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A Swiss neighbourhood index of socioeconomic position: development and association with mortality

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for the Swiss National Cohort and the Swiss Household Panel

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Abstract

Background—Area-based measures of socioeconomic position (SEP) suitable for epidemiological research are lacking in Switzerland. The authors developed the Swiss neighbourhood index of SEP (Swiss-SEP).

Methods—Neighbourhoods of 50 households with overlapping boundaries were defined using Census 2000 and road network data. Median rent per square metre, proportion households headed by a person with primary education or less, proportion headed by a person in manual or unskilled occupation and the mean number of persons per room were analysed in principle component analysis. The authors compared the index with independent income data and examined associations with mortality from 2001 to 2008.

Results—1.27 million overlapping neighbourhoods were defined. Education, occupation and housing variables had loadings of 0.578, 0.570 and 0.362, respectively, and median rent had a loading of -0.459. Mean yearly equivalised income of households increased from SFr42 000 to SFr72 000 between deciles of neighbourhoods with lowest and highest SEP. Comparing deciles of neighbourhoods with lowest to highest SEP, the age- and sex-adjusted HR was 1.38 (95% CI 1.36 to 1.41) for all-cause mortality, 1.83 (95% CI 1.71 to 1.95) for lung cancer, 1.48 (95% CI 1.44 to 1.51) for cardiovascular diseases, 2.42 (95% CI 1.94 to 3.01) for traffic accidents, 0.93 (95% CI 0.85 to 1.02) for breast cancer and 0.86 (95% CI 0.78 to 0.95) for suicide.

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Contributors

ME developed the original idea for the study. RP designed and implemented the data processing and analysis. MZ supervised the statistical analysis. All the authors contributed to the methodology used in the study. RP and ME wrote the first draft of the paper. All the authors have read and approved the final manuscript and contributed to the writing.

Competing interests

None to declare.

Ethics approval

Ethics approval was provided by Cantonal Ethics Committee Bern.

Conclusions—Developed using a novel approach to define neighbourhoods, the Swiss-SEP index was strongly associated with household income and some causes of death. It will be useful for clinical- and population-based studies, where individual-level socioeconomic data are often missing, and to investigate the effects on health of the socioeconomic characteristics of a place.

Keywords

socio-economic position; index; inequalities; income; mortality; cohort study; Switzerland

Introduction

Area-based measures of socioeconomic position (SEP) are used to investigate the effect the socioeconomic characteristics of a place has on health over and above individual attributes. They may also be used as a proxy for missing individual-level data, for example, in the context of adjusting for confounding for socioeconomic factors. It is widely recognised that poorer individual socioeconomic circumstances are generally associated with less favourable health outcomes.¹ Area-based SEP is also associated with a range of health outcomes,^{2–4} including all-cause and cause-specific mortality,⁵ and these associations often continue to be observed after controlling for individual-level socioeconomic factors.⁶

In the UK, the area-based deprivation indices of Jarman (1984), Townsend (1987) and Carstairs (1989) and the Breadline Britain Index (1990) were pioneering efforts to capture the socioeconomic profiles of areas, which cover several domains of the socioeconomic standing of a neighbourhood or area.⁷ The Townsend Index, for example, is based on unemployment, households not owner-occupied, households without cars and overcrowded households.⁸ More complex measures of multiple deprivation, which go beyond census data, were developed in more recent years. The English Indices of Deprivation (2000, 2004, 2007 and 2010)⁹ are based on income, employment, health and disability, education and skills, access to services and housing, living environment and crime. Lack of access to public services, including access to healthcare, is a new domain of deprivation, which is particularly relevant in rural areas.¹⁰

