

1 **TITLE PAGE**

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4 **Losing ground at the wrong time: Trends in self-reported**  
5 **influenza vaccination uptake in Switzerland, Health Survey**  
6 **2007-2017**

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Uptake of influenza vaccination in Switzerland

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patient factors

## 39 **Abstract**

40 **Objectives** We studied time trends in seasonal influenza vaccination and  
41 associations with socioeconomic and health-related determinants in Switzerland,  
42 overall and in people aged  $\geq 65$  years.

43 **Design** Three cross-sectional surveys.

44 **Participants** Individuals who participated in the Swiss Health Surveys 2007, 2012,  
45 and 2017. We calculated the proportion reporting influenza vaccination in the last 12  
46 months, and performed multivariable logistic regression analyses.

47 **Results:** The proportion of reporting a history of influenza vaccination overall was  
48 31.9% (95% confidence intervals [95% CI] 31.4-32.4); and dropped from 34.5% in  
49 2007 to 28.8% in 2017. The uptake of vaccination within the past 12 months was  
50 16% in 2007 and similar in 2012 and 2017 (around 14%). In people with chronic  
51 disease, uptake dropped from 43.8% in 2007 to 37.1% in 2012 and to 31.6% in 2017  
52 ( $p < 0.001$ ). In people aged  $\geq 65$  years, uptake dropped from 47.8% in 2007 to 38.5%  
53 in 2012 to 36.2% in 2017 ( $p < 0.001$ ). Similarly, a decrease in vaccine uptake was  
54 seen in people with poor self-reported health status (39.4%, 33.1%, and 27.0%). In  
55 logistic regression, self-reported vaccination coverage decreased in the 65 to 75  
56 years old (adjusted odds ratio (aOR) aOR 0.56, 95% CI 0.48-0.66 between 2007 and  
57 2012; aOR 0.89, 95% CI 0.77-1.03). Uptake was positively associated with the  $\geq 65$   
58 age group, living in French-speaking and urban areas, history of smoking, bad self-  
59 reported health status, private/semiprivate health insurance, having a medical  
60 profession, and having any underlying chronic disease. Use of any alternative  
61 medicine therapy was negatively associated with influenza vaccination (aOR 0.72,  
62 95% CI 0.67-0.80).

63 **Conclusion:** Influenza vaccination coverage was low in older and chronically ill  
64 persons. Significant efforts are required in preparing for the flu season 2020/21 to  
65 reduce the double burden of COVID-19 and seasonal influenza. These efforts should  
66 include campaigns but also novel approaches using social media.

67

## 68 **Strengths and limitations of this study**

- 69 • Data analysis of the Swiss Health Survey 2007, 2012, and 2017 focussing on  
70 influenza vaccine uptake overall and in the age group  $\geq 65$  years in  
71 Switzerland.
- 72 • The Swiss Health Survey is a nationwide, representative survey that is  
73 repeated every five years using the same methodology.
- 74 • Analyses were weighted and adjusted for a wide range of important cofactors.
- 75 • We calculated percent of people reporting having been vaccinated and  
76 associations between vaccination status and socio-demographic and health-  
77 related factors.
- 78 • Influenza vaccination status is self-reported in the Swiss Health Survey and  
79 the reliability of the data not ascertained.

80

81

## 82 **Introduction**

83 Seasonal influenza is pandemic, and a challenge for surveillance, control and  
84 treatment (1). Worldwide, it causes 3 to 5 million cases of severe illness each year  
85 and kills 250,000 to 500,000 people (2), particularly infants, the elderly, and the  
86 chronically ill. In Switzerland, influenza is responsible for 111,000 to 331,000 medical  
87 consultations yearly and 1,000 to 5,000 hospitalizations (3). The current COVID-19  
88 pandemic shows the impact of respiratory viruses on the burden of infectious  
89 diseases and the importance of vaccines in the control of viral respiratory diseases  
90 (4, 5).

91 In 2003, the World Health Assembly adopted a resolution urging member  
92 states to reach a target for uptake of influenza vaccines of 75% among people at  
93 high risk by 2010 (6). The Federal Office of Public Health (FOPH) in Switzerland has  
94 vaccine recommendations in place since 2007, which target mainly elderly people,  
95 but also those with chronic illnesses (including children older than six months),  
96 premature infants, pregnant women, residents of long-term health care facilities and  
97 those are in regular contact with vulnerable populations (7).

98 We earlier analyzed the data from the Swiss Health Survey 2007 and 2012  
99 and showed that overall influenza vaccine uptake in Switzerland decreased from  
100 2007 to 2012 (8). To examine recent trends and associations of socio-demographic  
101 characteristics and health-related factors with influenza vaccination practices in  
102 Switzerland, we analyzed the data from the most recent nationally representative  
103 health survey, in 2017, and compared the results with those from 2012 and 2007.

104

## 105 **Material and methods**

### 106 **Survey sample**

107 The cross-sectional Swiss Health Survey has been conducted every five years since  
108 1992 by the Swiss Federal Statistical Office (SFSO). The survey is a multistage  
109 probability sample drawn from all residents not living in institutions in Switzerland (8,  
110 9). Conducted between January and December of the year, the survey collects data  
111 using computer-assisted telephone interviews and self-completed questionnaires.

112 We compared the data set from 2017 with the data from 2012 and 2007 and  
113 only used survey data from the written forms. We excluded the telephone interviews  
114 because they were shorter and did not include all the questions as the written forms.  
115 We included a total of 51,582 people who responded to a written questionnaire;  
116 14,393 responded in 2007, 18,357 in 2012, and 18,632 in 2017.

