# A Dynamic Perspective On the Evolution of Perceived Stress Levels in Switzerland – Drivers Before and During the Covid-19 Pandemic

Hannah S. Klaas[ab], Ursina Kuhn[a], Valérie-Anne Ryser[a], Jan-Erik Refle[a], Robin Tillmann[a], and Marieke Voorpostel[a]

*[a]FORS (Swiss Centre of Expertise in the Social Sciences), Lausanne Switzerland*

*[b]Centre LIVES (Swiss Centre of Expertise in Life Course Research), Lausanne, Switzerland*

**Abstract**

As a major sociohistorical event affecting different aspects of life, the Covid-19 pandemic presents a unique opportunity to study how different population groups adapt. This contribution investigates the impact of this crisis on the evolution of perceived stress in the short and medium term in Switzerland.

We use data of the Swiss Household Panel from 2016 to early 2021, which include annual measures of perceived stress and a study between-waves, conducted in May and June 2020 at the end of the first semi-lockdown. Using the longitudinal structure of the data with pre-crisis measurements, we estimate pooled OLS, fixed effects and first difference models, which include sociodemographic variables, life events, socioeconomic status, work-related variables, stress-reducing resources and restrictions in place.

Results for the overall population show a continuous increase in stress levels between 2016 and 2019 and a stress reduction right after the first semi-lockdown followed by a return to pre-pandemic levels. Privileged groups with higher levels of stress before the pandemic were most likely to reduce perceived stress. Characteristics related to more favourable trajectories include stable or improved financial situations and high levels of education (short-term effects), and high-pressure jobs and working hours (short-and-medium-term effects). Our analyses reveal the importance of resources, such as social relations and work-life balance to individuals' management of the effects of the pandemic.

In summary our results show that the effects of the pandemic on perceived stress are context-specific. They underline the importance of longitudinal analyses to understand the complexity of vulnerability and adaptation processes.

**Key messages**

- Perceived stress decreased in the beginning of the pandemic and then returned to pre-pandemic levels
- A deteriorating financial situation hindered stress reduction before and in the beginning of the pandemic
- Workers in high-pressure jobs reduced their stress levels in the short and medium term

- Work-life conflict made stress reduction difficult throughout the pandemic, while social relations help

**Introduction**

For decades, researchers have pointed out that high levels of perceived stress are a major risk factor for negative health consequences throughout the life course, especially when experienced chronically (Pearlin and Skaff, 1996). Stress is a subjective perception that occurs when individuals feel that they do not have enough resources to meet the demands of their environment (Lazarus and Folkman, 1984). High levels of stress put individuals at risk of the development of health-risk behaviours, such as drug consumption or unhealthy eating, and various physical and psychological health problems, such as cardiovascular disease or depression (Thoits, 2010). Accordingly, the reduction of harmful stress is a central part of the WHO action plans on mental health (WHO, 2015) and on the prevention of non-communicable diseases (WHO, 2016).

Perceived stress plays an important role in the vulnerability process as a transmission mechanism between risk factors and negative consequences in health and other life domains (Spini *et al.*, 2013). It is thus crucial to understand under which conditions groups within a given population are more vulnerable to the experience of stress. A large-scale sociohistorical event such as the Covid-19 pandemic presents a unique opportunity to study factors fostering the experience of stress and identify resources that help individuals manage the effects of unpredictable enduring crises. The Covid-19 pandemic can be considered particularly stressful due to its long duration, the unpredictability of its course and its broad impact on different spheres of life, such as health, relationships, education and work. Covid-19 has shattered widely held beliefs about the possibility of living a typical life course and what to expect from different life

phases (Settersten *et al.*, 2020). Beyond the impact of the pandemic, the drastic environmental change presents a unique opportunity to test hypotheses on modern life stressors (Bruining *et al.*, 2021).

Yet, the few studies that investigate perceived stress during the Covid-19 pandemic have several pitfalls: They either do not include randomised samples of the population (e.g., de Quervain *et al.*, 2020a), are cross-sectional, looking at levels of stress at only one time point (e.g., Pieh *et al.*, 2021), include only short measurement intervals (e.g., Robinson and Daly, 2021), or do not have comparable pre-crisis-measurements (e.g., McBride *et al.*, 2021; Breslau *et al.*, 2021). Hence, these studies cannot investigate how different population groups experience changes in stress and adapt in the longer term.

The aim of this article is to close these gaps by investigating the factors related to the development of perceived stress over time, both before and during the Covid-19 pandemic. We take into account risk factors in several life domains such as work, health, financial situation, and family situation, while controlling for region-and time-specific restrictions related to the pandemic. We do this through a life course and vulnerability lens (Spini, Bernardi and Oris, 2017). This approach is well-suited to study the interactions between a major life event (here, the pandemic), latent vulnerability factors (e.g. experiencing financial difficulties), and manifest vulnerability (here, perceived stress levels) over time. We use data of the Swiss Household Panel (SHP; Tillmann *et al.*, 2016, 2021) that includes yearly measurements of perceived stress levels from 2016 to 2021 and an additional Covid-19 survey in May/June 2020. The strength of this data set is its longitudinal perspective on a random sample of individuals living in Switzerland, which allows us to estimate first-difference models that compare

stress levels in spring 2020 and in autumn/winter 2020 to stress before the pandemic, as well as fixed effects (FE) models to better understand the causes of stress before the pandemic. Hence, this study aims to answer the following questions: *1) How has the pandemic affected the evolution of perceived stress levels in Switzerland since 2016? 2) What are the main causes of perceived stress? 3) What are the key factors producing changes in perceived stress levels during the pandemic in the short and in the medium term?* In the following, we will first describe the Swiss context, and then develop our hypotheses along our theoretical framework.

### The Covid-19 pandemic in the Swiss context

To illustrate the Swiss context, the timeline of Figure 1 shows the number of restrictions in place measured via the Stringency Index calculated by the different cantonal regions (Pleninger et al. 2022).

*Figure 1: Number of survey interviews and restrictions in place over time*
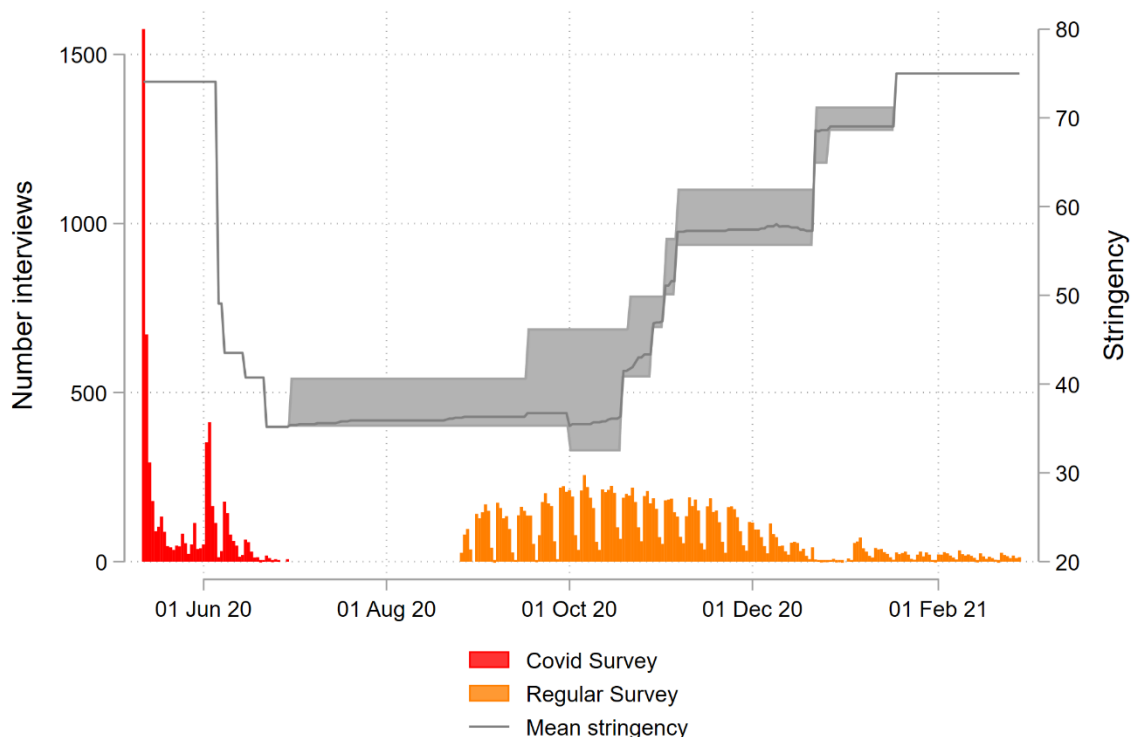
Note: Stringency index from (Pleninger et al, 2022); grey areas indicate cantonal variations

Switzerland was hit by the first wave of the Covid-19 pandemic in February 2020. Some regions were severely touched in spring 2020, with intensive care units being close to full occupancy by the end of March in cantons of Ticino, Geneva and Vaud (Federal Office of Public Health FOPH, 2021). The federal government declared a state of emergency and closed schools, shops, restaurants, bars, and entertainment facilities between March 16 and May 10. Restrictions were gradually lifted between May and September 2020 and authority to impose political measures was returned to the cantonal level on June 19, 2020, when the state of emergency ended (see Swiss TPH, 2021).