The definition of neighbourhoods and areas when developing such indices is not straightforward. Most analyses have hitherto been based on fixed boundaries, using administrative or census units, and were driven by the availability of data. Arbitrary boundaries lead to what geographers describe as the ‘modifiable areal unit problem’, where different scales and aggregations of data yield different results.¹¹ The problem is related to ecological bias and the ecological fallacy in epidemiology.¹² Automated zone design methodology has been used to maximise social homogeneity within areas¹³; however, the approach still depends on fixed areas. Areas centred on individuals’ residences (‘ego-centred neighbourhoods’), with sliding rather than fixed boundaries, define neighbourhoods that aim to capture the environmental and social conditions to which an individual is exposed to. Road network data can be used to define individual exposure areas, with their shape distorted in the direction of the nearest major roads with shops, services and public transportation.¹⁴

In Switzerland, sociocultural indices have been developed based on administrative units and 1990 and 2000 census data.¹⁵ An area-based index of SEP suitable to characterise individuals in epidemiological research is, however, lacking. We used georeferenced Census 2000 and road network connectivity data to develop the Swiss neighbourhood index of socioeconomic position (Swiss-SEP), a household-centred neighbourhood index with sliding boundaries. We examined the construct validity of the index by exploring its association with income and financial deprivation in the Swiss Household Panel (SHP), a longitudinal study following a random sample of Swiss households.¹⁶ Finally, we investigated the associations with all-cause and cause-specific mortality in the Swiss National Cohort (SNC).¹⁷

Methods

The development, validation and application of the Swiss-SEP index consisted of the following five steps: (1) the definition of neighbourhoods, with moving boundaries, around each of the 1.27 million buildings recorded in the 2000 census; (2) the characterisation of the socioeconomic standing of these neighbourhoods based on median rent, education and occupation of household heads and household crowding; (3) the construction of the index by combining the loadings of the first component from principle component analysis (PCA); (4) the validation of the index using independent data on the financial situation of households and (5) the analysis of associations between the Swiss-SEP index and all-cause and cause-specific mortality in the adult population resident in Switzerland.

Definition of neighbourhoods

We used Census 2000 data of all residential households in Switzerland. Each household was spatially referenced using the geographic coordinates of 1.27 million residential buildings provided by the Swiss Federal Statistical Office. We created sliding neighbourhood boundaries for each of the buildings on the basis of road network connectivity, using Network Analyst extension of ArcGIS (release 10, Environmental Systems Research Institute, Redlands, California, USA) and the road network model derived from the 2009 Tele Atlas MultiNet database (www.tomtom.com). We included major roads, secondary and local roads. Motorways and slip roads were excluded because they tend to divide communities rather than provide connections within them. We created 1.27 million overlapping areas, centred on each of the residential buildings in turn, consisting of about 50 of the nearest households. The target number of households within neighbourhoods was in line with the statistical output areas used for the 2000 UK Census.¹⁸ If the 50th household was located in a building with more than one household, the other households in the building were also included. Figure 1 shows a hypothetical example of an area created for one household.

Socioeconomic standing of neighbourhoods

We conceptualised the Swiss-SEP as a composite measure covering four domains: income, education, occupation and housing conditions. Each domain was represented by one variable. Each variable represented data aggregated on the level of neighbourhood. No data on household income are collected in the Census, and we therefore used the median rent in

Swiss Francs (SFr) per square metre of the 50 nearest rented flats. We restricted the analysis to flats with three to five bedrooms: apartments with fewer or more bedrooms were much more heterogeneous. For example, they included flats with one small bedroom or loft apartments. For education, we used the proportion of households headed by a person with primary education or less. Similarly, occupation was represented by the proportion of households headed by a person in manual or unskilled occupations. Manual and unskilled workers were defined according to the eight lowest categories and farmers of the 33 grade socio-professional categorisation of occupations developed by the Swiss Federal Statistical Office.¹⁹ The head of the household was the person economically responsible for the household, as reported in the Census. Finally, we used crowding, the mean number of persons per room, combining bed and living rooms, as the indicator of housing conditions.

Construction of index

PCA on area-level aggregated data was used to construct the index. The first principal component consisted of the linear weighted function of the four variables covering income, education, occupation and housing. We combined the loadings of the first principal component to form a score of the SEP of a neighbourhood such that higher values indicated areas of higher SEP. PCA was weighted by the number of households within the area to account for differences in the size of areas. Finally, we averaged the values of the Swiss-SEP index for 2879 local authorities and 289 residential districts of 17 towns and cities, reflecting the administrative structure of Switzerland at the time of the Census 2000²⁰ and compared analyses based on neighbourhoods with analyses based on the larger areas.

