missing data for each variable of interest	table 1
		(c) Summarise follow-up time (eg, average and total amount)	6

Outcome data	15*	Report numbers of outcome events or summary measures over time	6
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	table 1a & 1b, figure 2
		(b) Report category boundaries when continuous variables were categorized	n.a.
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7/8
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.



# BMJ Open

## Increase in Assisted Suicide in Switzerland: Did the socio-economic predictors change? Results from the Swiss National Cohort

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-020992.R1
Article Type:	Research
Date Submitted by the Author:	13-Feb-2018
Complete List of Authors:	Steck, Nicole; Universitat Bern, Institute of Social and Preventive Medicine (ISPM) Junker, Christoph; Federal Statistical Office, Medical Statistics Zwahlen, Marcel; University of Bern, Institute of Social and Preventive Medicine
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Palliative care
Keywords:	Assisted Suicide, End of Life Care, Cohort Study, Switzerland

SCHOLARONE™  
Manuscripts

# Increase in Assisted Suicide in Switzerland: Did the socio-economic predictors change? Results from the Swiss National Cohort

Nicole Steck<sup>1</sup>, PhD, Christoph Junker<sup>2</sup>, MD, and Marcel Zwahlen<sup>1</sup>, PhD, for the Swiss National Cohort

<sup>1</sup> Institute of Social and Preventive Medicine (ISPM), University of Bern, Switzerland

<sup>2</sup> Federal Statistical Office, Neuchatel, Switzerland

Correspondence:

Nicole Steck

Institute of Social and Preventive Medicine

University of Bern

Switzerland

[Nicole.steck@ispm.unibe.ch](mailto:Nicole.steck@ispm.unibe.ch)

Tel: +41 31 631 56 75

## Abstract

**Objective** To determine whether the strong increase in assisted suicides in Switzerland since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide and the diagnoses related thereto.

**Methods** Assisted suicides from 2003 to 2014 in Switzerland were investigated in a census-based longitudinal study of the whole Swiss population. Younger (25 to 64 years) and older (65 to 94 years) people were analysed separately. We calculated crude rates and used Cox proportional hazard and logistic regression models to examine associations with gender, marital status, education, religion, neighbourhood socio-economic position and other variables and to investigate time effects.

**Results** The analyses were based on 6,237,997 Swiss residents. Overall 3,941 assisted suicides were identified, 80 % thereof in the older age group. Crude rates of assisted suicide more than tripled during study period from 3.60 to 11.21 per 100,000 person years, with a more pronounced increase in the older age group. Cancer was the most common underlying diagnosis (41.8 %), but the percentage dying assisted was much higher among patients with diseases of the nervous system (5.25 % in the younger and 1.23 % in the older age group). The factors associated with assisted suicide did not change during the study period: Female gender, higher education, having no religious affiliation, no children and no Swiss passport, living in a neighbourhood with a higher socio-economic index and in the French speaking part of Switzerland were associated with a higher rate.

**Conclusions** The study results do not indicate any shift in socio-economic factors associated with assisted suicide, but a more pronounced increase in incidence in the elderly.

**Strengths and limitations of this study:**

- The nationwide cohort study with a virtually complete coverage and data on individual, household and building level allows investigating time trends in the associations of assisted dying and detailed socio-economic characteristics in Switzerland, one of few countries with long-term experience in assisted dying.
- In Switzerland there is no obligation to report assisted suicides to a central registry, so the cases may not be fully complete. However, the Federal statistical office makes a great effort to identify assisted suicides, in cooperation with right-to-die organisations, the institutes of Forensic Medicine and the physicians.
- Most socio-economic variables come from census 2000 and may not be completely up to date in 2014 for all individuals. However, particularly in the older age group characteristics as education, religion or language region are quite stable.
- For information on the underlying disease the study relies on the diagnoses given on the death certificate. Besides the issue of the reliability of these diagnoses, no information is available on the disease stage or severity.

## Introduction

Switzerland is one of few countries worldwide that allow assisted suicide [1-3]. In general a right-to-die organisation is involved in the process in Switzerland [4]. The organisations assist their members in dying, when a physician assessed the decisional capacity and confirmed that the person requesting assistance does either suffer from a terminal illness, an unendurable incapacitating disability or unbearable and uncontrollable pain [3]. According to article 115 of the Swiss penal code assistance in suicide is only considered a crime and open to prosecution if selfish interests are involved [5]. Though the lawmakers were not thinking of a medical perspective when article 115 was created in 1918, the judgments by the Tribunal Federal supported the activities of the right-to-die organisations [6]. While in Physician-Assisted-Suicides the role of the physician is limited to prescribing a lethal drug, in Euthanasia the physician injects the lethal drug when requested by the patient. Euthanasia is prohibited in Switzerland.

In an earlier study we described a higher rate of assisted suicide in Switzerland for female gender, people living alone or being divorced, but also for people with higher education and higher socio-economic position in the years 2003 to 2008 [7]. Cancer was the most common diagnosis, though the percentage dying assisted among all deaths was much higher among patients with diseases of the nervous system. In the last 15 years the numbers of assisted suicides reported by right-to-die-organizations increased substantially in Switzerland [8 9]. While the three main right-to-die organisations reported less than 200 assisted suicides of Swiss residents yearly at the beginning of the century, in 2014 the number reached more than 760 ([supplementary table 1](#))[10-12]. This increase is in line with the development in other European countries and US states that allow assisted suicide or euthanasia [13-20]. This intensified the debate about ethics and prohibition or controlled regulation of assisted death in Europe and worldwide. One main concern about assisted dying is the so called 'slippery slope', a shift from exceptional to routine practice, putting pressure particularly on patients who are chronically ill and socioeconomically vulnerable [2 21-23].

The aim of this study was to analyze, whether the increase in numbers of assisted suicide since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide. We wanted to identify groups with a disproportional increase in the rate of assisted dying and investigate possible shifts in diagnoses. Thus we wanted to test the 'slippery slope' hypothesis, if there is a trend towards more vulnerable patients dying assisted: less educated people, people living in a neighbourhood with a lower socio-economic position, but also people living alone and having no children.

## Methods

### *The Swiss National Cohort*

The Swiss National Cohort (SNC) is a longitudinal study of the Swiss Population, the core SNC is described in detail elsewhere [24 25]. The current version of the SNC is based on census data from 1990 and 2000

1 that were linked to mortality and emigration records until 2014 and to the newly introduced Registry  
2 Based Census (RBC) 2011, using deterministic and probabilistic linkage procedures. Participation in the  
3 Swiss census is mandatory, resulting in a coverage of 99% in the census 2000 [26]. The present analysis is  
4 based on the census 2000 and we included people who were between 25 and 95 years old in the study  
5 period 2003 to 2014. For exposing variables (education, religion, etc.) information from the census 2000  
6 was used, as the RBC does not contain the same detailed information. An exception is marital status,  
7 where we had information on the last change before RBC 2011 respectively before death and used the  
8 relevant information. All individuals were followed from 1 January 2003 until death, emigration or the end  
9 of the study period on 31 December 2014. The SNC was approved by the Cantonal Ethics Committees of  
10 Bern and Zurich, with approval covering this study.

### 11 *Identification of assisted suicides*

12 During study period, mainly three right-to-die associations were active in assisting Swiss residents in  
13 dying: Exit in the German speaking part, Exit in the French speaking part and Dignitas. The organisations  
14 have been described in detail elsewhere [1 27]. The Federal Statistical Office (FSO) identifies the assisted  
15 deaths based on information given by the physician respectively the institutes of Forensic Medicine on  
16 the death certificate, using code X61.8, as there is no official code for assisted deaths in the International  
17 Classification of Diseases (ICD) [9]. For the years 2003 to 2012 the right-to-die associations provided in  
18 addition anonymous data on all deaths of Swiss residents they assisted to the Federal statistical office.

### 19 *Determination of underlying diseases*

20 For the determination of the underlying diseases we used the ICD-10 codes on the death certificates. Until  
21 2008 suicide by poisoning was indicated as primary cause of death for assisted suicides in the Swiss  
22 mortality statistics. Therefore we used the first concomitant diseases as underlying cause for assisted  
23 suicides from 2003 until 2008. In 2009 the FSO changed the practice in coding assisted suicides based on  
24 the ICD-definition of the primary cause of death as “the disease or injury which initiated the train of  
25 morbid events leading directly to death, or the circumstances of the accident or violence which produced  
26 the fatal injury” [9 28]. Since 2009 the underlying disease is therefore labeled as primary cause and  
27 assisted suicide as concomitant circumstance. For 2009 to 2014 we used hence the primary cause to  
28 determine the underlying disease of assisted suicides. For all other deaths the primary cause of death was  
29 used during the whole study period.

30 We created broad categories of *all-cancer, mental and behavioural disorders, diseases of the nervous*  
31 *system, diseases of the circulatory system, diseases of the respiratory system, diseases of the*  
32 *musculoskeletal system* and *other diseases* and more detailed categories for the most common diagnoses  
33 (Supplementary table 2). We excluded all deaths with external causes as accident, unassisted suicide,  
34 assault (V, W, X and Y, except X61.8).

## Statistical analysis

Within the SNC we performed a survival analysis with age as time scale, observation time starting at 1 January 2003 and ending on the earliest of the date of death, emigration or on 31 December 2014. We calculated crude rates of assisted suicide and estimated hazard ratios using Cox proportional hazard regression. The multivariable model included gender, religion (Protestant, Catholic, no affiliation and other/unknown), education (compulsory, secondary and tertiary), marital status (single, married, widowed and divorced), type of household (single person, two or more persons, institution), having children, urbanity (urban, peri-urban or rural), the Swiss neighbourhood index of socioeconomic position (in quintiles)[29], language region (German, French or Italian speaking) and Nationality (Swiss or Foreigner). Because the result of Cox proportional hazard regression might not only identify risk factors for assisted suicide, but also for being terminally ill or being in chronic and uncontrollable pain and suffering, we performed also a logistic regression to identify determinants of assisted suicide among all deaths. We included the same variables and characteristics as in the Cox analysis but also age at death (10 year bands) and underlying diagnosis (broad categories, see above). Earlier studies showed interactions between age group and other variables [7], therefore the multivariable analyses were not only stratified by time period (2003-2008), but also by age-group (25 to 64 and 65 to 94). The cut-off at 65 years reflects retirement age for men in Switzerland. In multivariable analyses we tested for interaction between variables and time period by including appropriately constructed interaction terms and performing likelihood ratio tests. In addition, for potentially fatal diseases we calculated the percentage of assisted deaths with a certain underlying cause among all deaths with the same condition.

Statistical analyses were done in Stata version 14 (Stata Corporation, College Station, TX, USA). Results are given as rates per 100,000 person years, hazard ratios (HR), odds ratios (OR) and  $\chi^2$  and p-values from Wald tests for overall model significance. In addition percentages of assisted suicides among all deaths across underlying causes are reported, with 95% confidence intervals (Cis).

## Results

### Study population

6,237,997 individuals who filled in the census 2000 and were between 25 and 95 years old in the study period 2003 to 2014 were included. 5,102,268 contributed to the cohort of the 25-64 years old, 2,139,152 to the cohort of the 65-94 years old, whereby 1,003,423 individuals contributed to both ([table 1a](#) and [1b](#)).

We identified 3,941 assisted suicides, with an increasing number from 180 assisted suicides in 2003 (0.32% of all deaths) to 688 in 2014 (1.30 % of all deaths). This corresponds to 95.2 % of the number of assisted suicides of Swiss residents officially reported by the three main right-to-die-organisations in their annual reports ([supplementary table 1](#)). While a quarter of assisted suicides was in people younger than

1 65 in 2003/2004, the proportion decreased to 15% in 2013/2014. Crude rates more than tripled from the  
2 two-year-period 2003/2004 to 2013/2014, from 3.60 to 11.21 per 100.000 person years. The rates  
3 increased in both age groups, but more pronounced (from 12.23 to 35.35) in the group 65 to 94 years old  
4 than in the 25 to 64 years old (from 1.17 to 2.34) (table 1a and 1b, Figure 1). Rates increased  
5 exponentially with age from 0.14 (95% CI 0.063-0.314) per 100,000 person-years at age 25 to 56.25 (95%  
6 CI 49.76- 63.58) per 100,000 at age 90. Overall crude rates were higher in women (6.81, 95% CI 6.54-7.10)  
7 than in men (5.37, 95% CI 5.12-5.63), but stratified by age women have a higher rate until the age of 69,  
8 from the age of 70 on men had a higher rate (Figure 1).

9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only



**Table 1a Study population 25-64 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)	
		Number	%	Number	%	Estimate	95% CI
All		5,102,268	100	771	100	1.58	1.47-1.70
Gender	Male	2,568,557	50.3	343	44.5	1.40	1.26-1.56
	Female	2,533,711	49.7	428	55.5	1.76	1.60-1.94
Calendar years	2003/2004	4,045,063	79.3	96	12.4	1.17	0.96-1.43
	2005/2006	242,768**	4.8	101	13.1	1.23	1.01-1.50
	2007/2008	246,252**	4.8	113	14.7	1.38	1.15-1.66
	2009/2010	206,220**	4.0	134	17.4	1.65	1.39-1.95
	2011/2012	188,818**	3.7	140	18.2	1.73	1.47-2.05
Religious affiliation	2013/2014	173,147**	3.4	187	24.2	2.34	2.03-2.70
	Protestant	1,702,781	33.4	275	35.7	1.74	1.54-1.96
	Catholic	2,158,382	42.3	205	26.6	0.99	0.87-1.14
	No Affiliation	628,032	12.3	245	31.8	3.91	3.45-4.23
Education	Other/unknown	613,073	12.0	46	6.0	0.76	0.57-1.02
	Compulsory	1,137,885	22.3	88	11.4	0.87	0.71-1.07
	Secondary	2,420,063	47.4	449	58.2	1.77	1.62-1.95
	Tertiary	977,528	19.2	221	28.7	2.13	1.87-2.43
Marital status	Unknown	566,792	11.1	13	1.7	0.43	0.25-0.75
	Single	1,715,805	33.6	176	22.8	1.25	1.08-1.45
	Married	2,831,208	55.5	383	49.7	1.31	1.19-1.45
	Widowed	99,092	1.9	29	3.76	3.83	2.66-5.51
Type of household	Divorced	456,163	9.0	183	23.74	3.85	3.33-4.45
	1 person	772,331	15.1	255	33.1	3.20	2.83-3.62
	≥ 2 persons	4,183,879	82.0	498	64.6	1.26	1.16-1.38
Children	Institutions	146,058	2.9	18	2.3	1.25	0.79-1.99
	No	2,226,028	43.6	318	41.2	1.57	1.41-1.75
	Yes	2,566,001	50.3	414	53.7	1.61	1.46-1.77
Urbanicity	Unknown	310,239	6.1	39	5.1	1.42	1.03-1.94
	Urban	1,445,955	28.3	265	34.4	1.88	1.66-2.12
	Peri-urban	2,321,284	45.5	370	48.0	1.68	1.51-1.86
Neighborhood index of SEP	Rural	1,335,029	26.2	136	17.6	1.08	0.91-1.28
	Lowest quartile	1,242,745	24.4	111	14.4	0.94	0.78-1.13
	Second quartile	1,220,105	23.9	156	20.2	1.34	1.14-1.56
	Third quartile	1,225,580	24.0	196	25.4	1.67	1.45-1.92
	Fourth quartile	1,222,208	23.9	284	36.8	2.45	2.18-2.75
Language Region	Unknown	191,630	3.8	24	3.1	1.27	0.85- 1.89
	German	3,666,753	71.87	548	71.1	1.56	1.44-1.70
	French	1,199,458	23.51	209	27.1	1.82	1.59-2.08
	Italian	219,002	4.29	14	1.8	0.67	0.40-1.13
Nationality	Rhaeto-Roman	17,055	0.33	-	-	-	-
	Swiss	3,928,264	77.0	699	90.7	1.89	1.75-2.03
	Foreigner	1,174,004	23.0	72	9.3	0.61	0.49-0.77

\*at entry in study

\*\* People who entered the study at their 25th birthday

**Table 1b Study population 65-94 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)		
		Number	%	Number	%	Estimate	95% CI	
All		2,139,152	100	3,170	100	20.40	19.70-21.12	
Gender	Male	959,044	44.8	1,336	42.2	19.97	18.93-21.07	
	Female	1,180,108	55.2	1,834	57.9	20.72	19.79-21.69	
Calendar years	2003/2004	1,227,529	57.4	282	8.9	12.24	10.89-13.76	
	2005/2006	161,701**	7.6	326	10.3	13.67	12.2-15.24	
	2007/2008	184,728**	8.6	357	11.3	14.30	12.89-15.86	
	2009/2010	187,522**	8.8	474	15.0	18.00	16.45-19.70	
	2011/2012	191,358**	8.9	692	21.8	24.85	23.06-26.77	
2013/2014	186,314**	8.7	1039	32.8	35.35	33.27-37.57		
	Religious affiliation	Protestant	908,928	42.5	1,521	48.0	22.83	21.71-24.00
		Catholic	897,292	41.9	609	19.2	9.18	8.48-9.94
		No Affiliation	191,779	9.0	844	26.6	64.78	60.55-69.30
Other/unknown		141,153	6.6	196	6.2	20.82	18.11-23.95	
Education	Compulsory	689,219	32.2	600	18.9	11.61	10.72- 12.58	
	Secondary	1,043,833	48.8	1,688	53.3	22.41	21.36-23.50	
	Tertiary	377,305	17.6	850	26.8	32.15	30.06-34.38	
	Unknown	28,795	1.4	32	1.0	16.24	11.49-22.97	
Marital status	Single	171,876	8.0	259	8.2	22.03	19.50-24.88	
	Married	1,274,969	59.6	1,301	41.0	14.20	13.45-14.99	
	Widowed	480,234	22.5	1,105	34.9	28.98	27.32-30.74	
	Divorced	212,073	9.9	505	15.9	36.26	33.24-39.57	
Type of household	1 person	518,958	24.3	1,211	38.2	31.29	29.58-33.11	
	≥ 2 persons	1,546,029	72.3	1,878	59.2	16.62	15.88-17.39	
	Institutions	74,165	3.4	81	2.6	21.86	17.58-27.17	
Children	No	339,093	15.9	713	22.5	30.75	28.57-33.09	
	Yes	1,698,737	79.4	2,316	73.1	18.49	17.75-19.26	
	Unknown	101,322	4.7	141	4.4	20.16	17.10-23.78	
Urbanicity	Urban	640,844	29.9	1,306	41.2	27.79	26.33-29.34	
	Peri-urban	955,312	44.7	1,472	46.4	21.25	20.20-22.37	
	Rural	542,996	25.4	392	12.4	10.00	9.06-11.05	
Neighborhood index of SEP	Lowest quartile	475,150	22.2	383	12.1	11.11	10.05-12.28	
	Second quartile	509,464	23.8	537	16.9	14.42	13.25-15.69	
	Third quartile	517,807	24.2	778	24.5	20.54	19.15-22.04	
	Fourth quartile	557,424	26.1	1,384	43.7	33.74	32.01-35.57	
	Unknown	79,307	3.7	88	2.8	18.23	14.80-22.47	
Language Region	German	1,524,965	71.3	2,288	72.2	20.68	19.85-21.54	
	French	497,621	23.3	814	25.7	22.57	21.07-24.17	
	Italian	108,006	5.0	64	2.0	7.92	6.20-10.12	
	Rhaeto-Roman	8,560	0.4	4	0.1	6.37	2.39-16.96	
Nationality	Swiss	1,881,034	87.9	2,961	93.4	21.57	20.80-22.36	
	Foreigner	258,118	12.1	209	6.6	11.53	10.07-13.21	

\*at entry in study

\*\* People who entered the study at their 25th birthday

## Diagnoses

In the younger age group more than half of the 771 people who died assisted had a cancer diagnosis and every fifth person was diagnosed with a disease of the nervous system, mainly multiple sclerosis (MS) or motor neuron diseases as ALS (Supplementary table 3). Mental and behavioural disorders accounted for 45 or 5.8% of all assisted suicides, more than half thereof were assigned to mood disorders. The percentage of people who died assisted among all deaths with the same potentially fatal underlying cause varied from 0.073 % for diseases of the circulatory system to 5.25 % for diseases of the nervous system (table 2). Looking at the diagnoses more detailed, the percentage of assisted death was highest among MS patients (11.1 %) and people suffering from Huntington diseases (9.90 %).

