unisanté
Centre universitaire de médecine générale et santé publique · Lausanne

UNIL | Université de Lausanne

Mortality in Switzerland 2020-2021

Isabella Locatelli & Valentin Rousson

Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland
Département de Formation, Recherche et Innovation – DFRI, Secteur Recherche Quantitative (Biostatistique)

September 2021

Abstract

In this report, we update previously published results on all-cause mortality in Switzerland in 2020 and extend them to the first half of 2021. Whereas mortality in Switzerland increased by 9.2% in 2020 compared with 2019 as a result of the first two waves of COVID-19, it decreased by about 10.8 % in the first half of 2021 compared with 2020, bringing the level of mortality in 2021 below that of 2019. In terms of life expectancy, we have gained about 3.1 months so far in 2021 in Switzerland compared to 2019, 6.0 months for women and 0.3 months for men. By mid-2021, women have therefore more than recovered the secular downward trend in mortality, i.e. an increase in life expectancy of about 2 months each year, while men are still slightly behind. A look at the weekly mortality data reveals that mortality levels in 2021 were consistently lower than those observed in previous years, with the exception of the first 4-6 weeks of 2021, corresponding to the end of the second wave of COVID-19. Notably, 2021 is the second consecutive year without a visible impact of influenza on mortality in Switzerland, and there was no third wave of mortality related to COVID-19. Therefore, 2021 is so far the best year ever regarding mortality in Switzerland.

Résumé

Dans ce rapport, nous mettons à jour les résultats précédemment publiés sur la mortalité toutes causes confondues en Suisse en 2020 et les étendons au premier semestre 2021. Alors que la mortalité en Suisse a augmenté de 9,2 % en 2020 par rapport à 2019 suite aux deux premières vagues de COVID-19, elle a diminué d'environ 10,8 % au premier semestre 2021 par rapport à 2020, ramenant le niveau de mortalité en 2021 en dessous de celui de 2019. En termes d'espérance de vie, nous avons gagné en Suisse environ 3,1 mois jusqu'à présent en 2021 par rapport à 2019, 6,0 mois pour les femmes et 0,3 mois pour les hommes. À la mi-2021, les femmes ont donc plus que récupéré la tendance séculaire à la baisse de la mortalité, soit une augmentation de l'espérance de vie d'environ 2 mois chaque année, alors que les hommes sont encore légèrement en retard. Une analyse des données hebdomadaires de mortalité révèle que les niveaux de mortalité en 2021 étaient systématiquement inférieurs à ceux observés les années précédentes, à l'exception des 4 à 6 premières semaines de 2021, correspondant à la fin de la deuxième vague de COVID-19. En particulier, 2021 est la deuxième année consécutive sans impact visible de la grippe sur la mortalité en Suisse, et nous n'avons pas observé de troisième vague de mortalité liée au COVID-19. Par conséquent, 2021 est jusqu'à présent la meilleure année jamais enregistrée en matière de mortalité en Suisse.

Introduction

The year 2020 was marked by the global spread of the COVID-19 pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The impact of the pandemic on all-cause mortality has begun to be studied worldwide [1-5], with the difficulty that it usually takes several months (or years) to obtain complete and consolidated statistics on deaths in a country.

An early assessment of excess mortality in Switzerland in 2020 can be found in Locatelli and Rousson [6] (fully published on June 17, 2021). Based on provisional data collected until May 19, 2021 from the Swiss FSO (Federal Statistical Office), they estimated in 2020 an increase in standardized mortality rates of 8.8% compared with 2019, with significant excess mortality (only) for men over 70 and for women over 75. The estimated decrease in life expectancy at birth in 2020 was 0.7%, with a loss of 9.7 months for men and 5.3 months for women with respect to the previous year.

A few months later, these results can be updated using the completed death data now available for 2020, and extended using the (provisional) death data for the first half of 2021. The purpose of this report is therefore two-fold. First, to update the results published in [6]. Second, to provide an early analysis of the mortality in Switzerland in the first half of 2021. While recognizing that semiannual analyses are not common in demography, and that death statistics for the first half of the current year are still provisional (because some deaths are reported with delay), we believe that such an early analysis is interesting and useful to judge and follow the situation during the ongoing pandemic.

