Overweight-related cardiovascular and cancer mortality trends 1995–2021 in Switzerland: an analysis of multiple causes of death

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Abstract

Overweight and obesity are global major causes of mortality, particularly due to their contribution to two leading causes of death: cardiovascular diseases (CVDs) and cancers. In Switzerland, while mortality rates due to these diseases have declined steadily in the past 30 years, the prevalence of overweight (including obesity) has increased in the same period. We aimed to assess the contribution of overweight to trends of CVDs/cancers mortality rates between 1995 and 2021 in Switzerland, using multiple causes of death data. Because CVDs/cancers are frequently accompanied by co-existing ailments, the interplay of these conditions adds to the complexity of understanding mortality patterns. We conducted a population-based analysis of all deaths where CVDs/cancers were reported anywhere in the death certificate. CVDs/cancers were the underlying or contributing cause of death for 57%/32% of all deaths occurred 1995–2021. We identified overweight-related mortality as any death with at least one of the following conditions reported on the death certificate: diabetes, chronic kidney disease, obesity, lipidemias or hypertensive heart disease (DKOLH). DKOLH conditions were reported in 10% and 7% of the CVDs and cancers deaths, respectively. Both DKOLH CVDs/cancers and non-DKOLH CVDs/cancers age-standardized mortality rates decreased between 1995 and 2021, with different dynamics. While non-DKOLH mortality rates decreased steadily, DKOLH mortality rates increased until 2005 and decreased from 2006 onward. Additional analyses will be conducted to examine sex- and age-specific trends. This study highlights multiple causes of death data as a valuable source of data to track relevant mortality trends.

Background

Overweight and obesity are an important population health problem [1] and relevant contributors to mortality from cardiovascular diseases (CVDs) and cancers, which are the leading causes of death globally [2].

In Switzerland, the prevalence of overweight (including obesity) in adults has increased between 1992 and 2017, from 39% to 51% for men and from 22% to 33% for women [3]. These trends appeared to affect all age groups and have stabilised since 2012 [4], although the prevalence of obesity kept increasing. At the same time, death rates for coronary heart diseases and stroke have decreased steadily between 1995 and 2018 in most age/sex population strata in Switzerland [5]. This decline can be explained by an increased access to evidence-based medical therapies, an improved health care management of CVDs and CVDs risk factors (e.g., more efficient control of hypertension), and a reduction in the prevalence of CVDs risk factors (e.g. smoking and poor diet) [6]. Similarly, death rates for overall and most types of cancer have declined between 1995 and 2017 for both men and women in Switzerland, although the mortality rate for lung cancer continues to rise for women [7-9]. This trend may be explained by declining smoking prevalence among males while rising in females, particularly in those having low education and socioeconomic position [10,11], and improvements in early detection of cancers (e.g. breast cancer screening programs), treatment and medical care of cancers [12].

CVDs/cancers mortality rates can be decomposed into two components, namely i) deaths with co-occurring overweight-related diseases and ii) deaths unrelated to overweight. It has been hypothesized that these components have differing trends. For instance, an attenuation in the pace of the decline of CVDs mortality rates followed by an increase in CVDs mortality rate was observed among decedents with co-occurring overweight-related diseases in the USA and Australia between 2000 and 2017 [13]. Among decedents without overweight-related diseases, CVDs mortality rates kept declining steadily until 2010 in both countries, and the pace of decline started to attenuate only thereafter, without showing sign of increase. Similarly, in the USA, mortality rates for cancers not associated with obesity continue to decline, while mortality rates for cancers associated with obesity plateaued after 2011 [14].

One relevant approach to identify overweight-related and overweight-unrelated CVDs/cancers deaths is by using multiple causes of death (MCOD) data [13,15,16], which consider additional data from death certificates often overlooked in traditional mortality statistics. Multiple causes of death data better reflect the co-morbid nature of CVDs and cancers. Contrary to traditional mortality statistics focusing on the underlying cause of death, this approach allows considering the potential interaction of concurrent diseases leading to death. Therefore, we aimed to assess trends of MCOD-based overweight-related and -unrelated CVDs/cancers mortality rates in Switzerland between 1995 and 2021. We hypothesize differing temporal dynamics of these two components. This research endeavour may contribute to a call for maintaining and strengthening the prevention of overweight and for continued surveillance of cardiovascular and cancer mortality rates in Switzerland. Additionally, it can highlight MCOD data as a valuable source of data to track relevant mortality trends.

Data and Methods

Data We conducted a population-based analysis of all CVDs/cancers deaths in Switzerland between the years 1995 and 2021. Data about specific causes of death, age at death, sex and population size aggregated per year were extracted from the mortality statistics database of the Swiss Federal Statistical Office. Causes of death are recorded via the International

Classification of Diseases 10th Revision (ICD10) coding system. Mortality data contain the underlying cause of death as well as contributing causes related to concomitant diseases (part II of the death certificate).

Target population Individuals aged ≥20 resident in Switzerland.