The following waves of the pandemic hit Switzerland more strongly than the first (FOPH, 2021). Several cantons introduced stronger measures at different time

points between September and November 2020. These measures included restrictions on or closure of restaurants, clubs, leisure activities, and gatherings. With cases rising in all regions, new federal restrictions were gradually imposed between October 19, 2020, and January 18, 2021. In contrast to the first wave of the pandemic, child-care facilities, primary and secondary schools were never closed, gatherings could involve more people, fewer people worked from home, although home office was compulsory for jobs where this was possible, and there were no public appeals to stay at home.

      The Swiss situation is an interesting research case because, although the infection rate was relatively high in comparison to that of other European countries, especially in the west of Switzerland (Naqvi, 2021), restrictions were weaker than in neighbouring countries (Germany, France, Austria and Italy) almost for the entire period of the pandemic that this study examines, that is, May 2020 to February 2021. This can be seen from the Oxford Government Response Stringency Index developed by Hale and colleagues (2021; see Appendix A1). There were never curfews or formal restrictions on mobility and citizens were allowed to meet with up to five people at a time. Furthermore, though the pandemic strongly hit the Swiss economy, leading to a recession and to unprecedented levels of short-time work and increased unemployment (SECO, 2020), the decline of the gross domestic product was lower than that of the EU average (Eurostat, 2020). Financial measures limiting income losses included extensions and simplifications of short-time work, compensation for loss of income for the self-employed, government-guaranteed loans from Swiss banks and Covid-19 hardship assistance for companies (see Swiss Confederation, 2021). This means that the negative psychological consequences may generally be weaker in Switzerland compared with countries that imposed stricter lockdown measures, and that there may
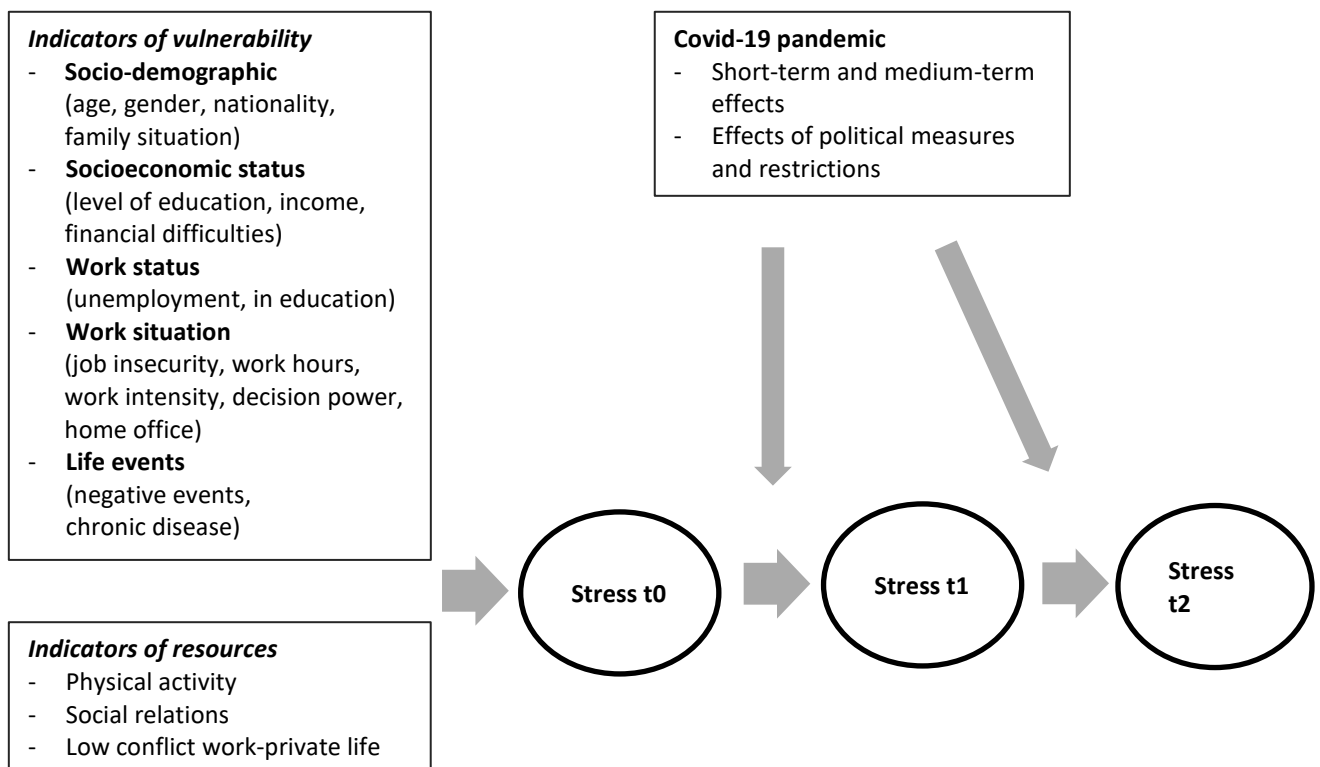
have even been positive consequences for some population groups (Bruining *et al.*, 2021).

### *A life course approach to vulnerability*

Spini and colleagues (2017, p. 8) define the development of vulnerability during the life course as a "weakening process and a lack of resources in one or more life domains that, in specific contexts, exposes individuals or groups to (1) negative consequences related to sources of stress, (2) an inability to cope effectively with stressors, and (3) an inability to recover from stressors or to take advantage of opportunities by a given deadline". Stress is an important element of this model (Pearlin *et al.*, 1981): Factors indicating latent vulnerability in several life domains (e.g., financial insecurity) can lead to manifest vulnerability (higher levels of perceived stress) and then, if stress persists over time, to possible negative consequences.

We have aligned our literature review and hypotheses with three central aspects of the vulnerability framework, namely evolution of stress *over time,* vulnerability factors from *multiple life domains* and the specific *context* of the Covid-19 pandemic (as illustrated in Figure 2).

*Figure 2: Theoretical model illustrating vulnerability as a dynamic process*

Figure. Conceptual model showing indicators of vulnerability, indicators of resources, the Covid-19 pandemic, and the evolution of stress across three time points (Stress t0, Stress t1, Stress t2).

**Indicators of vulnerability**
- **Socio-demographic** (age, gender, nationality, family situation)
- **Socioeconomic status** (level of education, income, financial difficulties)
- **Work status** (unemployment, in education)
- **Work situation** (job insecurity, work hours, work intensity, decision power, home office)
- **Life events** (negative events, chronic disease)

**Covid-19 pandemic**
- Short-term and medium-term effects
- Effects of political measures and restrictions

**Indicators of resources**
- Physical activity
- Social relations
- Low conflict work-private life

Stress t0 → Stress t1 → Stress t2

*Evolution of perceived stress over time – Research question 1 and Hypothesis 1*

Manifestations of vulnerability, such as perceived stress levels, evolve dynamically over time. For stress, a general increase over time has been observed in many countries. Explanations of this trend involve greater experienced or perceived economic insecurity after the financial global crises, digitalisation, less socially structured life courses which individuals must navigate, as well as the increasing pace of everyday life implying time pressure and the necessity of adaptation to frequent changes and new technical innovations (Almeida *et al.*, 2020). For Switzerland, studies document a rising trend of perceived stress in the work context (Promotion Santé Suisse, 2020; SECO, 2020); however, the evolution of general perceived stress has not yet been investigated.

Regarding the pandemic's effect on perceived stress levels, there is conflicting evidence. Reviews of studies on mental health issues during the pandemic show increased prevalence of such issues (in comparison to the pre-pandemic period) and

large variation between countries and population groups (Nochaiwong *et al.* 2021; Manchia *et al.*, 2022). Two studies asking respondents only retrospectively about perceived stress before and during the pandemic found an increase. They looked at a large ad-hoc sample in Switzerland (de Quervain *et al.*, 2020) and at US undergraduate students (Son *et al.*, 2020). Two longitudinal studies from China, which started only at the onset of the pandemic, found decreasing acute stress compared to the onset of the pandemic (Li *et al.*, 2021; Wang *et al.*, 2020).

Only few studies compare perceived stress during the pandemic to pre-pandemic measures. In the Swiss context, using also SHP data, Kuhn and colleagues (2020) observed a general decrease in perceived stress at the end of the first semi-lockdown in May and June 2020, which they explained by the relatively soft lockdown in Switzerland that slowed down private and work life. Shanahan and colleagues (2020) found a small increase in perceived stress among young adults who were 20 years old between 2018 and 2020. In the German context, Ahrens and colleagues (2021) reported fewer daily hassles during the pandemic and Voltmer and colleagues (2021) found no significant change in stress levels among students compared to those in the period before the pandemic. Yet, these studies did not examine whether their findings continued trends from the years before the pandemic, and it remains unclear whether the identified effects were short-term or have persisted over time.