Data

We used official data on deaths in Switzerland published by the Swiss FSO for 2000-2020 and the first six months (26 weeks) of 2021 (last access September 28, 2021). The annual number of deaths, separately for men and women, was available by 1-year age groups (with a last open class of

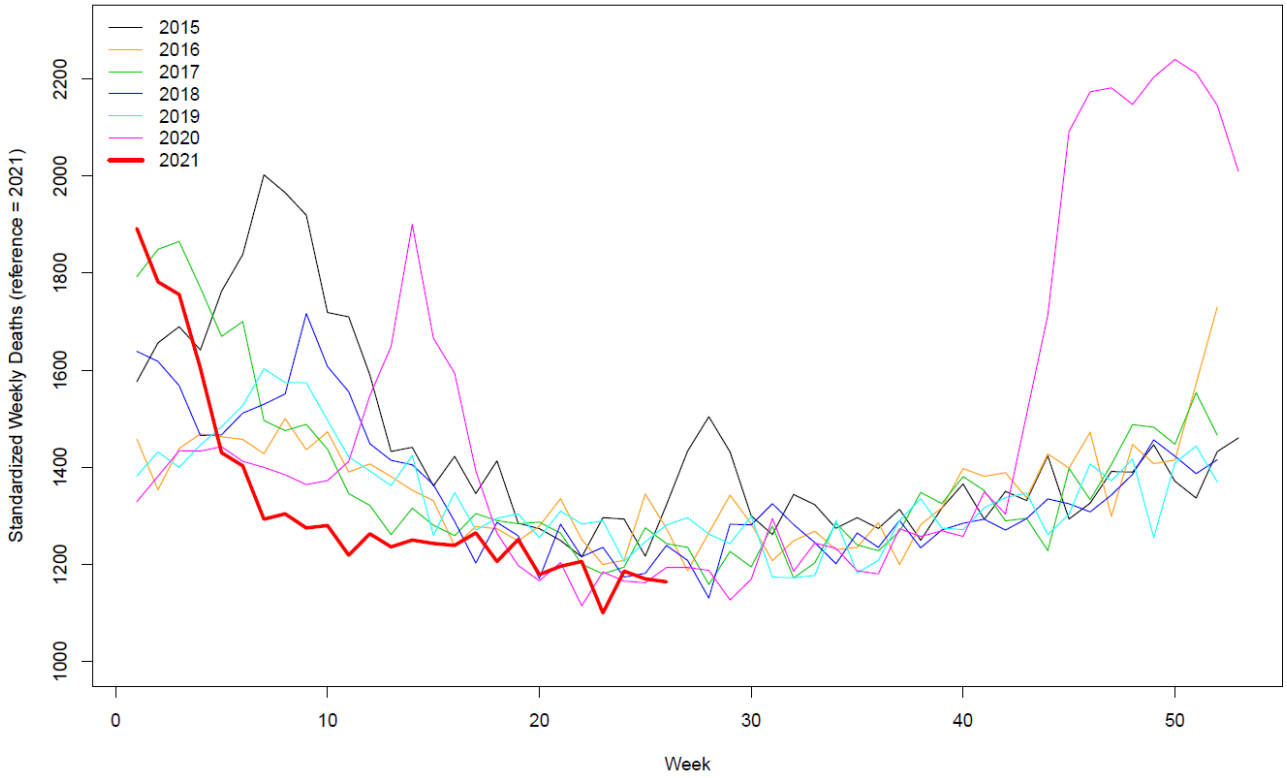

Figure 1. Standardized Weekly Deaths 2015-2021 (data: FSO)

110+) until year 2020[a]. On the other hand, it was available by 5-years age groups (with a last open class of 90+) for each of the first 26 weeks of 2021[b]. To facilitate comparisons, we excluded 1/366 of deaths in the case of leap years (including 2020). Weekly death data were also available for years 2015-2020 with a partition in 5 large age classes (0-19, 20-39, 40-64, 65-79, 80+)[c].

