

# BMJ Open Longitudinal panel data study of self-rated health among migrants in French-speaking Switzerland, 2003–2017

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## ABSTRACT

**Introduction** Studies have documented poorer health among migrants than natives of several European countries, but little is known for Switzerland. We assessed the association between country of birth, socioeconomic factors and self-reported health (SRH) in a prospective cohort of adults living in Lausanne, Switzerland.

**Methods** We used the data from the Colaus panel data study for three periods: 2003–2006 (n=6733), 2009–2012 (n=5064) and 2014–2017 (n=4555) corresponding to 35% of the source population. The response variable was SRH. Main explanatory variables were socioeconomic status, educational level, professional status, income, gender, age and years in Switzerland. The main covariate was country of birth, dichotomised as born in Switzerland or not. We specified random effects logistic regressions and used Bayesian methods for the inference.

**Results** Being born outside of Switzerland was not associated with worse SRH (OR 1.09, 95% CI 0.52 to 2.31). Several other patient variables were, however, predictive of poor health. Educational level was inversely associated with the risk of reporting poor health. Monthly household income showed a gradient where higher income was associated with lower odds of reporting poor SRH, for both for migrants and non-migrants. Migrant women had lower odds of reporting poor SRH than men (OR 0.73, 95% CI 0.55 to 0.98). Migrant people living in couple have less risk of reporting poor SRH than people who live alone and the risk is lower for migrant people living in couple with children (OR 0.66, 95% CI 0.55 to 0.80).

**Discussion** Migrant status was not associated with poorer SRH. However, differences in SRH were observed based on gender, age and several social determinants of health.

## INTRODUCTION

Differences in self-rated health (SRH) between migrants and natives have been documented in several European countries but not yet in Switzerland.<sup>1–4</sup> SRH is a well-established indicator used in epidemiology and public health research and is an independent predictor of health outcomes such as morbidity and mortality.<sup>5–9</sup> Numerous studies in European countries have reported that in regard to SRH, most migrant and ethnic minority groups studied appear, on average, to have lower health status compared with the

## Strengths and limitations of this study

- The strengths of this study are the large size of the sample and rigorous collection of data.
- Among the weaknesses, the predominant migration groups included in this study (from other European countries and often >25 years in Switzerland) may be more similar to those born in Switzerland, limiting the generalisability of the results.
- The lack of recent migrants in the sample is one of the main limitations of the current study.
- Lack of variables in the original panel study focusing on acculturation or experienced discrimination that which may influence self-reported health of migrants is another limitation of the study.

majority population.<sup>6 7 10 11</sup> Moreover, SRH appears to be associated with patient's mental health.<sup>12–16</sup>

Alternatively, differences in health status could be attributable to migrants being of lower socioeconomic status (SES) than non-migrants, and this key factor must be adequately accounted for when comparing SRH.<sup>17</sup> The scientific evidence of the social determinants of health (SDH) is well known.<sup>17–19</sup> SES is linked to overall health status not only through the direct physical effects of exposure to better or worse material conditions, but also as a result of one's position in the social hierarchy.<sup>17 18</sup> The migratory process often creates a period of vulnerability after arrival in the host country, as well as a sharp change in the SES that has an impact on health condition. Some authors even consider the migratory process as a SDH.<sup>20</sup>

Our main objective was to investigate differences in SRH of migrants compared with non-migrants in a representative cohort of Swiss adults followed for 10+ years. We focused on migrants as people born outside Switzerland and we analysed differences on country of birth and the number of years living in Switzerland. We focused on SES and the specific characteristics of migrant Cohort patients



compared with individuals who reported being born in Switzerland.<sup>21–26</sup>

## METHODS

### Population

We used data from the ColaUS cohort in Lausanne, Switzerland, and from the PsyCoLaUS study, a subsample from the larger CoLaUS study focused on mental health. The ColaUS cohort is a simple, non-stratified random sample of 19830 subjects (corresponding to 35% of the source population) invited to participate. The CoLaUS cohort is a population-based study designed to assess the prevalence and determinants of cardiovascular risk factors and diseases in Lausanne, a city of 145 000 inhabitants of whom 62 000 (43%) were born outside of Switzerland.