Validation using household panel data

We explored the association of the index with data on the financial situation of households recorded in the SHP.¹⁶ Among 5074 households participating in the first wave of SHP in 1999, we were able to geocode 4460 (87.9%) addresses using Tele Atlas data. The address of the remaining households was either missing or incomplete. We assigned the value of the index of the closest (Euclidean distance) building for each of the geocoded SHP households. We analysed self-reported information on household income and expenses, contributions to tax-free private pension schemes and reception of financial help across deciles of Swiss-SEP. In particular, we calculated the yearly mean equivalised household income, which adjusts for family size using the method of the Organisation for Economic Co-operation and Development.

Mortality across deciles of index

We examined the association of the index with mortality in the 4.31 million individuals older than 30 years included in the SNC. The SNC is a national longitudinal study of mortality in Switzerland based on deterministic and probabilistic linkage of Census data with mortality records. Described in detail elsewhere, the SNC was approved by the cantonal ethics committees of Bern and Zurich.¹⁷ We explored the associations of Swiss-SEP deciles with all-cause and cause-specific mortality during the years 2001e2008. We examined lung cancer (ICD-10 codes C33-C34), breast cancer (ICD-10 code C50), prostate cancer (ICD-10 code C61), respiratory diseases (ICD-10 codes J00-J99), cardiovascular diseases (ICD-10 codes I00-I99), myocardial infarction (ICD-10 codes I21-I22), stroke (ICD-10 codes I60-

I64), traffic accidents (ICD-10 codes V01-V99) and suicide (ICD-10 codes X60-X84). We used Cox proportional hazard regression measuring time from the date of the Census 2000 (5 December 2000) to the earliest of death, emigration or 31 December 2008. All models were adjusted for age (by using age as the time scale) and sex. Results are represented as HRs with 95% CIs; p values were obtained from log-likelihood ratio test. Analyses were performed using Stata software (V.11.0, Stata Corporation).

Results

The development of Swiss-SEP was based on data on 1.27 million neighbourhoods, with 2.95 million georeferenced households and 6.67 million individuals recorded in the Census 2000. The mean size of overlapping neighbourhoods was 52.7 households (SD 3.8) and 125 individuals (SD 20.4), with a median value of mean road distance between the reference building and the other buildings constituting the neighbourhood of 130.5 m. Switzerland has relatively compact spatial distribution of residential buildings therefore in 90% of cases the information about aggregate characteristics of neighbourhoods came from buildings within <700 m along the road network. The first principal component retained to construct the index explained 54.7% of the total variance. Education, occupation and housing domains had positive loadings of 0.578, 0.570 and 0.362, respectively, and income had a negative loading of -0.459. We standardised the index to a range of 0 (lowest SEP) to 100 (highest SEP), with a median of 63.32 (IQR 56.18-70.78). Seven of the 10 lowest Swiss-SEP neighbourhoods were found in a municipality of Canton Aargau and six of the 10 highest in a municipality on the 'gold coast' of the lake of Zurich (Canton Zurich).

Younger people and immigrants were more likely to live in decile 1 neighbourhoods (low SEP), whereas older people and the Swiss were more likely to be residents of decile 10 (high SEP) areas (Table 1). The proportion of French- and Italian-speaking neighbourhoods declined with increasing SEP, and the proportion of German-speaking neighbourhoods increased: 76.7% of neighbourhoods in decile 10 were German speaking compared with 45.3% in decile 1. Compared with Protestants, Catholics were more likely to live in decile 1 neighbourhoods, whereas individuals with no affiliation were more common in decile 10 areas. Figure 2 shows a map of the 1.27 million neighbourhoods. Neighbourhoods of higher SEP (in shades of green) are concentrated in the urban centres, most notably in Zurich, Geneva, Basel, Lausanne, Bern and surroundings; and along some of the lakes, for example, the arc of Lake Geneva and both sides of Lake Zurich. Neighbourhoods of lower SEP (in shades of red) dominate the regions immediately north of the alps that are free of lakes, the area north of the lakes of Neuchâtel and Bienne in the West of the country and much of the valleys of the alps (Figure 2).