The size of the Swiss population as of January 1, 2011-2021, stratified by sex and one-year age groups (with a last open class of 105+) was found in the FSO database[d]. The size of the Swiss population as of January 1, 2000-2019, stratified by sex and one-year age groups (with a last open class of 110+), was (also) found in the Human Mortality Database (HMD)[e]. Since the difference for the overlapping years were negligible, we used HMD source for the years 2000-2010 and FSO source for the years 2011-2021. Life expectancy for both sexes was also available in the HMD database for the period 1900-2018.

Results

Figure 1 shows the Standardized Weekly Deaths (SWD, see Methodological Appendix) for the years 2015-2020 and for the first 26 weeks of the year 2021, reflecting the weekly deaths that would have occurred each year if the weekly age-specific rates observed in that year were applied to the size and age distribution of a reference population (reference = January 1, 2021). We recognize the waves due to influenza each year until 2019 (except 2016, a year spared by the flu) and the two COVID-19 waves of 2020, the first one "replacing" the usual wave of influenza, the second one (much higher and broader than the first) ending during the first 4-6 weeks of 2021. With the exception of these initial weeks, the first half of 2021 was characterized by lower levels of mortality than in the corresponding period of the 6 previous years. In particular, neither an episode of flu nor a third wave of COVID-19 was observed.

Figure 2 shows the Standardized Mortality Rates (SMR, see Methodological Appendix) in Switzerland calculated for the years 2000-2020 and for the first half of 2021 (overall and stratified by sex). Crude mortality rates (number of deaths divided by the total population in a given year) are plotted for comparison. We also added to each graph an estimated trend based on the SMR of the pre-pandemic decade 2010-2019, as explained in the Methodological Appendix. As already discussed in [6], and contrary to the crude mortality rates, the standardized mortality rates declined sharply over the past 20 years. In 2020, the SMR for both sexes was higher than in previous years, returning to the level of about 5 years earlier. However, and this is a new result, the SMR in the first half of 2021 was lower than in 2020 and all previous years (including 2019), falling just below the projected trend for mid-2021. Similar conclusions can be drawn by analyzing men and women separately, although the SMR for men was still above the trend in the first half of 2021, whereas it was below the trend for women.

Table 1 shows the relative changes in SMR, comparing 2021, 2020 and 2019. Mortality in 2020 increased by 9.2% compared with 2019, this relative difference being greater for men (11.0%) than for women (7.4%). On the other hand, the SMR for the first half of 2021 decreased by 10.8%

(10.3% for men and 11.3% for women) compared with the SMR for 2020, being thus 2.7% lower than in 2019, and just below the projected trend for mid-2021 (-0.2%). Consistently with Figure 2, the relative difference from the trend was positive for men (+2.9%) and negative for women (-3.0%).