117

### 118 **Data collection and definitions**

119 All three surveys included two identical questions about influenza vaccination: (i)  
120 Have you ever had an influenza vaccination? (answers: yes, no, unknown). (ii) If yes:  
121 When were you last vaccinated? (answer: date).

122 The questionnaire collected demographic and socioeconomic as well as health-  
123 related information (Table 1) (5) on chronic diseases such as diabetes, cancer, lung,  
124 cerebrovascular, and cardiovascular disease. The basic health insurance is  
125 mandatory in Switzerland and cover for illness, maternity and accidents and offers  
126 the same range of services to all insured people (10). The respondents' health  
127 insurance plan regarding coverage in case of hospitalization (private, semi-private or  
128 general ward), free choice of physicians and coverage of complementary medicine

129 (including acupuncture, traditional Chinese medicine, homoeopathy, and osteopathy)  
130 in the past 12 months was recorded as well.

131 Pregnancy was recorded as current pregnancy among women 15 to 49 years  
132 old. Current chronic conditions included asthma, chronic bronchitis and emphysema.  
133 Diabetes was defined by the use of any diabetic drug, cardiovascular disease by the  
134 use of any heart medication, and all other chronic diseases were recorded as self-  
135 reported. We defined any chronic disease as the presence of at least one of the  
136 mentioned diseases. Health care workers were defined as individuals reporting  
137 profession in the health care system.

138 Cantons are the administrative subdivisions of Switzerland (see Figure 1 ).

139

#### 140 **Statistical analysis**

141 For each of the three survey years we calculated the proportions (overall and  $\geq 65$   
142 years) that reported having been vaccinated within the last 12 months. We estimated  
143 associations between vaccination status and socio-demographic and health-related  
144 factors. We included an interaction term with the year of survey and the variable of  
145 interest in multivariable logistic regression models. We used the SFSO's survey  
146 weights and reported all proportions and unadjusted and adjusted odds ratio (ORs  
147 and aOR) with the corresponding 95% confidence intervals (95% CI) derived from  
148 robust standard error calculations (Table 2). All analyses were performed in Stata  
149 (version 15.1, Corporation, College Station, Texas, USA).

150 We visualized changes in the frequency of vaccination uptake, and  
151 geographical distributions of the population that reported vaccination for influenza at  
152 the cantonal level using ArcGIS version 10.5 (Redlands, CA, USA).

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155 **Ethics statement**

156 Data were collected anonymized and ethical approval was not required but we  
157 obtained permission to analyze and publish the data through a contract with the  
158 SFSO (Ref. 624.110-1).

159

## 160 **Results**

### 161 **Trends of influenza vaccinations status over time**

162 The proportion of survey participants reporting a history of influenza vaccination  
163 overall was 31.9% (95% CI 31.4-32.4), having dropped from 34.5% in 2007 to 28.8%  
164 in 2017. The proportion reporting vaccination within the past 12 months was 16.4%  
165 (95% CI 15.6-17.2) in 2007, dropped to 14.1% (95% CI 13.5-14.8) in 2012, and  
166 remained at this level in 2017 (14.4%, 95% CI 13.8-15.0,  $p < 0.001$ , Table 1). Among  
167 those  $\geq 65$  years old, the principal target population of the Swiss recommendations  
168 (7), vaccination in the past 12 months dropped from 47.8% (95% CI 45.7-49.9) in  
169 2007, to 38.5% (95% CI 36.6-40.5) in 2012, and 36.2% (95% CI 34.6-37.9) in 2017  
170 ( $p < 0.001$ ). For those with any chronic disease, another at-risk population, the  
171 frequency of influenza vaccination dropped from 43.8% (95% CI 40.9-46.8) in 2007,  
172 to 37.1% (95% CI 34.6-39.7) in 2012, and further down to 31.6% (95% CI 29.7-33.6)  
173 in 2017. Similarly, a decrease in vaccine uptake was seen in people with poor self-  
174 reported health status (39.4%, 33.1%, and 27.0%, Figure 2).

175 From 2007 to 2012 the self-reported influenza vaccination decreased in age  
176 group 15–19 years (aOR 0.51, 95% CI 0.27-0.99) but increased from 2012 to 2017 in  
177 the younger age groups (e.g., aOR 1.59, 95% CI 0.92-2.74 in the 15 to 19 years age  
178 group; aOR 1.19, 95% CI 0.84-1.69 in the 30 to 39 years age group, Figure 2). In  
179 contrast, it decreased in the 65 to 75 years old between 2007 and 2017 (aOR 0.56,  
180 95% CI 0.48-0.66 for 2007- 2012; aOR 0.89, 95% CI 0.77-1.03 for 2012-2017,  
181 Supplementary Table S1). The p-value from the test for an interaction between  
182 period and age group was 0.01 for 2007-2012 and 0.051 for 2012-2017. In pregnant  
183 women, an increase of influenza vaccination was observed between 2007 and 2012  
184 (aOR 4.43, 95% CI 0.96–20.42,  $p = 0.02$ ), with no further increase between 2012 and  
185 2017 (aOR 0.94, 95% CI 0.36-2.47,  $p = 0.45$ ). The temporal trends over the period



186 2007 to 2012 and 2012 to 2017 were not associated with age, language region,  
187 urban/rural setting, citizenship, use of complementary medicine, or type of hospital  
188 stay insurance ( $p>0.05$ , Supplementary Table S1),

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### 190 **Influenza vaccination status in different population groups**