In the age group 65 to 94 years the percentage of assisted suicides with cancer was lower (39.3 %) (Supplementary table 3). Diseases of the nervous (11.8 %) and the circulatory system (12.0 %) accounted each for hardly one eighth of assisted deaths. 10.0 % of all assisted suicides were patients with diseases of the musculoskeletal system, 4.7 % with diseases of the respiratory system. Mental and behavioural diseases accounted for 4.2 percent of all assisted suicides, whereby mood disorders contributed most (2.9 %), followed by dementia (0.8 %) and other (0.5%). The percentage of assisted deaths among all deaths (table 2) with the same underlying disease was highest in diseases of the nervous system (1.2 %).

**Table 2 Percentage of assisted suicides among all deaths with the same, potentially fatal, underlying disease, by age group and time period**

	25-64 years		65-94 years	
	2003-2008	2009-2014	2003-2008	2009-2014
<b>Cancer</b>	<b>0.66 (0.56-0.77)</b>	<b>1.14 (1.00-1.29)</b>	<b>0.56 (0.51-0.62)</b>	<b>1.19 (1.11-1.27)</b>
<i>Digestive</i>	0.69 (0.50-0.92)	1.20 (0.94-1.50)	0.52 (0.42-0.63)	1.08 (0.95-1.22)
<i>Respiratory</i>	0.46 (0.31-0.67)	0.75 (0.54-1.02)	0.35 (0.25-0.47)	1.00 (0.84-1.18)
<i>Breast</i>	0.75 (0.46-1.14)	1.37 (0.94-1.92)	0.90 (0.66-1.20)	1.64 (1.32-2.00)
<i>Male genital</i>	1.14 (0.42-2.47)	1.68 (0.73-3.28)	0.78 (0.60-1.02)	1.40 (1.14-1.69)
<i>Other</i>	0.71 (0.54-0.91)	1.27 (1.02-1.56)	0.57 (0.47-0.67)	1.23 (1.09-1.37)
<b>Nervous system</b>	<b>3.80 (2.92-4.84)</b>	<b>6.68 (5.52-8.00)</b>	<b>0.73 (0.60-0.89)</b>	<b>1.66 (1.47-1.87)</b>
<i>Motor neuron disease</i>	5.82 (3.43-9.16)	7.26 (4.36-11.23)	4.01 (2.66-5.78)	6.87 (5.09-9.03)
<i>Parkinson</i>	2.38 (0.06-12.57)	6.67 (1.40-18.27)	0.97 (0.66-1.36)	1.96 (1.54-2.45)
<i>MS</i>	8.63 (5.86-12.16)	13.69 (10.09-18.00)	3.20 (1.72-5.41)	4.82 (3.05-7.21)
<i>Huntington</i>	2.04 (0.05-10.85)	17.3 (8.23-30.32)	-	5.88 (1.23-1.62)
<i>Paralytic syndromes</i>	2.80 (0.58-7.98)	7.69 (3.75-13.69)	2.56 (1.11-4.97)	3.67 (1.91-6.32)
<i>Alzheimer</i>	-	2.88(0.60-8.20)	0.07 (0.02-0.16)	0.25 (0.15-0.39)
<i>Other</i>	1.54 (0.77-2.73)	3.19 (20.5-4.71)	0.90 (0.55-1.39)	3.13 (2.53-3.84)
<b>Circulatory system</b>	<b>0.02 (0.00-0.07)</b>	<b>1.37 (0.07-0.24)</b>	<b>0.10 (0.08-1.18)</b>	<b>0.26 (0.23-0.29)</b>
<i>Cerebro-vascular</i>	0.14 (0.02-0.49)	0.59 (0.24-1.21)	0.50 (0.41-0.60)	0.53 (0.43-0.64)
<i>Other</i>	-	0.07 (0.02-0.15)	-	0.20 (0.17-0.23)
<b>Respiratory system</b>	<b>0.60 (0.29-1.09)</b>	<b>1.04 (0.60-1.68)</b>	<b>0.16 (0.11-0.22)</b>	<b>0.61 (0.50-0.72)</b>
<i>COPD</i>	1.08 (0.49-2.03)	1.25 (0.60-2.29)	0.32 (0.21-0.46)	0.93 (0.75-1.15)
<i>Other</i>	0.12 (0.00-0.66)	0.81 (0.30-1.76)	0.04 (0.01-0.09)	0.31 (0.21-0.43)
<b>All deaths*</b>	<b>0.63 (0.56-0.71)</b>	<b>1.08 (0.99-1.18)</b>	<b>0.35 (0.33-0.38)</b>	<b>0.79 (0.76-0.83)</b>

### *Multivariable Cox regression analysis*

The observed associations in the multivariable proportional hazard Cox models were very similar in the two time periods ([Figure 2](#) and [supplementary table 4](#)), but some differed by age group: In the younger age group men had a lower rate than women in both periods (HR of 0.78 in early and 0.77 in late period), but not in the older age group (HR 1.12 respectively 1.01). Having no affiliation to religion and being protestant were associated with a higher rate of assisted suicide than being catholic, with the effect being stronger in the older age group. Also the association between a higher education level and assisted suicide was stronger in the older age group, while in the younger age group only in the second period people with compulsory education had a 32% lower rate than people with secondary education. Concerning the marital status, in the younger age group the divorced had a 70% higher rate in the second period compared to married people. In the older age group widowed people had a 33 to 40% higher rate, the rate of the divorced was around twice as high as in married people. Living in a neighbourhood with a higher socioeconomic index was associated with a higher hazard of assisted suicide. People living in the French speaking area had a higher rate than people living in the German speaking area, although the effect was not statistically significant in younger people in the first time period. In the second time period younger (HR 0.35) and older people (HR 0.48) living in the Italian speaking part had a lower rate than people living in the German speaking part. Compared to Swiss citizens' foreigners living in Switzerland were less likely to die with a right-to-die organisation.

### *Multivariable logistic regression analysis*

We further analysed the odds of assisted suicides among all deaths with a multivariable logistic regression model ([supplementary table 5](#)). The associations were mostly the same as in the Cox proportional hazard model, with mainly one exception: In the logistic regression models men had not only a lower odds than women in the younger (OR of 0.52 in the early, of 0.54 in the late period), but also in the older age group (OR of 0.64 in the early, of 0.65 in the late period). To analyse differences in time trends between age groups 25 to 64 and 65 to 94 years, we additionally calculated a multivariable logistic regression overall. The model showed a significant interaction between age group and time period ( $\chi^2=10.4$ , 1 df,  $p=0.0013$ ) with a larger increase in the older than in the younger age group over time (OR of 2.25 compared to 1.72). Compared to people who died with cancer during study period, descendants with a disease of the nervous system on the death certificate were more likely to have died assisted (OR of 6.91 respectively 6.76 in the younger age group, 1.53 respectively 1.47 in the older age group). In the older age group the odds for *diseases of the circulatory system*, for *diseases of the respiratory system* and for *other diseases* were substantially lower. As *diseases of the musculoskeletal system* are in itself rarely fatal, the odds for dying assisted were high in all analyses. The associations between diagnoses and time periods were statistically significant in the likelihood ratio test for interactions ( $p=0.0018$  in the younger age group and  $p<0.001$  in the older age group) ([supplementary table 6](#)). In both age groups the odds of having no

1 diagnoses on the deaths certificate decreased clearly from the early to the late period (supplementary  
2 table 7). Furthermore, in the older age group the odds for people dying with diseases of the respiratory  
3 or the musculoskeletal system increased (supplementary table 7).  
4  
5

## 6 **Discussion**

7  
8 Crude rates of assisted suicide in Switzerland more than tripled from 2003 to 2014 and assisted suicides  
9 accounted for 1.3% of all deaths in 2014. The increase was stronger in the age group 65 to 94 than in  
10 those younger than 65, but has been shown independently of socioeconomic factors as gender and  
11 characteristics of the individual and the household. In consequence, factors associated with assisted  
12 suicide from 2003 to 2008 were also associated with assisted suicide from 2009 to 2014: Female gender,  
13 higher education, having no religious affiliation, no children and a Swiss passport, living in a  
14 neighbourhood with a higher area-based socio-economic index and in the French speaking part of  
15 Switzerland were associated with a higher rate of assisted suicides. In the younger age group people living  
16 alone were more likely to die assisted, in the older age group the widowed and the divorced. Cancer,  
17 diseases of the nervous system and – in the older age group – of the circulatory and the respiratory  
18 system were the most common diagnoses on death certificates of people who died assisted. There was a  
19 shift in the diagnoses between time periods with less death certificates with no first underlying diseases  
20 in the second period, while in the older age group diseases of the respiratory and the musculoskeletal  
21 system increased. Percentages of assisted suicides among all deaths were highest in diseases of the  
22 nervous system.  
23  
24  
25  
26  
27  
28  
29  
30  
31

32  
33 The strong increase in incidence of assisted suicide in Switzerland is based on a broad acceptance in the  
34 Swiss population, also confirmed by votes and surveys [30-32]. The increase is also in line with the  
35 development in other European countries with a long-term experience in assisted dying [13-17]. In  
36 Belgium the number of reported cases increased more than sevenfold since 2003. In 2013 more than  
37 1'800 people died by euthanasia, corresponding to 1.7 % of all deaths [14]. As in our study the increase  
38 was among both sexes and all age groups, and the proportion of older patients extended. In the  
39 Netherlands the number of reported assisted deaths, largely euthanasia, reached 5,500 in 2015 [15],  
40 three times higher than in 2003 and corresponding to almost four percent of all deaths. In the US states  
41 with long-term experience the numbers of assisted suicides also increase [16 17 19], but the numbers are  
42 with roughly 130 in Oregon (2016) and 200 in Washington (2015) significantly lower than in Europe.  
43  
44  
45  
46  
47  
48

49 The consistency of the socio-economic factors associated with assisted suicide over the study period does  
50 not support the slippery slope hypothesis: assisted suicides of less educated people and people living in  
51 neighbourhoods with a lower socioeconomic position did not increase disproportional. However, other  
52 factors persistently associated with assisted suicide as female gender, having no children and living alone,  
53 being widowed or divorced may reflect a social vulnerability. Of note, people who are single and have no  
54  
55  
56  
57  
58  
59

1 children were less likely to get their request for euthanasia granted in a study in a Dutch End-of-Life Clinic  
2 [33].  
3  
4

#### 5 *Strengths and limitations*

6

7 The study is based on data on individual, household and building level from the census 2000 with a  
8 virtually complete coverage. Selection or response biases are therefore unlikely. To our knowledge, this is  
9 the first study looking at time trends over more than 10 years in the associations of assisted dying and  
10 detailed socio-economic characteristics. Information given in obtained at the census 2000 is not  
11 completely up to date in 2014 for all individuals. In particular type of household, but also urbanity, the  
12 socioeconomic neighbourhood-index, language region, the existence of children, self-declared religion  
13 and nationality might have changed within these the maximal 14 years of follow-up, whereby  
14 misclassification changes over time are is more likely in the younger than in the older age group. We were  
15 able to account for the fact that marital status might change, and more accurately analyse the association  
16 of widowhood or divorce with assisted suicide. We do not have any individual data for the economic well-  
17 being. However, education is not only an important dimension of the socioeconomic position itself, it also  
18 precedes and influences others dimensions as occupational status and personal income[34]. In addition  
19 we have an indicator for the socio-economic standing of the closest neighbourhood of each individual  
20 [29].  
21  
22  
23  
24  
25  
26  
27  
28

29 An increasing number of countries and US-states [2] have legalized assisted suicide in the past years or  
30 are in the respective process. Switzerland is one of the few countries with long-term experience which  
31 allows studying time trends and the possible change of predictors. The Federal statistical office makes a  
32 great effort to identify assisted suicides in the mortality statistics, in cooperation with right-to-die  
33 organisations, the institutes of Forensic Medicine and the physicians. In suspected cases, the Federal  
34 statistical office consults the responsible physician. Therefore the risk to classify deaths wrongly as  
35 assisted is small. However, as there is no obligation to report the assisted suicides to a central registry,  
36 identification of assisted deaths is likely not complete. In particular suicides assisted without the  
37 involvement of one of the three main organisations may be missed. In recent years smaller right-to-die-  
38 organisations got active, LifeCircle in the region of Basel and LLExit in the Italian speaking part of  
39 Switzerland. It is possible that differences in the process and reporting may increase the proportion of  
40 assisted suicides that are not identified by the FSO and therefore at least partly explain the lower increase  
41 of assisted suicides in the Italian speaking region of Switzerland. A Belgian study showed that differences  
42 found in end-of-life-practices between the language regions Flanders and Wallonia were not only caused  
43 by differences in acceptance, but also by differences in the process and the reporting compliance [35]. It  
44 is also possible that physicians not associated with right-to-die-organisations do assist in suicides and do  
45 not report these cases appropriately. Even though this is concerned as a marginal problem compared to  
46 the numbers of suicides assisted by right-to-die-organisations in Switzerland, there are no numbers  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 because of the lack of an obligatory register. In a survey in 2006, 103 out of 1,650 doctors had ever  
2 assisted a suicide without involvement of a right-to-die association. [36]  
3  
4

5 Another limitation of our study is the fact that death certificates were the only source for information  
6 about the underlying disease. We did not have any information on the stage of the disease, the treatment  
7 and the alternative options, when the patient decided to die assisted. Also the comparability of the  
8 percentage of assisted deaths among all deaths between diseases is limited: In not or rarely fatal diseases  
9 as mental disorders or diseases of the musculoskeletal system the denominator does not reflect the  
10 number of people concerned and percentages of assisted deaths can therefore not be compared to fatal  
11 diseases. Another issue is the reliability of the death certificates. While studies report a high reliability for  
12 major groups such as cancer and for well-defined rare conditions such as ALS [37 38], the reliability is low  
13 for chronic conditions such as diabetes and renal insufficiency [37]. In Switzerland assisted suicides are  
14 treated as unnatural deaths and investigated by a forensic team, which relies on documents of the right-  
15 to-die organisations [39]. This might lead to a more accurate diagnosis on the death certificate than for  
16 natural deaths.  
17  
18  
19  
20  
21  
22  
23

24 The shift in diagnoses observed in our study may at least partially be explained by the change in the  
25 coding system of the Federal Statistical Office (FSO). The fact that assisted suicide was not “primary cause  
26 of death” from 2009 onwards may have increased the coding of underlying diseases. However, further  
27 studies are needed to monitor the development of diagnoses associated with assisted suicide. These  
28 studies should ideally not only base on death certificates to include also stage and severity of a disease as  
29 well as treatment undergone.  
30  
31  
32  
33

34 In summary, our study results show that the increase in assisted suicides in Switzerland was more  
35 pronounced in the older age group, but not associated with changing association with socio-economic  
36 and other factors. However, in context of assisted suicide vulnerability may not be limited factors such as  
37 socioeconomic status, living alone, being widowed or divorced. Serious illness, possibly accompanied by  
38 heavy pain, without perspective for improvement, but also old age may make any individual vulnerable. A  
39 register-based, sensitive monitoring of characteristics of assisted deaths and diagnoses involved should be  
40 implemented to identify trends and possible gaps in the health management of specific groups by the  
41 right-to-die organisations.  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 **Funding:** This work was supported by the Swiss National Science Foundation (grant numbers:  
2 325130\_160171 and 33CS30\_148415).  
3  
4

5 **Conflict of interest:** We have read and understood BMJ policy on declaration of interests and declare  
6 that we have no competing interests.  
7

8 **Ethical approval:** Approval for the Swiss National Cohort study was obtained from the Ethics  
9 Committees of the Cantons of Zurich and Bern and a data centre was established at ISPM Bern. For this  
10 type of study formal consent is not required.  
11  
12

13 **Author's contribution:** Nicole Steck, Christoph Junker and Marcel Zwahlen developed the study design.  
14 Christoph Junker did the identification of the assisted suicides and the data preparation. Nicole Steck  
15 conducted the data processing, the analyses and wrote the first draft of the paper. Marcel Zwahlen  
16 supervised the statistical analyses. All authors critically revised the first draft and approved the final  
17 manuscript submitted for publication.  
18  
19  
20  
21

22 **Data sharing statement:** Individual data from different data sets were used for the construction of the  
23 SNC. All these data are the property of the Swiss Federal Statistical Office (SFSO) and can only be made  
24 available by legal agreements with the SFSO. This also applies to derivatives such as the analysis files used  
25 for this study. However, after approval of the SNC Scientific Board, a specific SNC module contract with  
26 SFSO would allow researchers to receive analysis files for replication of the analysis. Data requests should  
27 be sent to Prof. Milo Puhan (chairman of the SNC Scientific Board, miloalan.puhan@uzh.ch).  
28  
29  
30  
31

32 **Acknowledgements:** We thank the Swiss Federal Statistical Office for providing mortality and census  
33 data and for the support which made the Swiss National Cohort and this study possible. The members of  
34 the Swiss National Cohort Study Group are Matthias Egger (Chairman of the Executive Board), Adrian  
35 Spoerri and Marcel Zwahlen (all Bern), Milo Puhan (Chairman of the Scientific Board), Matthias Bopp  
36 (both Zurich), Nino Kunzli (Basel), Fred Paccaud (Lausanne) and Michel Oris (Geneva).  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## References