The source population was defined as all subjects aged between 35 and 75 years registered in the population register of the city. The inclusion criteria were to sign the written informed consent and be willing to take part in the study.

Its aims and sampling strategy have been reported previously.<sup>27</sup>

### Data collected

Recruitment was performed between 2003 and 2006 and included 6733 participants. The first follow-up visit was conducted between April 2009 and September 2012 and included 5064 participants; the second follow-up was conducted between<sup>12</sup> and April 2017 and included 4555 participants. The first and second follow-ups included all participants willing to be recontacted. For this study, data from the baseline study and both follow-up examinations were used.

### Measurement

The response variable is SRH from self-reported Likert scale that we transformed into a dichotomic variable. The SRH has been collected since the second period (2009–2012). The following categories: very good and good transformed as a single variable—good health—and categories fair, bad and very bad transformed as a single variable—poor health. We also considered the mental health as a dependent or response variable through three main different indicators (each categorised as present or absent (1 or 0, respectively): anxiety disorders (general anxiety, trouble panic, social phobia, agoraphobia, other), depressive disorders (atypical depressive disorder, depressive disorder, other) and the post-traumatic stress disorder (PTSD). Participants born in other countries, that is, outside Switzerland, were grouped in a single category (n=1191).

The main explanatory variables were being born outside Switzerland, the country of birth and the years living in Switzerland. We included interactions between being born abroad and the years living in Switzerland with all explanatory variables. The control variables were gender, age, the SES following the Hollingshead scale,

the educational level, job type, current professional status, monthly household gross income and alcohol consumption.

## STATISTICAL ANALYSIS

We compared individuals by using Student's t-test and the Mann-Whitney U test for quantitative variables and Pearson's  $X^2$  for qualitative variables. For the multivariable analysis, we used a generalised linear mixed model with binomial response and a logistic link,

$$\log \left( \frac{\text{Prob}(Y_{it}=1)}{1-\text{Prob}(Y_{it}=1)} \right) = \eta_{it}$$

We included in the linear predictor of each individual in the logistic model, the explanatory variables of interest that could explain the probability of being a case (ie, poor SRH, presence of an anxiety disorder, presence of a depressive disorder or presence of a PTSD).

In addition, we checked for the confounding factors observed (including all control variables) and those possibly not measured by the available data. These have been highlighted by including several random effects in the linear prediction. In particular, we checked the presence of heterogeneity of individuals (ie, variables that were not initially observed, did not change over time and were specific to each person). We also accounted for possible temporal heterogeneity by including a random effect of order.<sup>28</sup>

The reduced number of cases (ie, poor SRH, presence of an anxiety disorder, presence of depressive disorder and presence of PTSD) reduced the statistical power to demonstrate differences between groups. To increase any the statistical power—not increasing the sample size—we increased the level of significance (ie, alpha), reducing the likelihood of making a type II error while increasing statistical power. Given the complexity of our model, we preferred to make the inferences using a Bayesian conceptual framework. This model allowed us to incorporate several levels of uncertainty in our reported credibility intervals (CrIs), including model uncertainty, missing data and unobserved confounding. In particular, we used the integrated nested laplace approach (INLA) in a pure Bayesian conceptual framework.<sup>29</sup> Today, in the Bayesian approach, two great alternatives can be used to make the Markov chain Monte Carlo (MCMC) and the INLA inferences. The latter is both significantly faster and more robust than MCMC and, therefore, has become the most widely used alternative for inference.

Apart from the ORs and their CrIs at 95%, the probability of the parameter estimator (the log(OR) as an absolute value being more than 1 (Prob) is also shown (note that it is unilateral and so does not necessarily have to coincide with the CrI in all the cases). Unlike the p value in a usual environment, this probability allows us to make inferences about the possible association.