Definition of overweight-related CVDs and cancers mortality ICD10 codes corresponding to CVDs and cancers matched those provided by corresponding chapters in the Global Burden of Disease (GBD) Study 2019 [17]. Following previous research [13,15], overweight-related deaths were identified by any mention on the death certificate of diabetes, chronic kidney disease, obesity, lipidemias, or hypertensive heart disease.

Statistical analyses We performed a multiple causes of death analysis. Specifically, we considered CVDs/cancers deaths as reported anywhere in the death certificate, that is CVDs/cancers as either the underlying or contributing causes of death. Subsequently, we partitioned the so identified CVDs/cancers deaths into two groups according to whether they were associated with overweight and obesity or not: (a) DKOLH CVDs/cancers, that is, any mention on the death certificate of diabetes, chronic kidney disease, obesity, lipidemias, or hypertensive heart disease, and (b) non-DKOLH CVDs/cancers, i.e., all other deaths [13]. The chosen DKOLH diseases are largely due to overweight and obesity, and previous studies have i) used them to identify overweight-related CVDs mortality trends in the USA and Australia[13], and ii) provided evidence to use them for standardizing reporting of obesity-related mortality[15].

We estimated age-standardized mortality rates via the direct standardization method using the 1976 European standard population as a reference. Finally, to assess dynamics in the MCOD-based mortality trends, we estimated the average annual percentage change in mortality rates via linear regression.

Preliminary results and anticipated significance

CVDs were the underlying or contributing causes of death of 57% of all deaths occurred 1995–2021, with 10% of these CVDs deaths related to overweight. Cancers were the underlying or contributing causes of death of 32% of all deaths occurred 1995–2021, with 7% of these cancers deaths related to overweight. Both DKOLH CVDs/cancers and non-DKOLH CVDs/cancers mortality rates decreased (Figure), with different dynamics. Non-DKOLH mortality rates decreased steadily. Non-DKOLH CVDs rates decreased from 296 deaths per 100 000 persons in 1995 to 175 deaths per 100 000 persons in 2021, corresponding to an average annual decrease of 2%. Non-DKOLH cancers rates decreased from 201 deaths per 100 000 persons in 1995 to 131 deaths per 100 000 persons in 2021, corresponding to an average annual decrease of 1%. DKOLH mortality rates increased until 2005 with an average annual increase of 1% for CVDs and of 9% for cancers; and decreased from 2006 onward with an average annual decrease of 4% for CVDs and of 3% for cancers.

Additional analyses will be conducted to examine sex- and age-specific trends, and to decompose the observed trends into specific categories of CVDs/cancers and into socioeconomic groups.

Current findings indicate that overweight-related mortality rates for two leading causes of death as CVDs and cancers have been decreasing in Swiss adults since 2006, contrary to adults living in countries as the US and Australia [13,14]. This finding highlights multiple causes of death data as a valuable source of data to track relevant mortality trends.