Research investigating how people adapt to different life events shows that on average a person's subjective well-being or clinical symptoms return to pre-event levels within the first year of the event (Bonanno, Westphal and Mancini, 2011; Luhmann *et al.*, 2012). Based on this evidence *we expect a short-term decrease in stress levels, followed by a return to pre-pandemic stress levels in the medium term (H1).*

On the other hand, adaptation to potentially traumatising life events such as natural disasters is not homogeneous. The ways in which individuals adapt depend on multiple factors (Bonanno *et al.,* 2011), which is the next important perspective in the vulnerability framework.

### *Risk factors for perceived stress from multiple life domains – Research question 2, exploratory*

Latent vulnerability factors can include aspects from different life domains (see Figure 2). Different risk factors can add to cumulative advantages or disadvantages (Dannefer, 2003). Importantly, these can be counteracted by the resources at individual's disposal. For perceived stress, the scientific literature has identified many risk factors for example, socio-economic situation (e.g. low income), work status (e.g. unemployment), health (e.g. chronic illness), family situation, and critical life events (Steinmann, 2005). Concerning an individual's work situation, responsibility, an intense job rhythm, and a high number of working hours have been shown to be important risk factors for stress (Johnston and Lee, 2013). This is also why people with higher levels of education have been found to report higher levels of stress, though they are not part of the typically vulnerable groups (Hämmig and Bauer, 2013). Moreover, women seem to consistently report higher stress levels (e.g. Matud, 2004; Ruppanner, Perales and Baxter, 2019) and younger adults report higher stress levels than older adults (e.g. Scott *et al.*, 2017). Protective resources preventing stress are social support, physical activity, and conciliation of work and private life (Allen and Martin, 2017; Uchino, Cacioppo and Kiecolt-Glaser, 1996; Thoits, 2010). As these factors were mainly identified by cross-sectional approaches, models that capture causal effects and look at factors influencing

changes in perceived stress levels over time are important. This is why we would like to test in an exploratory way, which of these factors that have been identified by the literature influence changes in perceived stress levels over time in Switzerland.

*Changes in perceived stress in the context of the Covid-19 pandemic for specific population groups – Research question 3, Hypotheses 2-6*

The Covid-19 pandemic can influence the vulnerability process and hence the evolution of perceived stress levels of groups of individuals in several ways. First, it can present a stressor itself, for example related to anxiety about one's own health or others' health, or present second-order stressors through the political restrictions enacted to fight the spread of the virus. Secondly, the pandemic might influence either risk factors related to stress, such as having a busy lifestyle or working long-hours, or protective factors such as physical activity or social relations.

For major life events, research on the short-term adaptation trajectories of individuals' clinical psychological symptoms (e.g. depression, posttraumatic stress symptoms) has identified a number of predictors of a resilient stable trajectory (Bonanno *et al.*, 2007; Bonanno *et al.*, 2011; Debnar *et al.*, 2020): male gender, older age, a higher level of education, maintenance of economic resources through the event, absence of financial difficulties, lower exposure to the consequences of the event, fewer past negative life events, no chronic health conditions and social support or relationship satisfaction. A longitudinal study from the US found persons under 60 and those belonging to the low-middle range of household incomes to be more likely to have increases in stress levels during the pandemic (Breslau *et al.*, 2021). In Switzerland, several population groups showed reduced perceived stress levels at the end of the first

semi-lockdown compared to before the pandemic, among them: people in short time work due to the pandemic, people with high level of education, those with high household income, those whose financial situation had remained stable or improved, and people with children in the household (Kuhn *et al.* 2020). Yet, this research could not look at the influence of these factors in the medium term, did not control for the restrictions in place and did not include other important factors that have been identified as stressors in previous research, such as life events, work characteristics and resources of an individual.

We have the following expectations regarding the influence of the pandemic on specific population groups: First, the pandemic might increase the vulnerability of older individuals as they are part of the risk group for Covid-19. Second, women might be less likely to experience decreased stress during the pandemic, as they still bear the main part of care and housework. Moreover, parents might have been especially challenged during the first semi-lockdown in spring 2020, when schools and child-care institutions were closed. In contrast, open schools and extended possibilities for working at home, might have been beneficial for parents later in the pandemic because of the accompanying reduction of daily hassles and social obligations (Achterberg *et al.*, 2021; Bruining *et al.*, 2021). *Hence, we expect, compared to their reference groups, less favourable adaptation trajectories for women and people in old age both in the short and in the medium term (H2a). For parents with children in the household, we expect less favourable adaptation trajectories in the short but not in the medium term (H2b).*

According to the theory of cumulative disadvantages, the pandemic could also exacerbate the vulnerability of individuals who experienced other *negative life events*

and of those with chronic health problems. *Hence, we hypothesise less favourable adaptation trajectories for individuals who had experienced negative life events in the preceding year and for those with chronic health conditions (H3).*

For the *socioeconomic situation, we expect less favourable adaptation trajectories for persons with fewer resources, namely those with lower levels of education, lower income or whose financial situation worsened throughout the pandemic (H4).*

Regarding *work-related variables, we hypothesise less favourable adaptation trajectories for people in insecure work positions, that is, in unemployment, in education, or at greater risk of job loss (H5a).* The restrictions in place both in spring 2020, to a lesser extent in autumn 2020 slowed down work life and increased flexibility, which could reduce stress for these groups. *We hypothesise further that individuals with intense job rhythms, a high degree of responsibility at their jobs, and high numbers of working hours before the pandemic would reduce their stress levels more, especially in the short term during the first stricter semi-lockdown (H5b).*

We expect that several *resources* are related to advantageous adaptation processes. Next to social relations and physical activity we expect that the ability to reconcile work and private life has become crucial throughout the pandemic. Hence, *we expect more favourable trajectories for individuals who engage more in physical activity, who are more satisfied with their social relationships and who report a better ability to reconcile work and private life (H6).*

Last, whether the pandemic is perceived as stressful or not could also depend on macro factors, such as the severity of the pandemic, restrictions in place, help available, political and societal climate, or seasonal effects. One study using a small sample

showed decreasing stress over time during the pandemic as a function of the diminishing restrictions in place (Rehmann *et al.*, 2021). As these effects cannot be disentangled, we focus on the influence of individual characteristics but will take into account some region and time-specific control variables.

**Method**

*Sample*

We use data from the Swiss Household Panel (SHP; SHP Group, 2021), an annual survey of a probability-based sample of the population living in private households in Switzerland. All household members 14 years of age or older are invited to participate. The survey started in 1999 and added refreshment samples in 2004 and 2013 (see Tillmann *et al.*, 2016 for details). An additional sample was added at the end of 2020 but is not included in this study.

We use six waves of data collection: the regular waves 2016-2020, conducted between September and February of the following year, as well as the special Covid-19 survey conducted between May 12 and June 30, 2020. We restricted our sample to individuals aged 18 or older. The pooled sample includes 49,571 observations from 18,952 individuals. The number of interviews in the regular panel waves varies between 9,520 (in 2016) and 7,985 (in 2020) observations. The additional Covid-19 study was conducted among respondents to the previous panel wave of 2019 with a response rate of 66.7 % and 5,657 responding individuals aged 18 or older. While the regular panel waves were mainly administered by telephone (95% telephone, 5% web), the Covid-19 survey was fully self-administered, with 67% responding by web and 33% filling out a paper questionnaire (see Refle *et al.*, 2020).

As for survey data in general, there are different types of non-response in the SHP. Not all households and individuals participate in the first wave of the survey (initial non-response), other individuals drop out in later waves (attrition) and some participants do not answer specific questions (item non-response). The potential bias arising from these different types of non-response needs to be kept in mind when interpreting the results. We use imputed values for household income only, where item non-response is most pronounced. Regarding attrition, we found that individuals who are highly stressed are more likely to drop out of the SHP, which means that we might slightly underestimate stress increase over time. We conducted a series of sensitivity analyses using different samples (e.g. balanced panel) to ensure that reported trends and patterns are robust. We found little selectivity in responding to the Covid-19 questionnaire, based on information from the previous wave, with a slight overrepresentation of women, older and married individuals, Swiss citizens, and higher earners. In particular, we cannot analyse differences between migrants and natives during the pandemic due to selectivity. Because of the small number of individuals from the Italian-speaking part of Switzerland and other factors related to linguistic regions, we will not further interpret differences between regions. Health, social participation, and variables related to working conditions were not significantly related to response.

*Measures*

*Perceived stress* was measured with a question about how often respondents felt stressed or nervous during the preceding four weeks, with answers ranging from 'never' (1) to 'very often' (5). This question stems from the Perceived Stress Scale (PSS; Cohen, Kamarck and Mermelstein, 1983). While the survey in 2016 included five items of the PSS, only this general item was retained in the following waves (see factor

analysis, Appendix A2, confirming results of previous studies, e.g., Nielsen *et al.*, 2016). In our study, item non-response was less than 1% for perceived stress.

In our base model (see Figure 2), we included the following independent variables from the regular SHP waves. The *socio-demographic* variables were age (recoded into 18-25, 26-35, 36-55, 56-65, 66-75, and 76 and older), gender, nationality (Swiss, others), partner status (yes/no), household type (multiple adults, single parents, single), number of pre-school-aged children in the household, and number of school children (15 years or younger) in the household.

To assess respondents' *socioeconomic status,* we included educational level (low, upper secondary, tertiary), and disposable household income (equalized using modified OECD scale; missing values were imputed).