191 In all three surveys, self-reported influenza vaccination was highest in the age group  
192  $\geq 65$  years, and also higher in urban settings, among Swiss citizens, former smokers,  
193 and in persons with supplemental health insurance (Table 1). In all three surveys, the  
194 proportion of self-reported influenza vaccination was higher in the French- and  
195 Italian-speaking region compared to the German region. Persons with chronic  
196 diseases were more frequently vaccinated for influenza, with uptake ranging from  
197 around 20% to 57% depending on age group and type of chronic disease. A lower  
198 proportion of self-reported vaccination was observed in ages 15 years to 50 years  
199 (range 4-9%), the German-speaking area of Switzerland, current smokers, and  
200 person who reported their health status as very good. Pregnant women had  
201 increased frequency of influenza vaccination in 2007 and 2012, and then the  
202 influenza vaccine uptake stabilized between 2012 and 2017 (Table 1, Figure 2). The  
203 regional differences in the vaccination status in the last 12 months in the overall  
204 population and the  $\geq 65$  age group are shown in Figures 1A and 1B.

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206

### 207 **Individual and health system factors associated with the influenza vaccination** 208 **status**

209 In all three surveys, influenza vaccination in the last 12 months was positively  
210 associated with age 65 years or older, living in French-speaking and urban areas,  
211 having a tertiary education, history of smoking, bad self-reported health status,

212 private/semiprivate hospital stay insurance, being a health care worker, and having  
213 any underlying chronic disease. Use of any alternative medicine therapy was  
214 negatively associated with influenza vaccination (aOR 0.72, 95% CI 0.67-0.80). We  
215 found no association with sex, body mass index, or non-Swiss citizenship.(Table 2).  
216 Similar findings were observed when analyzing only participants' ≥65 years old.  
217 Supplementary Table 2 shows unadjusted and adjusted ORs of the associations  
218 between self-reported vaccination for influenza in the last 12 months and socio-  
219 demographic characteristics and health-related factors.  
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## 222 Discussion

223 Progress toward the WHO target of 75% vaccination coverage among high-risk  
224 groups has not only stalled in Switzerland, some of the gains made in earlier years  
225 were lost by 2017. Of particular concern is that the self-reported seasonal influenza  
226 vaccination rate among elderly persons declined from 47.8% in 2007 to 38.5% in  
227 2012, and declined further to 36.2% in 2017. People at risk due to underlying chronic  
228 diseases reported coverage of influenza vaccination of 31.6% in 2017. Overall, after  
229 declining from 16.4% in 2007 to 14.1% in 2012, coverage in Switzerland was, with  
230 14.4%, similar in 2017.

231 A decline in influenza vaccine coverage in recent years has been observed in  
232 other European countries. In the European Region of WHO, vaccine uptake in older  
233 people ranged from 0.03% to 76.3% over seven seasons (2008/2009–2014/2015).  
234 The median was 34.4%. In 2014/15, only Scotland reached the WHO and European  
235 Council goal with an uptake of 75%. Among countries providing data for seasons  
236 2008/2009 and 2014/2015, over half reported a drop in vaccination coverage among  
237 older people (11). Among people with chronic diseases, coverage in the European  
238 Region ranged from 0.3% in Kyrgyzstan to 86.8% in Georgia in 2014/2015 (11).

239 The decline in coverage and an increase in vaccine hesitancy is of concern. In  
240 the last years, several countries of the WHO European Region including Switzerland,  
241 had large outbreaks of vaccine-preventable diseases, including measles, rubella and  
242 influenza. Switzerland and other countries identified steps to improve vaccination  
243 coverage for influenza and other infectious diseases (12, 13). The relationship  
244 between vaccination uptake, knowledge, attitudes, and awareness is complex (14).  
245 Reasons for people not getting vaccinated against influenza include underestimation  
246 of disease severity, fear of side effects, and the cost of vaccines (15-17). Often

247 people are unaware that they should receive the vaccination (15). Of note, the  
248 coverage of measles vaccination increased to almost 90% in young adults in  
249 Switzerland, probably due to the campaigns and a national measles strategy (18).  
250 The experience with measles could serve as a model for influenza.

251         The advent of the novel coronavirus SARS-Cov-2 has profoundly changed  
252 everyday life in Switzerland and elsewhere. It is unclear how the COVID-19  
253 pandemic will affect attitudes toward vaccines. The director of the US Centers for  
254 Disease Control has warned that a possible second wave of Covid-19 could be worse  
255 than the first (19). This has already been seen in the “Spanish flu” pandemic of  
256 1918/19. The Spanish flu affected Switzerland in two waves. The first one occurred in  
257 July 1918, the second, more severe one, in October–November 1918 (20). However,  
258 even in the absence of a second wave, a resurgence of Covid-19 that coincides with  
259 the start of the flu season could significantly stress health care systems. An effective  
260 and safe vaccine against COVID 19 is unlikely to become widely available in 2020.  
261 Therefore, low influenza vaccination rates at around half the 75% coverage  
262 recommended for high-risk groups constitute a hazard that merits prompt, focused  
263 attention by public health authorities.

264         A concerted effort to increase influenza vaccination coverage in 2020/21,  
265 when the COVID-19 pandemic to continue to pose a threat to the public’s health, is  
266 urgently needed. Influenza vaccination prevents deaths, morbidity, hospital  
267 admissions, and other adverse health outcomes, in target populations such as older  
268 people, chronically ill people (21-26), and also children (27) and pregnant women  
269 (28). The continued promotion of infection control measures such as avoiding close  
270 contact with sick people, covering one’s nose and mouth while coughing or sneezing,

271 social distancing and hand hygiene will contribute to reducing the spread of both  
272 influenza and Covid-19 (3).