1. Steck N, Egger M, Maessen M, et al. Euthanasia and Assisted Suicide in Selected European Countries and US States: Systematic Literature Review. *Med Care* 2013;**51**(10):938-44 doi: 10.1097/MLR.0b013e3182a0f427[published Online First: Epub Date]].
2. Emanuel EJ, Onwuteaka-Philipsen BD, Urwin JW, et al. Attitudes and Practices of Euthanasia and Physician-Assisted Suicide in the United States, Canada, and Europe. *JAMA* 2016;**316**(1):79-90 doi: 10.1001/jama.2016.8499[published Online First: Epub Date]].
3. Burkhardt S, La HR. Debates About Assisted Suicide in Switzerland. *Am J Forensic Med Pathol.* 2012
4. Bosshard G, Fischer S, Bar W. Open regulation and practice in assisted dying. *Swiss Med Wkly.* 2002;**132**(37-38):527-34
5. Schweizerisches Strafgesetzbuch, 1937.
6. Judgements 2A.48/2006 and 2A.66/2006, 2006.
7. Steck N, Junker C, Maessen M, et al. Suicide assisted by right-to-die associations: a population based cohort study. *International journal of epidemiology* 2014;**43**(2):614-22 doi: 10.1093/ije/dyu010[published Online First: Epub Date]].
8. Bosshard G, Zellweger U, Bopp M, et al. Medical End-of-Life Practices in Switzerland: A Comparison of 2001 and 2013. *JAMA internal medicine* 2016;**176**(4):555-6 doi: 10.1001/jamainternmed.2015.7676[published Online First: Epub Date]].
9. FSO. Assistierter Suizid (Sterbehilfe) und Suizid in der Schweiz. BFS Aktuell: Federal Statistical Office, 2016:1-4.
10. Exit. Annual reports. Secondary Annual reports. Available at: <https://www.exit.ch/news/jahresberichte/jahresbericht-2016/> (accessed 23.01.2018).
11. Dignitas. Annual reports. Secondary Annual reports. Available at: [http://www.dignitas.ch/index.php?option=com\\_content&view=article&id=24&Itemid=64&lang=de](http://www.dignitas.ch/index.php?option=com_content&view=article&id=24&Itemid=64&lang=de) (accessed 23.01.2018).
12. Exit ADMD. Annual reports. Secondary Annual reports. Available at: <http://www.exit-geneve.ch/journalistes.html> (accessed 23.01.2018).
13. Dyer O, White C, Garcia Rada A. Assisted dying: law and practice around the world. *BMJ* 2015;**351**:h4481 doi: 10.1136/bmj.h4481[published Online First: Epub Date]].
14. Dierickx S, Deliens L, Cohen J, et al. Euthanasia in Belgium: trends in reported cases between 2003 and 2013. *CMAJ* 2016;**188**(16):E407-E14 doi: 10.1503/cmaj.160202[published Online First: Epub Date]].
15. Regional euthanasia review c. JAARVERSLAG 2015, 2016.
16. Authority OH. Oregon Death with Dignity Act: Data summary 2016. In: 8579 O, ed., 2017:12.
17. Washington State Department of H. Death with Dignity Act Report 2015. 2016
18. Chambaere K, Bilsen J, Cohen J, et al. Trends in medical end-of-life decision making in Flanders, Belgium 1998-2001-2007. *Med Decis Making* 2011;**31**(3):500-10
19. Hedberg K, New C. Oregon's Death With Dignity Act: 20 Years of Experience to Inform the Debate. *Annals of internal medicine* 2017;**167**(8):579-83 doi: 10.7326/m17-2300[published Online First: Epub Date]].
20. van der Heide A, van Delden JJM, Onwuteaka-Philipsen BD. End-of-Life Decisions in the Netherlands over 25 Years. *The New England journal of medicine* 2017;**377**(5):492-94 doi: 10.1056/NEJMc1705630[published Online First: Epub Date]].
21. Lerner BH, Caplan AL. Euthanasia in Belgium and the Netherlands: On a Slippery Slope? *JAMA internal medicine* 2015 doi: 10.1001/jamainternmed.2015.4086[published Online First: Epub Date]].
22. Lewis P. The empirical slippery slope from voluntary to non-voluntary euthanasia. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics* 2007;**35**(1):197-210 doi: 10.1111/j.1748-720X.2007.00124.x[published Online First: Epub Date]].
23. Calabro RS, Naro A, De Luca R, et al. The Right to Die in Chronic Disorders of Consciousness: Can We Avoid the Slippery Slope Argument? *Innovations in clinical neuroscience* 2016;**13**(11-12):12-24

- 1 24. Bopp M, Spoerri A, Zwahlen M, et al. Cohort Profile: the Swiss National Cohort--a longitudinal study of  
2 6.8 million people. *Int.J.Epidemiol.* 2009;**38**(2):379-84
- 3 25. Spoerri A, Zwahlen M, Egger M, et al. The Swiss National Cohort: a unique database for national and  
4 international researchers. *Int.J Public Health* 2010;**55**(4):239-42
- 5 26. Renaud A. Methodology Report - Coverage Estimation for the Swiss Population Census 2000: Swiss  
6 Federal Statistical Office, 2004.
- 7 27. Andorno R. Nonphysician-assisted suicide in Switzerland. *Camb.Q.Healthc.Ethics* 2013;**22**(3):246-53
- 8 28. WHO. International Statistical Classification of Diseases and Related Health Problems: Instruction  
9 manual, 2010:1-201.
- 10 29. Panczak R, Galobardes B, Voorpostel M, et al. A Swiss neighbourhood index of socioeconomic  
11 position: development and association with mortality. *J.Epidemiol.Community Health* 2012
- 12 30. Zürich K. Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der Suizidhilfe!".  
13 Secondary Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der  
14 Suizidhilfe!" 2011. Available at: [http://www.wahlen-  
15 abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
16 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 17 31. Zürich K. Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" Secondary  
18 Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" 2011. Available at:  
19 [http://www.wahlen-  
20 abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
21 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 22 32. Vaud K. Assistance au suicide. Secondary Assistance au suicide 2012. Available at:  
23 [http://www.elections.vd.ch/votelec/  
24 results.html?scrutin=VDVO20120617](http://www.elections.vd.ch/votelec/results.html?scrutin=VDVO20120617) (accessed 22.03.2017).
- 25 33. Snijde wind MC, Willems DL, Deliens L, et al. A Study of the First Year of the End-of-Life Clinic for  
26 Physician-Assisted Dying in the Netherlands. *JAMA internal medicine* 2015;**175**(10):1633-40 doi:  
27 10.1001/jamainternmed.2015.3978[published Online First: Epub Date]].
- 28 34. Mirowsky J. RC. *Education, Social Status, and Health*. Hawthorne, NY: Aldine de Gruyter, 2003.
- 29 35. Cohen J, Van WY, Smets T, et al. Cultural differences affecting euthanasia practice in Belgium: one law  
30 but different attitudes and practices in Flanders and Wallonia. *Soc.Sci.Med.* 2012;**75**(5):845-53
- 31 36. Burkhardt S, Wyss K, La HR. [Assisted suicide in Switzerland: physicians' position]. *Revue Medicale*  
32 *Suisse* 2007;**3**(137):2861-64
- 33 37. Harteloh P, de BK, Kardaun J. The reliability of cause-of-death coding in The Netherlands.  
34 *Eur.J.Epidemiol.* 2010;**25**(8):531-38
- 35 38. Chio A, Magnani C, Oddenino E, et al. Accuracy of death certificate diagnosis of amyotrophic lateral  
36 sclerosis. *J.Epidemiol.Community Health* 1992;**46**(5):517-18
- 37 39. Bartsch C. Praxis und Probleme des assistierten Suizids in der Schweiz aus rechtsmedizinischer Sicht.  
38 In: Welsch CO, Ch; Frewer, A; Bielefeld H, ed. *Autonomie und Menschenrechte am Lebensende*.  
39 Boston: Transcript Verlag, 2016:203-20.
- 40
- 41
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

1  
2 Figure legends:  
3

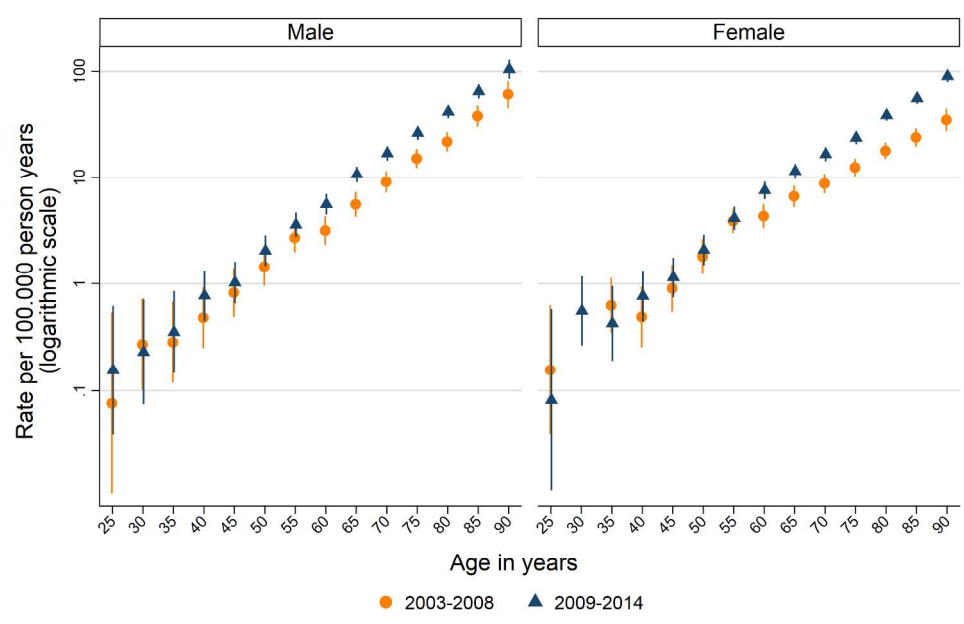
4 **Figure 1 Crude rate of assisted suicide by age and time period (2003-2008 and 2009-2014) for men and**  
5 **women**  
6

7  
8 **Figure 2 Results of multivariable Cox regression, by age group and time period (2003-2008 and 2009-**  
9 **2014)**  
10

11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

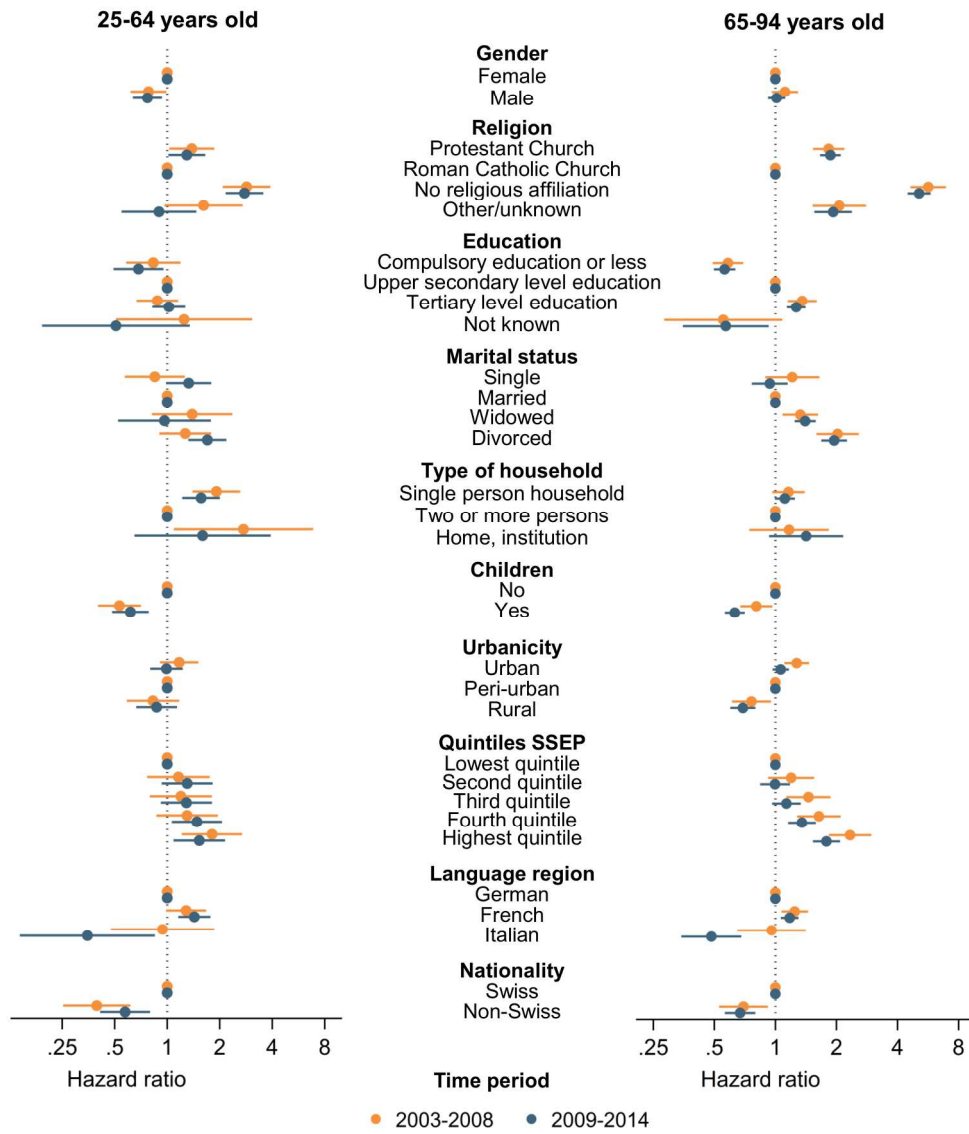
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



254x169mm (300 x 300 DPI)

view only

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



189x217mm (300 x 300 DPI)

**Supplementary table 1 Number of assisted suicides of Swiss residents in the annual reports of the right-to-die organisations Exit Deutschschweiz (Exit\_DS), Exit Suisse Romande (Exit\_SR) and Dignitas and number of assisted suicides identified in the SNC by year**

Year	Annual Reports of Right-to-Die Organisations				Identified in SNC	%
	Exit_DS	Exit_SR	Dignitas	Total		
<b>2003</b>	131	48	9	<b>188</b>	180	95.7
<b>2004</b>	154	42	14	<b>210</b>	198	94.3
<b>2005</b>	162	54	12	<b>228</b>	209	91.7
<b>2006</b>	150	65	15	<b>230</b>	218	94.8
<b>2007</b>	179	66	6	<b>251</b>	231	92.0
<b>2008</b>	167	75	10	<b>252</b>	239	94.8
<b>2009</b>	217	69	4	<b>290</b>	278	95.9
<b>2010</b>	257	91	6	<b>354</b>	330	93.2
<b>2011</b>	305	111	11	<b>427</b>	386	90.4
<b>2012</b>	356	144	13	<b>513</b>	446	86.9
<b>2013</b>	459	155	8	<b>622</b>	538	86.5
<b>2014</b>	583	175	6	<b>764</b>	688	90.1
<b>Total</b>	<b>3120</b>	<b>1095</b>	<b>114</b>	<b>4329</b>	<b>3941</b>	91.0

Supplementary table 2 Categories of underlying diseases and corresponding ICD-10 codes

Category	ICD-10 codes
<b>All cancer</b>	C00-C97
<i>Colon and other digestive organs</i>	C15-C26
<i>Lung and other respiratory organs</i>	C30-C39
<i>Breast</i>	C50
<i>Prostate and other male genital</i>	C60-C63
<i>Others</i>	C00-C14, C40-C49, C51-C58, C64-C97
<b>Mental and behavioural disorders</b>	F00-F99
<i>Dementia</i>	F00-F03
<i>Mood disorders</i>	F30-F39
<i>Other mental and behav. disorders</i>	F04-F29, F40-F99
<b>Diseases of the nervous system</b>	G00-G99
<i>Huntington disease</i>	G10
<i>Motor neuron disease (incl. ALS)</i>	G12.2
<i>Parkinson's disease</i>	G20
<i>Alzheimer</i>	G30
<i>Multiple sclerosis</i>	G35
<i>Paralytic syndromes</i>	G80-G83
<i>Other diseases of the nervous system</i>	G00-G09, G11-G12.1, G12.8-G14, G21-G26, G31-G32, G36-G73, G90-G99
<b>Diseases of the circulatory system</b>	I00-I99
<i>Ischaemic heart diseases</i>	I20-I25
<i>Heart failure</i>	I50
<i>Cerebrovascular disease</i>	I60-I69
<i>Other diseases of the circulatory system</i>	I00-I15, I26-I49, I51-I52, I70-I99
<b>Diseases of the respiratory system</b>	J00-J99
<i>Chronic obstructive pulmonary disease (COPD)</i>	J44
<i>Other diseases of the respiratory system</i>	J00-J43, J45-J99
<b>Diseases of the musculoskeletal system</b>	M00-M99
<i>Arthropathies</i>	M00-M25
<i>Dorsopathies</i>	M40-M54
<i>Osteoporosis</i>	M80-M82
<i>Other diseases of the musculoskeletal system</i>	M30-M36, M60-M79, M83-M99
<b>Other diseases</b>	A00-B99, D00-D89, E00-E90, H00-H95, K00-K93, L00-L99, N00-N99, O00-O99, P00-P96, Q00-Q99, R00-R68, R70-R98
<b>No/Unknown cause of death</b>	R69, R99

**Supplementary table 3 Underlying diagnoses: Number and percentage of assisted suicides, per age group and time period**

Diagnosis	25-64 years old						65-94 years old					
	2003-2008		2009-2014		Total		2003-2008		2009-2014		Total	
	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%
<b>Cancer</b>	<b>159</b>	<b>51.3</b>	<b>243</b>	<b>52.7</b>	<b>402</b>	<b>52.1</b>	<b>385</b>	<b>39.9</b>	<b>862</b>	<b>39.1</b>	<b>1,247</b>	<b>39.3</b>
<i>Colon and other digestive organs</i>	44	14.2	73	15.9	117	15.1	104	10.8	236	10.7	340	10.7
<i>Lung and other respiratory organs</i>	28	9.0	40	8.7	68	8.9	43	4.5	135	6.1	178	5.6
<i>Breast</i>	21	6.8	32	6.9	53	6.9	47	4.9	90	4.1	137	4.3
<i>Prostate and other male genital</i>	6	1.9	8	1.7	14	1.8	57	5.9	102	4.6	159	5.0
<i>Others</i>	60	19.4	90	19.5	150	19.4	134	13.9	299	13.6	433	13.7
<b>Mental and behavioural</b>	<b>14</b>	<b>4.5</b>	<b>31</b>	<b>6.7</b>	<b>45</b>	<b>5.8</b>	<b>36</b>	<b>3.7</b>	<b>98</b>	<b>4.4</b>	<b>134</b>	<b>4.2</b>
<i>Mood disorders</i>	11	3.5	12	2.6	23	2.9	28	2.9	64	2.9	92	2.9
<i>Dementia</i>	0		2	0.4	2	0.2	5	0.5	22	1.0	27	0.8
<i>Other</i>	3	1.0	17	3.7	20	2.6	3	0.3	12	0.5	15	0.5
<b>Nervous system</b>	<b>62</b>	<b>20.0</b>	<b>110</b>	<b>23.9</b>	<b>172</b>	<b>22.3</b>	<b>105</b>	<b>10.9</b>	<b>268</b>	<b>12.2</b>	<b>373</b>	<b>11.8</b>
<i>Motor neuron disease</i>	17	5.5	18	3.9	35	4.5	27	2.8	47	2.1	74	2.3
<i>Parkinson's</i>	1	0.3	3	0.7	4	0.5	32	3.3	74	3.4	106	3.3
<i>Multiple sclerosis</i>	29	9.4	43	9.3	72	9.4	13	1.4	22	1.0	35	1.1
<i>Huntington</i>	1	0.3	9	1.9	10	1.3	0	0	3	0.1	3	0.1
<i>Paralytic syndromes</i>	3	1.0	10	2.2	13	1.7	8	0.8	12	0.6	20	0.6
<i>Alzheimer</i>	0	0	3	0.7	3	0.4	5	0.5	20	0.9	25	0.8
<i>Other</i>	11	3.5	24	5.2	35	4.5	20	2.1	90	4.1	110	3.5
<b>Circulatory system</b>	<b>2</b>	<b>0.7</b>	<b>12</b>	<b>2.6</b>	<b>14</b>	<b>1.8</b>	<b>112</b>	<b>11.6</b>	<b>268</b>	<b>12.2</b>	<b>380</b>	<b>12.0</b>
<i>Ischaemic</i>	0	0	1	0.2	1	0.1	2	0.2	61	2.8	63	2.0
<i>Heart failure</i>							1	0.1	26	1.2	27	0.8
<i>Cerebrovascular</i>	2	0.7	7	1.5	9	1.2	109	11.3	99	4.5	208	6.6
<i>Other</i>	-		4	0.8	4	0.5	0	0	82	3.7	219	2.6
<b>Respiratory system</b>	<b>10</b>	<b>3.2</b>	<b>16</b>	<b>3.5</b>	<b>26</b>	<b>3.4</b>	<b>31</b>	<b>3.2</b>	<b>118</b>	<b>5.4</b>	<b>149</b>	<b>4.7</b>
<i>COPD</i>	9	2.9	10	2.2	19	2.5	27	2.8	87	4.0	114	3.6
<i>Other</i>	1	0.3	6	1.3	7	0.9	4	0.4	31	1.4	35	1.1
<b>Musculoskeletal</b>	<b>6</b>	<b>1.9</b>	<b>13</b>	<b>2.8</b>	<b>19</b>	<b>2.5</b>	<b>62</b>	<b>6.4</b>	<b>255</b>	<b>11.6</b>	<b>317</b>	<b>10.0</b>
<i>Arthropathies</i>	2	0.6	-	-	2	0.3	16	1.7	88	4.0	104	3.3
<i>Dorsopathies</i>	1	0.3	6	1.3	7	0.9	23	2.3	90	4.1	113	3.5
<i>Osteoporosis</i>	-	-	1	0.2	1	0.1	17	1.8	46	2.1	63	2.0
<i>Other</i>	3	1.0	6	1.3	9	1.2	6	0.6	31	1.4	37	1.2
<b>Other</b>	<b>32</b>	<b>10.3</b>	<b>24</b>	<b>5.2</b>	<b>56</b>	<b>7.3</b>	<b>83</b>	<b>8.6</b>	<b>239</b>	<b>10.8</b>	<b>322</b>	<b>10.2</b>
<b>No condition listed</b>	<b>25</b>	<b>8.1</b>	<b>12</b>	<b>2.6</b>	<b>37</b>	<b>4.8</b>	<b>151</b>	<b>15.7</b>	<b>97</b>	<b>4.4</b>	<b>248</b>	<b>7.8</b>
<b>Total</b>	<b>310</b>		<b>461</b>		<b>771</b>		<b>965</b>		<b>2,205</b>		<b>3,170</b>	