Regarding *work-related variables,* we included working status (dummy variables: employed, self-employed, unemployed or looking for a job, inactive, in education); to discern the work situation, we included job insecurity (work in temporary position, yes/no; perceived unemployment risk, scale from 0 to 10), several indicators of job pressure such as number of working hours per week, degree of work rhythm intensity (scale from 0 to 10), having decision power (yes/no), and whether people were working from home (yes/no).

Regarding *life events,* we determined the number of negative events in the previous year (assessed with a list of eight possible negative life events, yes/no) and whether individuals had a chronic disease (self-assessment, yes/no).

*Protective resources* that could counteract stressors were conflict between private life and work (scale from 0 to 10), physical activity (number of days per week) and degree of satisfaction with personal relations (scale from 0 to 10).

The Covid-19 survey did not include all of these variables, omitting, notably, socio-demographic information, income levels, and job characteristics. For relatively stable and objective measures, namely educational level, nationality, household income, and chronic disease, we use the measure from the previous regular wave. To measure the financial situation, we assessed respondents' subjective perceptions of change in their financial situation since the beginning of the Covid-19 crisis, with 0 indicating 'very much worsened', 5 'no change', and 10 'very much improved'. Moreover, the question wording for some of the measurements is slightly different (namely, conflict of work with private life, home office, assessment of income) and cannot be directly compared between regular panel waves and the Covid-19 study. Descriptive statistics and phrasing of all variables are included in the Appendices (A3 and A4).

The analysis includes a number of control variables. We included linguistic regions (German-speaking, French-speaking, Italian-speaking) because these were not equally affected during the first and second semi-lockdown (Swiss TPH, 2021). We added two measures to capture the *effect of the pandemic* itself: firstly, a canton-specific Stringency Index provided by the Swiss Economic Institute (Pleninger *et al.*, 2022) indicating the severity of the measures in place at the time of the interview (at t1 and t2) in every Swiss canton; second, the interview date, which ranged from March 2020 to January 2021, measuring the time since the start of the pandemic. As time and political measures are related to many aspects (e.g. infection numbers, knowledge about the virus, seasonality, adaptation), this is a control for such systematic effects that cannot be further interpreted. Finally, we added the interview mode, because modes administered by interviewers yield more socially desirable results than self-administered surveys

(Klausch, Hox and Schouten, 2013), and regular waves were mostly conducted by telephone while the special Covid-19 study was self-administered (web or paper).

### *Statistical analysis*

Our main aim is to understand the causes of perceived stress and factors explaining changes during the pandemic. Our analysis consists of three main parts related to the different research questions displayed in Table 1.

*Table 1. Overview of methods and data.*

|  | **Evolution of perceived stress over time** | **Factors influencing perceived stress before the pandemic** | **Factors predicting short-term changes in perceived stress during the pandemic (t1)** | **Factors predicting medium-term changes in perceived stress during the pandemic (t2)** |
| --- | --- | --- | --- | --- |
| Related to research question | 1 | 2 | 3 | 3 |
| Method | pooled OLS | pooled OLS, fixed effects | first difference | first difference |
| Dependent variable | perceived stress | perceived stress | difference in perceived stress spring 2020 (t1)-autumn/winter 2019 (t0) | difference in perceived stress autumn/winter 2020 (t2) – autumn/winter 2019 (t0) |
| Data (waves of SHP) | regular panel waves (2016-2020), Covid-19 study | regular panel waves (2016-2019) | 2019, Covid-19 study +Stringency index | 2019, 2020/21 +Stringency index |

To answer our first question, we pool all waves since 2016 to estimate the overall time trend in experienced stress levels and the impact of the pandemic on this evolution.

We address the second research question about factors influencing perceived stress with panel waves from before the pandemic. The longitudinal data structure allows us to estimate both cross-sectional (pooled ordinary least squares, OLS) and longitudinal (fixed effects, FE) regression. With this complementary approach, we can go beyond previous research explaining stress mainly with cross-sectional models, which suffer from bias due to unobserved heterogeneity and, therefore, show correlations rather than causes of stress. The estimates of the FE models are identified via within-person change and therefore control for stable characteristics such as gender, social origin, genetic disposition, personality or any other unobserved factor which might influence both independent and dependent variables.[1] The FE models thus give insights into the causal mechanisms explaining perceived stress. Considering the large number of interrelated explanatory factors, we show a reduced model including socio-demographic, socio-economic and work status variables, and a full model adding work situation, job characteristics and resources. To address our third research question on the short-term and medium-term effect of the pandemic for different population groups, we apply first difference models. For the short-term effects, we compare perceived stress levels in spring 2020 (first wave of the pandemic) to those before the pandemic. For the medium-term effects, we compare perceived stress levels in autumn 2020 (following waves of the pandemic) to those before the pandemic (see Figure 1, Table 1). For the medium-

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[1]We used the xtreg, fe estimator by Stata.

term effects, we included only individuals who participated in the additional Covid-19

survey, to analyse the same population group as in the short-term. Results for the less

selective sample show the same patterns (see Appendix A5/ Table A4).

**Results**

***Research Question 1 (H1): The evolution of individuals' perceived stress levels in***

***Switzerland since 2016***

Figure 3 shows a continuous increase in perceived stress levels between 2016

and 2019 controlling only for interview mode and age. At t1 (referring to the end of the

first semi-lockdown in May and June 2020), perceived stress levels decreased

significantly. However, at t2 (between autumn 2020 and February 2021) stress returned

to nearly pre-pandemic levels. Hence, H1, which stated that we could observe short-

term changes in perceived stress levels, is supported by the data.

Considering that highly stressed individuals are more likely to drop out of the

panel, we might slightly underestimate the increase in stress before the pandemic and

overestimate the drop during the pandemic. However, the pattern is confirmed when we

restrict the sample to a balanced panel. When other control variables are introduced, the

picture remains consistent, indicating that changes in these factors capture only a small

part of variation in stress over time.

Figure 3: Average perceived stress levels before and during the pandemic.
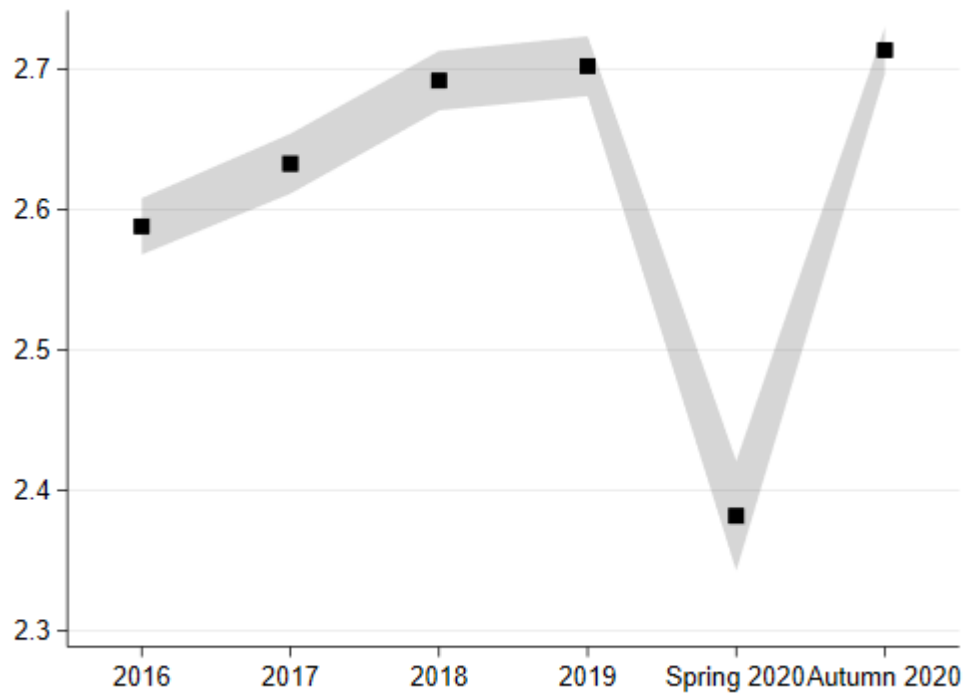
Source: SHP (2016-2020), authors' calculations; grey areas indicate confidence intervals.

***Research Question 2 (exploratory): Main causal factors related to perceived stress***

Table 2 shows cross-sectional (pooled OLS regression) and longitudinal analyses (FE models) using data from the period before the pandemic (2016-2019). Rather stable characteristics are not part of the FE model.

The comparison of the OLS and the FE models gives interesting insight into differences between population groups and explanations for changes in stress-levels within individuals. If a variable is significant in the FE models, this means that effects found in the cross-sectional OLS model are likely to have a causal impact on changes in stress, and do not refer only to correlations caused by unobserved factors. Table 2 displays reduced models as well as full models that include the work situation and protective resources.

Alone, the cross-sectional models show that, of the *sociodemographic variables,* women, individuals with a partner and those with school-aged or pre-school-aged children perceive higher stress levels. Moreover, perceived stress levels tend to decline with age. Living with a chronic illness as well as having experienced a higher number of negative life events are also related to higher stress levels. Findings from the FE models confirm that having a partner, negative events and chronical illness are causes of stress. By contrast, the effects of children are not significant in the FE model, although the effect size is similar, suggesting heterogeneity among parents.