The analysis of the 4460 households from the SHP showed that with increasing level of neighbourhood SEP equivalised yearly income of households increased (Figure 3). Mean household income increased from about SFr42 000 in decile 1 to SFr72 000 in decile 10 (Table 2). Trends in the same direction were observed for contributions to voluntary tax-free pension schemes, whereas financial help was received by almost twice as many households in decile 1 (low SEP) compared with decile 10 (high SEP). The proportion of households

reporting that all the income was spent on current expenses decreased from 48.5% to 35.7% between the first and 10th decile (Table 2).

The Swiss-SEP index was associated with all-cause and cause-specific mortality. The age- and sex-adjusted HR comparing neighbourhoods within decile of lowest SEP with highest was 1.38 (95% CI 1.36 to 1.41) for all-cause mortality, with a clear gradient across deciles (Figure 4, left panel). Stronger associations in the same direction were seen for lung cancer, respiratory diseases and traffic accidents (Table 3). There was little association with breast cancer mortality, and an association in the opposite direction for suicide. HRs were attenuated when further adjusted for nationality, marital status, level of urbanisation, individual-level education and professional status, but important associations remained. Finally, repeating analyses using mean values of the index for the 2879 local authorities and 289 urban districts resulted in a weaker association with mortality from all-causes (HR 1.20, 95% CI 1.17 to 1.23), with the increase levelling off between first and sixth deciles (Figure 4, right panel).

Discussion

We developed an area-based index of SEP for Switzerland, the Swiss-SEP, based on data on income, education, occupation and housing obtained from the 2000 census. The census collected data on education and occupation of the heads of households and on housing. The data on housing allowed us to use crowding as an index of housing conditions and also provided a proxy measure for income, that is, the median rent per square metre. Of note, only 34% of homes are owner-occupied: Switzerland has the lowest rate of home ownership in Western Europe.²¹ The analysis of independent data from the SHP study showed that the index has criterion validity, with a clear trend in equivalised mean household income across deciles of the index. Finally, the index was associated with mortality from all-causes and more strongly with causes associated with socioeconomically patterned behaviours, such as smoking or diet. For example, the index was strongly associated with lung cancer and cardiovascular mortality.

Strengths of the study

A novel aspect of the development of Swiss-SEP was the definition of neighbourhoods using moving boundaries, based on road connectivity: to our knowledge, this is the first example of an area-based index of SEP using such techniques. Ego-centred neighbourhoods with sliding boundaries overcome some of the conceptual problems associated with fixed boundaries. The widely used political or administrative boundaries were not designed for this purpose and are often too large and heterogeneous. We used the road network to model relations between buildings, thus taking into account spatial accessibility and natural and man-made barriers. The move from arbitrary fixed boundaries to boundaries defined by relations should thus better capture interactions between and within areas and help to prevent aggregation bias.¹⁴

We a priori chose the domains of income, education, occupation and housing, based on theoretical considerations.²² Income directly measures the material resources available in a household, which can influence a wide range of material circumstances and access to

services with direct implications for health. The educational attainment of household heads captures the knowledge-related assets of a household: households with a higher level of education may be more receptive to health education messages and more able to communicate with and access appropriate health services. The occupation of the head of the household is a reflection of its social standing. Occupation is strongly related to education and income and may also capture occupational exposures, such as work stress, control and autonomy and specific exposures at the workplace.²³ Housing characteristics measure material aspects of socioeconomic circumstances, including housing tenure, amenities and conditions. We used crowding, the mean number of persons per room, as the indicator of housing conditions. Overcrowded households are often households with fewer economic resources, and there may also be direct effects on health, for example, through the spread of infectious diseases.²² We explored other housing characteristics, for example, the availability of central heating, but these were less discriminatory.