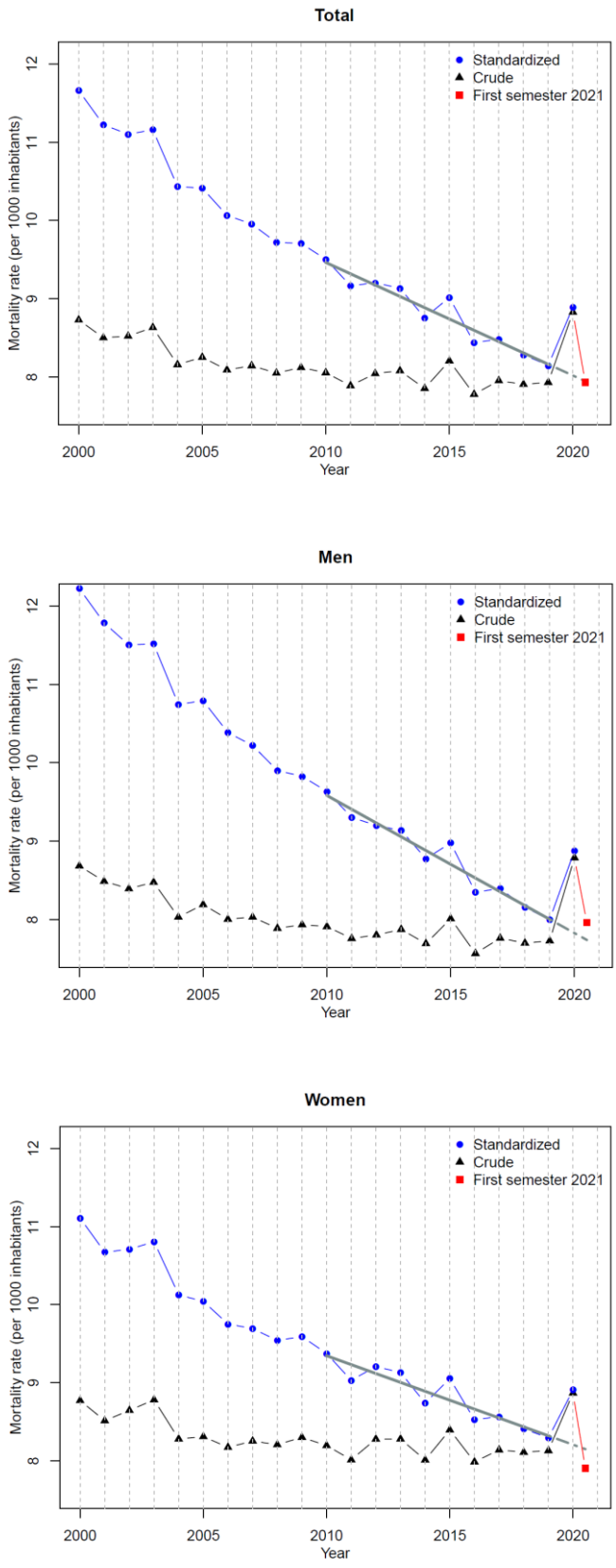

Figure 2: Mortality rates 2000-21 overall and by sex (data: FSO)

SMR			
	Total	Men	Women
	%	%	%
2020 vs 2019	+9.2	+11.0	+7.4
mid-2021 vs 2019	-2.7	-0.5	-4.7
mid-2021 vs 2020	-10.8	-10.3	-11.3
mid-2021 vs trend	-0.2	+2.9	-3.0

Table 1: Relative changes in Standardized Mortality Rates (SMR)

Figure 3 shows life expectancy at birth in Switzerland for the years 1900-2020 and the first half of 2021, separately for men and women (see Methodological Appendix). We retrieve the spectacular increase in life expectancy during period 1900-2019 (from 46 to 81.9 years for men and from 49 to 85.6 years for women) with the impressive drop due to the Spanish flu in 1918, a loss of life expectancy of more than 8 years for women and more than 10 years for men. Considering the decade 2010-2019, we estimated an increasing linear trend of around 2.5 months per year for men and 1.6 months per year for women.

Table 2 shows the relative changes in life expectancy, comparing 2021, 2020 and 2019. Compared to 2019, life expectancy decreased in 2020 by 1% (10.1 months) for men and 0.6% (5.8 months) for women. However, as for standardized mortality rates, life expectancy resumed its upward trend in the first half of 2021, remaining stilly below the trend for men (-0.3%, -3.0 months) but appearing above the trend for women (+0.3%, +3.6 months).

Discussion

In this report, we updated the results obtained in Locatelli and Rousson [6], "A first analysis of excess mortality in Switzerland in 2020", using the consolidated FSO death data. We estimate now the excess mortality in 2020 compared to 2019 at +9.2% (instead of +8.8%), +11.0% for men and +7.4% for women, and the loss in life expectancy between 2019 and 2020 at -7.9 months (instead of -7.5 months), -10.1 months for men and -5.8 months for women. All these results remain close to what has been published in [6].

As we now dispose of provisional data on deaths for the first six months (first 26 weeks) of 2021, we could also estimate the semiannual standardized mortality rate and the corresponding life expectancy at birth for the first half of 2021. These data could be compared with the standardized mortality rates and life expectancies of 2020, 2019, and with the projected trends for mid-2021.

According to our estimates, the SMR of mid-2021 has decreased by 10.8% and life expectancy at birth have increased by 1.1% (11.2 months) compared to 2020. As a result, both seem to have already recovered the pre-pandemic trend lost in 2020. When stratifying by sex, we found that women have actually more than retrieved the previous tendency, while men are still slightly below. These results are at least partly due to the fact that, apart from

the first 4-6 weeks of the year, characterized by the ending of the second wave of COVID-19, the first half of 2021 has been free of influenza. However, the standardized weekly deaths for the first semester 2021 appear uniformly lower than those of previous years, also after the winter, outside the usual periods of influenza. Furthermore, contrary to the first and second waves, the third wave of COVID-19 cases registered in Switzerland during the months of March and April 2021 had no visible impact on all-cause mortality.