All analyses were performed with the free software R (V.3.5.1) through the INLA approach.<sup>28–31</sup>

**Table 1** Descriptive statistics of demographic characteristics and variables for the three periods analysed (2003–2006; 2009–2012; 2014–2017) of the CoLaus study

|  | Period 1<br>2003–2006<br>(n=6733) | Period 2<br>2009–2012<br>(n=5064) | Period 3<br>2014–2017<br>(4881) |
|--|-----------------------------------|-----------------------------------|---------------------------------|
| Variable   | N (%)                             | N (%)                             | N (%)                           |
| Self-reported health status (good or very good)                                    | –                                 | 4164 (82)                         | 3743 (78)                       |
| Fair, poor or very poor  | –                                 | 873 (17)                          | 1088 (22)                       |
| Country of birth (other than Switzerland)  | 2700 (40)                         | 1880 (37)                         | 1818 (37)                       |
| Switzerland  | 4031 (60)                         | 3184 (63)                         | 3062 (63)                       |
| Socioeconomical status quantiles following Hollingshead including relatives (1≤20) | 271 (4)                           | 130 (3)                           | –                               |
| 21–39  | 658 (10)                          | 386 (8)                           | –                               |
| 30–39  | 1027 (15)                         | 781 (15)                          | –                               |
| 40–54  | 982 (15)                          | 905 (18)                          | –                               |
| ≥55  | 781 (12)                          | 624 (12)                          | –                               |
| Missing  | 3014 (45)                         | 2238 (44)                         | –                               |
| Educational level (mandatory education)  | 1397 (21)                         | 878 (17)                          | 839 (17)                        |
| Apprenticeship   | 2377 (35)                         | 1796 (35)                         | 1749 (36)                       |
| High school  | 1625 (24)                         | 1306 (26)                         | 1258 (26)                       |
| University education   | 1320 (20)                         | 1079 (21)                         | 1031 (21)                       |
| Job type (high)  | 803 (12)                          | 458 (9)                           | 476 (11)                        |
| Middle   | 2662 (40)                         | 1111 (22)                         | 714 (16)                        |
| Low  | 1306 (19)                         | 1479 (29)                         | 939 (22)                        |
| Not working  | 1945 (29)                         | 1772 (35)                         | 2205 (51)                       |
| Current situation (living alone)   | –                                 | 1414 (28)                         | 1286 (30)                       |
| Single parent family   | –                                 | 285 (6)                           | 228 (5)                         |
| Couple without children  | –                                 | 1757 (35)                         | 1508 (35)                       |
| Couple with children   | –                                 | 1547 (31)                         | 1074 (25)                       |
| Missing  | –                                 | 61 (1)                            | 238 (5)                         |
| Current professional status (Manoeuvre)  | –                                 | 207 (4)                           | 138 (3)                         |
| Qualified worker   | –                                 | 249 (5)                           | 194 (4)                         |
| Farmer   | –                                 | 7 (0.1)                           | 8 (0.2)                         |
| Non qualified employee   | –                                 | 262 (5)                           | 147 (3)                         |
| Qualified employee (f.e. secretary)  | –                                 | 781 (15)                          | 543 (11)                        |
| Low manager  | –                                 | 789 (16)                          | 247 (5)                         |
| Middle manager   | –                                 | 335 (7)                           | 515 (11)                        |
| Top manager  | –                                 | 262 (5)                           | 363 (7)                         |
| Liberal professional (medical doctor, lawyer)                                      | –                                 | 197 (4)                           | 145 (3)                         |
| Not employed or missing  | –                                 | 1975 (39)                         | 2581 (53)                       |
| Monthly household gross income (<CHF2.999)   | –                                 | –                                 | 253 (6)                         |
| CHF3000–CHF4999  | –                                 | –                                 | 656 (15)                        |
| CHF5000–CHF6999  | –                                 | –                                 | 792 (18)                        |
| CHF7000–CHF9499  | –                                 | –                                 | 715 (17)                        |
| CHF9500–CHF13000   | –                                 | –                                 | 543 (13)                        |
| >CHF13000  | –                                 | –                                 | 466 (11)                        |
| Refused or missing   | –                                 | –                                 | 909 (21)                        |
| Do you currently drink alcohol (no)  | 1505 (22)                         | 878 (17)                          | 939 (19)                        |
| Yes  | 5221 (78)                         | 4123 (82)                         | 3419 (70)                       |
| Missing  | 7 (0.1)                           | 63 (1)                            | 523 (11)                        |