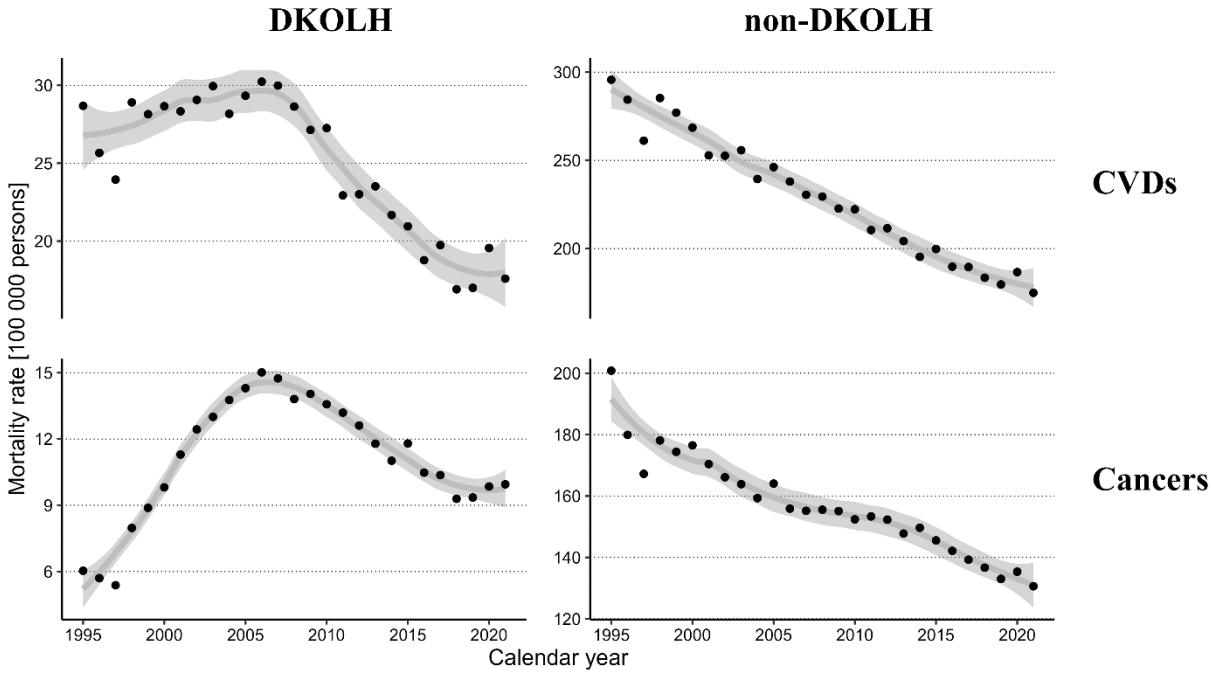

Figure. Trends of age-standardized mortality rates between 1995 and 2021 for CVDs (first row) and Cancers (second row) as underlying or contributing causes of death. Overweight-related deaths (DKOLH) are reported on the first column, while overweight-unrelated deaths (non-DKOLH) on the second column. Observed yearly mortality rates are reported with black dots and smoothed via locally weighted polynomial regression (line in dark gray with 95% confidence intervals in light gray).

References

1. The Lancet Public H. Obesity prevention: changing perspectives. *The Lancet Public Health* 2023;**8**(3):e161.
2. Bray F, Laversanne M, Weiderpass E, Soerjomataram I. The ever-increasing importance of cancer as a leading cause of premature death worldwide. *Cancer* 2021;**127**(16):3029-3030.
3. Bundesamt für Statistik. Schweizerische Gesundheitsbefragung 2017: Übergewicht und Adipositas. https://www.bfs.admin.ch/bfs/de/home/statistiken/gesundheit/determinanten/uebergewicht.assetdetail.14147705.html Accessed 1 December 2022.
4. Diseases M-SMSoAaN. Overweight and obesity 2017. https://ind.obsan.admin.ch/en/indicator/monam/overweight-and-obesity-age-15 Accessed 11 December 2022.
5. Sorrentino L, Chiolero A, Carmeli C. Cardiovascular mortality trends in Switzerland 1995–2018. *European Journal of Public Health* 2022;**32**(891).
6. Mensah GA, Wei GS, Sorlie PD, et al. Decline in Cardiovascular Mortality: Possible Causes and Implications. *Circulation Research* 2017;**120**(2).
7. Bundesamt für Statistik. Krebs. https://www.bfs.admin.ch/bfs/de/home/statistiken/gesundheit/gesundheitszustand/krankheiten/krebs.html Accessed 25 January 2023.
8. Arndt V, Feller A, Hauri D, et al. Swiss Cancer Report 2015: Current situation and developments. *Swiss Statistics*. Neuchatel: Federal Statistical Office, National Institute for Cancer Epidemiology and Registration, Swiss Childhood Cancer Registry, 2016.

9. Bundesamt für Statistik. Schweizerischer Krebsbericht 2021 - Stand und Entwicklungen. https://www.bfs.admin.ch/bfs/fr/home/statistiques/catalogues-banques-donnees.assetdetail.19305696.html.
10. Vaccarella S, Georges D, Bray F, et al. Socioeconomic inequalities in cancer mortality between and within countries in Europe: a population-based study. *Lancet Reg Health Eur* 2023;**25**:100551.
11. Pizzato M, Martinsen JI, Heikkinen S, et al. Socioeconomic status and risk of lung cancer by histological subtype in the Nordic countries. *Cancer Medicine* 2022;**11**(8):1850-1859.
12. Feller A, Mark MT, Steiner A, Clough-Gor KM. Time trends in avoidable cancer mortality in Switzerland and neighbouring European countries 1996 – 2010. *Swiss Medical Weekly* 2015;**145**(w14184).
13. Adair T, Lopez A. The role of overweight and obesity in adverse cardiovascular disease mortality trends: an analysis of multiple cause of death data from Australia and the USA. *BMC Medicine* 2020;**18**(199).
14. Avery CL, Howard AG, Nichols HB. Comparison of 20-Year Obesity-Associated Cancer Mortality Trends With Heart Disease Mortality Trends in the US. *JAMA Network Open* 2021;**4**(5):e218356.
15. Tilstra AM, Aburto JM, Gutin I, Dowd JB. Coding of Obesity-related Mortality Impacts Estimates of Obesity on U.S. Life Expectancy. medRxiv, 2022.
16. Barbieri M, Désesquelles A, Egidi V, et al. Obesity-related mortality in France, Italy, and the United States: a comparison using multiple cause-of-death analysis. *International Journal of Public Health* 2017;**62**(6):623-9.
17. Institute for Health Metrics and Evaluation. Global Burden of Disease Study 2019 (GBD 2019) Cause List Mapped to ICD Codes. https://ghdx.healthdata.org/record/ihme-data/gbd-2019-cause-icd-code-mappings Accessed 6 March 2023.