This analysis is still a preliminary one and requires some caution and clarifications. First, the deaths reported up to week 26 of 2021 are provisional, as part of the deaths are recorded with delay. However, three months after the last week considered (the 26th), the number of deaths recorded up to this week is not far from having stabilized, as we could verify by repeating the analysis for the last weeks. Second, when we compare the standardized mortality rate and the life expectancy of the first semester 2021 with that of previous years and with the projected trend, we implicitly rely on the fact that a "typical" first semester contains around half of the year's deaths. This assumption is however in line with what has been observed during the last few years, where consistently slightly more deaths occurred in the first than in the second semester, which makes our comparison with the trend slightly conservative. The single exception was of course 2020, where more deaths occurred during the second part of the year due to the second wave of COVID-19. Therefore, in an ongoing pandemic situation, our estimates of the standardized mortality rate and life expectancy at mid-2021 are not intended to be a prediction of what will be observed at the end of the year. This analysis is just a useful indication that 2021 has so far been a good year (in fact the best year ever) for mortality in Switzerland, perfectly in line with the continuous progress of humanity in this regard.

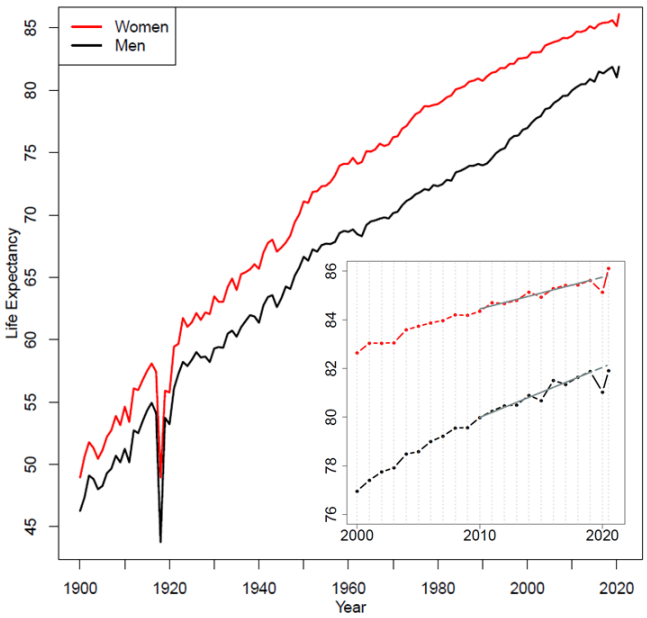

Figure 3: Life expectancy at birth 1900-2021 (data: SFO/HMD)

Life Expectancy						
	Total		Men		Women	
	%	Months	%	Months	%	Months
2020 vs 2019	-0.8	-7.9	-1.0	-10.1	-0.6	-5.8
mid-2021 vs 2019	+0.3	+3.1	+0.0	+0.3	+0.6	+6.0
mid-2021 vs 2020	+1.1	+11.2	+1.1	+10.4	+1.2	+11.8
mid-2021 vs trend	+0.0	+0.3	-0.3	-3.0	+0.3	+3.6

Table 2: Relative changes in life expectancy at birth

Methodological Appendix

In order to compare the number of weekly deaths across years while accounting for the increase and aging of the population, weekly deaths series for years 2015-2020 and first half of 2021 were standardized using the 5 available age classes (0-19, 20-39, 40-64, 65-79, 80+). Standardized Weekly Deaths (SWD) $\dot{D}_s^{y,w}$ (y = 2015,…,2020 ; w = 1,…,52) are obtained as:

$$\dot{D}_s^{y,w} = \sum_{k=1}^{5} \frac{D_k^{y,w}}{P_k^y} \cdot P_k^s$$

In this formula $D_k^{y,w}$ represents the number of observed deaths for year y (y = 2015-2020), week w (w = 1,…,52) and age class k (k = 1, …,5), P_k^y is the population of age class k as of January 1 of year y, and s is the reference year. Of note, by choosing the year 2021 as the reference year (s=2021), the standardized weekly deaths for (the first 26 weeks of) 2021 coincide with the observed weekly deaths $D^{2021,w} = \sum_{k=1}^{5} D_k^{2021,w}$ that year, that is $\dot{D}_s^{2021,w} = D^{2021,w}$ (w = 1,…,26).