Continued



Table 1 Continued

|  | Period 1<br>2003–2006<br>(n=6733) | Period 2<br>2009–2012<br>(n=5064) | Period 3<br>2014–2017<br>(4881) |
|--|-----------------------------------|-----------------------------------|---------------------------------|
| Gender (man)   | 3189 (47)                         | 2357 (47)                         | 2193 (45)                       |
| Women  | 3544 (53)                         | 2707 (53)                         | 2688 (55)                       |
| Age category (0–44 years)                                | 1987 (30)                         | –                                 | –                               |
| 45–54 years  | 1967 (29)                         | –                                 | –                               |
| 55–64 years  | 1778 (26)                         | –                                 | –                               |
| 65–74 years  | 988 (15)                          | –                                 | –                               |
| >75 years  | 13 (0.2)                          | –                                 | –                               |
| How many years have you lived in Switzerland (<25 years) | 1389 (21)                         | –                                 | –                               |
| 25–39 years  | 1274 (19)                         | –                                 | –                               |
| 40–48 years  | 1407 (21)                         | –                                 | –                               |
| 49–59 years  | 1230 (18)                         | –                                 | –                               |
| 60–75 years  | 1284 (19)                         | –                                 | –                               |

It should be noted that several variables have missing data for one or two waves of CoLaus. This has been taken into account in the context of the Bayesian analysis which takes into account the missing values in the treatment of uncertainty.

### Patient and public involvement

No patient involved.

### RESULTS

Tables 1 and 2 show descriptive statistics for all variables included. Our sample included mainly people from Switzerland (n=4031, 60%), France (n=447, 6.6%), Italy (n=409, 6.1%), Portugal (n=391, 5.8%), Spain (n=262, 3.9%) and 1191 from all other countries (18%).

In unadjusted analyses, people born outside Switzerland reported having worse SRH during the second and third CoLaus waves ( $p < 0.001$  for both waves). Nevertheless, in

**Table 2** Proportions of SRH during waves 2 (2009–2012) and 3 (2014–2017), stratified by place of birth (non-migrants=born in Switzerland vs migrants=born in another country) of the CoLaus study

| Time period           | Group                   | Self-reported health status |            |           |         |           |
|-----------------------|-------------------------|-----------------------------|------------|-----------|---------|-----------|
|                       |                         | Very good                   | Good       | Fair      | Poor    | Very poor |
| Period 2<br>2009–2012 | Born in Switzerland     | 838 (26%)                   | 1870 (59%) | 416 (13%) | 38 (1%) | 4 (0.1%)  |
|                       | Born in another country | 381 (20%)                   | 1075 (57%) | 362 (19%) | 44 (2%) | 9 (0.5%)  |
| Period 3<br>2014–2017 | Born in Switzerland     | 702 (23%)                   | 1731 (57%) | 537 (18%) | 54 (2%) | 6 (0.2%)  |
|                       | Born in another country | 330 (18%)                   | 979 (54%)  | 429 (24%) | 56 (3%) | 6 (0.3%)  |

The very good and good categories (perceived health status) were transformed into a single variable—good health—and the average, poor and very poor health categories perceived as a second variable—poor health. SRH, self-reported health.

models adjusting for other participant characteristics, we did not find a statistically significant difference for SRH among the migrant and non-migrant populations. This result showed implies that other factors might explain observed differences in SRH.

Table 3 shows that older age groups were more likely to report poor health than younger age groups, with stronger associations among those from certain countries. All individuals aged 55–64 years had 44% greater odds (OR 1.44, 95% CrI 0.97 to 2.15) of reporting poor health than younger populations. Interactions between country of birth and years of residence in Switzerland showed that those born in France and living in Switzerland for 54 years had a 121% higher risk of reporting poor health (OR 2.21, 95% CrI 0.94 to 5.19) than those born in France and living in Switzerland for 32 years. The same pattern was found among people born in Spain who have lived in Switzerland for 54 years. They were 146% more likely to report health problems (OR 2.46, 95% CrI 0.87 to 6.98) than those born in Spain and living in Switzerland for less than 32 years.

There was a gradient in health status by level of education. The higher the level of education, the better the SRH among both migrant and non-migrant populations. Those with the level of an apprenticeship had 33% less risk (OR 0.66, 95% CrI 0.49 to 0.90) of reporting poor health when compared with those with compulsory education only. Those with a high school education were 37% less likely and those with a higher education level 60% less likely to report poor health (OR 0.40, 95% CrI 0.42 to 0.92) than those with compulsory schooling. This is important since 33% of the migrant population had only a compulsory education compared with 13% of the Swiss born.