273 Our study has several limitations. Influenza vaccination status is self-reported  
274 in the Swiss Health Survey, and the reliability of the data unclear. For example,  
275 vaccination coverage could be lower if social desirability bias led to an overestimation  
276 of uptake. Conversely, incomplete recall of vaccinations could bias coverage  
277 downwards. Individuals younger than 15 years are excluded from the survey, but  
278 coverage in this age group is probably even lower than in the 15 to 19-year-olds. A  
279 strength of our analysis is the fact that the survey is a nationwide and representative,  
280 and repeated every five years using the same methodology. Also, the analyses were  
281 weighted and adjusted for a range of potential confounders, which did not  
282 substantially change the results.

283 In conclusion, we need to increase influenza vaccination uptake, particularly  
284 in the elderly and chronically ill, who are also the risk groups most heavily affected by  
285 COVID-19. These efforts should include classic information campaigns, but novel  
286 approaches using social media should also be considered (29, 30).  
287 Recommendations by health care professionals are essential to improve influenza  
288 vaccination coverage, such as client reminder/recall and standing orders (31). The  
289 preparation of influenza season 2020/21 must start now to address the double  
290 burden of COVID-19 and seasonal influenza.

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292

## 293 **Patient and Public involvement**

294 The Swiss Health Survey is a nationwide, representative survey that is repeated  
295 every five years using the same methodology. The survey is conducted by the Swiss  
296 Federal Statistical Office (SFSO) on behalf of the Swiss Government. The content of  
297 the survey is based on a holistic and dynamic health framework and contains  
298 questions on essential topics for the public and politics. The wording of the questions  
299 is regularly harmonized with the statistical offices of other countries in Europe.

300

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303 Health Survey 2012 and 2017, and the people who participated in the surveys.

304

## 305 **Competing interests**

306 All authors declare no conflicts of interest.

307

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311

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412

## TABLES AND FIGURES

**Figure 1.** Geographical distribution (by canton) of people reporting influenza vaccination in the last 12 months in Switzerland, 2012 and 2017. Panel a, overall; panel b, people aged  $\geq 65$  years. na, not applicable (no. of respondents  $< 100$ ).

**Figure 2.** Temporal trends of selected groups of people reporting influenza vaccination in the last 12 months in Switzerland, comparing 2012 and 2017. Percent of people reporting having been vaccinated and the 95% confidence intervals are presented.

Good health: self-reported health status good and very good; Poor health: self-reported health status bad and very bad; With chronic disease: any chronic illness

**Table 1.** Percent of people reporting having been vaccinated for influenza in the last 12 months in Switzerland, 2012 and 2017, overall and among people ≥65 years old.

Characteristic	2007		2012		2017	
	All	≥65 years old	All	≥65 years old	All	≥65 years old
% (95% CI)						
<b>Total</b>	16.37 (15.61-17.16)	47.79 (45.66-49.93)	14.09 (13.45-14.75)	38.53 (36.60-40.49)	14.38 (13.81-14.97)	36.22 (34.58-37.90)
<b>Age group, years</b>						
15-19	7.75 (5.32-11.16)	-	5.23 (3.91-6.97)	-	6.51 (5.11-8.27)	-
20-29	5.45 (3.98-7.42)	-	4.94 (3.92-6.20)	-	7.17 (5.91-8.66)	-
30-39	7.05 (5.80-8.56)	-	4.55 (3.70-5.59)	-	6.37 (5.37-7.54)	-
40-49	8.80 (7.43-10.39)	-	6.67 (5.72-7.77)	-	7.52 (6.53-8.65)	-
50-64	14.94 (13.51-16.49)	-	12.65 (11.46-13.94)	-	12.26 (11.23-13.36)	-
65-75	41.64 (38.90-44.44)	41.64 (38.90-44.44)	29.31 (27.28-31.43)	29.31 (27.28-31.44)	26.74 (24.81-28.76)	26.74 (24.81-28.76)
>75	55.24 (51.94-58.50)	55.24 (51.94-58.50)	48.99 (45.73-52.26)	48.99 (45.73-52.26)	47.96 (45.29-50.63)	47.96 (45.29-50.63)
<b>Sex</b>						
Male	15.74 (14.67-16.86)	48.69 (45.39-52.00)	13.52 (12.67-14.43)	38.44 (35.81-41.15)	13.89 (13.08-14.73)	37.01 (34.65-39.43)
Female	16.97 (15.90-18.09)	47.11 (44.31-49.92)	14.63 (13.71-15.60)	38.57 (35.84-41.37)	14.86 (14.06-15.70)	35.56 (33.29-37.89)
<b>Pregnancy (current) <sup>1</sup></b>						
Yes	2.25 (0.62-7.90)	-	8.95 (4.91-15.75)	-	8.48 (4.50-15.40)	-
No	7.88 (6.65-9.30)	-	5.11 (4.40-5.94)	-	7.34 (6.52-8.26)	-
<b>BMI group</b>						
Underweight	12.43 (9.21-16.57)	53.33 (39.66-66.52)	14.30 (11.07-18.29)	40.59 (29.03-53.30)	12.26 (9.65-15.44)	43.17 (32.16-54.89)
Normal	13.67 (12.74-14.67)	44.70 (41.63-47.81)	12.24 (11.44-13.08)	39.41 (36.54-42.36)	12.95 (12.20-13.74)	35.36 (32.91-37.90)
Overweight	20.49 (19.00-22.07)	50.42 (47.02-53.82)	15.99 (14.78-17.29)	37.26 (34.15-40.48)	15.85 (14.79-16.96)	35.67 (33.09-38.34)
Obese	23.03 (20.09-26.25)	52.81 (46.13-59.39)	18.20 (16.16-20.44)	38.52 (33.55-43.76)	18.23 (16.42-20.20)	39.80 (35.29-44.50)
<b>Language region</b>						
German-speaking	15.63 (14.70-16.60)	45.40 (42.78-48.06)	13.35 (12.57-14.17)	37.43 (35.03-39.88)	13.89 (13.18-14.63)	34.89 (32.88-36.96)
French-speaking	18.03 (16.62-19.53)	54.15 (50.18-58.06)	16.13 (14.96-17.37)	41.66 (38.17-45.23)	15.71 (14.66-16.81)	39.65 (36.62-42.75)
Italian-speaking	19.02 (16.45-21.88)	52.78 (46.15-59.31)	14.16 (12.22-16.34)	38.64 (32.81-44.82)	14.66 (12.78-16.75)	40.66 (35.09-46.48)
<b>Setting</b>						
Urban	17.30 (16.39-18.25)	48.70 (46.23-51.17)	15.07 (14.32-15.85)	39.79 (37.66-41.95)	15.40 (14.70-16.13)	37.82 (35.86-39.82)
Rural	13.82 (12.49-15.26)	45.00 (40.76-49.32)	11.38 (10.20-12.66)	34.40 (30.08-39.00)	11.49 (10.57-12.48)	31.45 (28.55-34.50)
<b>Citizenship</b>						
Swiss	17.13 (16.35-17.94)	48.06 (45.92-50.21)	15.20 (14.48-15.94)	38.64 (36.62-40.69)	15.27 (14.62-15.95)	36.36 (34.62-38.12)
Non-Swiss	13.46 (11.43-15.78)	45.44 (36.42-54.78)	10.37 (9.08-11.82)	37.46 (31.22-44.15)	11.60 (10.44-12.88)	35.15 (30.12-40.54)
<b>Education level</b>						
Primary	19.74 (17.85-21.77)	46.21 (42.41-50.07)	15.59 (13.87-17.49)	35.56 (31.15-40.24)	14.21 (12.92-15.60)	35.79 (32.27-39.46)
Apprenticeship	15.49 (14.41-16.62)	46.26 (42.41-50.07)	13.89 (12.96-14.87)	38.74 (36.08-41.46)	13.96 (13.03-14.94)	34.27 (31.78-36.85)