To compare mortality in the first half of 2021 with that of previous years we used (one-year of) age and sex Standardized Mortality Rates (SMR), considering population as of January 1, 2021 as the standard. The SMRs for years y (y=2000,…,2020), m_s^y, are obtained as follows:

$$m_s^y = \sum_{i=0}^{100+} \sum_{j=1}^{2} \frac{D_{ij}^y}{P_{ij}^y} \frac{P_{ij}^s}{P^s}$$

In this formula D_{ij}^y and P_{ij}^y are annual deaths and population size (as of January 1) in year y (y = 2000,…,2020) for age i (i = 0,1,…99,100+) and sex j (j=1 for men and j=2 for women), while P_{ij}^s is the population of age i and sex j as of January 1 of the reference year s (s=2021), and P^s the total population as of January 1 of the same year: $P^s = \sum_{i=0}^{100+} \sum_{j=1}^{2} P_{ij}^s$.

The SMR for the first half of the reference year s=2021 corresponds to the crude mortality rate for the same period, i.e:

$$m_s^{mid-2021} = \frac{D^{mid-2021}}{0.5 \cdot P^s}$$

In this formula $D^{mid-2021}$ represents the number of deaths observed during the first 26 weeks of 2021. As usual for a crude mortality rate, the denominator is expressed in person-years. Since only six months are considered here, the size of the population in the denominator had thus to be multiplied by 0.5. Note that we are updating the results of [6] with a slightly different standardization, using 2021 instead of 2020 as the reference year, in order to be able to include the year 2021 for which we have broader age classes. This had however almost no impact on the results, as such comparisons do not depend much of the reference year chosen [7].

In order to update results of [6], we compared m_s^{2020} with m_s^{2019} via a relative change in SMR (expressed in %) calculated as $100(m_s^{2020} - m_s^{2019})/m_s^{2019}$. We did the same comparison for the first half of 2021 using $100(m_s^{mid-2021} - m_s^y)/m_s^y$ and y = 2019, 2020. In addition, to account for the expected reduction of mortality along the years, which reflects the undeniable and remarkable human progress in this regard, we estimated a linear trend on the standardized mortality rates m_s^y based on 10 years before pandemic y = 2010-2019 using linear regression:

$$m_s^y = \alpha + \beta y \qquad y = 2010, \ldots, 2019$$

We then compared the observed SMR for the first half of 2021 with the one predicted according to this trend for the middle of 2021, $\hat{m}_s^{mid-2021} = \hat{\alpha} + \hat{\beta} \cdot 2020.5$, via the relative difference: $100(m_s^{mid-2021} - \hat{m}_s^{mid-2021})/\hat{m}_s^{mid-2021}$ ($\hat{\alpha}$ and $\hat{\beta}$ are estimated regression parameters). Predicting the SMR for the middle of a year, in our case 2021, from data on previous annual SMRs can be justified by the fact that the number of deaths in the first half of a year roughly corresponds (on average) to the number of deaths in the second half of the year. For example, considering the years 2015 to 2019, the percentage of annual deaths observed in the first half of the year ranged from 50.2% in 2016 to 52.9% in 2015 (while it was 47.6% in 2020 due to the second wave of COVID-19). This means that our predicted SMR for the first half of 2021 might be indeed slightly too optimistic, our analysis being conservative on this point.