Results in context with other studies

Previous studies largely relied on administrative areas, and there is little research on the appropriate size of moving spatial units. Similar population size and homogeneity in terms of the area's socioeconomic characteristics will reduce misclassification and are therefore desirable attributes when developing an area-based index of SEP. Schuurman and colleagues²⁴ argued that the smallest areas possible should be used; however, very small spatial units will be difficult to characterise reliably, and the danger of identifying individuals will increase. Our decision to define areas of 50 households was informed by the Census Output Areas developed in the UK, but nevertheless arbitrary. Our approach was more powerful than aggregating the data at the level of local authorities and urban districts, resulting in a steeper mortality gradient. The relatively small size of neighbourhoods allows a view of differences in SEP across space in fine resolution and improves geographic visualisation by giving little emphasis to thinly populated areas. Swiss-SEP data can of course always be aggregated into larger areas, including administrative areas, and results can then be shown using traditional choropleth techniques, with their usual drawbacks.²⁵

Suicide was somewhat more common in areas of higher SEP. Previous studies have reported conflicting results, including no relation of area suicide rates with SEP, and associations with lower or higher SEP.²⁶ Interestingly, analyses of smaller geographical units were more likely to show an association with lower SEP than studies based on larger areas.²⁶ In Switzerland, assisted suicide has become increasingly important in recent years: it is legal if the motive is not selfish and several right-to-die associations offer such assistance.²⁷ Preliminary results from an ongoing analysis of the SNC indicate that assisted suicide is more common among higher educated urban populations, and this may at least partly explain the findings of the present study. We found a weak statistically non-significant inverse association between SEP and mortality from breast cancer. Two large American Cancer Society cohorts showed that breast cancer mortality was about 20% lower in women with Grammar School education only compared with college graduates.²⁸ Of note, the association became weaker in multivariate analyses including parity and age at first birth. A study of 12 European populations found similar educational gradients with breast cancer mortality.²⁹

Limitations of the study

Our approach to measuring SEP and constructing and validating the Swiss-SEP index has several limitations. Income is sensitive and difficult to assess: it was not available in the census and the response rate in the SHP was 82% only. It is possible that this may have biased our analysis of the panel data. Our proxy measure for income, the average rent per square metre in the neighbourhood may have the advantage of being more closely correlated with disposable income than gross income, as rent will reflect what households can actually spend.²² The meaning of educational level and occupation varies for different birth cohorts: older cohorts will be over-represented in those classified as having lower education and occupations of lower socioeconomic standing, and analyses stratified by age may therefore be warranted. Similarly, income may be a less reliable indicator of SEP in young and older adults: income typically follows a curvilinear trajectory with age.²² Lack of access to public services, including access to healthcare, was particularly relevant in rural England.¹⁰ Access to public services is probably also relevant in remote and mountainous areas of Switzerland; however, no data on access were available. Results from studies using Swiss-SEP will be difficult to compare with studies from other countries that used different instruments to assess the SEP of neighbourhoods. Finally, we followed the example of others^{30 31} and used PCA to create the composite index of SEP from a set of variables. Several other approaches have been suggested, including multilevel modelling,³² cluster analysis,³³ Multicriteria Analysis³⁴ and Bayesian factor analysis.³⁵ Future theoretical and empirical research should clarify which method is best used in different situations.

Implications

The Swiss-SEP index will be useful to the research community in Switzerland and allow a better characterisation of the SEP of study participants enrolled in clinical- and population-based studies, both in studies where individual-level information on SEP was not collected and in studies specifically examining neighbourhood SEP over and above individual SEP. It already has been useful to gain a more detailed picture of the geography of SEP in Switzerland. We will make the Swiss-SEP data available to interested researchers. Further information can be found at www.swissnationalcohort.ch.

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Summary Box

What is already known on this subject

- Indices of area-based SEP are useful to substitute missing individual-level data in epidemiological studies or to study neighbourhood effects on health over and above individual-level SEP.
- Indices are often developed using fixed administrative boundaries to define areas, which are large and heterogeneous.
- Area-based measures of SEP suitable for epidemiological research are lacking in Switzerland.