Secondary	12.01 (10.00-14.37)	44.29 (36.07-52.84)	13.97 (12.11-16.06)	43.84 (37.70-50.17)	15.02 (13.40-16.80)	42.00 (37.10-47.05)
Tertiary	16.37 (15.61-17.16)	55.89 (50.85-60.80)	13.37 (12.32-14.49)	39.48 (35.62-43.46)	14.56 (13.57-15.62)	36.56 (33.32-39.92)
<b>Smoking</b>						
Never smoked	16.55 (15.46-17.70)	47.31 (44.40-50.23)	13.94 (13.02-14.90)	37.19 (34.50-39.97)	13.94 (13.15-14.78)	35.14 (32.85-37.51)
Former smoker	22.50 (20.79-24.31)	50.32 (46.56-54.08)	20.21 (18.71-21.80)	41.55 (38.31-44.86)	20.32 (18.97-21.74)	39.43 (36.64-42.29)
Current smoker	10.89 (9.71-12.19)	43.20 (37.63-48.93)	9.58 (8.63-10.62)	36.34 (31.30-41.71)	10.31 (9.36-11.35)	31.98 (27.82-36.44)
<b>Self-reported health status</b>						
Very good	10.97 (9.50-12.63)	34.51 (29.18-40.25)	8.50 (7.73-9.34)	28.40 (24.81-32.30)	10.05 (9.27-10.88)	26.57 (23.68-29.69)
Good	14.76 (13.88-15.67)	45.57 (42.89-48.29)	14.22 (13.26-15.24)	37.56 (34.77-40.43)	14.43 (13.58-15.32)	35.35 (33.02-37.75)
Moderate	33.13 (31.10-36.31)	58.16 (53.28-62.90)	25.87 (23.68-28.19)	46.48 (42.57-50.44)	26.84 (22.74-29.04)	47.52 (43.74-51.32)
Bad	38.55 (31.45-46.17)	65.80 (54.60-75.48)	33.83 (28.60-39.50)	54.16 (44.07-63.91)	26.55 (22.23-31.37)	51.35 (42.28-60.33)
Very bad	44.33 (27.56-62.49)	73.69 (37.76-92.82)	29.13 (17.36-44.58)	41.73 (21.00-65.86)	28.91 (19.51-40.56)	43.91 (25.87-63.71)
<b>Hospital stay insurance</b>						
Basic	14.04 (13.15-14.99)	44.87 (42.07-47.70)	12.30 (11.53-13.12)	35.39 (32.83-38.05)	12.38 (11.72-13.07)	32.75 (30.68-34.88)
Semiprivate	21.39 (19.58-23.33)	51.23 (47.02-55.43)	19.74 (18.16-21.41)	41.38 (37.82-45.03)	20.26 (18.78-21.83)	39.99 (36.80-43.27)
Private	28.34 (25.47-31.40)	55.06 (49.58-60.43)	27.15 (24.34-30.15)	50.55 (45.37-55.72)	26.77 (23.99-29.76)	46.29 (41.20-51.46)
Other	23.45 (15.11-34.52)	62.63 (35.66-83.52)	9.65 (6.25-14.52)	25.21 (12.25-45.87)	13.46 (9.11-19.44)	21.46 (10.86-37.99)
<b>Use of any alternative medicine therapy<sup>2</sup></b>						
Yes	16.68 (15.35-18.10)	45.55 (41.93-49.21)	11.22 (10.19-12.35)	30.55 (27.09-34.24)	11.70 (10.74-12.73)	30.32 (27.20-33.62)
No	16.23 (15.32-17.19)	48.95 (46.31-51.60)	15.01 (14.24-15.81)	40.73 (38.48-43.01)	15.45 (14.74-16.17)	38.05 (36.14-40.00)
<b>Chronic diseases<sup>3</sup></b>						
Any chronic disease	43.40 (40.42-46.43)	60.81 (57.04-64.46)	37.10 (34.57-39.71)	48.93 (45.45-52.41)	31.61 (29.70-33.59)	48.92 (45.93-51.92)
Diabetes	41.51 (36.70-46.48)	59.95 (53.36-66.20)	37.58 (33.48-41.87)	49.58 (43.97-55.20)	33.24 (29.71-36.96)	51.65 (46.17-57.09)
Lung disease	42.27 (33.23-51.85)	65.88 (52.59-77.08)	42.13 (32.52-52.38)	50.43 (37.15-63.65)	21.60 (18.68-24.85)	49.85 (41.61-58.09)
Cerebrovascular disease	55.12 (41.54-67.97)	69.03 (51.79-82.21)	34.78 (24.61-46.57)	45.67 (31.05-61.09)	35.05 (22.56-50.00)	42.12 (25.50-60.75)
Cardiovascular disease	54.48 (50.42-58.48)	64.16 (59.64-68.44)	42.50 (38.96-46.12)	51.97 (47.51-56.39)	43.23 (40.12-46.40)	52.09 (48.33-55.82)
Cancer	29.76 (22.82-37.77)	53.84 (40.87-66.32)	31.46 (25.88-37.63)	46.35 (37.54-55.39)	35.65 (29.87-41.87)	43.11 (35.29-51.29)
<b>Health care worker<sup>4</sup></b>	17.56 (15.47-19.86)	-	15.15 (13.16-17.37)	-	18.42 (16.42-20.61)	-
<b>Season of interview</b>						
Feb-Aug	16.22 (15.31-17.16)	47.58 (44.91-50.26)	15.34 (14.53-16.20)	42.44 (40.02-44.90)	15.03 (14.34-15.74)	38.15 (36.19-40.14)
Sep-Dec	16.69 (15.33-18.14)	48.22 (44.70-51.76)	12.08 (11.10-13.14)	31.93 (28.81-35.22)	12.75 (11.74-13.83)	31.41 (28.44-34.54)