Supplementary table 4 Results of the Cox regression models by age group and time period

Characteristics	Age group 25-64 years				Age group 65-94 years				
	2003-2008		2009-2014		2003-2008		2009-2014		
	HR	95%CI	HR	95%CI	HR	95% CI	HR	95% CI	
Gender	Male	0.78	0.62-0.99	0.77	0.64-0.93	1.12	0.96-1.29	1.01	0.92-1.12
	<b>Female</b>	1		1		1		1	
	Wald test, 1df	$\chi^2=4.20, p=0.04$		$\chi^2=7.08, p=0.008$		$\chi^2=2.10, p=0.15$		$\chi^2=0.08, p=0.7751$	
Religious affiliation	Protestant	1.38	1.03-1.86	1.30	1.02-1.65	1.83	1.54-2.49	1.87	1.66-2.10
	<b>Catholic</b>	1		1		1		1	
	No Affiliation	2.86	2.08-3.90	2.77	2.16-3.56	5.68	4.64-6.94	5.12	4.49-5.83
	Other/unknown	1.61	0.96-2.71	0.90	0.55-1.47	2.07	1.53-2.80	1.93	1.56-2.39
	Wald test, 3 df	$\chi^2=46.44, p<0.001$		$\chi^2=77.60, p<0.001$		$\chi^2=314.58, p<0.001$		$\chi^2=645.78, p<0.001$	
Education	Compulsory	0.83	0.58-1.19	0.68	0.49-0.95	0.58	0.49-0.69	0.56	0.50-0.64
	<b>Secondary</b>	1		1		1		1	
	Tertiary	0.88	0.67-1.16	1.02	0.82-1.27	1.36	1.15-1.60	1.27	1.14-1.41
	Unknown	1.25	0.51-3.07	0.51	0.19-1.35	0.55	0.28-1.08	0.57	0.35-0.93
	Wald test, 3 df	$\chi^2=2.03, p=0.57$		$\chi^2=6.70, p=0.08$		$\chi^2=64.07, p<0.001$		$\chi^2=126.96, p<0.001$	
Marital status	Single	0.85	0.57-1.26	1.33	0.99-1.79	1.21	0.89-1.65	0.94	0.77-1.15
	<b>Married</b>	1		1		1		1	
	Widowed	1.39	0.82-2.36	0.96	0.52-1.79	1.33	1.09-1.62	1.40	1.24-1.58
	Divorced	1.27	0.90-1.79	1.70	1.32-2.19	2.03	1.59-2.58	1.95	1.69-2.26
	Wald test, 3 df	$\chi^2=5.48, p=0.14$		$\chi^2=17.71, p<0.001$		$\chi^2=34.57, p<0.001$		$\chi^2=105.03, p<0.001$	
Type of household	1 person	1.91	1.40-2.62	1.56	1.22-2.00	1.16	0.97-1.40	1.11	0.99-1.24
	<b>≥ 2 persons</b>	1		1		1		1	
	Institutions	2.74	1.09-6.86	1.59	0.65-3.92	1.17	0.74-1.84	1.42	0.93-2.16
	Wald test, 2 df	$\chi^2=18.20, p<0.001$		$\chi^2=12.74, p=0.002$		$\chi^2=2.57, p=0.28$		$\chi^2=5.33, p=0.07$	
Children	<b>No</b>	1		1		1		1	
	Yes	0.53	0.40-0.71	0.61	0.48-0.78	0.81	0.67-0.97	0.63	0.56-0.71
	Unknown	0.84	0.46-1.53	1.09	0.66-1.79	0.64	0.45-0.91	0.70	0.55-0.89
	Wald test, 1 df	$\chi^2=18.94, p<0.001$		$\chi^2=15.51, p<0.001$		$\chi^2=5.45, p=0.02$		$\chi^2=63.09, p<0.001$	
Urbanicity	Urban	1.17	0.90-1.51	0.99	0.80-1.23	1.28	1.11-1.47	1.06	0.97-1.17
	<b>Peri-urban</b>	1		1		1		1	
	Rural	0.8	0.59-1.17	0.87	0.66-1.14	0.76	0.61-0.95	0.69	0.60-0.80
	Wald test, 2 df	$\chi^2=18.94, p<0.001$		$\chi^2=1.10, p=0.58$		$\chi^2=25.72, p<0.001$		$\chi^2=34.26, p<0.001$	
Neighbourhood index of SEP	<b>Lowest quintile</b>	1		1		1		1	
	Second quintile	1.16	0.77-1.75	1.30	0.93-1.82	1.20	0.92-1.55	1.00	0.84-1.18
	Third quintile	1.20	0.79-1.80	1.29	0.92-1.81	1.46	1.13-1.87	1.12	0.96-1.34
	Fourth quintile	1.30	0.87-1.95	1.48	1.06-2.06	1.64	1.28-2.10	1.35	1.16-1.58
	Highest quintile	1.81	1.21-2.69	1.53	1.09-2.15	2.34	1.83-2.98	1.79	1.53-2.08
	Wald test, 4 df	$\chi^2=18.94, p<0.001$		$\chi^2=6.95, p=0.14$		$\chi^2=65.39, p<0.001$		$\chi^2=97.24, p<0.001$	
Language Region	<b>German</b>	1		1		1		1	
	French	1.28	0.99-1.67	1.43	1.16-1.77	1.25	1.07-1.45	1.18	1.06-1.30
	Italian	0.94	0.47-1.86	0.35	0.14-0.85	0.96	0.65-1.41	0.48	0.34-0.68
	Wald test, 2 df	$\chi^2=3.61, p=0.16$		$\chi^2=17.72, p<0.001$		$\chi^2=8.46, p=0.01$		$\chi^2=30.58, p<0.001$	
Nationality	<b>Swiss</b>	1		1		1		1	
	Foreigner	0.39	0.25-0.62	0.57	0.41-0.80	0.70	0.53-0.92	0.67	0.56-0.80
	Wald test, 1 df	$\chi^2=16.81, p<0.001$		$\chi^2=10.93, p<0.001$		$\chi^2=6.58, p=0.01$		$\chi^2=20.54, p<0.001$	

Supplementary table 5 Results of the logistic regression models by age group and time period

Characteristics	Age group 25-64 years				Age group 65-94 years				
	2003-2008		2009-2014		2003-2008		2009-2014		
	OR	95%CI	OR	95%CI	OR	95% CI	OR	95% CI	
Gender	Male	0.52	0.41-0.66	0.54	0.44-0.65	0.64	0.55-0.75	0.65	0.59-0.72
	<b>Female</b>	1		1		1		1	
	Wald test, 1 df	$\chi^2=28.80, p<0.01$		$\chi^2=37.92, p<0.01$		$\chi^2=33.65, p<0.01$		$\chi^2=69.95, p<0.01$	
Age at death	<b>25-34</b>	1		1				1	
	35-44	1.36	0.59-3.12	0.66	0.33-1.332				
	45-54	1.25	0.56-2.78	0.55	0.29-1.07				
	55-64	1.33	0.60-2.94	0.67	0.35-1.28				
	<b>65-74</b>					1		1	
	75-84					0.94	0.80-1.10	0.92	0.82-1.03
	85-94					0.77	0.64-0.94	0.73	0.64-0.83
	Wald test	3df: $\chi^2=0.72, p=0.87$		$\chi^2=4.74, p=0.19$		2df: $\chi^2=7.74, p=0.02$		$\chi^2=27.07, p<0.01$	
Underlying disease	<b>Cancer</b>	1		1		1		1	
	Mental	1.38	0.78-2.44	2.19	1.45-3.30	0.61	0.43-0.87	0.42	0.34-0.53
	Nervous system	6.91	5.06-9.42	6.76	5.29-8.65	1.53	1.23-1.92	1.47	1.27-1.60
	Circulatory	0.04	0.01-0.14	0.13	0.07-0.25	0.21	0.17-0.27	0.26	0.22-0.30
	Respiratory	1.08	0.57-2.06	1.06	0.63-1.77	0.35	0.24-0.51	0.57	0.47-0.70
	Musculoskeletal	3.81	1.64-8.84	4.63	2.51-8.52	4.92	3.70-6.54	9.45	8.08-11.06
	Other diseases	0.79	0.53-1.18	0.44	0.29-0.68	0.52	0.41-0.66	0.68	0.58-0.78
	No disease	1.57	1.01-2.43	0.45	0.25-0.81	4.05	3.32-4.95	1.06	0.85-1.32
	Wald test, 7 df	$\chi^2=198.53, p<0.01$		$\chi^2=374.96, p<0.01$		$\chi^2=741.59, p<0.01$		$\chi^2=1684.34, p<0.01$	
Religious affiliation	Protestant	1.29	0.96-1.74	1.27	0.99-1.62	1.81	1.52-2.17	1.85	1.64-2.08
	<b>Catholic</b>	1		1		1		1	
	No Affiliation	2.76	2.01-3.79	2.75	2.14-3.55	5.49	4.48-6.72	5.00	4.37-5.70
	Other/unknown	1.52	0.91-2.55	0.94	0.57-1.54	1.86	1.37-2.53	1.81	1.46-2.25
	Wald test, 3 df	$\chi^2=44.75, p<0.01$		$\chi^2=73.00, p<0.01$		$\chi^2=294.46, p<0.01$		$\chi^2=600.21, p<0.01$	
Education	Compulsory	0.64	0.45-0.91	0.50	0.36-0.70	0.54	0.45-0.64	0.51	0.45-0.57
	<b>Secondary</b>	1		1		1		1	
	Tertiary	1.20	0.91-1.59	1.45	1.16-1.81	1.52	1.29-1.80	1.49	1.34-1.66
	Unknown	0.94	0.38-2.29	0.38	0.15-0.97	0.53	0.27-1.04	0.59	0.36-0.97
	Wald test, 3 df	$\chi^2=9.36, p=0.02$		$\chi^2=36.32, p<0.01$		$\chi^2=94.71, p<0.01$		$\chi^2=210.35, p<0.01$	
Marital status	Single	0.68	0.46-1.01	0.92	0.68-1.26	1.18	0.87-1.61	0.92	0.75-1.13
	<b>Married</b>	1		1		1		1	
	Widowed	1.00	0.59-1.71	0.90	0.52-1.56	1.22	0.99-1.49	1.43	1.26-1.61
	Divorced	1.06	0.75-1.49	1.19	0.92-1.53	1.81	1.42-2.31	1.83	1.58-2.13
	Wald test, 3 df	$\chi^2=5.27, p=0.15$		$\chi^2=3.39, p=0.34$		$\chi^2=23.72, p<0.01$		$\chi^2=92.22, p<0.01$	
Type of household	1 person	1.48	1.08-2.02	1.36	1.06-1.74	1.06	0.88-1.27	0.97	0.86-1.08
	<b>≥ 2 persons</b>	1		1		1		1	
	Institutions	0.76	0.30-1.93	0.63	0.25-1.57	0.52	0.33-0.81	0.86	0.56-1.33
	Wald test, 2 df	$\chi^2=7.15, p=0.03$		$\chi^2=7.48, p=0.02$		$\chi^2=10.35, p<0.01$		$\chi^2=0.66, p=0.72$	
Children	<b>No</b>	1		1		1		1	
	Yes	0.73	0.55-0.97	0.80	0.63-1.02	0.91	0.76-1.09	0.74	0.66-0.83
	Unknown	0.75	0.41-1.38	0.95	0.57-1.57	0.60	0.42-0.85	0.70	0.55-0.89
	Wald test, 1 df	$\chi^2=4.62, p=0.03$		$\chi^2=3.28, p=0.07$		$\chi^2=12.37, p<0.01$		$\chi^2=25.85, p<0.01$	
Urbanicity	Urban	1.02	0.79-1.32	0.93	0.74-1.16	1.17	1.02-1.35	1.02	0.93-1.13
	<b>Peri-urban</b>	1		1		1		1	
	Rural	0.96	0.68-1.35	0.95	0.72-1.25	0.81	0.65-1.01	0.71	0.61-0.82
	Wald test, 2 df	$\chi^2=0.13, p=0.94$		$\chi^2=0.46, p=0.80$		$\chi^2=0.99, p=0.32$		$\chi^2=25.27, p<0.01$	
Neighbourhood index of SEP	<b>Lowest quintile</b>	1		1		1		1	
	Second quintile	1.22	0.81-1.86	1.32	0.94-1.86	1.27	0.97-1.65	1.04	0.88-1.23
	Third quintile	1.32	0.87-1.98	1.46	1.03-2.05	1.57	1.22-2.02	1.25	1.06-1.48
	Fourth quintile	1.64	1.09-2.47	1.78	1.27-2.50	1.82	1.42-2.33	1.56	1.33-1.84
	Highest quintile	2.49	1.67-3.72	2.11	1.49-2.98	2.75	2.16-3.52	2.26	1.93-2.65
	Wald test, 4 df	$\chi^2=26.13, p<0.01$		$\chi^2=20.65, p<0.01$		$\chi^2=89.86, p<0.01$		$\chi^2=170.28, p<0.01$	
Language Region	<b>German</b>	1		1		1		1	
	French	1.25	0.96-1.63	1.39	1.12-1.73	1.14	0.97-1.33	1.24	1.12-1.37
	Italian	1.00	0.50-1.99	0.36	0.15-0.88	1.05	0.71-1.56	0.53	0.38-0.75
	Wald test, 2 df	$\chi^2=2.72, p=0.26$		$\chi^2=15.20, p<0.01$		$\chi^2=0.07, p=0.79$		$\chi^2=12.83, p<0.01$	
	<b>Swiss</b>	1		1		1		1	
Nationality	Foreigner	0.59	0.38-0.91	0.73	0.53-1.02	0.82	0.62-1.08	0.88	0.73-1.04
	Wald test, 1 df	$\chi^2=5.60, p=0.02$		$\chi^2=3.40, p=0.07$		$\chi^2=1.98, p=0.16$		$\chi^2=2.18, p=0.14$	

**Supplementary table 6** Degrees of freedom (df), chi square (chi2) and p-values for likelihood ratio tests for interactions with time period (2003-2008 vs 2009-2014) in multivariable Cox respectively logistic regression models

Variable	df	Cox regression		Logistic regression	
		chi2	p-value	chi2	p-value
<b>Age group 25-64 years</b>					
Sex	1	0.07	0.7922	0.26	0.6124
Diagnosis	7			22.92	0.0018
Religion	3	3.71	0.2949	3.08	0.3790
Education	3	3.78	0.2868	3.66	0.3001
Marital status	3	2.45	0.4837	2.61	0.4555
Household	2	0.88	0.6454	0.08	0.9629
Parenthood	1	0.50	0.4785	0.00	0.9578
Urbanicity	2	1.31	0.5205	0.38	0.8276
SSEP	4	2.10	0.7169	1.58	0.8120
Language region	2	0.98	0.6133	3.79	0.1505
Nationality	1	0.32	0.5721	0.11	0.7387
<b>Age group 65-94 years</b>					
Sex	1	0.10	0.7524	0.44	0.5060
Diagnosis	7			134.80	<0.001
Religion	3	3.42	0.3308	3.23	0.3581
Education	3	1.33	0.7220	1.52	0.6776
Marital status	3	2.13	0.5453	3.86	0.2768
Household	2	1.27	0.5292	4.66	0.0972
Parenthood	1	1.67	0.1959	0.45	0.5015
Urbanicity	2	3.16	0.2055	3.30	0.1923
SSEP	4	3.29	0.5100	2.27	0.6854
Language region	2	5.39	0.0676	5.58	0.0613
Nationality	1	0.94	0.3310	0.01	0.9200

**Supplementary table 7** Odds ratios and 95% Confidence Intervals (CI) for interactions between time period and diagnosis in multivariable logistic regression models (corrected for sex, age, religion, education, marital status, type of household, urbanization, the neighborhood index of socioeconomic position, language region and nationality)

	Age group 25-64		Age group 65-94	
	OR	95%CI	OR	95%CI
<b>Diagnosis</b>				
Cancer	1 (Ref)		1 (Ref)	
Mental and behavioural	1.67	0.84-3.31	0.71	0.48-1.07
Nervous System	0.98	0.66-1.45	0.99	0.76-1.29
Circulatory System	3.92	0.86-17.93	1.22	0.94-1.57
Respiratory System	0.99	0.43-2.25	1.67	1.10-2.53
Musculoskeletal System	1.19	0.42-3.37	1.97	1.43-2.71
Other diseases	0.56	0.32-1.00	1.32	0.99-1.76
No disease	0.30	0.15-0.62	0.27	0.20-0.36

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	page in the manuscript
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	4/5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4/5
4/5Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4/5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5, suppl. table 2
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	n.a.
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4/5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	n.a.
		(d) If applicable, explain how loss to follow-up was addressed	n.a.
		(e) Describe any sensitivity analyses	n.a.
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6/7
		(b) Give reasons for non-participation at each stage	n.a.
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, table 1
		(b) Indicate number of participants with missing data for each variable of interest	table 1
		(c) Summarise follow-up time (eg, average and total amount)	6

1	Outcome data	15*	Report numbers of outcome events or summary measures over time	6/7
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-	table 1a & 1b, figure 2
3			adjusted estimates and their precision (eg, 95% confidence	
4			interval). Make clear which confounders were adjusted for and why	
5			they were included	
6			(b) Report category boundaries when continuous variables were	n.a.
7			categorized	
8			(c) If relevant, consider translating estimates of relative risk into	n.a.
9			absolute risk for a meaningful time period	
10	Other analyses	17	Report other analyses done—eg analyses of subgroups and	10/11
11			interactions, and sensitivity analyses	
12	<b>Discussion</b>			
13	Key results	18	Summarise key results with reference to study objectives	12
14	Limitations	19	Discuss limitations of the study, taking into account sources of	13/14
15			potential bias or imprecision. Discuss both direction and magnitude	
16			of any potential bias	
17	Interpretation	20	Give a cautious overall interpretation of results considering	12/13/14
18			objectives, limitations, multiplicity of analyses, results from similar	
19			studies, and other relevant evidence	
20	Generalisability	21	Discuss the generalisability (external validity) of the study results	12
21	<b>Other information</b>			
22	Funding	22	Give the source of funding and the role of the funders for the	15
23			present study and, if applicable, for the original study on which the	
24			present article is based	

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

# BMJ Open

## Increase in Assisted Suicide in Switzerland: Did the socioeconomic predictors change? Results from the Swiss National Cohort

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-020992.R2
Article Type:	Research
Date Submitted by the Author:	12-Mar-2018
Complete List of Authors:	Steck, Nicole; Universitat Bern, Institute of Social and Preventive Medicine (ISPM) Junker, Christoph; Federal Statistical Office, Medical Statistics Zwahlen, Marcel; University of Bern, Institute of Social and Preventive Medicine
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Palliative care
Keywords:	Assisted Suicide, End of Life Care, Cohort Study, Switzerland

SCHOLARONE™  
Manuscripts

# Increase in Assisted Suicide in Switzerland: Did the socioeconomic predictors change? Results from the Swiss National Cohort

Nicole Steck<sup>1</sup>, PhD, Christoph Junker<sup>2</sup>, MD, and Marcel Zwahlen<sup>1</sup>, PhD, for the Swiss National Cohort

<sup>1</sup>Institute of Social and Preventive Medicine (ISPM), University of Bern, Switzerland

<sup>2</sup>Federal Statistical Office, Neuchatel, Switzerland

Correspondence:

Nicole Steck

Institute of Social and Preventive Medicine

University of Bern

Switzerland

[Nicole.steck@ispm.unibe.ch](mailto:Nicole.steck@ispm.unibe.ch)

Tel: +41 31 631 56 75



## Abstract

**Objective** To determine whether the strong increase in assisted suicides in Switzerland since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide and its related diagnoses.