**Table 3** Results of the mixed models of the explanatory variables for the perceived health of the entire cohort of the CoLaus study for the period 2003–2017

| Self-rated health  | OR (95%<br>credibility interval) | Prob( log(OR) )>0 |
|--|----------------------------------|-------------------|
| Country of birth (other than Switzerland)  |                                  |                   |
| Switzerland  | 1.09 (0.52 to 2.31)              | 0.5932            |
| Socioeconomical status quantiles following Hollingshead including relatives (1≤20) |                                  |                   |
| 21–39  | 0.92 (0.65 to 1.30)              | 0.6821            |
| 30–39  | 1.11 (0.81 to 1.51)              | 0.7439            |
| 40–54  | 0.83 (0.60 to 1.14)              | 0.8754            |
| ≥55  | 0.82 (0.55 to 1.20)              | 0.8479            |
| Educational level (mandatory education)  |                                  |                   |
| Apprenticeship   | 0.67 (0.49 to 0.90)              | 0.9960*           |
| High school  | 0.63 (0.45 to 0.84)              | 0.9992*           |
| University education   | 0.40 (0.28 to 0.58)              | 0.9999*           |
| Job type (high)  |                                  |                   |
| Middle   | 0.58 (0.35 to 0.95)              | 0.9853*           |
| Low  | 0.60 (0.41 to 0.88)              | 0.9958*           |
| Not working  | 0.62 (0.42 to 0.92)              | 0.9917*           |
| Current situation (living alone)   |                                  |                   |
| Single parent family   | 1.17 (0.78 to 1.78)              | 0.7758            |
| Couple without children  | 0.84 (0.64 to 1.09)              | 0.9115            |
| Couple with children   | 0.89 (0.68 to 1.16)              | 0.8084            |
| Current professional status (manoeuvre)  |                                  |                   |
| Qualified worker   | 0.81 (0.45 to 1.45)              | 0.7646            |
| Farmer   | 0.58 (0.04 to 7.49)              | 0.6631            |
| Non-qualified worker (office assistant)  | 1.09 (0.70 to 1.70)              | 0.6530            |
| Qualified employee (f.e. secretary)  | 0.90 (0.61 to 1.32)              | 0.7119            |
| Low manager  | 0.94 (0.59 to 1.49)              | 0.6063            |
| Middle manager   | 1.03 (0.62 to 1.69)              | 0.5382            |
| Top manager  | 1.13 (0.85 to 1.51)              | 0.7991            |
| Monthly household gross income (<CHF2.999)   |                                  |                   |
| CHF3000–CHF4999  | 1.04 (0.73 to 1.47)              | 0.5761            |
| CHF5000–CHF6999  | 1.01 (0.70 to 1.46)              | 0.5187            |
| CHF7000–CHF9499  | 0.68 (0.45 to 1.02)              | 0.9690*           |
| CHF9500–CHF13000   | 1.21 (0.76 to 1.92)              | 0.7886            |
| >CHF13000  | 0.55 (0.29 to 1.06)              | 0.9640*           |
| Do you currently drink alcohol (no)  |                                  |                   |
| Yes  | 0.63 (0.51 to 0.79)              | 0.9999*           |
| Gender (man)   |                                  |                   |
| Women  | 1.28 (1.02 to 1.60)              | 0.9850*           |
| Age category (0–45 years)  |                                  |                   |
| 45–54 years  | 1.17 (0.82 to 1.68)              | 0.8047            |
| 55–64 years  | 1.44 (0.97 to 2.15)              | 0.9643*           |
| 65–74 years  | 1.29 (0.82 to 2.04)              | 0.8667            |
| >75 years  | 1.17 (0.67 to 2.06)              | 0.7130            |

Continued

**Table 3** Continued

| Self-rated health   | OR (95%<br>credibility interval) | Prob( log(OR) )>0 |
|---|----------------------------------|-------------------|
| How many years have you been living in Switzerland (first quintile <32 years) |                                  |                   |
| Second quintile   | 0.92 (0.72 to 1.18)              | 0.7364            |
| Third quintile  | 0.92 (0.70 to 1.22)              | 0.7108            |
| Fourth quintile   | 0.93 (0.68 to 1.28)              | 0.6691            |
| Fifth quintile  | 1.03 (0.68 to 1.57)              | 0.5552            |

\*The very good and good categories (perceived health status) were transformed into a single variable—good health—and the average, poor and very poor health categories perceived as a second variable—poor health. SRH, Self-reported health.