95% CI, 95% confidence interval; BMI, body mass index

<sup>1</sup> Current pregnancy in women 15 to 49 years

<sup>2</sup> Use of any alternative therapy in the past 12 months (including acupuncture, traditional Chinese medicine, homeopathy, non-medical practitioner, osteopathy)

- <sup>3</sup> Current chronic diseases vs. no disease (reference); lung diseases: asthma bronchiale, chronic bronchitis and emphysema; diabetes: use of any diabetic drug; cardiovascular disease: use of any heart medication; all other diseases: self-reported
- <sup>4</sup> Any profession in the health care system (in the 2007 survey, the veterinary professions were also included in this category) vs. any other profession (reference)

**Table 2.** Associations of having been vaccinated for influenza in the last 12 months with socio-demographic characteristics and health-related factors (as compared to no vaccination) in Switzerland, 2012 and 2017, overall and among people  $\geq 65$  years old.

Characteristic	All		$\geq 65$ years old	
	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
<b>Year of survey</b>		<0.001		<0.001
2007	1		1	
2012	0.74 (0.66-0.83)		0.60 (0.51-0.71)	
2017	0.72 (0.64-0.80)		0.57 (0.49-0.66)	
<b>Age group, years</b>		<0.001		<0.001
15-19	1.07 (0.67-1.71)		-	
20-29	1		-	
30-39	1.05 (0.77-1.44)		-	
40-49	1.32 (0.99-1.75)		-	
50-64	2.27 (1.74-2.96)		-	
65-75	6.26 (4.78-8.20)		1	
>75	12.94 (9.81-17.08)		2.04 (1.82-2.30)	<0.001
<b>Sex</b>		0.66		0.37
Male	1		1	
Female	0.97 (0.88-1.08)		1.06 (0.93-1.21)	
<b>Pregnancy</b>		0.67		
Yes	0.91 (0.56-1.70)		-	
No	1		-	
<b>BMI group</b>		0.87		0.93
Underweight	1		1	
Normal	0.97 (0.74-1.28)		0.88 (0.58-1.34)	
Overweight	0.94 (0.72-1.25)		0.89 (0.59-1.36)	
Obese	0.99 (0.74-1.32)		0.91 (0.58-1.41)	
<b>Language region</b>				
German-speaking	1	<0.001	1	0.010
French-speaking	1.31 (1.20-1.44)		1.22 (1.07-1.38)	
Italian-speaking	0.95 (0.82-1.12)		1.05 (0.86-1.29)	
<b>Setting</b>		<0.001		0.017
Urban	1.24 (1.12-1.38)		1.19 (1.03-1.37)	
Rural	1		1	
<b>Citizenship</b>		0.80		0.199
Swiss	1		1	
Non-Swiss	0.98 (0.85-1.13)		0.87 (0.70-1.08)	
<b>Education level</b>		<0.001		0.064
Primary	1		1	
Apprenticeship	1.00 (0.88-1.14)		1.05 (0.89-1.23)	
Secondary	1.11 (0.93-1.31)		1.14 (0.91-1.43)	
Tertiary	1.26 (1.09-1.46)		1.26 (1.04-1.53)	
<b>Smoking</b>		<0.001		0.009
Never smoked	1		1	
Former smoker	1.17 (1.05-1.28)		1.22 (1.07-1.39)	
Current smoker	0.91 (0.81-1.02)		1.01 (0.85-1.20)	
<b>Self-reported health status</b>		<0.001		<0.001
Very good	1		1	
Good	1.16 (1.03-1.31)		1.30 (1.10-1.53)	
Moderate	1.56 (1.36-1.80)		1.65 (1.36-2.01)	
Bad	2.13 (1.70-2.65)		2.03 (1.46-2.81)	
Very bad	2.07 (1.26-3.40)		1.79 (0.92-3.45)	
<b>Hospital stay insurance</b>		<0.001		<0.001
Basic	1		1	
Semiprivate	1.43 (1.30-1.59)		1.42 (1.24-1.63)	