**Methods** In a population-based longitudinal study, we investigated assisted suicides in Switzerland over the period 2003 to 2014. Two groups of younger (25 to 64 years) and older (65 to 94 years) persons were analysed separately and compared. We calculated crude rates and used Cox proportional hazard and logistic regression models to examine associations of assisted dying with gender, marital status, education, religion, neighbourhood socioeconomic status, and other variables, and investigated trends over time.

**Results** We identified 3,941 assisted suicides among 6,237,997 Swiss residents, 80% of which occurred in the older age group. Crude rates of assisted suicide more than tripled during the study period from 3.60 to 11.21 per 100,000 person years; the increase was more pronounced in the older age group. Cancer was the most common underlying diagnosis (41.8%), but the percentage dying assisted was highest among patients with diseases of the nervous system (5.25% in the younger and 1.23% in the older age group). The factors associated with assisted suicide did not change during the study period. Female gender, higher education, having no religious affiliation, no children, and a Swiss passport, living in a neighbourhood with a higher socioeconomic index, and living in the French-speaking part of Switzerland were associated with a higher rate.

**Conclusions** The study results do not indicate any shift in socioeconomic factors associated with assisted suicide, but a more pronounced increase in incidence among the elderly .

**Strengths and limitations of this study:**

- The nationwide cohort study with virtually complete coverage and data at individual, household, and building levels allows investigating time trends in the association of assisted dying with detailed socioeconomic characteristics in Switzerland, one of the few countries with long-term experience in assisted dying.
- In Switzerland there is no obligation to report assisted suicides to a central registry, so the case records may not be complete. However, the Federal Statistical Office makes a great effort to identify assisted suicides, in cooperation with right-to-die organisations, institutes of forensic medicine, and physicians.
- Most socioeconomic variables come from census 2000 and may not be completely up to date in 2014 for all individuals. However, particularly in the older age group characteristics such as education, religion, and language region are quite stable.
- For information on the underlying disease, the study relies on the diagnoses given on the death certificate. Besides the issue of the reliability of these diagnoses, no information is available on the disease stage or severity.

## Introduction

Switzerland is one of few countries worldwide that allows assisted suicide [1-3]. According to article 115 of the Swiss penal code, assistance with suicide is only considered a crime and open to prosecution if selfish interests are involved [4]. Though lawmakers did not have a medical perspective when article 115 was created in 1918, judgments of the Tribunal Federal supported the activities of right-to-die organisations [5] which, in general, are involved in the process of assisted suicide in Switzerland [6]. These organisations assist their members in dying after a physician has confirmed both a person's ability to make decisions and that the person requesting assistance suffers from a terminal illness, an unendurable incapacitating disability, or unbearable and uncontrollable pain [3]. While the role of the physician in physician assisted suicides is limited to prescribing a lethal drug, in euthanasia the physician injects the lethal drug when requested by the patient. Euthanasia is prohibited in Switzerland.

In an earlier study of the period 2003 to 2008, we reported higher rates of assisted suicide in Switzerland among women, persons who live alone or are divorced, and persons with higher education and higher socioeconomic status [7]. Cancer was the most frequently diagnosed disease in assisted suicide, while the proportion of assisted deaths among patients with diseases of the nervous system was much higher. In the last 15 years, the numbers of assisted suicides reported by right-to-die-organizations increased substantially in Switzerland [8 9]. While the three main right-to-die organisations reported fewer than 200 assisted suicides of Swiss residents per year at the beginning of the century, in 2014 the number exceeded 760 ([supplementary table 1](#))[10-12]. Similar increases have been observed in other European countries and US states that allow assisted suicide or euthanasia [13-20]. This has intensified the debate about the ethics and prohibition or control of assisted death both in Europe and worldwide. One main concern about assisted dying is the so called slippery slope, a shift from exceptional to routine practice that puts pressure on patients who are chronically ill and socioeconomically vulnerable [2 21-23].

This study examined whether the increase in assisted suicides since 2008 is linked to a shift in the socioeconomic factors associated with assisted suicide. We wanted to identify groups with a disproportional increase in the rate of assisted dying and investigate possible shifts in diagnoses. Thus we wanted to test the slippery slope hypothesis that there is an intensified trend towards dying with assistance among patients who are more vulnerable: those with less education, who live in lower socioeconomic status neighbourhoods, and also among persons who live alone and have no children.

## Methods

### *The Swiss National Cohort*

The Swiss National Cohort (SNC) is a longitudinal study of the Swiss population described in detail elsewhere [24 25]. The current version of the SNC is based on census data from 1990 and 2000 that were linked to mortality and emigration records until 2014, and to the newly introduced Registry Based Census

1 (RBC) 2011 using deterministic and probabilistic linkage procedures. Participation in the Swiss census is  
2 mandatory, resulting in a coverage of 99% in the census 2000 [26]. This analysis is based on the census  
3 2000 and we included people who were between 25 and 95 years old during the study period 2003 to  
4 2014. For exposing variables (education, religion, etc.) information from the census 2000 was used  
5 because the RBC does not contain the same, detailed information. An exception is marital status, for  
6 which we had information on the last change in status before RBC 2011, respectively before death, and  
7 used the relevant information. All individuals were followed from 1 January 2003 until death, emigration,  
8 or the end of the study period on 31 December 2014. The SNC was approved by the Cantonal Ethics  
9 Committees of Bern and Zurich, with approval covering this study.  
10  
11  
12  
13  
14  
15

#### 16 *Patient and Public Involvement*

17 Neither patients nor public were involved in the development of the research question, in the analysis,  
18 and in drawing conclusions from the results.  
19  
20  
21

#### 22 *Identification of assisted suicides*

23 During the study period, it was mainly three right-to-die associations that were active in assisting Swiss  
24 residents in dying: Exit in the German-speaking part, Exit in the French-speaking part of Switzerland, and  
25 Dignitas. The organisations have been described in detail elsewhere [1 27]. The Federal Statistical Office  
26 (FSO) identifies assisted deaths based on information given by the physician or the institute of forensic  
27 medicine on the death certificate, assigning code X61.8 for assisted deaths since the International  
28 Classification of Diseases (ICD) has no code for assisted death [9]. For the years 2003 to 2012, the right-to-  
29 die associations additionally provided anonymous data to the FSO on all deaths of Swiss residents they  
30 assisted.  
31  
32  
33  
34  
35  
36

#### 37 *Determination of underlying diseases*

38 We used the ICD-10 codes on death certificates to determine the diseases underlying assisted suicides.  
39 Because until 2008, suicide by poisoning was indicated as primary cause of death for assisted suicides in  
40 the Swiss mortality statistics, we used the first, concomitant disease as the underlying cause for assisted  
41 suicides from 2003 until 2008. In 2009 the FSO changed the practice of coding according to the ICD  
42 definition of the primary cause of death as “the disease or injury which initiated the train of morbid  
43 events leading directly to death” [9 28]: The underlying disease is labelled as primary cause and assisted  
44 suicide as a concomitant circumstance. For 2009 to 2014 we thus used a death certificate's primary cause  
45 of death to determine the disease underlying assisted suicides. For all other deaths the primary cause of  
46 death was used throughout the study period.  
47  
48  
49  
50  
51  
52

53 We created broad categories of *all cancers, mental and behavioural disorders, diseases of the nervous*  
54 *system, diseases of the circulatory system, diseases of the respiratory system, diseases of the*  
55 *musculoskeletal system, and other diseases*, and more detailed categories for the most common  
56  
57  
58  
59  
60

1 diagnoses ([Supplementary table 2](#)). We excluded all deaths with external causes such as accidents,  
2 unassisted suicide, and assault (V, W, X, and Y, except X61.8).

### 3 *Statistical analysis*

4  
5  
6  
7 Within the SNC we performed a survival analysis with age as time scale, and observation interval starting  
8 at 1 January 2003 and ending on the earliest of the date of death or emigration, or 31 December 2014.

9  
10 We calculated crude rates of assisted suicide and estimated hazard ratios using Cox proportional hazard  
11 regression. The multivariable model included gender, religion (Protestant, Catholic, no affiliation,  
12 other/unknown), education (compulsory, secondary, tertiary), marital status (single, married, widowed,  
13 divorced), type of household (single person, two or more persons, institution), having children, urbanicity  
14 (urban, periurban, rural), the Swiss neighbourhood index of socioeconomic position (in quintiles) [29],  
15 language region (German, French, Italian) and nationality (Swiss, foreign). The result of Cox proportional  
16 hazard regression might identify risk factors not only for assisted suicide but also for being terminally ill or  
17 being in chronic and uncontrollable pain and suffering. Therefore, we also performed a logistic regression  
18 to identify determinants of assisted suicide among all deaths. We included the same variables and  
19 characteristics as in the Cox analysis, and also age at death (in 10 year bands) and underlying diagnosis  
20 (according to broad categories, see above). Earlier studies showed interactions between age group and  
21 other variables [7]. The multivariable analyses were therefore stratified not only by interval (2003-2008  
22 and 2009-2014), but also by age-group (25 to 64 and 65 to 94). The cut-off at 65 years reflects retirement  
23 age for men in Switzerland. In multivariable analyses we tested for interaction between variables and  
24 period by including appropriately constructed interaction terms and performing likelihood ratio tests. For  
25 potentially fatal diseases we also calculated the percentage of assisted deaths with a certain underlying  
26 cause among all deaths with the same condition.

27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
Statistical analyses were done with Stata version 14 (Stata Corporation, College Station, TX, USA). Results  
are given as rates per 100,000 person years, hazard ratios (HR), odds ratios (OR), and  $\chi^2$  and p-values from  
Wald tests for overall model significance. Percentages of assisted suicides among all deaths across  
underlying causes are reported with 95% confidence intervals (Cis).

## 46 **Results**

### 47 *Study population*

48  
49  
50 We included 6,237,997 persons who participated in the 2000 census and were between 25 and 95 years  
51 old in the study period 2003 to 2014. Among this population, 5,102,268 were in the 25-64 year-old  
52 cohort, 2,139,152 were in the 65-94 year-old cohort, and 1,003,423 were represented in both during the  
53 study period ([table 1a](#) and [1b](#)).

1 We counted a total of 3,941 assisted suicides between 2003 and 2014. This corresponds to 95.2% of the  
2 number of assisted suicides of Swiss residents officially reported by the three main right-to-die-  
3 organisations in their annual reports (supplementary table 1). The number of assisted suicides increased  
4 from 180 in 2003 (0.32% of all deaths) to 688 in 2014 (1.30% of all deaths). While one-quarter of assisted  
5 suicides occurred in persons younger than 65 during the years 2003 and 2004, the proportion decreased to  
6 15% during 2013 and 2014. Crude rates more than tripled from 3.60 per 100,000 person years during the  
7 two-year period 2003–2004 to 11.21 during 2013–2014. The rates increased in both age groups, but it  
8 was more pronounced in the 65 to 94 year-old group, in which it rose from 12.23 to 35.35, than among  
9 those 25 to 64 years old, for whom it rose from 1.17 to 2.34 (table 1a and 1b, Figure 1). Rates increased  
10 exponentially with age from 0.14 (95% CI 0.063-0.314) per 100,000 person-years at age 25 to 56.25 (95%  
11 CI 49.76- 63.58) per 100,000 at age 90. Overall crude rates were higher in women (6.81, 95% CI 6.54-7.10)  
12 than in men (5.37, 95% CI 5.12-5.63), but stratified by age women have a higher rate until the age of 69,  
13 while from the age of 70 on men had a higher rate (Figure 1).

**Table 1a Study population 25-64 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)	
		Number	%	Number	%	Estimate	95% CI
All		5,102,268	100	771	100	1.58	1.47-1.70
Gender	Male	2,568,557	50.3	343	44.5	1.40	1.26-1.56
	Female	2,533,711	49.7	428	55.5	1.76	1.60-1.94
Calendar years	2003/2004	4,045,063	79.3	96	12.4	1.17	0.96-1.43
	2005/2006	242,768**	4.8	101	13.1	1.23	1.01-1.50
	2007/2008	246,252**	4.8	113	14.7	1.38	1.15-1.66
	2009/2010	206,220**	4.0	134	17.4	1.65	1.39-1.95
	2011/2012	188,818**	3.7	140	18.2	1.73	1.47-2.05
	2013/2014	173,147**	3.4	187	24.2	2.34	2.03-2.70
Religious affiliation	Protestant	1,702,781	33.4	275	35.7	1.74	1.54-1.96
	Catholic	2,158,382	42.3	205	26.6	0.99	0.87-1.14
	No Affiliation	628,032	12.3	245	31.8	3.91	3.45-4.23
	Other/unknown	613,073	12.0	46	6.0	0.76	0.57-1.02
Education	Compulsory	1,137,885	22.3	88	11.4	0.87	0.71-1.07
	Secondary	2,420,063	47.4	449	58.2	1.77	1.62-1.95
	Tertiary	977,528	19.2	221	28.7	2.13	1.87-2.43
	Unknown	566,792	11.1	13	1.7	0.43	0.25-0.75
Marital status	Single	1,715,805	33.6	176	22.8	1.25	1.08-1.45
	Married	2,831,208	55.5	383	49.7	1.31	1.19-1.45
	Widowed	99,092	1.9	29	3.76	3.83	2.66-5.51
	Divorced	456,163	9.0	183	23.74	3.85	3.33-4.45
Type of household	1 person	772,331	15.1	255	33.1	3.20	2.83-3.62
	≥ 2 persons	4,183,879	82.0	498	64.6	1.26	1.16-1.38
	Institutions	146,058	2.9	18	2.3	1.25	0.79-1.99
Children	No	2,226,028	43.6	318	41.2	1.57	1.41-1.75
	Yes	2,566,001	50.3	414	53.7	1.61	1.46-1.77
	Unknown	310,239	6.1	39	5.1	1.42	1.03-1.94
Urbanicity	Urban	1,445,955	28.3	265	34.4	1.88	1.66-2.12
	Periurban	2,321,284	45.5	370	48.0	1.68	1.51-1.86
	Rural	1,335,029	26.2	136	17.6	1.08	0.91-1.28
Neighborhood index of SEP	Lowest quartile	1,242,745	24.4	111	14.4	0.94	0.78-1.13
	Second quartile	1,220,105	23.9	156	20.2	1.34	1.14-1.56
	Third quartile	1,225,580	24.0	196	25.4	1.67	1.45-1.92
	Fourth quartile	1,222,208	23.9	284	36.8	2.45	2.18-2.75
	Unknown	191,630	3.8	24	3.1	1.27	0.85- 1.89
Language region	German	3,666,753	71.87	548	71.1	1.56	1.44-1.70
	French	1,199,458	23.51	209	27.1	1.82	1.59-2.08
	Italian	219,002	4.29	14	1.8	0.67	0.40-1.13
	Rhaeto-Roman	17,055	0.33	-	-	-	-
Nationality	Swiss	3,928,264	77.0	699	90.7	1.89	1.75-2.03
	Foreigner	1,174,004	23.0	72	9.3	0.61	0.49-0.77

\*At entry in study

\*\*People who entered the study at their 25th birthday

**Table 1b Study population 65-94 years old: characteristics, number and crude rates of assisted suicides**

Characteristics		Study population*		Assisted suicides		Crude rate (per 100.000 person-years)	
		Number	%	Number	%	Estimate	95% CI
All		2,139,152	100	3,170	100	20.40	19.70-21.12
Gender	Male	959,044	44.8	1,336	42.2	19.97	18.93-21.07
	Female	1,180,108	55.2	1,834	57.9	20.72	19.79-21.69
Calendar years	2003/2004	1,227,529	57.4	282	8.9	12.24	10.89-13.76
	2005/2006	161,701**	7.6	326	10.3	13.67	12.2-15.24
	2007/2008	184,728**	8.6	357	11.3	14.30	12.89-15.86
	2009/2010	187,522**	8.8	474	15.0	18.00	16.45-19.70
	2011/2012	191,358**	8.9	692	21.8	24.85	23.06-26.77
	2013/2014	186,314**	8.7	1039	32.8	35.35	33.27-37.57
Religious affiliation	Protestant	908,928	42.5	1,521	48.0	22.83	21.71-24.00
	Catholic	897,292	41.9	609	19.2	9.18	8.48-9.94
	No Affiliation	191,779	9.0	844	26.6	64.78	60.55-69.30
	Other/unknown	141,153	6.6	196	6.2	20.82	18.11-23.95
Education	Compulsory	689,219	32.2	600	18.9	11.61	10.72- 12.58
	Secondary	1,043,833	48.8	1,688	53.3	22.41	21.36-23.50
	Tertiary	377,305	17.6	850	26.8	32.15	30.06-34.38
	Unknown	28,795	1.4	32	1.0	16.24	11.49-22.97
Marital status	Single	171,876	8.0	259	8.2	22.03	19.50-24.88
	Married	1,274,969	59.6	1,301	41.0	14.20	13.45-14.99
	Widowed	480,234	22.5	1,105	34.9	28.98	27.32-30.74
	Divorced	212,073	9.9	505	15.9	36.26	33.24-39.57
Type of household	1 person	518,958	24.3	1,211	38.2	31.29	29.58-33.11
	≥ 2 persons	1,546,029	72.3	1,878	59.2	16.62	15.88-17.39
	Institutions	74,165	3.4	81	2.6	21.86	17.58-27.17
Children	No	339,093	15.9	713	22.5	30.75	28.57-33.09
	Yes	1,698,737	79.4	2,316	73.1	18.49	17.75-19.26
	Unknown	101,322	4.7	141	4.4	20.16	17.10-23.78
Urbanicity	Urban	640,844	29.9	1,306	41.2	27.79	26.33-29.34
	Periurban	955,312	44.7	1,472	46.4	21.25	20.20-22.37
	Rural	542,996	25.4	392	12.4	10.00	9.06-11.05
Neighborhood index of SEP	Lowest quartile	475,150	22.2	383	12.1	11.11	10.05-12.28
	Second quartile	509,464	23.8	537	16.9	14.42	13.25-15.69
	Third quartile	517,807	24.2	778	24.5	20.54	19.15-22.04
	Fourth quartile	557,424	26.1	1,384	43.7	33.74	32.01-35.57
	Unknown	79,307	3.7	88	2.8	18.23	14.80-22.47
Language region	German	1,524,965	71.3	2,288	72.2	20.68	19.85-21.54
	French	497,621	23.3	814	25.7	22.57	21.07-24.17
	Italian	108,006	5.0	64	2.0	7.92	6.20-10.12
	Rhaeto-Roman	8,560	0.4	4	0.1	6.37	2.39-16.96
Nationality	Swiss	1,881,034	87.9	2,961	93.4	21.57	20.80-22.36
	Foreigner	258,118	12.1	209	6.6	11.53	10.07-13.21

\*At entry in study

\*\*People who entered the study at their 25th birthday



## Diagnoses

In the younger age group, more than half of the 771 who died with assistance had a cancer diagnosis and every fifth person was diagnosed with a disease of the nervous system, mainly multiple sclerosis (MS) or a motor neuron disease such as ALS (Supplementary table 3). Mental and behavioural disorders accounted for 45 assisted suicides (5.8%), more than half of which were mood disorders. The percentage of assisted deaths among all deaths with the same potentially fatal underlying cause varied from 0.073% for diseases of the circulatory system to 5.25% for diseases of the nervous system (table 2). Looking at the diagnoses in more detail, the percentage of assisted deaths was highest among patients with MS (11.1%) and Huntington's disease (9.90%).