*Table 2:* Regression models predicting stress levels between 2016-2019 and at t1 during the pandemic

| | OLS regression 2016-2019 | | Fixed effects regression 2016-2019 | | Pandemic spring 2020 (t1) | |
|---|---|---|---|---|---|---|
| *Sociodemographic variables* | | | | | | |
| Age | | | 1.313 | (1.4) | | |
|   18-25 | 0.302*** | (10.2) | | | 0.205* | (2.5) |
|   26-35 | 0.195*** | (8.6) | | | 0.223*** | (4.5) |
|   36-55 (Ref.) | | | | | | |
|   56-65 | -0.150*** | (-7.3) | | | -0.103* | (-2.5) |
|   66-75 | -0.258*** | (-9.4) | | | -0.264*** | (-4.7) |
|   76+ | -0.299*** | (-8.9) | | | -0.199** | (-3.1) |
| Female (Ref.: Male) | 0.312*** | (22.2) | | | 0.352*** | (13.0) |
| Foreigner (Ref.: Swiss) | 0.095*** | (3.3) | | | -0.005 | (-0.1) |
| Partner (Ref.: no partner) | 0.073*** | (3.6) | 0.075** | (2.8) | 0.108* | (2.5) |
| Household type (Ref.: Multiple adults) | | | | | | |
|   Single parents | -0.043 | (-1.5) | 0.050 | (1.0) | 0.115 | (1.7) |
|   Single household | -0.000 | (-0.0) | -0.030 | (-0.9) | -0.008 | (-0.2) |
| Nb pre-school children | 0.049** | (2.6) | 0.051 | (1.7) | 0.037 | (0.9) |
| Nb. School children | 0.071*** | (6.2) | 0.036 | (1.5) | 0.062** | (2.6) |
| *Life events* | | | | | | |
| Nb. negative events | 0.118*** | (17.1) | 0.044*** | (6.5) | 0.089*** | (5.9) |
| Chronic disease (Ref.: none) | 0.172*** | (13.3) | 0.034* | (2.2) | 0.171*** | (6.2) |
| *Socioeconomic status* | | | | | | |
| Education (Ref.: low) | | | | | | |
|   Upper secondary | -0.017 | (-0.8) | | | -0.060 | (-1.2) |
|   Tertiary | 0.009 | (0.4) | | | -0.010 | (-0.2) |
| Household income | 0.007* | (2.5) | 0.001 | (0.3) | 0.002 | (0.3) |
| Change of financial situation | -0.026*** | (-5.9) | -0.025*** | (-5.9) | -0.049*** | (-4.0) |
|     Expenses (Ref.: Income covers expenses) | | | | | | |
|   Use savings | 0.106*** | (5.0) | 0.038 | (1.7) | 0.037 | (0.5) |
|   Gets into debt | 0.200*** | (3.4) | -0.024 | (-0.4) | 0.415* | (2.2) |
| Working status (Ref.: employed) | | | | | | |
|   Self-employed | 0.025 | (1.0) | 0.002 | (0.1) | 0.016 | (0.3) |
|   Unemployed | 0.438*** | (7.0) | 0.202*** | (3.5) | 0.524*** | (4.5) |
|   In education | 0.301*** | (11.5) | 0.157*** | (5.4) | 0.411*** | (4.8) |
|   Not economically active | 0.256*** | (9.5) | 0.063 | (1.9) | 0.241*** | (3.7) |
| Fixed-term contract | 0.025 | (1.0) | 0.002 | (0.1) | | |
| Unemployment risk | 0.014*** | (4.4) | 0.003 | (1.0) | 0.009 | (1.2) |
| Working from home | 0.037* | (2.3) | 0.003 | (0.2) | -0.046 | (-1.3) |
| Working hours | 0.001 | (1.1) | 0.001** | (2.6) | 0.004*** | (4.7) |
| Work intensity | 0.066*** | (20.8) | 0.042*** | (12.2) | | |
| Decision power | -0.001 | (-0.0) | 0.029 | (1.6) | | |
| *Resources* | | | | | | |
| Conflict work-private | 0.065*** | (21.0) | 0.047*** | (14.5) | 0.066*** | (9.3) |
| Physical activity | -0.010*** | (-3.6) | -0.003 | (-1.1) | -0.009 | (-1.6) |
| Satisfaction with personal relations | -0.103*** | (-23.1) | -0.035*** | (-7.1) | -0.114*** | (-15.0) |

*Table 2 Continued*

| Control variables | | | | | | |
|---|---|---|---|---|---|---|
| Stringency index | | | | | -0.002 | (-1.1) |
| Linguistic region (Ref.: German-speaking) | | | | | | |
| French speaking | 0.290*** | (18.0) | | | 0.220*** | (7.2) |
| Italian speaking | 0.249*** | (7.5) | | | 0.326*** | (5.0) |
| Year : 2016 (Ref.) | | | | | | |
| 2017 | 0.059*** | (4.9) | -1.277 | (-1.4) | | |
| 2018 | 0.103*** | (8.5) | -2.550 | (-1.4) | | |
| 2019 | 0.107*** | (8.7) | -3.869 | (-1.4) | | |
| Time trend (interview date) | | | | | 0.002 | (1.5) |
| Interview mode: cati (Ref. Cawi) | -0.142*** | (-4.7) | -0.221*** | (-5.1) | -0.104 | (-0.2) |
| Constant | 3.018*** | (46.1) | -63.636 | (-1.4) | 3.088*** | (18.1) |
| | | | | | | |
| Observations | 34,867 | | 34,867 | | 4,763 | |
| Number of idpers | 11,394 | | 11,394 | | 4,763 | |
| R-squared | 0.267 | | 0.037 | | 0.222 | |

Note: Robust t-statistics in parentheses (taking account of clustering); *** p<0.001, ** p<0.01, * p<0.05. Sources: Swiss Household Panel.

With regard to indicators of *socioeconomic resources,* we find in the reduced cross-sectional model higher perceived stress levels for highly educated individuals and those with higher household income; however, these effects are explained by the work situation, as the full model shows. The effect is also reduced in the longitudinal model. This suggests that high income and educational level are not source of stress per se, but that they are related to other stressors, such as working hours and unobserved factors. While income level itself does not influence stress, the effect of change in the financial situation shows the importance of financial resources: In all models, individuals who report a deterioration of financial circumstances in the last year also tend to have higher perceived stress.

As regards *work-related variables,* we assess working status mainly in the reduced models, as the ceteris paribus assumption for work characteristics is confusing in comparisons of individuals in paid work to those who are unemployed or not

economically active. People not active in the labour market have lower stress levels (cross-sectional model), and exiting the labour market decreases stress (longitudinal model). Surprisingly, being unemployed seems to reduce stress. Comparison of the reduced and full models seems to suggest that the reduction in work-related stressors outweighs the stress caused by unemployment. Similarly, unemployment risk is not a relevant causal factor of stress as it is only significant in the cross-sectional model. Another unexpected result concerns temporary contracts, which do not seem to be a source of stress. Possible explanations for this result are the liberal labour market and low unemployment rates during the time of the study.[2] In contrast, more working hours per week and a more intense job rhythm are strong causal predictors of perceived stress, as these variables are also important in the FE models. Findings differ between the models for working from home. While the cross-sectional model suggests that working from home accompanies greater stress, the longitudinal model does not relate the two phenomena, suggesting that the cross-sectional model measures a selection effect (individuals with stressful jobs are more likely to work at home) rather than a direct impact of working from home.

Regarding the *protective resources,* satisfaction with social relationships and less conflict between work and private life reduce perceived stress levels in both the cross-sectional and longitudinal models. Physical activity is related to lower stress in the cross-sectional model, but its insignificant effects in the longitudinal model suggest that other factors that influence both physical activity and stress might drive this relationship.

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[2] While the models in Table 2 suggest the opposite effect, the coefficients are insignificant when other work-related variables are removed from the model.

Overall, our analyses confirm the importance of most sources of perceived stress identified in previous literature. However, the longitudinal analysis suggests that the influence of some stressors and stress-reducing resources have been overestimated by previous cross-sectional analyses. This is the case for working at home, income, unemployment risk and physical activity, which are likely to reflect mainly selection effects rather than causal impacts. Cross-sectional analyses during the pandemic showing similar correlates of stress as pre-pandemic results can be found in the Appendix (A5/ Table A5).

***Research Question 3 (H2-6): Heterogeneous changes in perceived stress levels during the pandemic in the short and medium term***

Table 3 shows first difference models that compare perceived stress during the pandemic either at t1 (referring to the end of the first semi-lockdown in May and June 2020) or at t2 (referring to the period between autumn 2020 and February 2021) to levels before the pandemic. Models for a larger sample for t2 and for different time points during the pandemic can be seen in Appendix A5.