Private	1.78 (1.56-2.03)		1.86 (1.56-2.21)	
Other	1.28 (0.86-1.92)		0.89 (0.50-1.58)	
<b>Use of any alternative medicine therapy</b> <sup>1</sup>		<0.001		<0.001
Yes	0.72 (0.66-0.80)		0.65 (0.57-0.75)	
No			1	
<b>Chronic diseases</b> <sup>2</sup>				
Any chronic disease	1.84 (1.69-2.09)	<0.001	1.68 (1.51-1.88)	<0.001
Diabetes	1.54 (1.33-1.77)	<0.001	1.46 (1.23-1.73)	<0.001
Lung disease	1.81 (1.46-2.26)	<0.001	1.59 (1.16-2.18)	0.004
Cerebrovascular disease	1.12 (0.74-1.69)	0.59	0.91 (0.58-1.42)	0.679
Cardiovascular disease	1.50 (1.34-1.68)	<0.001	1.44 (1.26-1.64)	<0.001
Cancer	1.22 (0.97-1.55)	0.09		
<b>Health care worker</b> <sup>3</sup>	1.92 (1.64-2.24)	<0.001	-	

95% CI, 95% confidence interval; BMI, body mass index; OR, odds ratio

Model adjusted for all variables included in the table. Unadjusted ORs are shown in Supplementary Table S2.

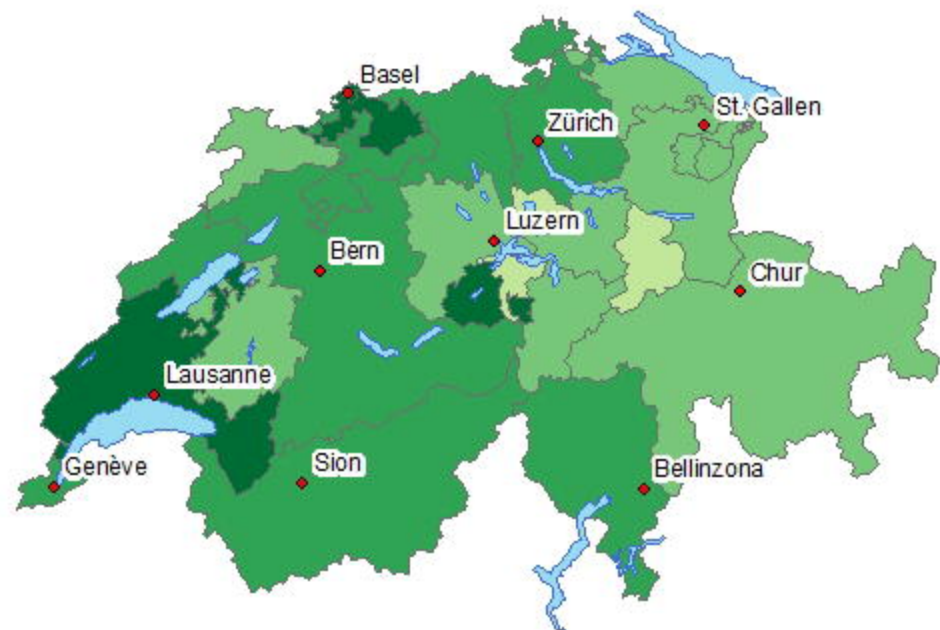
<sup>1</sup> Current pregnancy in women 15 to 49 years

<sup>2</sup> Use of any alternative therapy in the past 12 months (including acupuncture, traditional Chinese medicine, homeopathy, non-medical practitioner, osteopathy)