The monthly household income also showed a gradient in health status. Households with a monthly gross income between CHF7000 and CHF9499 had 32% lower odds of reporting poor SRH than households with incomes below CHF3000. Households with a monthly income greater than CHF13 000 had a 45% lower odds of (OR 0.55, 95% CrI 0.28 to 1.06) describing a poor SRH. This monthly income gradient was the same for migrant's households. We found significant different effects for the current profession for both migrant and non-migrant populations. A Swiss born with a liberal profession had a 62% lower risk of reporting poor SRH (OR 0.38, 95% CrI 0.16 to 0.91) than a manual labourer; in contrast migrants with a liberal profession the risk of reporting poor health was greater. Indeed, we found that migrants with a liberal profession (doctor or lawyer) had 152% higher risk of describing a poor SRH (OR 2.52, 95% CrI 0.91 to 6.96) than manual labourer.

Tables 4 and 5, for the group of people born in Switzerland, all categories of civil status had the same risk of perceiving poor SRH as people living alone. However, childless migrant couples were 22% less likely (OR 0.78, 95% CrI 0.67 to 0.92) to report poor SRH than those living alone and migrant couples with children were 34% less likely (OR 0.66, 95% CrI 0.55 to 0.80) of perceived poor SRH than people living alone. The interaction between country of birth and couple with children was also statistically significant, and a foreign-born couple with children was at 41% lower risk of poor SRH health (OR 0.59, 95% CrI 0.40 to 0.87) than people living alone.

There was no association between the risk of having a psychiatric illness (major depressive disorder, generalised anxiety disorder, panic disorder, social phobia, PTSD or agoraphobia) and belonging to the migrant group. Habitual alcohol consumers had 37% less risk of poor SRH (OR 0.63, 95% CrI 0.51 to 0.78) than non-consumers (p=0.999) and this pattern was the same for both groups.

## DISCUSSION

In this study, we focused on the migrant/non-migrant populations of the CoLaus cohort and their SRH.

**Table 4** Results of the mixed models of the explanatory variables for the perceived health of people born in Switzerland of the CoLaus study population of the CoLaus study for the period 2009–2012 and 2014–2017