*Table 3:* First-difference-regressions regarding changes in stress at t1 and t2 during the Covid-19 pandemic as compared to t0 before the pandemic

|  | t1 – Full model | | t2 – Full model | |
| --- | --- | --- | --- | --- |
| *Sociodemographic variables* | | | | |
| Age (Ref. : 36-55) | | | | |
|   18-25 | -0.039 | (-0.4) | -0.041 | (-0.5) |
|   26-35 | -0.001 | (-0.0) | -0.006 | (-0.1) |
|   56-65 | -0.011 | (-0.2) | -0.004 | (-0.1) |
|   66-75 | -0.063 | (-0.9) | 0.050 | (0.8) |
|   76+ | -0.000 | (-0.0) | 0.025 | (0.3) |
| Female (Ref. : Male) | 0.018 | (0.5) | 0.040 | (1.3) |
| Foreigner (Ref.: Swiss) | -0.112 | (-1.5) | -0.017 | (-0.2) |
| Partner (Ref.: no partner) | 0.133* | (2.5) | 0.127* | (2.4) |
| Household type: (Ref.: multiple adults) | | | | |
|   Single parents | 0.153 | (1.9) | 0.129 | (1.6) |
|   Single household | 0.036 | (0.7) | 0.049 | (0.9) |
| Nb pre-school children | -0.051 | (-1.1) | -0.028 | (-0.6) |
| Nb. School children | -0.050 | (-1.8) | -0.080** | (-2.9) |
| *Life events* | | | | |
| Negative life events | -0.019 | (-1.1) | 0.013 | (0.7) |
| Chronic disease (Ref.: none) | -0.030 | (-0.9) | 0.022 | (0.7) |
| *Socioeconomic status* | | | | |
| Education: (Ref.: low) | | | | |
|   Upper secondary | -0.122* | (-2.1) | -0.016 | (-0.3) |
|   Tertiary | -0.102 | (-1.7) | -0.004 | (-0.1) |
| Household income before pandemic | -0.004 | (-0.6) | -0.005 | (-0.8) |
| Change in financial situation | -0.040** | (-2.7) | 0.008 | (0.6) |
| Expenses (Ref.: Income covers expenses) | | | | |
|   Use savings | 0.043 | (0.4) | 0.000 | (0.0) |
|   Gets into debt | 0.333 | (1.5) | -0.030 | (-0.2) |
| *Work-related variables* | | | | |
| Working status (Ref.: employed) | | | | |
|   Self-employed | -0.005 | (-0.1) | -0.092 | (-1.6) |
|   Unemployed | 0.115 | (0.8) | -0.450** | (-2.7) |
|   In education | 0.014 | (0.1) | 0.025 | (0.3) |
|   Not economically active | 0.237** | (2.9) | -0.171** | (-2.8) |
| Temporary contract before pandemic | 0.011 | (0.2) | -0.051 | (-0.7) |
| Unemployment risk | -0.014 | (-1.5) | -0.001 | (-0.1) |
| Working from home | -0.084 | (-1.9) | 0.027 | (0.7) |
| Working hours before pandemic | -0.003* | (-2.5) | -0.003* | (-2.0) |
| Work intensity before pandemic | -0.049*** | (-6.6) | -0.040*** | (-5.5) |
| Decision power before pandemic | -0.058 | (-1.4) | 0.021 | (0.5) |

*Table 3 continued*

| | | | | |
|---|---|---|---|---|
| *Resources* | | | | |
| Conflict work-private life | 0.124*** | (7.4) | 0.037*** | (4.9) |
| Physical activity | -0.004 | (-0.6) | -0.007 | (-1.0) |
| Satisfaction with personal relations | -0.039*** | (-4.3) | -0.020 | (-1.8) |
| *Control variables* | | | | |
| Stringency index | -0.003 | (-1.3) | -0.005 | (-1.7) |
| Time: Interview date | 0.001 | (0.4) | 0.002* | (2.4) |
| Linguistic region (Ref.: German speaking) | | | | |
| French speaking | -0.139*** | (-3.8) | 0.040 | (1.1) |
| Italian speaking | 0.049 | (0.6) | -0.167* | (-2.2) |
| Interview mode: change to CAWI | 0.156* | (2.3) | 0.025 | (0.3) |
| Constant | -17.313 | (-0.4) | -47.817* | (-2.4) |
| Observations | 4,761 | | 4,409 | |
| R-squared | 0.062 | | 0.026 | |

Note: R-statistics in parentheses; *** p<0.001, ** p<0.01, * p<0.05. Sources: Swiss Household Panel.

Regarding sociodemographic variables, changes in perceived stress are similar across age groups. There are no differences by gender, irrespective of the model specification. Hence, we reject hypothesis H2a. Our hypothesis on children (H2b) is partly supported. Having children was not associated with changes in stress-levels in the short term, but parents of school-aged children reduced their stress in the medium term. Moreover, individuals with partners were less likely to reduce their stress levels than individuals without partners were, both in the short and medium term. Individuals with chronic illnesses or negative life events in the past year did not show different trajectories.

Therefore, we reject our hypotheses of less favourable trajectories of these groups (H3).

However, the data support our hypothesis (H4) regarding *socioeconomic status.* Individuals with higher levels of education reduced stress more in the short term, as did those individuals whose financial situation had been stable or improved.

Regarding *work-related variables,* in contrast to our hypothesis H5a, both unemployed individuals and those not in the labour force reduced their stress levels in the medium term more substantially than individuals engaged in paid work or in education did. Job insecurity and unemployment risk were not associated with less favourable trajectories.

Our results support hypothesis 5b: Individuals with higher degrees of work intensity and higher numbers of working hours before the pandemic were able to reduce their perceived stress levels to a greater extent, both in the short and the medium-term. We found no additional significant stress reduction for individuals with decision-making power, which is strongly correlated with high numbers of working hours.

With regards to our hypothesis on *resources* that help with stress reduction (H6), we found that, in the short term, individuals who were more satisfied with their personal relationships reduced their perceived stress levels more. During both measurement periods, individuals who found it difficult to reconcile work and private life were less able to reduce stress levels.

There was no significant impact of the stringency index, which captures the variation of political measures between cantons over time. There was a small time effect during the medium term period (t2), which suggests that stress levels increased gradually over time. Time showed no significant effect in the short term (t1), where interviews were conducted within a shorter period of only two months.

**Discussion**

Taking a vulnerability perspective (Spini *et al.*, 2013, 2017) and a longitudinal

approach, we investigated how the Covid-19 pandemic has impacted the evolution of

perceived stress in Switzerland in the short and medium term. Our data and analytical

approach expand previous research by including pre-pandemic measures and by

identifying the influence of factors from multiple life domains on the evolution of

perceived stress. Hence, we are able to show both general and context-specific effects of

the pandemic and draw a complex picture of the development of perceived stress levels

before and during the pandemic for different population groups.

Addressing our first research question on the impact of the Covid-19 pandemic

on the evolution of perceived stress levels, we find a general increase in perceived stress

between 2016 and 2019. This adds to earlier studies that established this trend for work-

related stress (SECO, 2020; Promotion Santé Suisse, 2020). The pandemic led to a

temporary decrease in stress at the end of the first semi-lockdown in May/ June 2020,

followed by a return to nearly pre-pandemic levels between September 2020 and

February 2021. This is a paradoxical result that contrasts with studies pointing to the

perception of the pandemic as a stressful event. We think that explanations lie in the

context of our survey, in the longitudinal data analyses and in research on psychological

adaptation. First, the results might be specific to the Swiss situation, characterised by

relatively weak political restrictions and available support measures for income loss.

Moreover, the data from the first semi-lockdown were collected when the end of the

restrictions was foreseeable and the risk of overburdening the healthcare system was no

longer acute. Second, most previous studies did not include pre-pandemic measures of

perceived stress or were based on selective samples. We think that cross-sectional

studies and retrospective questions explicitly mentioning the pandemic are likely to

measure whether the pandemic is perceived as a stressful event and not the net change in perceived stress as our research does. In one of the explicit questions in our Covid-19 study, 19% of the population reported physical reactions when thinking about the experience with the corona virus (Refle *et al.*, 2020, p. 34). Hence, our results do not contradict findings that the pandemic as such can represent a stress factor. They rather seem to capture the longitudinally assessed net change in the perception of general stress. Third, our evidence showing a short-term decrease in perceived stress followed by a return to pre-pandemic levels can be explained by research in the field of psychological adaptation and the set-point theory. This research shows that people adapt, on average, during the first year after stressful life events, returning to pre-event levels of positive and negative emotional states (Diener *et al.,* 2006; Luhmann *et al.*, 2012). In this line, although the number of restrictions did not have an effect in our models, we found a linear time trend of increasing stress in the medium term.

Our research questions 2 and 3 were aimed at revealing factors effecting the evolution of perceived stress beyond the general observed tendency. We found considerable heterogeneity of trajectories, depending on socioeconomic situation (level of education, change in financial situation), work-related variables (working hours, work intensity), family situation (having school-aged children), and stress-reducing resources (personal relationships, conciliation of private and working life). While most of these factors were only relevant in the short term during the pandemic, the perceived stress levels of those with jobs with intense working rhythms and more working hours, as well as those with satisfying relationships, remained below pre-pandemic levels also in the medium term, while those having difficulty to reconcile work and private life seemed to struggle at both time periods. This is in line with findings from research on

retirement, which shows unique benefits for those with psychologically stressful jobs (van den Bogaard, Henkens and Kalmijn, 2016).