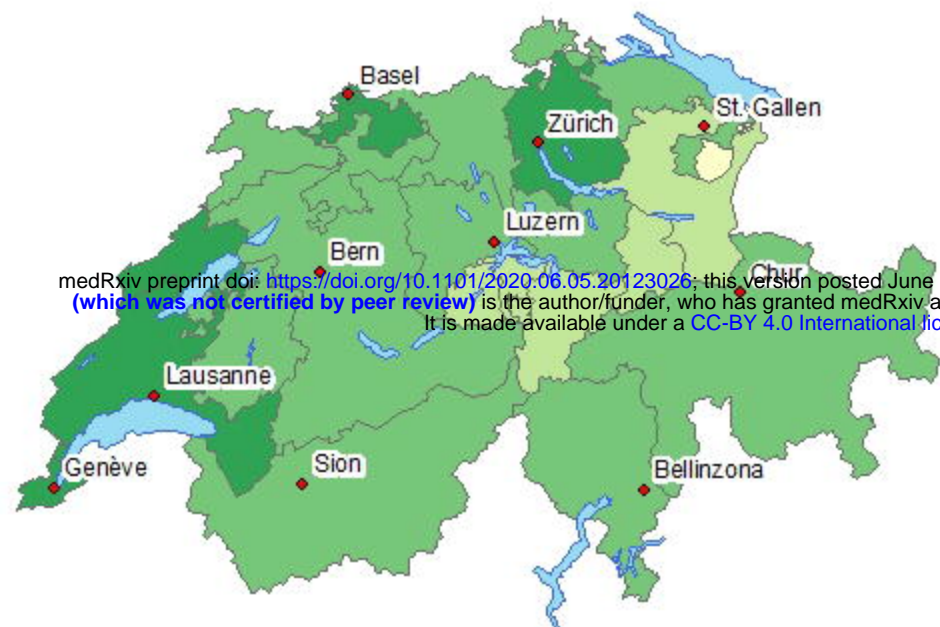
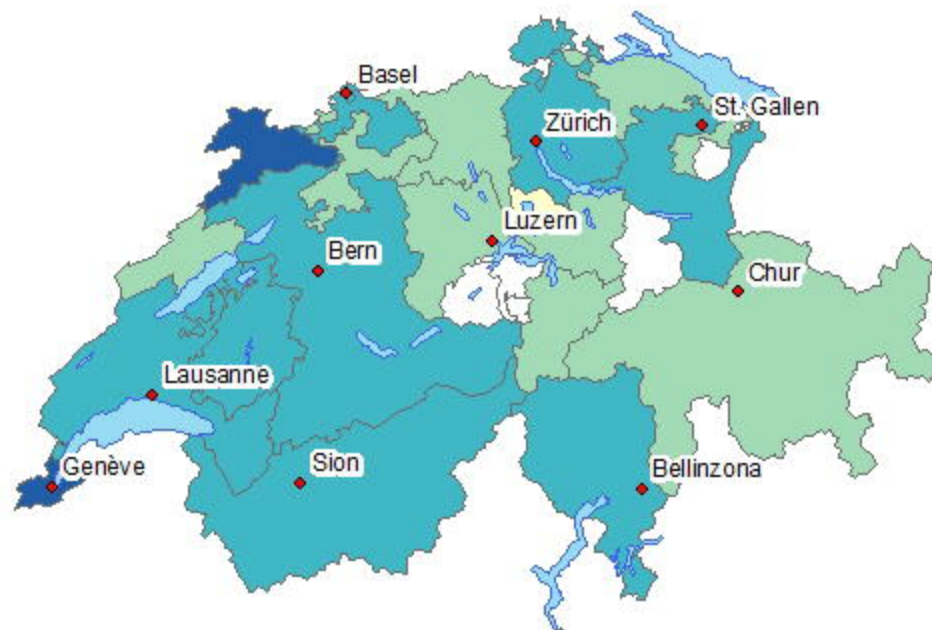
<sup>3</sup> Any current chronic disease versus no chronic disease (reference); lung diseases: asthma bronchiale, chronic bronchitis and emphysema vs. no lung disease (reference); diabetes: use of any diabetic drug vs. no diabetes (reference); cardiovascular disease: use of any heart medication vs. no cardiovascular disease (reference); all other diseases: self-reported disease vs. no disease (reference)

<sup>4</sup> Estimates from separate models which included the variable “any chronic disease” instead of specific chronic diseases

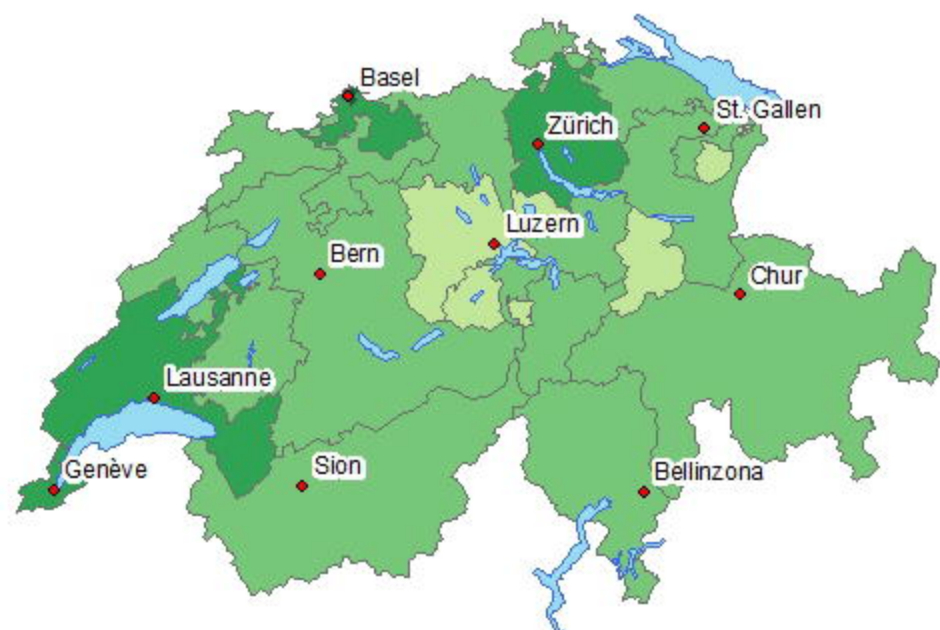
<sup>5</sup> Any profession in the health care system (in the 2007 survey, the veterinary professions were also included in this category) vs. any other profession (reference)



2007



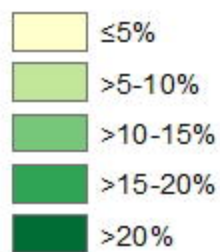
2012



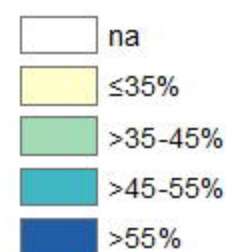
2017



a



b



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