| Self-rated health  | OR (95% credibility interval) | Prob( log(OR) >0) |
|--|-------------------------------|-------------------|
| Socioeconomical status quantiles following Hollingshead including relatives (1≤20) |                               |                   |
| 21–39  | 1.04 (0.63 to 1.73)           | 0.5646            |
| 30–39  | 0.94 (0.63 to 1.39)           | 0.6305            |
| 40–54  | 1.18 (0.78 to 1.77)           | 0.7817            |
| ≥55  | 1.22 (0.74 to 2.03)           | 0.7812            |
| Educational level (mandatory education)  |                               |                   |
| Apprenticeship   | 0.97 (0.65 to 1.46)           | 0.5584            |
| High school  | 0.97 (0.63 to 1.49)           | 0.5622            |
| University education   | 1.15 (0.68 to 1.93)           | 0.6961            |
| Job type (high)  |                               |                   |
| Middle   | 1.45 (0.75 to 2.78)           | 0.8664            |
| Low  | 1.36 (0.82 to 2.25)           | 0.8807            |
| Not working  | 1.30 (0.74 to 2.29)           | 0.8202            |
| Current situation (living alone)   |                               |                   |
| Single parent family   | 0.82 (0.46 to 1.47)           | 0.7483            |
| Couple without children  | 0.93 (0.67 to 1.29)           | 0.6620            |
| Couple with children   | 0.59 (0.40 to 0.87)           | 0.9965*           |
| Current professional status (manoeuvre)  |                               |                   |
| Qualified worker   | 1.24 (0.49 to 3.13)           | 0.6780            |
| Farmer   | 1.59 (0.05 to 52.74)          | 0.6009            |
| Non-qualified worker (office assistant)  | 0.81 (0.39 to 1.66)           | 0.7221            |
| Qualified employee (f.e. secretary)  | 0.91 (0.53 to 1.57)           | 0.6357            |
| Low manager  | 0.97 (0.53 to 1.78)           | 0.5354            |
| Middle manager   | 0.62 (0.31 to 1.25)           | 0.9117            |
| Top manager  | 0.99 (0.69 to 1.45)           | 0.5033            |
| Liberal professional (medical doctor, lawyer)                                      | 2.52 (0.91 to 6.96)           | 0.9623            |
| Monthly household gross income (<CHF2.999)   |                               |                   |
| CHF3000–CHF4999  | 1.30 (0.81 to 2.10)           | 0.8636            |
| CHF5000–CHF6999  | 1.24 (0.78 to 1.99)           | 0.8177            |
| CHF7000–CHF9499  | 1.39 (0.82 to 2.37)           | 0.8876            |
| CHF9500–CHF13000   | 0.92 (0.51 to 1.68)           | 0.6051            |
| >CHF13000F   | 1.24 (0.56 to 2.74)           | 0.7032            |
| Do you currently drink alcohol (no)  |                               |                   |
| Yes  | 1.01 (0.75 to 1.34)           | 0.5188            |
| Gender (man)   |                               |                   |
| Women  | 0.73 (0.55 to 0.98)           | 0.9826*           |
| Age category (0–45 years)  |                               |                   |
| 45–54 years  | 0.80 (0.46 to 1.40)           | 0.7833            |
| 55–64 years  | 0.62 (0.33 to 1.15)           | 0.9363            |
| 65–74 years  | 0.45 (0.22 to 0.92)           | 0.9862*           |
| >75 years  | 0.75 (0.35 to 1.63)           | 0.7673            |

\*The very good and good categories (perceived health status) were transformed into a single variable—good health—and the average, poor and very poor health categories perceived as a second variable—poor health. SRH, Self-reported health.

**Table 5** Results of the mixed models of the explanatory variables for the perceived health of people born outside of Switzerland of the CoLaus study population of the CoLaus study for the period 2009–2012 and 2014–2017

| Self-rated health  | OR (95% credibility interval) | Prob( log(OR) )>0 |
|--|-------------------------------|-------------------|
| Socioeconomical status quantiles following Hollingshead including relatives (1≤20) |                               |                   |
| 21–39  | 1.04 (0.63 to 1.73)           | 0.5646            |
| 30–39  | 0.94 (0.63 to 1.39)           | 0.6305            |
| 40–54  | 1.18 (0.78 to 1.77)           | 0.7817            |
| ≥55  | 1.22 (0.74 to 2.03)           | 0.7812            |
| Educational level (mandatory education)  |                               |                   |
| Apprenticeship   | 0.97 (0.65 to 1.46)           | 0.5584            |
| High school  | 0.97 (0.63 to 1.49)           | 0.5622            |
| University education   | 1.15 (0.68 to 1.93)           | 0.6961            |
| Job type (high)  |                               |                   |
| Middle   | 1.45 (0.75 to 2.78)           | 0.8664            |
| Low  | 1.36 (0.82 to 2.25)           | 0.8807            |
| Not working  | 1.30 (0.74 to 2.29)           | 0.8202            |
| Current situation (living alone)   |                               |                   |
| Single parent family   | 0.82 (0.46 to 1.47)           | 0.7483            |
| Couple without children  | 0.93 (0.67 to 1.29)           | 0.6620            |
| Couple with children   | 0.59 (0.40 to 0.87)           | 0.9965*           |
| Current professional status (manoeuvre)  |                               |                   |
| Qualified worker   | 1.24 (0.49 to 3.13)           | 0.6780            |
| Farmer   | 1.59 (0.05 to 52.74)          | 0.6009            |
| Non-qualified worker (office assistant)  | 0.81 (0.39 to 1.66)           | 0.7221            |
| Qualified employee (f.e. secretary)  | 0.91 (0.53 to 1.57)           | 0.6357            |
| Low manager  | 0.97 (0.53 to 1.78)           | 0.5354            |
| Middle manager   | 0.62 (0.31 to 1.25)           | 0.9117            |
| Top manager  | 0.99 (0.69 to 1.45)           | 0.5033            |
| Liberal professional (medical doctor, lawyer)                                      | 2.52 (0.91 to 6.96)           | 0.9623            |
| Monthly household gross income (<CHF2.999)   |                               |                   |
| CHF3000–CHF4999  | 1.30 (0.81 to 2.10)           | 0.8636            |
| CHF5000–CHF6999  | 1.24 (0.78 to 1.99)           | 0.8177            |
| CHF7000–CHF9499  | 1.39 (0.82 to 2.37)           | 0.8876            |
| CHF9500–CHF13000   | 0.92 (0.51 to 1.68)           | 0.6051            |
| >CHF13000 CHF  | 1.24 (0.56 to 2.74)           | 0.7032            |
| Do you currently drink alcohol (no)  |                               |                   |
| Yes  | 1.01 (0.75 to 1.34)           | 0.5188            |
| Gender (man)   |                               |                   |
| Women  | 0.73 (0.55 to 0.98)           | 0.9826*           |
| Age category (0–45 years)  |                               |                   |