In the 65 to 94 age group, the percentage of assisted suicides with cancer was lower (39.3%) (Supplementary table 3). Diseases of the nervous (11.8%) and the circulatory system (12.0%) each accounted for about one-eighth of assisted deaths. Among the 373 assisted deaths with diseases of the nervous system, patients with Parkinson's disease (106) and motor neuron diseases als ALS (74) contributed most. Patients with musculoskeletal diseases comprised 10.0% of all assisted suicides, mainly arthropathies and dorsopathies, while 4.7% had diseases of the respiratory system. Mental and behavioural disorders accounted for 4.2% of all assisted suicides, the largest number of which were mood disorders, 2.9%, followed by dementia at 0.8%. The percentage of assisted deaths among all deaths (table 2) with the same underlying disease was highest for diseases of the nervous system (1.2%).

**Table 2 Percentage of assisted suicides among all deaths with the same, potentially fatal, underlying disease, by age group and period**

	25-64 years		65-94 years	
	2003-2008	2009-2014	2003-2008	2009-2014
<b>Cancer</b>	<b>0.66 (0.56-0.77)</b>	<b>1.14 (1.00-1.29)</b>	<b>0.56 (0.51-0.62)</b>	<b>1.19 (1.11-1.27)</b>
<i>Digestive</i>	0.69 (0.50-0.92)	1.20 (0.94-1.50)	0.52 (0.42-0.63)	1.08 (0.95-1.22)
<i>Respiratory</i>	0.46 (0.31-0.67)	0.75 (0.54-1.02)	0.35 (0.25-0.47)	1.00 (0.84-1.18)
<i>Breast</i>	0.75 (0.46-1.14)	1.37 (0.94-1.92)	0.90 (0.66-1.20)	1.64 (1.32-2.00)
<i>Male genital</i>	1.14 (0.42-2.47)	1.68 (0.73-3.28)	0.78 (0.60-1.02)	1.40 (1.14-1.69)
<i>Other</i>	0.71 (0.54-0.91)	1.27 (1.02-1.56)	0.57 (0.47-0.67)	1.23 (1.09-1.37)
<b>Nervous system</b>	<b>3.80 (2.92-4.84)</b>	<b>6.68 (5.52-8.00)</b>	<b>0.73 (0.60-0.89)</b>	<b>1.66 (1.47-1.87)</b>
<i>Motor neuron disease</i>	5.82 (3.43-9.16)	7.26 (4.36-11.23)	4.01 (2.66-5.78)	6.87 (5.09-9.03)
<i>Parkinson's</i>	2.38 (0.06-12.57)	6.67 (1.40-18.27)	0.97 (0.66-1.36)	1.96 (1.54-2.45)
<i>MS</i>	8.63 (5.86-12.16)	13.69 (10.09-18.00)	3.20 (1.72-5.41)	4.82 (3.05-7.21)
<i>Huntington's</i>	2.04 (0.05-10.85)	17.3 (8.23-30.32)	-	5.88 (1.23-1.62)
<i>Paralytic syndromes</i>	2.80 (0.58-7.98)	7.69 (3.75-13.69)	2.56 (1.11-4.97)	3.67 (1.91-6.32)
<i>Alzheimer's</i>	-	2.88(0.60-8.20)	0.07 (0.02-0.16)	0.25 (0.15-0.39)
<i>Other</i>	1.54 (0.77-2.73)	3.19 (20.5-4.71)	0.90 (0.55-1.39)	3.13 (2.53-3.84)
<b>Circulatory system</b>	<b>0.02 (0.00-0.07)</b>	<b>1.37 (0.07-0.24)</b>	<b>0.10 (0.08-1.18)</b>	<b>0.26 (0.23-0.29)</b>
<i>Cerebro-vascular</i>	0.14 (0.02-0.49)	0.59 (0.24-1.21)	0.50 (0.41-0.60)	0.53 (0.43-0.64)
<i>Other</i>	-	0.07 (0.02-0.15)	-	0.20 (0.17-0.23)
<b>Respiratory system</b>	<b>0.60 (0.29-1.09)</b>	<b>1.04 (0.60-1.68)</b>	<b>0.16 (0.11-0.22)</b>	<b>0.61 (0.50-0.72)</b>
<i>COPD</i>	1.08 (0.49-2.03)	1.25 (0.60-2.29)	0.32 (0.21-0.46)	0.93 (0.75-1.15)

<i>Other</i>	0.12 (0.00-0.66)	0.81 (0.30-1.76)	0.04 (0.01-0.09)	0.31 (0.21-0.43)
<b>All deaths*</b>	<b>0.63 (0.56-0.71)</b>	<b>1.08 (0.99-1.18)</b>	<b>0.35 (0.33-0.38)</b>	<b>0.79 (0.76-0.83)</b>

### *Multivariable Cox regression analysis*

The associations observed in the multivariable proportional hazard Cox models were very similar in the two time periods ([figure 2](#) and [supplementary table 4](#)), though some differed by age group. Men in the younger age group had a lower assisted suicide rate than women in both periods (HR of 0.78 in earlier and 0.77 in later period), but men in the older age group did not (respectively HR 1.12 and 1.01). Having no religious affiliation and being Protestant were associated with higher rates of assisted suicide than being Catholic; the effect was stronger in the older age group. The association between a higher level of education and assisted suicide was stronger in the older age group, while in the younger age group persons with compulsory education had a 32% lower rate than those with secondary education in only the second period. Regarding marital status, the rate in the younger age group of those who were divorced was 70% higher in the second period compared to married people. In the older age group, widowed persons had a 33 to 40% higher assisted suicide rate, and the rate among the divorced was around twice as high as that of those who were married. Living in a neighbourhood with a higher socioeconomic index was associated with a higher hazard of assisted suicide. People living in the French-speaking region had a higher rate than people living in the German-speaking region, although the effect was not statistically significant in younger people in the first period. In the second, younger (HR 0.35) and older people (HR 0.48) living in the Italian-speaking region had a lower rate than people living in the German-speaking region. Compared to Swiss citizens, foreigners living in Switzerland were less likely to die with a right-to-die organisation.

### *Multivariable logistic regression analysis*

We further analysed the odds of assisted suicides among all deaths with a multivariable logistic regression model ([supplementary table 5](#)). The associations were mostly the same as in the Cox proportional hazard model, with one main exception: in the logistic regression models, men had lower odds than women not only in the younger group (OR 0.52 in the earlier and 0.54 in the later period), but also in the older age group (respectively OR 0.64 and 0.65). To analyse differences between age groups 25 to 64 and 65 to 94 years over time, we fitted multivariable logistic regression models in the entire data set with interaction terms. The model showed a significant interaction between age group and period ( $\chi^2=10.4$ , 1 df,  $p=0.0013$ ) with a larger increase in the older group than the younger group over time (OR of 2.25 compared to 1.72).

Compared to patients who died with cancer during study period, decedents with a disease of the nervous system on the death certificate were more likely to have died with assistance (respectively OR of 6.91 and 6.76 in the younger age group, 1.53 and 1.47 in the older age group). In the older age group, the odds for

1 diseases of the circulatory system, diseases of the respiratory system, and other diseases were  
2 substantially lower. As diseases of the musculoskeletal system are in themselves rarely fatal, the odds for  
3 assisted dying were high in all analyses. The associations between diagnoses and time periods were  
4 statistically significant in the likelihood ratio test for interactions ( $p=0.0018$  in the younger age group and  
5  $p<0.001$  in the older age group) ([supplementary table 6](#)). In both age groups the odds of having no  
6 diagnoses on death certificates clearly decreased from the first to the second period ([supplementary table](#)  
7 [7](#)). In the older age group the odds of dying with diseases of the respiratory or the musculoskeletal system  
8 increased ([supplementary table 7](#)).

## 14 Discussion

15 Crude rates of assisted suicide in Switzerland more than tripled from 2003 to 2014, and assisted suicides  
16 accounted for 1.3% of all deaths in 2014. The increase was greater in the 65 to 94 age group than in those  
17 younger than 65 but is independent of socioeconomic factors such as gender, and characteristics of the  
18 individual and the household. Factors associated with assisted suicide from 2003 to 2008 were the same  
19 as those associated with assisted suicide from 2009 to 2014: female gender, higher education, having no  
20 religious affiliation, no children and a Swiss passport, living in a neighbourhood with a higher area-based  
21 socioeconomic index, and in the French-speaking part of Switzerland were associated with a higher rate  
22 of assisted suicides. In the younger age group, people living alone were more likely to die with assistance,  
23 as were in the older age group the widowed and the divorced. Cancer, diseases of the nervous system  
24 and—in the older age group—of the circulatory and the respiratory system were the most common  
25 diagnoses on death certificates of people who died with assistance. Diagnoses shifted between time  
26 periods; with less death certificates with no first underlying diseases in the second period, and in the  
27 older age group, diseases of the respiratory and the musculoskeletal system increased. Percentages of  
28 assisted suicides among all deaths were highest in diseases of the nervous system.

29 The strong increase in incidence of assisted suicide in Switzerland is based on a broad acceptance in the  
30 Swiss population that has been confirmed by referenda and surveys [30 31][32]. The increase is also in  
31 line with the development in other European countries with long-term experience in assisted dying [13-  
32 17]. In Belgium the number of reported cases increased more than sevenfold since 2003. In 2013 more  
33 than 1,800 people died by euthanasia, corresponding to 1.7% of all deaths [14]. As in our study, the  
34 increase occurred in both sexes and all age groups, and the proportion grew among older patients. In the  
35 Netherlands the number of reported assisted deaths, largely euthanasia, reached 5,500 in 2015 [15],  
36 three times higher than in 2003, which corresponds to almost four percent of all deaths. In US states with  
37 long-term experience with assisted dying, the numbers of assisted suicides also increased [16 17 19], but  
38 with roughly 130 in Oregon (2016) and 200 in Washington (2015) the numbers are significantly lower than  
39 in Europe.

1 The stability of socioeconomic factors associated with assisted suicide over the study period does not  
2 support the slippery slope hypothesis: assisted suicides did not increase disproportionately among less  
3 educated people and people living in neighbourhoods with lower socioeconomic status. Other factors  
4 persistently associated with assisted suicide—female gender, having no children and living alone, being  
5 widowed or divorced—may reflect a degree of social vulnerability. Of note, persons who were single and  
6 had no children were less likely to get their request for euthanasia granted in a Dutch end-of-life clinic  
7 [33].  
8  
9  
10  
11  
12

### 13 *Strengths and limitations*

14  
15 This is the first study we know of that looked at trends in the association of assisted dying with detailed  
16 socioeconomic characteristics over a period greater than 10 years. It is based on individual, household,  
17 and building-level data from the census 2000 with virtually complete coverage, and selection or response  
18 biases are therefore unlikely. However, census 2000 information is not completely up to date in 2014 for  
19 all persons. Type of household, in particular, may have changed over the 14 years of follow-up, and also  
20 urbanicity, the socioeconomic neighbourhood-index, language region, the existence of children, and self-  
21 declared religion and nationality; changes over time are more likely in the younger than in the older age  
22 group. We were able to account for the fact that marital status might change, and more accurately  
23 analyse the association of widowhood or divorce with assisted suicide. We did not have any direct,  
24 individual data for economic well-being. However, education is not only an important dimension of  
25 socioeconomic status itself, it also precedes and influences other personal attributes such as occupation  
26 and personal income [34]. Added to that information, we also had socioeconomic status at the  
27 neighbourhood level for each person [29].  
28  
29  
30  
31  
32  
33  
34  
35

36 An increasing number of countries and states in the US [2] have legalized assisted suicide in recent years  
37 or are in the process of doing so. Switzerland is one of the few countries with long-term experience that  
38 allows studying time trends and the possible change of predictors. The Federal Statistical Office makes a  
39 great effort to identify assisted suicides in the mortality statistics in cooperation with right-to-die  
40 organisations, cantonal institutes of forensic medicine, and physicians. In suspected cases, the FSO  
41 consults the responsible physician. The risk of classifying deaths wrongly as assisted is therefore small.  
42 However, because there is no obligation to report assisted suicides to a central registry, identification of  
43 assisted deaths is likely not complete. Suicides assisted without the involvement of one of the three main  
44 organisations may in particular be missed. In recent years, smaller right-to-die-organisations have become  
45 active: LifeCircle in the region of Basel and LLExit in the Italian-speaking part of Switzerland. It is possible  
46 that differences in process and reporting may increase the proportion of assisted suicides that are not  
47 identified by the FSO, and therefore at least partly explain the lower increase of assisted suicides in the  
48 Italian-speaking region of Switzerland. A Belgian study showed that differences in end-of-life-practices  
49 found between the language regions of Flanders and Wallonia were not only caused by differences in  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 acceptance, but also by differences in the process and reporting compliance [35]. It is also possible that  
2 physicians not associated with right-to-die-organisations do assist in suicides and do not report these  
3 cases appropriately. Even though this is considered a marginal problem compared to the numbers of  
4 suicides assisted by right-to-die-organisations in Switzerland, there are no numbers because of the lack of  
5 an obligatory register. In a survey in 2006, 103 out of 1,650 doctors had assisted a suicide without  
6 involvement of a right-to-die association. [36]  
7  
8  
9  
10

11 Another limitation of our study is the fact that death certificates were the only source for information  
12 about the underlying disease. They did not provide nor did we have other sources of information on stage  
13 of disease, treatments and their alternatives, and when patients decided to die with assistance. The  
14 comparability of the figures for assisted deaths among all deaths for different diseases is also limited. For  
15 assisted deaths involving nonfatal or rarely fatal mental disorders or diseases of the musculoskeletal  
16 system, the denominator does not fully reflect the number of persons thus afflicted and percentages of  
17 these assisted deaths are therefore not comparable to those involving fatal diseases. Finally, we have the  
18 matter of the reliability of death certificates. While their reliability for major disease groups such as  
19 cancer and well-defined rare conditions such as ALS is high [37 38], reliability is low for chronic conditions  
20 such as diabetes and renal insufficiency [37]. In Switzerland assisted suicides are treated as unnatural  
21 deaths and are investigated by a forensic team, which relies on documents of the right-to-die  
22 organisations [39]. This might lead to a more accurate diagnoses on death certificates of persons dying  
23 with assistance compared to those who have natural deaths.  
24  
25  
26  
27  
28  
29  
30  
31

32 The shift in diagnoses observed in our study may be at least partially explained by the change in the  
33 coding system of the Federal Statistical Office. The fact that assisted suicide was not a primary cause of  
34 death from 2009 onwards may have increased the coding of the underlying diseases. However, further  
35 studies are needed to monitor the development of diagnoses associated with assisted suicide. These  
36 studies ideally should not only be based on death certificates but also recover information on severity and  
37 stage of patients' diseases and the treatments they underwent.  
38  
39  
40  
41

42 In summary, our study results show that the increase in assisted suicides in Switzerland was more  
43 pronounced in the older of the two age groups, but not associated with changing association with  
44 socioeconomic and other factors. However, in a context of assisted suicide vulnerability may not be  
45 limited to factors such as socioeconomic status, living alone, being widowed or divorced. Serious illness,  
46 possibly accompanied by heavy pain with no prospect of improvement, and also mere old age may make  
47 any person more vulnerable. Register-based, sensitive monitoring of the characteristics of assisted deaths  
48 and their underlying diagnoses should be implemented to identify trends and possible omissions in the  
49 health management of specific groups.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 **Funding:** This work was supported by the Swiss National Science Foundation (grant numbers:  
2 325130\_160171 and 33CS30\_148415).  
3  
4

5 **Conflict of interest:** We have read and understood BMJ policy on declaration of interests and declare that  
6 we have no competing interests.  
7

8 **Ethical approval:** Approval for the Swiss National Cohort study was obtained from the ethics committees  
9 of the Cantons of Zurich and Bern. A data centre was established at ISPM Bern, but for analyses  
10 conducted there of this type of study formal consent is not required.  
11  
12

13 **Author's contribution:** Nicole Steck, Christoph Junker, and Marcel Zwahlen developed the study design.  
14 Christoph Junker did the identification of the assisted suicides and the data preparation. Nicole Steck did  
15 the data processing and analyses, and wrote the first draft of the paper. Marcel Zwahlen supervised the  
16 statistical analyses. All authors critically revised the first draft and approved the final manuscript  
17 submitted for publication.  
18  
19

20 **Data sharing statement:** Individual data from different data sets were used for the construction of the  
21 SNC. All these data are the property of the Swiss Federal Statistical Office and can only be made available  
22 by legal agreements with the SFSO. This also applies to derivatives such as the analysis files used for this  
23 study. However, after approval of the SNC Scientific Board a specific SNC module contract with SFSO  
24 allows researchers to receive analysis files for replication of the analysis. Data requests should be sent to  
25 Prof. Milo Puhan (chairman of the SNC Scientific Board, miloalan.puhan@uzh.ch).  
26  
27

28 **Acknowledgements:** The authors thank the Swiss Federal Statistical Office for providing mortality and  
29 census data and for the support which made the Swiss National Cohort and this study possible. The  
30 members of the Swiss National Cohort Study Group are Matthias Egger (Chairman of the Executive  
31 Board), Adrian Spoerri and Marcel Zwahlen (both Bern), Milo Puhan (Chairman of the Scientific Board)  
32 and Matthias Bopp (both Zurich), Nino Kunzli (Basel), Fred Paccaud (Lausanne), and Michel Oris (Geneva).  
33 The authors would like to thank Chris Ritter for editorial services.  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