What this study adds

- The Swiss-SEP was developed based on Census 2000 data and road network connectivity between areas including 50 households, with sliding boundaries.
- Swiss-SEP was strongly associated with independent data on household income and mortality from all-causes and causes associated with socioeconomically patterned behaviours, such as smoking or diet.
- The index will be useful for clinical- and population-based research in Switzerland, where individual-level socioeconomic data are often missing, and to investigate the effects on health of the socioeconomic characteristics of a place.

Figure 1.

Hypothetical example of a neighbourhood of 50 households created for one household based on road network proximity.

Figure 2.

Map of deciles of Swiss neighbourhood index of socioeconomic position (Swiss-SEP) of 1.27 million neighbourhoods, Switzerland 2000. Neighbourhoods of higher SEP are shown in shades of green, and neighbourhoods of lower SEP are shown in shades of red.

Figure 3.

Box plots of yearly equivalised household incomes of 3669 households of Swiss Household Panel across deciles of Swiss neighbourhood index of socioeconomic position (Swiss-SEP).

Source: Swiss Household Panel.

Figure 4.

HRs with 95% CIs of all-cause mortality across deciles of the Swiss neighbourhood index of socioeconomic position (Swiss-SEP) using different spatial resolutions: original index of neighbourhoods of 50 households (left panel) and index averaged over administrative units (right panel). The reference category is the 10th decile (highest SEP).

Table 1

Characteristics of the resident population in Switzerland across first (lowest SEP), fifth and tenth (highest SEP) decile of the Swiss neighbourhood index of Socio-Economic Position (Swiss-SEP), Switzerland. Source: Census 2000 and Swiss National Cohort.

Characteristic	Index decile						Total	
	1		5		10			
	N	%	N	%	N	%	N	%
Total	881411	(100.0)	653363	(100.0)	540947	(100.0)	6661655	(100.0)
Gender								
Male	441293	(50.1)	319066	(48.8)	262124	(48.5)	3262465	(49.0)
Female	440118	(49.9)	334297	(51.2)	278823	(51.5)	3399190	(51.0)
Age								
Below 18	215067	(24.4)	137574	(21.1)	100055	(18.5)	1418365	(21.3)
18-34	213440	(24.2)	147248	(22.5)	101953	(18.8)	1480845	(22.2)
35-49	203592	(23.1)	154551	(23.7)	133579	(24.7)	1584861	(23.8)
50-64	136667	(15.5)	113085	(17.3)	119786	(22.1)	1187965	(17.8)
Above 64	112645	(12.8)	100905	(15.4)	85574	(15.8)	989619	(14.9)
Civil status								
Single	374359	(42.5)	268623	(41.1)	212507	(39.3)	2736481	(41.1)
Married	419073	(47.5)	311541	(47.7)	272673	(50.4)	3203391	(48.1)
Widowed	44532	(5.1)	35916	(5.5)	24609	(4.5)	349278	(5.2)
Divorced	43447	(4.9)	37283	(5.7)	31158	(5.8)	372505	(5.6)
Nationality								
Switzerland	560503	(63.6)	537129	(82.2)	468665	(86.6)	5313323	(79.8)
Other Europe	289879	(32.9)	102387	(15.7)	59925	(11.1)	1192517	(17.9)
Other /unknown	31029	(3.5)	13847	(2.1)	12357	(2.3)	155815	(2.3)
Language								
German	399100	(45.3)	439378	(67.2)	414939	(76.7)	4288058	(64.4)
French	248284	(28.2)	120144	(18.4)	79205	(14.6)	1353876	(20.3)
Italian	94835	(10.8)	45387	(6.9)	8815	(1.6)	438489	(6.6)
Other language	139192	(15.8)	48454	(7.4)	37988	(7.0)	581232	(8.7)
Religion								
Protestant	190949	(21.7)	246068	(37.7)	233321	(43.1)	2366170	(35.5)
Roman Catholic	444223	(50.4)	273018	(41.8)	172379	(31.9)	2795739	(42.0)
No religious affiliation	67020	(7.6)	68609	(10.5)	96808	(17.9)	751051	(11.3)
Other/ unknown	179219	(20.3)	65668	(10.1)	38439	(7.1)	748695	(11.2)
Education								
Primary education or less	304841	(34.6)	143740	(22.0)	55438	(10.2)	1480749	(22.2)
Upper secondary level education	296218	(33.6)	285293	(43.7)	218062	(40.3)	2752852	(41.3)
Tertiary level education	61199	(6.9)	91400	(14.0)	174347	(32.2)	1052663	(15.8)
Not known	38447	(4.4)	17472	(2.7)	9686	(1.8)	187853	(2.8)
School age or younger	180706	(20.5)	115458	(17.7)	83414	(15.4)	1187538	(17.8)