Overall, the pandemic has not changed the factors that were related to perceived stress before it began, but it has reduced time-variant stressors for specific population groups when the financial security was given. Specifically, the pandemic seems to have reduced differences in perceived stress levels (in the short term) between individuals with higher and lower levels of education, and (in the short and medium term) between those in jobs with more or less intense rhythms and extended working hours, and between those with greater or lesser difficulty combining private and work life. During the pandemic working from home had neither positive nor negative effects when living and job conditions were controlled for, which shows the importance of contextual characteristics.

Interestingly, several vulnerability factors that are generally related to increased levels of perceived stress, such as being female, of young age, being a single parent, or having a chronic illness, do not explain different trajectories. We do not observe an increase in the stress gap between these population groups. Furthermore, while job insecurity and becoming unemployed were related to increases in stress before the pandemic, having an unstable job did not influence stress during the pandemic and being economically inactive actually decreased stress. On the other hand, a stable or improved financial situation was important for stress reduction both before and during the pandemic (in the short term).

Another result worth mentioning concerns the situation of families. Surprisingly, the semi-lockdown, which involved the closure of schools and child-care facilities did not increase parents' perceived stress. In the medium term, parents with school-children

showed even lower stress levels than before the pandemic, most likely because schools remained open, while other restrictions eased the demands of other domains. Possible reasons for these positive aspects for families include facilitated parent-child bonding and time for reflection due to fewer daily hassles and social obligations, as well as the alleviation of social and school pressure (Achterberg *et al.*, 2021; Bruining *et al.*, 2021).

Despite significantly contributing to a better understanding of the longitudinal dynamics of stress during a large-scale sociohistorical event, our research has some limitations. First, individuals in financial precarity and foreigners were underrepresented in our survey, and the SHP does not include vulnerable groups such as persons in care homes or without residence permit. Secondly, the SHP comprises relatively few measurement points during the pandemic, and the time of the interview is partly chosen by respondents. Nevertheless, a Swiss study that had several measurement points shows the same trend (*COVID-19 Social Monitor*, 2021). Moreover, we cannot exclude the possibility that results are influenced by seasonal effects, but also do not believe the potential impact is important. Sensitivity analyses of previous panel waves showed negligible influence of survey month and analyses from other household panel studies rule out this explanation (Daly, Sutin and Robinson, 2020). Thirdly, the SHP is a multi-disciplinary survey that includes only one item to measure perceived stress. We think that this limitation is counterbalanced by the large probability-based sample, the rich longitudinal data, and the good performance of this single item (Nielsen et al., 2016). Finally, the Swiss situation might not be generalized to other European countries that experienced more restrictions, less support for income loss or less capacity in the health system. As our results show that the effect of the pandemic is context-specific, more longitudinal research on the evolution of perceived stress should be conducted

using cross-country comparisons and following trajectories for specific population

subgroups in more detail.

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**Declaration of interest statement**

The authors have no declaration of interest.

**Data availability statement**

The authors take responsibility for the integrity of the data and the accuracy of the

analyses. The data (doi: 10.23662/FORS-DS-932-5) is freely available to other

researchers after signing a contract, and can be downloaded from SWISSUbase

(https://www.swissubase.ch/en/catalogue/studies/6097/18018/overview).

**Statement on human and animal experimentation and informed consent:**

Our research complies with the principles of the Declaration of Helsinki. All

participants of the Swiss Household Panel have given their consent to participate in the

study and are informed on the anonymous data analysis for research purposes.

Participation and the answering of single questions is on a voluntary basis, and can be interrupted or refused at any time point.

**Online Appendix**

**Appendix A1: Oxford Stringency index**

**Table A1.** Stringency by country and month Switzerland and neighbouring countries

|  | Switzerland | Germany | Austria | Italy | France |
|---|---|---|---|---|---|
| March 2020 | 49 | 49 | 53 | 84 | 66 |
| April 2020 | 73 | 77 | 79 | 93 | 88 |
| Mai 2020 | 62 | 64 | 61 | 69 | 80 |
| June 2020 | 45 | 61 | 50 | 56 | 66 |
| July 2020 | 39 | 57 | 39 | 57 | 48 |
| August 2020 | 43 | 58 | 38 | 53 | 47 |
| September 2020 | 43 | 50 | 37 | 52 | 48 |
| October 2020 | 33 | 55 | 51 | 57 | 50 |
| November 2020 | 58 | 62 | 78 | 79 | 78 |
| December 2020 | 59 | 75 | 76 | 80 | 69 |
| January 2021 | 60 | 84 | 82 | 80 | 63 |
| February 2021 | 60 | 83 | 78 | 81 | 61 |

*Note.* Source: Hale *et al.*, 2021.

**Appendix A2: Results of the factor analysis of the Perceived Stress Scale**

**Table A2.** Factor loadings for items of the Perceived Stress Scale on the negative (1) and positive (2) dimensions of stress (bold: item that is part of the regular SHP waves).

|  | Factor loading | |
|---|---|---|
|  | 1 | 2 |
| **How often have you felt nervous and stressed?** | **.744** | **.034** |
| How often have you felt difficulties were piling up so high that you could not overcome them? | .698 | -.183 |
| How often have you felt that things were going your way? (or going the right way for you) | -.258 | .683 |
| How often have you felt confident about your ability to handle your personal problems? | .142 | .916 |
| How often have you felt that you were unable to control the important things in your life? | .736 | .076 |

*Note.* Rotation: oblimin; two factor solution, first factor explaining 41.05% of the variance, second factor explaining 20.23% of the variance; the item loading highest on the first factor (negative dimension of stress) was selected for regular SHP waves since 2017; question wording: 'The following questions ask you about your feelings and thoughts during THE LAST MONTH. Please indicate how much they apply to you.'; Source: SHP, wave 2016.

# Appendix A3: Descriptive statistics

**Table A3.** Mean values, range and number of observations

| | min | max | | Before pandemic 2016-2019 | First measure pandemic (Spring 2020) Covid-19 study Participation 2019 | | Second measure pandemic (Autumn 2020) 2020 Participation Covid Study | | 2020 Participation 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | n | mean | n | mean | n | mean | n | mean |
| Stress | 1 | 5 | 35886 | 2.6 | 5635 | 2.5 | 5281 | 2.6 | 7368 | 2.6 |
| Female (Ref. Male) | 0 | 1 | 35929 | 54.2% | 5657 | 55.2% | 5288 | 44.9% | 7379 | 53.6% |
| Age: 18-25 | 0 | 1 | 35929 | 10.1% | 5657 | 6.6% | 5288 | 6.0% | 7379 | 8.1% |
| 26-35 | 0 | 1 | | 11.6% | | 10.0% | | 9.6% | | 11.9% |
| 36-55 (Ref.) | 0 | 1 | | 33.1% | | 29.6% | | 29.7% | | 31.1% |
| 56-65 | 0 | 1 | | 18.7% | | 21.8% | | 22.1% | | 20.3% |
| 66-75 | 0 | 1 | | 16.4% | | 19.7% | | 20.1% | | 17.4% |
| 76+ | 0 | 1 | | 10.1% | | 12.3% | | 12.4% | | 11.2% |
| Household type: Multiple adults | 0 | 1 | 35929 | 75.6% | 5657 | 75.8% | | 75.6% | 7379 | 74.3% |
| Single parents | 0 | 1 | | 5.8% | | 4.8% | | 4.7% | | 5.4% |
| Single household | 0 | 1 | | 18.6% | | 19.4% | | 19.8% | | 20.3% |
| Partner (Ref: no partner) | 0 | 1 | 35902 | 76.9% | 5582 | 79.6% | 5283 | 79.1% | 7372 | 77.2% |
| Nb pre-school children | 0 | 3 | 35929 | 0.1 | 5657 | 0.1 | 5288 | 0.1 | 7379 | 0.1 |
| Nb. School children | 0 | 7 | 35929 | 0.3 | 5657 | 0.2 | 5288 | 0.2 | 7379 | 0.3 |
| Negative events (number) | 0 | 6 | 35929 | 0.7 | | | 5288 | 0.7 | 7379 | 0.7 |
| Chronic disease (Ref.: none) | 0 | 1 | 35804 | 37.3% | 5614 | 38.6% | 5277 | 39.4% | 7357 | 37.8% |
| Foreigner (Ref. Swiss) | 0 | 1 | 35929 | 6.8% | 5657 | 5.0% | 5288 | 4.8% | 7379 | 5.8% |
| Linguistic region (Ref.: German) | | | | 68.2% | 5657 | | | | | |
| French speaking | 0 | 1 | | 26.7% | 5658 | 25.8% | | 26.4% | 7379 | 27.8% |
| Italian speaking | 0 | 1 | | 5.1% | 5659 | 4.8% | | 4.9% | 7379 | 5.3% |
| Education: low | | | 35929 | 13.0% | 5630 | 10.3% | 5267 | 10.0% | 7378 | 11.3% |
| Upper secondary | 0 | 1 | | 47.3% | 5631 | 46.6% | | 46.6% | | 46.3% |
| Tertiary | 0 | 1 | | 49.6% | 5632 | 43.0% | | 43.4% | | 42.4% |
| Household income (log, equivalised) | 0 | 15.8 | 35878 | 5.2 | | | 5291 | 5.4 | 7376 | 5.3 |
| Satisfaction with income | 0 | 10 | 35864 | 7.3 | | | 5294 | 7.6 | 7367 | 7.4 |
| Change of financial situation | 0 | 10 | 35690 | 5.2 | 5477 | 4.9 | 5295 | 5.2 | 7355 | 5.2 |
| Working status: employed | 0 | 1 | 35846 | 49.5% | 5604 | 47.4% | 5275 | 47.6% | 7359 | 48.9% |
| Self-employed | 0 | 1 | | 9.9% | | 6.9% | | 9.2% | | 9.8% |
| Unemployed | 0 | 1 | | 1.2% | | 1.5% | | 0.8% | | 1.2% |
| In education | 0 | 1 | | 9.2% | | 5.5% | | 6.4% | | 7.8% |
| Not economically active | 0 | 1 | | 30.2% | | 38.7% | | 36.1% | | 32.4% |
| Working hours | 0 | 84 | 35929 | 20.2 | 5657 | 11.7 | 5297 | 18.6 | 7379 | 19.7 |
| Work intensity | 0 | 10 | 35929 | 3.5 | | | 5302 | 3.1 | 7379 | 3.3 |
| Decision power | 0 | 1 | 35929 | 30.1% | | | 5303 | 26.1% | 7379 | 27.3% |
| Fixed-term contract | 0 | 1 | 35929 | 5.8% | | | 5299 | 4.4% | 7375 | 4.9% |
| Working from home | 0 | 1 | 35929 | 27.1% | 5657 | 33.8% | 5304 | 32.5% | 7379 | 33.6% |
| Unemployent risk | 0 | 10 | 35929 | 1.3 | 5657 | 0.9 | 5300 | 1.3 | 7379 | 1.4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Conciliation work-private | 0 | 10 | 35929 | 2.5 | | | 5298 | 2.2 | 7379 | 2.4 |
| Change conciliation work-private | 0 | 10 | | | 5657 | 3.2 | | | | |
| Phyical activity | 0 | 7 | 35677 | 2.8 | 4984 | 4.0 | 5314 | 3.1 | 7334 | 3.0 |
| Satisfaction with personal relations | 0 | 10 | 35878 | 8.2 | 5569 | 7.9 | 5315 | 8.2 | 7371 | 8.1 |
| Stringency index | 0 | 75 | | | 5657 | 69.5 | 5327 | 41.1 | 7379 | 42.1 |
| Interview mode: cati (Ref. Cawi) | 0 | 1 | 35929 | 96.3% | 5657 | 0.0% | 5313 | 93.5% | 7379 | 93.4% |