1. Steck N, Egger M, Maessen M, et al. Euthanasia and Assisted Suicide in Selected European Countries and US States: Systematic Literature Review. *Med Care* 2013;**51**(10):938-44 doi: 10.1097/MLR.0b013e3182a0f427[published Online First: Epub Date]].
2. Emanuel EJ, Onwuteaka-Philipsen BD, Urwin JW, et al. Attitudes and Practices of Euthanasia and Physician-Assisted Suicide in the United States, Canada, and Europe. *JAMA* 2016;**316**(1):79-90 doi: 10.1001/jama.2016.8499[published Online First: Epub Date]].
3. Burkhardt S, La HR. Debates About Assisted Suicide in Switzerland. *Am J.Forensic Med.Pathol.* 2012
4. Schweizerisches Strafgesetzbuch, 1937.
5. Judgements 2A.48/2006 and 2A.66/2006, 2006.
6. Bosshard G, Fischer S, Bar W. Open regulation and practice in assisted dying. *Swiss Med.Wkly.* 2002;**132**(37-38):527-34
7. Steck N, Junker C, Maessen M, et al. Suicide assisted by right-to-die associations: a population based cohort study. *International journal of epidemiology* 2014;**43**(2):614-22 doi: 10.1093/ije/dyu010[published Online First: Epub Date]].
8. Bosshard G, Zellweger U, Bopp M, et al. Medical End-of-Life Practices in Switzerland: A Comparison of 2001 and 2013. *JAMA internal medicine* 2016;**176**(4):555-6 doi: 10.1001/jamainternmed.2015.7676[published Online First: Epub Date]].
9. FSO. Assistierter Suizid (Sterbehilfe) und Suizid in der Schweiz. BFS Aktuell: Federal Statistical Office, 2016:1-4.
10. Exit. Annual reports. Secondary Annual reports. Available at: <https://www.exit.ch/news/jahresberichte/jahresbericht-2016/> (accessed 23.01.2018).
11. Dignitas. Annual reports. Secondary Annual reports. Available at: [http://www.dignitas.ch/index.php?option=com\\_content&view=article&id=24&Itemid=64&lang=de](http://www.dignitas.ch/index.php?option=com_content&view=article&id=24&Itemid=64&lang=de) (accessed 23.01.2018).
12. Exit ADMD. Annual reports. Secondary Annual reports. Available at: <http://www.exit-geneve.ch/journalistes.html> (accessed 23.01.2018).
13. Dyer O, White C, Garcia Rada A. Assisted dying: law and practice around the world. *BMJ* 2015;**351**:h4481 doi: 10.1136/bmj.h4481[published Online First: Epub Date]].
14. Dierickx S, Deliens L, Cohen J, et al. Euthanasia in Belgium: trends in reported cases between 2003 and 2013. *CMAJ* 2016;**188**(16):E407-E14 doi: 10.1503/cmaj.160202[published Online First: Epub Date]].
15. Regional euthanasia review c. JAARVERSLAG 2015, 2016.
16. Authority OH. Oregon Death with Dignity Act: Data summary 2016. In: 8579 O, ed., 2017:12.
17. Washington State Departement of H. Death with Dignity Act Report 2015. 2016
18. Chambaere K, Bilsen J, Cohen J, et al. Trends in medical end-of-life decision making in Flanders, Belgium 1998-2001-2007. *Med.Decis.Making* 2011;**31**(3):500-10
19. Hedberg K, New C. Oregon's Death With Dignity Act: 20 Years of Experience to Inform the Debate. *Annals of internal medicine* 2017;**167**(8):579-83 doi: 10.7326/m17-2300[published Online First: Epub Date]].
20. van der Heide A, van Delden JJM, Onwuteaka-Philipsen BD. End-of-Life Decisions in the Netherlands over 25 Years. *The New England journal of medicine* 2017;**377**(5):492-94 doi: 10.1056/NEJMc1705630[published Online First: Epub Date]].
21. Lerner BH, Caplan AL. Euthanasia in Belgium and the Netherlands: On a Slippery Slope? *JAMA internal medicine* 2015 doi: 10.1001/jamainternmed.2015.4086[published Online First: Epub Date]].
22. Lewis P. The empirical slippery slope from voluntary to non-voluntary euthanasia. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics* 2007;**35**(1):197-210 doi: 10.1111/j.1748-720X.2007.00124.x[published Online First: Epub Date]].
23. Calabro RS, Naro A, De Luca R, et al. The Right to Die in Chronic Disorders of Consciousness: Can We Avoid the Slippery Slope Argument? *Innovations in clinical neuroscience* 2016;**13**(11-12):12-24

- 1 24. Bopp M, Spoerri A, Zwahlen M, et al. Cohort Profile: the Swiss National Cohort--a longitudinal study of  
2 6.8 million people. *Int.J.Epidemiol.* 2009;**38**(2):379-84
- 3 25. Spoerri A, Zwahlen M, Egger M, et al. The Swiss National Cohort: a unique database for national and  
4 international researchers. *Int.J Public Health* 2010;**55**(4):239-42
- 5 26. Renaud A. Methodology Report - Coverage Estimation for the Swiss Population Census 2000: Swiss  
6 Federal Statistical Office, 2004.
- 7 27. Andorno R. Nonphysician-assisted suicide in Switzerland. *Camb.Q.Healthc.Ethics* 2013;**22**(3):246-53
- 8 28. WHO. International Statistical Classification of Diseases and Related Health Problems: Instruction  
9 manual, 2010:1-201.
- 10 29. Panczak R, Galobardes B, Voorpostel M, et al. A Swiss neighbourhood index of socioeconomic  
11 position: development and association with mortality. *J.Epidemiol.Community Health* 2012
- 12 30. Zürich K. Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der Suizidhilfe!".  
13 Secondary Kantonale Volksinitiative zur Einreichung einer Standesinitiative "Stopp der  
14 Suizidhilfe!" 2011. Available at: [http://www.wahlen-  
15 abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
16 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 17 31. Zürich K. Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" Secondary  
18 Kantonale Volksinitiative "Nein zum Sterbetourismus im Kanton Zürich!" 2011. Available at:  
19 [http://www.wahlen-  
20 abstimmungen.zh.ch/internet/justiz\\_inneres/wahlen-  
21 abstimmungen/de/abstimmungen/abstimmungsarchiv.html](http://www.wahlen-abstimmungen.zh.ch/internet/justiz_inneres/wahlen-abstimmungen/de/abstimmungen/abstimmungsarchiv.html) (accessed 22.03.2017).
- 22 32. Vaud K. Assistance au suicide. Secondary Assistance au suicide 2012. Available at:  
23 [http://www.elections.vd.ch/votelec/  
24 results.html?scrutin=VDVO20120617](http://www.elections.vd.ch/votelec/results.html?scrutin=VDVO20120617) (accessed 22.03.2017).
- 25 33. Snijde wind MC, Willems DL, Deliens L, et al. A Study of the First Year of the End-of-Life Clinic for  
26 Physician-Assisted Dying in the Netherlands. *JAMA internal medicine* 2015;**175**(10):1633-40 doi:  
27 10.1001/jamainternmed.2015.3978[published Online First: Epub Date]].
- 28 34. Mirowsky J. RC. *Education, Social Status, and Health*. Hawthorne, NY: Aldine de Gruyter, 2003.
- 29 35. Cohen J, Van WY, Smets T, et al. Cultural differences affecting euthanasia practice in Belgium: one law  
30 but different attitudes and practices in Flanders and Wallonia. *Soc.Sci.Med.* 2012;**75**(5):845-53
- 31 36. Burkhardt S, Wyss K, La HR. [Assisted suicide in Switzerland: physicians' position]. *Revue Medicale*  
32 *Suisse* 2007;**3**(137):2861-64
- 33 37. Harteloh P, de BK, Kardaun J. The reliability of cause-of-death coding in The Netherlands.  
34 *Eur.J.Epidemiol.* 2010;**25**(8):531-38
- 35 38. Chio A, Magnani C, Oddenino E, et al. Accuracy of death certificate diagnosis of amyotrophic lateral  
36 sclerosis. *J.Epidemiol.Community Health* 1992;**46**(5):517-18
- 37 39. Bartsch C. Praxis und Probleme des assistierten Suizids in der Schweiz aus rechtsmedizinischer Sicht.  
38 In: Welsch CO, Ch; Frewer, A; Bielefeld H, ed. *Autonomie und Menschenrechte am Lebensende*.  
39 Boston: Transcript Verlag, 2016:203-20.
- 40
- 41
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60



1  
2 Figure legends:  
3

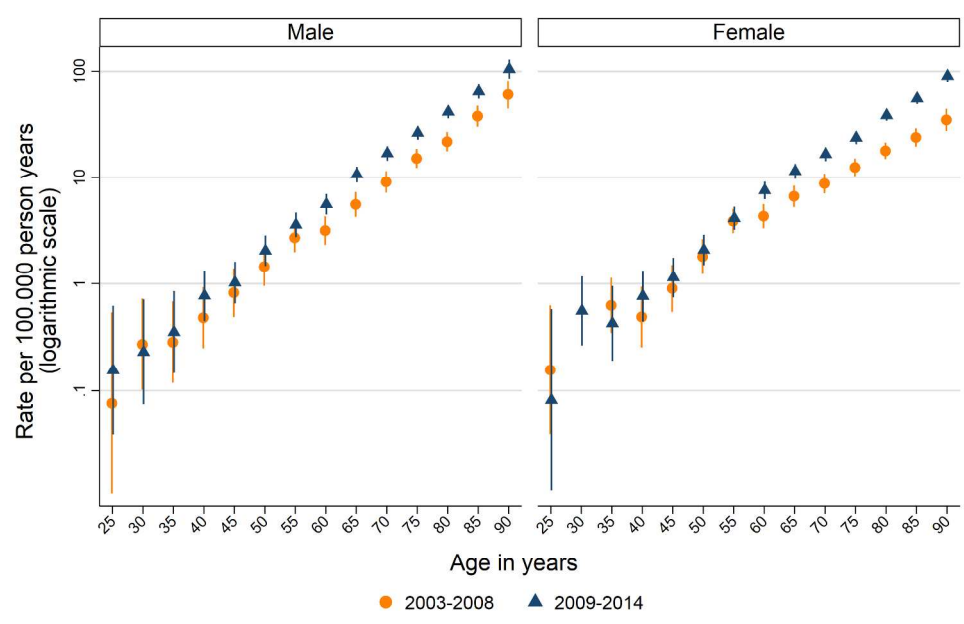
4 **Figure 1 Crude rate of assisted suicide by age and time period (2003-2008 and 2009-2014) for men and**  
5 **women**  
6

7  
8 **Figure 2 Results of multivariable Cox regression, by age group and time period (2003-2008 and 2009-**  
9 **2014)**  
10

11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

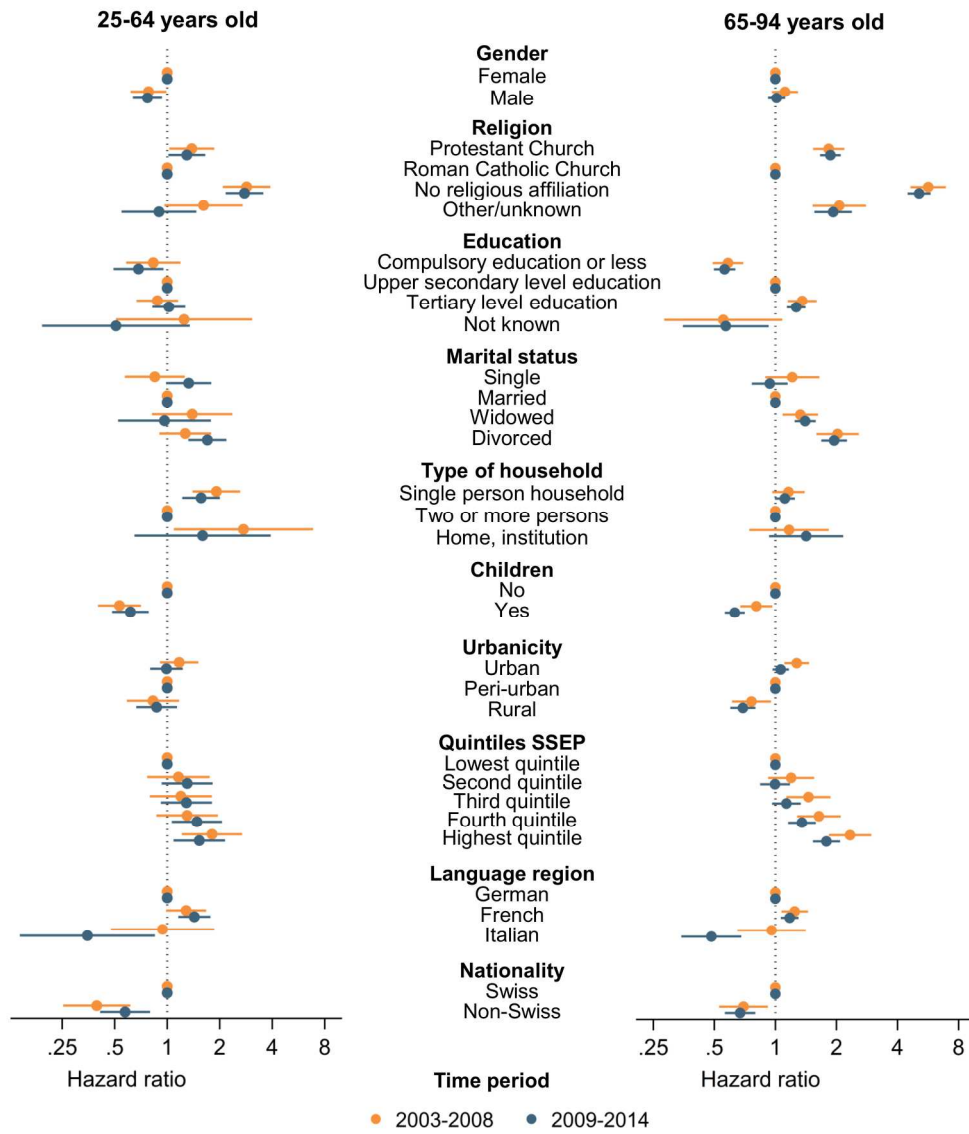
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



254x169mm (300 x 300 DPI)

view only

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



189x217mm (300 x 300 DPI)

**Supplementary table 1 Number of assisted suicides of Swiss residents in the annual reports of the right-to-die organisations Exit Deutschschweiz (Exit\_DS), Exit Suisse Romande (Exit\_SR) and Dignitas and number of assisted suicides identified in the SNC by year**

Year	Annual Reports of Right-to-Die Organisations				Identified in SNC	%
	Exit_DS	Exit_SR	Dignitas	Total		
<b>2003</b>	131	48	9	<b>188</b>	180	95.7
<b>2004</b>	154	42	14	<b>210</b>	198	94.3
<b>2005</b>	162	54	12	<b>228</b>	209	91.7
<b>2006</b>	150	65	15	<b>230</b>	218	94.8
<b>2007</b>	179	66	6	<b>251</b>	231	92.0
<b>2008</b>	167	75	10	<b>252</b>	239	94.8
<b>2009</b>	217	69	4	<b>290</b>	278	95.9
<b>2010</b>	257	91	6	<b>354</b>	330	93.2
<b>2011</b>	305	111	11	<b>427</b>	386	90.4
<b>2012</b>	356	144	13	<b>513</b>	446	86.9
<b>2013</b>	459	155	8	<b>622</b>	538	86.5
<b>2014</b>	583	175	6	<b>764</b>	688	90.1
<b>Total</b>	<b>3120</b>	<b>1095</b>	<b>114</b>	<b>4329</b>	<b>3941</b>	91.0

Supplementary table 2 Categories of underlying diseases and corresponding ICD-10 codes

Category	ICD-10 codes
<b>All cancer</b>	C00-C97
<i>Colon and other digestive organs</i>	C15-C26
<i>Lung and other respiratory organs</i>	C30-C39
<i>Breast</i>	C50
<i>Prostate and other male genital</i>	C60-C63
<i>Others</i>	C00-C14, C40-C49, C51-C58, C64-C97
<b>Mental and behavioural disorders</b>	F00-F99
<i>Dementia</i>	F00-F03
<i>Mood disorders</i>	F30-F39
<i>Other mental and behav. disorders</i>	F04-F29, F40-F99
<b>Diseases of the nervous system</b>	G00-G99
<i>Huntington disease</i>	G10
<i>Motor neuron disease (incl. ALS)</i>	G12.2
<i>Parkinson's disease</i>	G20
<i>Alzheimer</i>	G30
<i>Multiple sclerosis</i>	G35
<i>Paralytic syndromes</i>	G80-G83
<i>Other diseases of the nervous system</i>	G00-G09, G11-G12.1, G12.8-G14, G21-G26, G31-G32, G36-G73, G90-G99
<b>Diseases of the circulatory system</b>	I00-I99
<i>Ischaemic heart diseases</i>	I20-I25
<i>Heart failure</i>	I50
<i>Cerebrovascular disease</i>	I60-I69
<i>Other diseases of the circulatory system</i>	I00-I15, I26-I49, I51-I52, I70-I99
<b>Diseases of the respiratory system</b>	J00-J99
<i>Chronic obstructive pulmonary disease (COPD)</i>	J44
<i>Other diseases of the respiratory system</i>	J00-J43, J45-J99
<b>Diseases of the musculoskeletal system</b>	M00-M99
<i>Arthropathies</i>	M00-M25
<i>Dorsopathies</i>	M40-M54
<i>Osteoporosis</i>	M80-M82
<i>Other diseases of the musculoskeletal system</i>	M30-M36, M60-M79, M83-M99
<b>Other diseases</b>	A00-B99, D00-D89, E00-E90, H00-H95, K00-K93, L00-L99, N00-N99, O00-O99, P00-P96, Q00-Q99, R00-R68, R70-R98
<b>No/Unknown cause of death</b>	R69, R99

**Supplementary table 3 Underlying diagnoses: Number and percentage of assisted suicides, per age group and time period**

Diagnosis	25-64 years old						65-94 years old					
	2003-2008		2009-2014		Total		2003-2008		2009-2014		Total	
	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%
<b>Cancer</b>	<b>159</b>	<b>51.3</b>	<b>243</b>	<b>52.7</b>	<b>402</b>	<b>52.1</b>	<b>385</b>	<b>39.9</b>	<b>862</b>	<b>39.1</b>	<b>1,247</b>	<b>39.3</b>
<i>Colon and other digestive organs</i>	44	14.2	73	15.9	117	15.1	104	10.8	236	10.7	340	10.7
<i>Lung and other respiratory organs</i>	28	9.0	40	8.7	68	8.9	43	4.5	135	6.1	178	5.6
<i>Breast</i>	21	6.8	32	6.9	53	6.9	47	4.9	90	4.1	137	4.3
<i>Prostate and other male genital</i>	6	1.9	8	1.7	14	1.8	57	5.9	102	4.6	159	5.0
<i>Others</i>	60	19.4	90	19.5	150	19.4	134	13.9	299	13.6	433	13.7
<b>Mental and behavioural</b>	<b>14</b>	<b>4.5</b>	<b>31</b>	<b>6.7</b>	<b>45</b>	<b>5.8</b>	<b>36</b>	<b>3.7</b>	<b>98</b>	<b>4.4</b>	<b>134</b>	<b>4.2</b>
<i>Mood disorders</i>	11	3.5	12	2.6	23	2.9	28	2.9	64	2.9	92	2.9
<i>Dementia</i>	0		2	0.4	2	0.2	5	0.5	22	1.0	27	0.8
<i>Other</i>	3	1.0	17	3.7	20	2.6	3	0.3	12	0.5	15	0.5
<b>Nervous system</b>	<b>62</b>	<b>20.0</b>	<b>110</b>	<b>23.9</b>	<b>172</b>	<b>22.3</b>	<b>105</b>	<b>10.9</b>	<b>268</b>	<b>12.2</b>	<b>373</b>	<b>11.8</b>
<i>Motor neuron disease</i>	17	5.5	18	3.9	35	4.5	27	2.8	47	2.1	74	2.3
<i>Parkinson's</i>	1	0.3	3	0.7	4	0.5	32	3.3	74	3.4	106	3.3
<i>Multiple sclerosis</i>	29	9.4	43	9.3	72	9.4	13	1.4	22	1.0	35	1.1
<i>Huntington</i>	1	0.3	9	1.9	10	1.3	0	0	3	0.1	3	0.1
<i>Paralytic syndromes</i>	3	1.0	10	2.2	13	1.7	8	0.8	12	0.6	20	0.6
<i>Alzheimer</i>	0	0	3	0.7	3	0.4	5	0.5	20	0.9	25	0.8
<i>Other</i>	11	3.5	24	5.2	35	4.5	20	2.1	90	4.1	110	3.5
<b>Circulatory system</b>	<b>2</b>	<b>0.7</b>	<b>12</b>	<b>2.6</b>	<b>14</b>	<b>1.8</b>	<b>112</b>	<b>11.6</b>	<b>268</b>	<b>12.2</b>	<b>380</b>	<b>12.0</b>
<i>Ischaemic</i>	0	0	1	0.2	1	0.1	2	0.2	61	2.8	63	2.0
<i>Heart failure</i>							1	0.1	26	1.2	27	0.8
<i>Cerebrovascular</i>	2	0.7	7	1.5	9	1.2	109	11.3	99	4.5	208	6.6
<i>Other</i>	-		4	0.8	4	0.5	0	0	82	3.7	219	2.6
<b>Respiratory system</b>	<b>10</b>	<b>3.2</b>	<b>16</b>	<b>3.5</b>	<b>26</b>	<b>3.4</b>	<b>31</b>	<b>3.2</b>	<b>118</b>	<b>5.4</b>	<b>149</b>	<b>4.7</b>
<i>COPD</i>	9	2.9	10	2.2	19	2.5	27	2.8	87	4.0	114	3.6
<i>Other</i>	1	0.3	6	1.3	7	0.9	4	0.4	31	1.4	35	1.1
<b>Musculoskeletal</b>	<b>6</b>	<b>1.9</b>	<b>13</b>	<b>2.8</b>	<b>19</b>	<b>2.5</b>	<b>62</b>	<b>6.4</b>	<b>255</b>	<b>11.6</b>	<b>317</b>	<b>10.0</b>
<i>Arthropathies</i>	2	0.6	-	-	2	0.3	16	1.7	88	4.0	104	3.3
<i>Dorsopathies</i>	1	0.3	6	1.3	7	0.9	23	2.3	90	4.1	113	3.5
<i>Osteoporosis</i>	-	-	1	0.2	1	0.1	17	1.8	46	2.1	63	2.0
<i>Other</i>	3	1.0	6	1.3	9	1.2	6	0.6	31	1.4	37	1.2
<b>Other</b>	<b>32</b>	<b>10.3</b>	<b>24</b>	<b>5.2</b>	<b>56</b>	<b>7.3</b>	<b>83</b>	<b>8.6</b>	<b>239</b>	<b>10.8</b>	<b>322</b>	<b>10.2</b>
<b>No condition listed</b>	<b>25</b>	<b>8.1</b>	<b>12</b>	<b>2.6</b>	<b>37</b>	<b>4.8</b>	<b>151</b>	<b>15.7</b>	<b>97</b>	<b>4.4</b>	<b>248</b>	<b>7.8</b>
<b>Total</b>	<b>310</b>		<b>461</b>		<b>771</b>		<b>965</b>		<b>2,205</b>		<b>3,170</b>	