<i>Characteristic</i>	<i>Index decile</i>						<i>Total</i>	
	<i>1</i>		<i>5</i>		<i>10</i>			
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Professional status								
Top management and independent professions	6669	(0.8)	9429	(1.4)	23803	(4.4)	117538	(1.8)
Other self-employed	35908	(4.1)	30677	(4.7)	30542	(5.6)	315614	(4.7)
Professionals and senior management	11259	(1.3)	22598	(3.5)	54266	(10.0)	281688	(4.2)
Supervisors/low level management and skilled labour	159043	(18.0)	157947	(24.2)	115536	(21.4)	1514869	(22.7)
Unskilled employees and workers	94539	(10.7)	39408	(6.0)	11719	(2.2)	412180	(6.2)
In paid employment, not classified elsewhere	132224	(15.0)	81121	(12.4)	53964	(10.0)	831157	(12.5)
Unemployed/job-seeking	26872	(3.0)	13495	(2.1)	8053	(1.5)	141981	(2.1)
Not in paid employment	234190	(26.6)	183230	(28.0)	159650	(29.5)	1859088	(27.9)
In compulsory education / aged up to 15	180707	(20.5)	115458	(17.7)	83414	(15.4)	1187540	(17.8)
Level of urbanisation								
Urban	242849	(27.6)	172210	(26.4)	182111	(33.7)	1875414	(28.2)
Peri-urban	263114	(29.9)	288421	(44.1)	351929	(65.1)	3027288	(45.4)
Rural	375448	(42.6)	192732	(29.5)	6907	(1.3)	1758953	(26.4)

Table 2

Financial situation of 4,460 households across first (lowest SEP), fifth and tenth (highest SEP) decile of Swiss neighbourhood index of Socio-Economic Position (Swiss-SEP), Switzerland 1999. Source: Swiss Household Panel.