In order to give more weight to the deaths of young people compared to the deaths of older people (while not needing to define a reference year), an alternative way to express mortality in a given year y and for a given sex j is to calculate the Life expectancy at birth e_{0j}^y obtained from the age and sex specific mortality rates observed in that year. Using the same method [8] detailed in [6], and based on age stratification into 5-years age classes (last open class 90+), the one for which deaths were available for 2021, we updated the calculation of life expectancy for 2020, e_{0j}^{2020} (j = 1 for men and 2 for women) published in [6]. We could similarly calculate men and women life expectancy for the first half of 2021, $e_{0j}^{mid-2021}$. Other estimations of life expectancies are taken from [6] for 1970 - 2019 and from the HMD database for 1900 - 1969. As in [6] and with the same aim of updating their results, we compared e_{0j}^{2020} with e_{0j}^{2019} either via a relative change (expressed in %), $100(e_{0j}^{2020} - e_{0j}^{2019})/e_{0j}^{2019}$, or via an absolute change (expressed in months), $12(e_{0j}^{2020} - e_{0j}^{2019})$. A similar comparison was performed for the first half of 2021 via $100(e_{0j}^{mid-2021} - e_{0j}^y)/e_{0j}^y$ and $12(e_{0j}^{mid-2021} - e_{0j}^y)$ with y = 2019, 2020. As for the SMRs, and using a similar justification, we also estimated a linear trend by fitting the men and women life expectancies at birth e_{0j}^y (j = 1,2) for years y = 2010-2019 via linear regression:

$$e_{0j}^y = \alpha_j + \beta_j y \qquad y = 2010, \ldots, 2019 \quad ; \quad j = 1,2$$

We then compared (via a relative and absolute difference) the estimated life expectancies of the first half 2021, $e_{0j}^{mid-2021}$ (j = 1,2), with the ones predicted according to the trend for the middle of 2021: $\hat{e}_{0j}^{mid-2021} = \hat{\alpha}_j + \hat{\beta}_j \cdot 2020.5, \ j = 1,2$.

References

1. Woolf S, Chapman D, Salbo R, Weinberger D, Hill L (2021). Excess deaths from COVID-19 and other causes in the US, March 1, 2020, to January 2, 2021. JAMA. Epub ahead of print.
2. Ahmad F, Cisewski J, Minino A, Anderson R (2021). Provisional mortality data – United States, 2020. Morbidity and Mortality Weekly Report, 70, 519-522.
3. Andrasafay T & Goldman N (2021). Reduction in 2020 US life expectancy due to COVID-19 and the disproportionate impact on the Black and Latino populations. PNAS, 118, e2014746118.
4. Heuveline P & Tzen M (2021). Beyond deaths per capita: comparative COVID-19 mortality indicators. BMJ Open, 11, e042934.
5. Aburto JM, Schöley J, Kashnitsky I, Zhang L, Rahal C, Missov TI, Mills MC, Dowd JB, Kashyap R (2021). Quantifying impacts of the COVID-19 pandemic through life-expectancy losses: a population-level study of 29 countries. International Journal of Epidemiology. doi: 10.1093/ije/dyab207. Epub ahead of print.
6. Locatelli I & Rousson V (2021). A first analysis of excess mortality in Switzerland in 2020. Plos One. https://doi.org/10.1371/journal.pone.0253505
7. Spiegelman M & Marks HH (1966). Empirical testing of standards for the age adjustment of death rates by the direct method. Human Biology, 38, 280-292
8. Friedman M (1982). Piecewise exponential models for survival data with covariates. Annals of Statistics, 10, 101-113.

Data references

[a] https://www.bfs.admin.ch/bfs/fr/home/statistiques/population/naissances-deces/deces.assetdetail.17444232.html

[b] https://www.bfs.admin.ch/bfs/fr/home/statistiques/population/naissances-deces/deces.assetdetail.19104012.html

[c] https://www.bfs.admin.ch/bfs/fr/home/statistiques/population/naissances-deces/deces.assetdetail.19104010.html

[d] https://www.bfs.admin.ch/bfs/fr/home/statistiques/population/effectif-evolution/age-etat-civil-nationalite.assetdetail.18344199.html

[e] https://www.mortality.org/cgi-bin/hmd/country.php?cntr=CHE&level=1

Suggested citation

Locatelli I, Rousson V. Mortality in Switzerland 2020-2021. Center for Primary Care and Public Health (Unisanté), University of Lausanne, Lausanne, 2021 (Raisons de Santé: Les Essentiels 35) https://doi.org/10.16908/rds-essentiels/35