Continued

**Table 5** Continued

| Self-rated health | OR (95% credibility interval) | Prob( log(OR) )>0 |
|-------------------|-------------------------------|-------------------|
| 45–54 years       | 0.80 (0.46 to 1.40)           | 0.7833            |
| 55–64 years       | 0.62 (0.33 to 1.15)           | 0.9363            |
| 65–74 years       | 0.45 (0.22 to 0.92)           | 0.9862*           |
| >75 years         | 0.75 (0.35 to 1.63)           | 0.7673            |

\*The very good and good categories (perceived health status) were transformed into a single variable—good health—and the average, poor and very poor health categories perceived as a second variable—poor health.  
SRH, Self-reported health.

Scientific literature has shown that a perceived poor SRH is correlated with greater morbidity and mortality. In addition, studies in other countries have shown that, with regard to SRH, most of the groups of migrants and ethnic minorities report poorer health than local and non-migrant populations.<sup>6 7 10 11</sup> This was also the case in our unadjusted results.

However, in our statistical model with complete adjustment of both measured and unmeasured confounding factors, we found no statistically significant difference in SRH between those born outside of Switzerland and in Switzerland. Instead, several SDH and some sociodemographic characteristics appeared to be stronger explanatory variables for SRH than migrant/non-migrant status. In particular, there is a gradient for the level of education and for the monthly income, regardless of the migration status. These gradients are found in other countries, although the strength of the relationship varies somewhat across countries, for different age groups, by health measures used, and by sex of collectives.<sup>31–33</sup>

Regarding mental health diagnoses, migration is often seen as a risk factor contributing to psychopathology, which may then have an adverse impact on SRH. In this study, however, the risk of presenting a severe psychiatric illness was not greater among migrants.<sup>34–36</sup>

Finally, in the population born in Switzerland, all categories of civil status had the same risk of reporting poor SRH as people living alone. However, childless migrant couples were less likely to report poor SRH than people living alone, and this risk was even lower for migrant couples with children. This is also reflected in the literature, where migrant women are described as a key player in health—for their health, as well as of their children and their families. Conversely, single migrants were more likely to view their health as poor among both men and women, when compared with those who were married or in a common law relationship.<sup>34–36</sup>

The strengths of this study were the size of the sample, the rigorous collection of data and the advanced statistical approaches that made it possible to control both measured and unmeasured confounding factors. Among the weaknesses, the predominant migration groups included in this study (from other European countries

and often >25 years in Switzerland) may be more similar to those born in Switzerland, limiting the generalisability of these results to other countries with different composition of their migrant populations. The lack of recent migrants in the sample is one of the main limitations of the current study. The variables included in the panel data study are lacking on variables focus on acculturation, intergroup relations or experienced discrimination that which may influence directly or indirectly the relationship between level of education and SRH of migrants. Another weakness is the likely selection bias in the participants of the study due to the relative low participant rate of 34% of the invited population. We did not capture the health status at baseline as in many other longitudinal studies of health selective migration. Finally, the complex modelling used in this study generates large confidence intervals makes it more difficult to exclude a small influence of the country of birth.

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**Data availability statement** Data are available on reasonable request at: CoLaus study (<https://www.colaus-psycolaus.ch/>).

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