Characteristic	Index decile						Total		p Value
	1		5		10		N	(%)	
	N	(%)	N	(%)	N	(%)			
Number of households	437	(100.0)	447	(100.0)	426	(100.0)	4460	(100.0)	--
Mean yearly equivalised* household net income in CHF (SD)	42329	(21253)	54785	(33488)	72074	(56796)	55372	(38781)	< 0.0001
Saving at least 100 CHF/month									< 0.0001
no answer / does not know	4	(0.9)	5	(1.1)	6	(1.4)	54	(1.2)	
yes	329	(75.3)	366	(81.9)	363	(85.2)	3629	(81.4)	
no	104	(23.8)	76	(17.0)	57	(13.4)	777	(17.4)	
Reason why not saving at least 100 CHF/month									< 0.0001
inapplicable	333	(76.2)	371	(83.0)	369	(86.6)	3683	(82.6)	
because you cannot afford it	88	(20.1)	66	(14.8)	47	(11.0)	642	(14.4)	
for another reason	16	(3.7)	10	(2.2)	10	(2.3)	135	(3.0)	
Voluntary private pension scheme									< 0.0001
no answer / does not know	9	(2.1)	8	(1.8)	4	(0.9)	67	(1.5)	
yes	210	(48.1)	266	(59.5)	266	(62.4)	2581	(57.9)	
no	218	(49.9)	173	(38.7)	156	(36.6)	1812	(40.6)	
Reason why no voluntary private pension scheme									< 0.0001
inapplicable	219	(50.1)	274	(61.3)	270	(63.4)	2648	(59.4)	
no answer / does not know	1	(0.2)	0	(0.0)	2	(0.5)	25	(0.6)	
because you cannot afford it	81	(18.5)	53	(11.9)	30	(7.0)	553	(12.4)	
for another reason	136	(31.1)	120	(26.8)	124	(29.1)	1234	(27.7)	
Reception of financial help									0.002
no answer / does not know	1	(0.2)	5	(1.1)	1	(0.2)	23	(0.5)	
yes	102	(23.3)	75	(16.8)	56	(13.1)	765	(17.2)	
no	334	(76.4)	367	(82.1)	369	(86.6)	3672	(82.3)	
Assessment of household income and expenses									< 0.0001
no answer / does not know	2	(0.5)	3	(0.7)	7	(1.6)	38	(0.9)	
your household can save money	189	(43.2)	233	(52.1)	239	(56.1)	2262	(50.7)	
your household spends what it earns	212	(48.5)	170	(38.0)	152	(35.7)	1821	(40.8)	
your household eats into its assets and savings	27	(6.2)	39	(8.7)	23	(5.4)	296	(6.6)	
your household gets into debt	7	(1.6)	2	(0.4)	5	(1.2)	43	(1.0)	
Financial situation manageable, mean (SD) †	6.6	(2.6)	7.5	(2.3)	8.0	(2.1)	7.3	(2.3)	< 0.0001

Numbers (%) are shown unless otherwise indicated. p values from χ^2 tests across all 10 deciles.

* Equivalised using Organisation for Economic Co-operation and Development (OECD) Equivalence Scale.

† Response on 11 point scale from 0 ('with great difficulty') to 10 ('very easily').

Table 3

Hazard ratios of death from all causes and selected causes in the Swiss resident population comparing the first decile (lowest SEP) of the Swiss neighbourhood index of Socio-Economic Position (Swiss-SEP) to the tenth decile (highest SEP), Switzerland 2001-2008. Source: Swiss National Cohort.

<i>Cause</i>	<i>Age and sex adjusted</i>			<i>Fully adjusted *</i>		
	<i>HR</i>	<i>95% CI</i>	<i>p Value</i>	<i>HR</i>	<i>95% CI</i>	<i>P Value</i>
All causes	1.38	(1.36-1.41)	< 0.0001	1.22	(1.20-1.24)	< 0.0001
Lung cancer	1.83	(1.71-1.95)	< 0.0001	1.49	(1.39-1.59)	< 0.0001
Breast cancer	0.93	(0.85-1.02)	0.747	0.96	(0.87-1.05)	0.826
Prostate cancer	1.17	(1.07-1.28)	0.013	1.09	(0.99-1.20)	0.294
Cardiovascular diseases	1.48	(1.44-1.51)	< 0.0001	1.26	(1.23-1.29)	< 0.0001
Myocardial infarction	1.68	(1.57-1.80)	< 0.0001	1.43	(1.33-1.54)	< 0.0001
Stroke	1.28	(1.20-1.36)	< 0.0001	1.15	(1.08-1.23)	0.001
Respiratory diseases	1.99	(1.87-2.12)	< 0.0001	1.62	(1.52-1.73)	< 0.0001
Traffic accidents	2.42	(1.94-3.01)	< 0.0001	1.96	(1.55-2.48)	< 0.0001
Suicide	0.86	(0.78-0.95)	< 0.0001	0.82	(0.74-0.91)	< 0.0001

Results from Cox proportional hazard models adjusted for age by using age as the time scale, based on 2,241,596 women older than 30 years (breast cancer), 2,065,969 men older than 30 years (prostate cancer) or 4,307,565 people older than 30 years (all other causes). p values from log-likelihood tests.

HR: hazard ratio; CI: confidence interval.

* Adjusted for age, sex, nationality, marital status, level of urbanisation, education and professional status.