Supplementary table 4 Results of the Cox regression models by age group and time period

Characteristics	Age group 25-64 years				Age group 65-94 years				
	2003-2008		2009-2014		2003-2008		2009-2014		
	HR	95%CI	HR	95%CI	HR	95% CI	HR	95% CI	
Gender	Male	0.78	0.62-0.99	0.77	0.64-0.93	1.12	0.96-1.29	1.01	0.92-1.12
	<b>Female</b>	1		1		1		1	
	Wald test, 1df	$\chi^2=4.20, p=0.04$		$\chi^2=7.08, p=0.008$		$\chi^2=2.10, p=0.15$		$\chi^2=0.08, p=0.7751$	
Religious affiliation	Protestant	1.38	1.03-1.86	1.30	1.02-1.65	1.83	1.54-2.49	1.87	1.66-2.10
	<b>Catholic</b>	1		1		1		1	
	No Affiliation	2.86	2.08-3.90	2.77	2.16-3.56	5.68	4.64-6.94	5.12	4.49-5.83
	Other/unknown	1.61	0.96-2.71	0.90	0.55-1.47	2.07	1.53-2.80	1.93	1.56-2.39
	Wald test, 3 df	$\chi^2=46.44, p<0.001$		$\chi^2=77.60, p<0.001$		$\chi^2=314.58, p<0.001$		$\chi^2=645.78, p<0.001$	
Education	Compulsory	0.83	0.58-1.19	0.68	0.49-0.95	0.58	0.49-0.69	0.56	0.50-0.64
	<b>Secondary</b>	1		1		1		1	
	Tertiary	0.88	0.67-1.16	1.02	0.82-1.27	1.36	1.15-1.60	1.27	1.14-1.41
	Unknown	1.25	0.51-3.07	0.51	0.19-1.35	0.55	0.28-1.08	0.57	0.35-0.93
	Wald test, 3 df	$\chi^2=2.03, p=0.57$		$\chi^2=6.70, p=0.08$		$\chi^2=64.07, p<0.001$		$\chi^2=126.96, p<0.001$	
Marital status	Single	0.85	0.57-1.26	1.33	0.99-1.79	1.21	0.89-1.65	0.94	0.77-1.15
	<b>Married</b>	1		1		1		1	
	Widowed	1.39	0.82-2.36	0.96	0.52-1.79	1.33	1.09-1.62	1.40	1.24-1.58
	Divorced	1.27	0.90-1.79	1.70	1.32-2.19	2.03	1.59-2.58	1.95	1.69-2.26
	Wald test, 3 df	$\chi^2=5.48, p=0.14$		$\chi^2=17.71, p<0.001$		$\chi^2=34.57, p<0.001$		$\chi^2=105.03, p<0.001$	
Type of household	1 person	1.91	1.40-2.62	1.56	1.22-2.00	1.16	0.97-1.40	1.11	0.99-1.24
	<b>≥ 2 persons</b>	1		1		1		1	
	Institutions	2.74	1.09-6.86	1.59	0.65-3.92	1.17	0.74-1.84	1.42	0.93-2.16
	Wald test, 2 df	$\chi^2=18.20, p<0.001$		$\chi^2=12.74, p=0.002$		$\chi^2=2.57, p=0.28$		$\chi^2=5.33, p=0.07$	
Children	<b>No</b>	1		1		1		1	
	Yes	0.53	0.40-0.71	0.61	0.48-0.78	0.81	0.67-0.97	0.63	0.56-0.71
	Unknown	0.84	0.46-1.53	1.09	0.66-1.79	0.64	0.45-0.91	0.70	0.55-0.89
	Wald test, 1 df	$\chi^2=18.94, p<0.001$		$\chi^2=15.51, p<0.001$		$\chi^2=5.45, p=0.02$		$\chi^2=63.09, p<0.001$	
Urbanicity	Urban	1.17	0.90-1.51	0.99	0.80-1.23	1.28	1.11-1.47	1.06	0.97-1.17
	<b>Peri-urban</b>	1		1		1		1	
	Rural	0.8	0.59-1.17	0.87	0.66-1.14	0.76	0.61-0.95	0.69	0.60-0.80
	Wald test, 2 df	$\chi^2=18.94, p<0.001$		$\chi^2=1.10, p=0.58$		$\chi^2=25.72, p<0.001$		$\chi^2=34.26, p<0.001$	
Neighbourhood index of SEP	<b>Lowest quintile</b>	1		1		1		1	
	Second quintile	1.16	0.77-1.75	1.30	0.93-1.82	1.20	0.92-1.55	1.00	0.84-1.18
	Third quintile	1.20	0.79-1.80	1.29	0.92-1.81	1.46	1.13-1.87	1.12	0.96-1.34
	Fourth quintile	1.30	0.87-1.95	1.48	1.06-2.06	1.64	1.28-2.10	1.35	1.16-1.58
	Highest quintile	1.81	1.21-2.69	1.53	1.09-2.15	2.34	1.83-2.98	1.79	1.53-2.08
	Wald test, 4 df	$\chi^2=18.94, p<0.001$		$\chi^2=6.95, p=0.14$		$\chi^2=65.39, p<0.001$		$\chi^2=97.24, p<0.001$	
Language Region	<b>German</b>	1		1		1		1	
	French	1.28	0.99-1.67	1.43	1.16-1.77	1.25	1.07-1.45	1.18	1.06-1.30
	Italian	0.94	0.47-1.86	0.35	0.14-0.85	0.96	0.65-1.41	0.48	0.34-0.68
	Wald test, 2 df	$\chi^2=3.61, p=0.16$		$\chi^2=17.72, p<0.001$		$\chi^2=8.46, p=0.01$		$\chi^2=30.58, p<0.001$	
Nationality	<b>Swiss</b>	1		1		1		1	
	Foreigner	0.39	0.25-0.62	0.57	0.41-0.80	0.70	0.53-0.92	0.67	0.56-0.80
	Wald test, 1 df	$\chi^2=16.81, p<0.001$		$\chi^2=10.93, p<0.001$		$\chi^2=6.58, p=0.01$		$\chi^2=20.54, p<0.001$	

Supplementary table 5 Results of the logistic regression models by age group and time period

Characteristics		Age group 25-64 years				Age group 65-94 years			
		2003-2008		2009-2014		2003-2008		2009-2014	
		OR	95%CI	OR	95%CI	OR	95% CI	OR	95% CI
Gender	Male	0.52	0.41-0.66	0.54	0.44-0.65	0.64	0.55-0.75	0.65	0.59-0.72
	<b>Female</b>	1		1		1		1	
	Wald test, 1 df	$\chi^2=28.80, p<0.01$		$\chi^2=37.92, p<0.01$		$\chi^2=33.65, p<0.01$		$\chi^2=69.95, p<0.01$	
Age at death	<b>25-34</b>	1		1				1	
	35-44	1.36	0.59-3.12	0.66	0.33-1.332				
	45-54	1.25	0.56-2.78	0.55	0.29-1.07				
	55-64	1.33	0.60-2.94	0.67	0.35-1.28				
	<b>65-74</b>					1		1	
	75-84					0.94	0.80-1.10	0.92	0.82-1.03
	85-94					0.77	0.64-0.94	0.73	0.64-0.83
	Wald test	3df: $\chi^2=0.72, p=0.87$		$\chi^2=4.74, p=0.19$		2df: $\chi^2=7.74, p=0.02$		$\chi^2=27.07, p<0.01$	
Underlying disease	<b>Cancer</b>	1		1		1		1	
	Mental	1.38	0.78-2.44	2.19	1.45-3.30	0.61	0.43-0.87	0.42	0.34-0.53
	Nervous system	6.91	5.06-9.42	6.76	5.29-8.65	1.53	1.23-1.92	1.47	1.27-1.60
	Circulatory	0.04	0.01-0.14	0.13	0.07-0.25	0.21	0.17-0.27	0.26	0.22-0.30
	Respiratory	1.08	0.57-2.06	1.06	0.63-1.77	0.35	0.24-0.51	0.57	0.47-0.70
	Musculoskeletal	3.81	1.64-8.84	4.63	2.51-8.52	4.92	3.70-6.54	9.45	8.08-11.06
	Other diseases	0.79	0.53-1.18	0.44	0.29-0.68	0.52	0.41-0.66	0.68	0.58-0.78
	No disease	1.57	1.01-2.43	0.45	0.25-0.81	4.05	3.32-4.95	1.06	0.85-1.32
	Wald test, 7 df	$\chi^2=198.53, p<0.01$		$\chi^2=374.96, p<0.01$		$\chi^2=741.59, p<0.01$		$\chi^2=1684.34, p<0.01$	
Religious affiliation	Protestant	1.29	0.96-1.74	1.27	0.99-1.62	1.81	1.52-2.17	1.85	1.64-2.08
	<b>Catholic</b>	1		1		1		1	
	No Affiliation	2.76	2.01-3.79	2.75	2.14-3.55	5.49	4.48-6.72	5.00	4.37-5.70
	Other/unknown	1.52	0.91-2.55	0.94	0.57-1.54	1.86	1.37-2.53	1.81	1.46-2.25
	Wald test, 3 df	$\chi^2=44.75, p<0.01$		$\chi^2=73.00, p<0.01$		$\chi^2=294.46, p<0.01$		$\chi^2=600.21, p<0.01$	
Education	Compulsory	0.64	0.45-0.91	0.50	0.36-0.70	0.54	0.45-0.64	0.51	0.45-0.57
	<b>Secondary</b>	1		1		1		1	
	Tertiary	1.20	0.91-1.59	1.45	1.16-1.81	1.52	1.29-1.80	1.49	1.34-1.66
	Unknown	0.94	0.38-2.29	0.38	0.15-0.97	0.53	0.27-1.04	0.59	0.36-0.97
	Wald test, 3 df	$\chi^2=9.36, p=0.02$		$\chi^2=36.32, p<0.01$		$\chi^2=94.71, p<0.01$		$\chi^2=210.35, p<0.01$	
Marital status	Single	0.68	0.46-1.01	0.92	0.68-1.26	1.18	0.87-1.61	0.92	0.75-1.13
	<b>Married</b>	1		1		1		1	
	Widowed	1.00	0.59-1.71	0.90	0.52-1.56	1.22	0.99-1.49	1.43	1.26-1.61
	Divorced	1.06	0.75-1.49	1.19	0.92-1.53	1.81	1.42-2.31	1.83	1.58-2.13
	Wald test, 3 df	$\chi^2=5.27, p=0.15$		$\chi^2=3.39, p=0.34$		$\chi^2=23.72, p<0.01$		$\chi^2=92.22, p<0.01$	
Type of household	1 person	1.48	1.08-2.02	1.36	1.06-1.74	1.06	0.88-1.27	0.97	0.86-1.08
	<b><math>\geq 2</math> persons</b>	1		1		1		1	
	Institutions	0.76	0.30-1.93	0.63	0.25-1.57	0.52	0.33-0.81	0.86	0.56-1.33
	Wald test, 2 df	$\chi^2=7.15, p=0.03$		$\chi^2=7.48, p=0.02$		$\chi^2=10.35, p<0.01$		$\chi^2=0.66, p=0.72$	
Children	<b>No</b>	1		1		1		1	
	Yes	0.73	0.55-0.97	0.80	0.63-1.02	0.91	0.76-1.09	0.74	0.66-0.83
	Unknown	0.75	0.41-1.38	0.95	0.57-1.57	0.60	0.42-0.85	0.70	0.55-0.89
	Wald test, 1 df	$\chi^2=4.62, p=0.03$		$\chi^2=3.28, p=0.07$		$\chi^2=12.37, p<0.01$		$\chi^2=25.85, p<0.01$	
Urbanicity	Urban	1.02	0.79-1.32	0.93	0.74-1.16	1.17	1.02-1.35	1.02	0.93-1.13
	<b>Peri-urban</b>	1		1		1		1	
	Rural	0.96	0.68-1.35	0.95	0.72-1.25	0.81	0.65-1.01	0.71	0.61-0.82
	Wald test, 2 df	$\chi^2=0.13, p=0.94$		$\chi^2=0.46, p=0.80$		$\chi^2=0.99, p=0.32$		$\chi^2=25.27, p<0.01$	
Neighbourhood index of SEP	<b>Lowest quintile</b>	1		1		1		1	
	Second quintile	1.22	0.81-1.86	1.32	0.94-1.86	1.27	0.97-1.65	1.04	0.88-1.23
	Third quintile	1.32	0.87-1.98	1.46	1.03-2.05	1.57	1.22-2.02	1.25	1.06-1.48
	Fourth quintile	1.64	1.09-2.47	1.78	1.27-2.50	1.82	1.42-2.33	1.56	1.33-1.84
	Highest quintile	2.49	1.67-3.72	2.11	1.49-2.98	2.75	2.16-3.52	2.26	1.93-2.65
	Wald test, 4 df	$\chi^2=26.13, p<0.01$		$\chi^2=20.65, p<0.01$		$\chi^2=89.86, p<0.01$		$\chi^2=170.28, p<0.01$	
Language Region	<b>German</b>	1		1		1		1	
	French	1.25	0.96-1.63	1.39	1.12-1.73	1.14	0.97-1.33	1.24	1.12-1.37
	Italian	1.00	0.50-1.99	0.36	0.15-0.88	1.05	0.71-1.56	0.53	0.38-0.75
	Wald test, 2 df	$\chi^2=2.72, p=0.26$		$\chi^2=15.20, p<0.01$		$\chi^2=0.07, p=0.79$		$\chi^2=12.83, p<0.01$	
Nationality	<b>Swiss</b>	1		1		1		1	
	Foreigner	0.59	0.38-0.91	0.73	0.53-1.02	0.82	0.62-1.08	0.88	0.73-1.04
	Wald test, 1 df	$\chi^2=5.60, p=0.02$		$\chi^2=3.40, p=0.07$		$\chi^2=1.98, p=0.16$		$\chi^2=2.18, p=0.14$	



**Supplementary table 6** Degrees of freedom (df), chi square (chi2) and p-values for likelihood ratio tests for interactions with time period (2003-2008 vs 2009-2014) in multivariable Cox respectively logistic regression models

Variable	df	Cox regression		Logistic regression	
		chi2	p-value	chi2	p-value
<b>Age group 25-64 years</b>					
Sex	1	0.07	0.7922	0.26	0.6124
Diagnosis	7			22.92	0.0018
Religion	3	3.71	0.2949	3.08	0.3790
Education	3	3.78	0.2868	3.66	0.3001
Marital status	3	2.45	0.4837	2.61	0.4555
Household	2	0.88	0.6454	0.08	0.9629
Parenthood	1	0.50	0.4785	0.00	0.9578
Urbanicity	2	1.31	0.5205	0.38	0.8276
SSEP	4	2.10	0.7169	1.58	0.8120
Language region	2	0.98	0.6133	3.79	0.1505
Nationality	1	0.32	0.5721	0.11	0.7387
<b>Age group 65-94 years</b>					
Sex	1	0.10	0.7524	0.44	0.5060
Diagnosis	7			134.80	<0.001
Religion	3	3.42	0.3308	3.23	0.3581
Education	3	1.33	0.7220	1.52	0.6776
Marital status	3	2.13	0.5453	3.86	0.2768
Household	2	1.27	0.5292	4.66	0.0972
Parenthood	1	1.67	0.1959	0.45	0.5015
Urbanicity	2	3.16	0.2055	3.30	0.1923
SSEP	4	3.29	0.5100	2.27	0.6854
Language region	2	5.39	0.0676	5.58	0.0613
Nationality	1	0.94	0.3310	0.01	0.9200

**Supplementary table 7** Odds ratios and 95% Confidence Intervals (CI) for interactions between time period and diagnosis in multivariable logistic regression models (corrected for sex, age, religion, education, marital status, type of household, urbanization, the neighborhood index of socioeconomic position, language region and nationality)

Diagnosis	Age group 25-64		Age group 65-94	
	OR	95%CI	OR	95%CI
Cancer	1 (Ref)		1 (Ref)	
Mental and behavioural	1.67	0.84-3.31	0.71	0.48-1.07
Nervous System	0.98	0.66-1.45	0.99	0.76-1.29
Circulatory System	3.92	0.86-17.93	1.22	0.94-1.57
Respiratory System	0.99	0.43-2.25	1.67	1.10-2.53
Musculoskeletal System	1.19	0.42-3.37	1.97	1.43-2.71
Other diseases	0.56	0.32-1.00	1.32	0.99-1.76
No disease	0.30	0.15-0.62	0.27	0.20-0.36

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	page in the manuscript
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	4/5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4/5
4/5Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4/5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5, suppl. table 2
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	n.a.
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4/5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	n.a.
		(d) If applicable, explain how loss to follow-up was addressed	n.a.
		(e) Describe any sensitivity analyses	n.a.
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6/7
		(b) Give reasons for non-participation at each stage	n.a.
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, table 1
		(b) Indicate number of participants with missing data for each variable of interest	table 1
		(c) Summarise follow-up time (eg, average and total amount)	6

1	Outcome data	15*	Report numbers of outcome events or summary measures over time	6/7
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-	table 1a & 1b, figure 2
3			adjusted estimates and their precision (eg, 95% confidence	
4			interval). Make clear which confounders were adjusted for and why	
5			they were included	
6			(b) Report category boundaries when continuous variables were	n.a.
7			categorized	
8			(c) If relevant, consider translating estimates of relative risk into	n.a.
9			absolute risk for a meaningful time period	
10				
11	Other analyses	17	Report other analyses done—eg analyses of subgroups and	10/11
12			interactions, and sensitivity analyses	
13				
14	<b>Discussion</b>			
15	Key results	18	Summarise key results with reference to study objectives	12
16	Limitations	19	Discuss limitations of the study, taking into account sources of	13/14
17			potential bias or imprecision. Discuss both direction and magnitude	
18			of any potential bias	
19				
20	Interpretation	20	Give a cautious overall interpretation of results considering	12/13/14
21			objectives, limitations, multiplicity of analyses, results from similar	
22			studies, and other relevant evidence	
23				
24	Generalisability	21	Discuss the generalisability (external validity) of the study results	12
25				
26	<b>Other information</b>			
27	Funding	22	Give the source of funding and the role of the funders for the	15
28			present study and, if applicable, for the original study on which the	
29			present article is based	
30				

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.