*Note:* Source: SHP.


**Table A4**: Within variance of time-variant variables used in the fixed effects model

| | Mean | Sd | Sd within | % within |
|---|---|---|---|---|
| Partner (Ref.: no partner) | 0.77 | 0.42 | 0.07 | 16% |
| Household type (Ref.: Multiple adults) | 0.32 | 0.70 | 0.08 | 12% |
| Nb pre-school children | 0.09 | 0.35 | 0.04 | 14% |
| Nb. School children | 0.26 | 0.66 | 0.07 | 11% |
| Nb. negative events | 0.71 | 0.86 | 0.59 | 69% |
| Chronic disease (Ref.: none) | 0.37 | 0.48 | 0.18 | 36% |
| Household income | 5.23 | 2.51 | 0.81 | 32% |
| Change of financial situation | 5.22 | 1.34 | 0.83 | 62% |
| Expenses (Ref.: Income covers expenses) | 0.11 | 0.35 | 0.11 | 32% |
| Working status (Ref.: employed) | 2.61 | 1.80 | 0.40 | 22% |
| Fixed-term contract | 0.06 | 0.23 | 0.06 | 25% |
| Unemployent risk | 0.28 | 2.16 | 0.93 | 43% |
| Working from home | 0.27 | 0.44 | 0.13 | 30% |
| Working hours | 20.2 | 20.3 | 6.0 | 30% |
| Work intensity | 3.45 | 3.28 | 1.13 | 34% |
| Decision power | 0.30 | 0.46 | 0.15 | 33% |
| Conflict work-private | 2.46 | 2.82 | 1.13 | 40% |
| Phyical activity | 2.80 | 2.20 | 1.17 | 53% |
| Satisfaction with personal relations | 7.83 | 1.81 | 0.98 | 54% |

*Note:* Source: SHP 2016-2019.

**Appendix A4: Question wordings**

*Perceived stress*: "How often have you felt stressed or nervous during the last four weeks?"
Never (1), almost never (2), Sometimes (3), Fairly often (4), Very often (5)

*Partner*: "Do you have a partner?" Answer categories: yes, living together (1), yes, but not living together (2), no (3)

*Chronic disease*: "Do you suffer from any chronic illness or long-standing health problem?"

*Negative life events*: Number of the following events since the last interview (yes/no): Illness, accident or another serious health problem (1), death of a closely related person (2), end of a close and important relationship by break-up, separation divorce (3), serious conflicts with or among persons closely related to you (4), serious problems concerning your child/children (5), any other serious event that affected you (6)

*Change in financial situation*:
Regular SHP waves: "Since (date of last interview) has your financial situation worsened or improved, if 0 means "very much worsened" and 10 "very much improved"?" If no change: 5.
Covid-19 study: Since the beginning of the Corona crisis, has your financial situation worsened or improved, if 0 means "very much worsened" and 10 "very much improved"?"

*Working hours*:
Regular SHP waves: "How many hours do you usually work each week for your main job?"
Covid-19 study: "During the period of the strictest confinement measures, how many hours did you work on average per week for your main job?"

*Work intensity*: "Do you have to work at a high pace, if 0 means "never" and 10 means "all the time"?

*Decision power*: "Within the responsibilities of your job, do you take part in decision making, or provide advice on the management of the company?"

*Temporary contract*: "Is your job limited in time"?

*Working from home*:
Regular SHP-waves: "Do you sometimes work at home?" Considered as home-working if one of the following response categories are chosen "Yes, occasionally", "Yes, always", "Yes, workshop/office of own company within own home/farm"
"How long, in all, are the journeys between your home and your workplace, each working day?" (working at home as response category).
Covid-19 study: Respondents are considered as working from home if they did so in the regular SHP-wave in 2019 and are employed or self-employed or if they answered yes to the following question: "Where there any short-term changes to your work situation that are due to the Corona crisis? I work party from home. I work entirely from home"

*Unemployment risk*:
"How do you evaluate the risk of becoming personally unemployed in the next 12 month, if 0 means "no risk at all" and 10 "a real risk"?

*Conflict work-private (regular SHP waves)*: "How strongly does your work interfere with your private activities and family obligations, more than you would want this to be, if 0 means "not at all" and 10 "very strongly"?

*Change of conflict work-private* (Covid-19 study): "Since the introduction of the confinement measures, have there been any changes in how difficult it is to combine work and non-work life?" It has become much easier (1), It has become somewhat easier (2), It stayed the same (3), It has become somewhat harder (4), It has become much harder (5). Scales have been transformed to fit the scale of 0 to 10 for the analysis.

*Physical activity*:
Regular SHP waves: "At present, how many days a week do you practise for half an hour minimum a physical activity which makes you slightly breathless?"
Covid-19 study: "In the period with the strictest confinement measures, how many days a week did you practise for half an hour minimum a physical activity which made you slightly breathless?"

*Satisfaction with personal relations*: "How satisfied are you with your personal, social and family relationships, if 0 means "not at all satisfied" and 10 "completely satisfied"?"

*Household income*: Disposable household income (idispy) divided by the modified OECD equivalence scale to take account of household size.

*Working status*:
Regular SHP waves: Constructed from variables wstat (active occupied, unemployed, not in labour force), type of employment (employed, self-employed), and current training or school ("are you currently studying at a school?").

*Educational levels*: Low education: incomplete compulsory school, compulsory school, Upper Secondary education: general training school, apprenticeship, full time vocational school, maturity. Tertiary education: vocational high school, technical school, university

Variables on children and household types are constructed using the household grid containing basic information on all household members and relationships between household member

## Appendix A5: Additional models

**Table A5.** First difference models with extended sample for autumn 2020 (t2)

| | Medium term | | Medium term | |
|---|---|---|---|---|
| | Reduced | | Full | |
| *Sociodemographic variables* | | | | |
| Age (Ref. : 36-55) | | | | |
| 18-25 | -0.081 | (-1.4) | -0.081 | (-1.3) |
| 26-35 | -0.041 | (-0.9) | -0.037 | (-0.8) |
| 56-65 | -0.004 | (-0.1) | -0.044 | (-1.2) |
| 66-75 | 0.050 | (0.8) | 0.024 | (0.5) |
| 76+ | 0.025 | (0.3) | 0.009 | (0.1) |
| Female (Ref. : Male) | 0.040 | (1.3) | 0.009 | (0.3) |
| Foreigner (Ref.: Swiss) | -0.017 | (-0.2) | -0.005 | (-0.1) |
| Partner (Ref.: no partner) | 0.127* | (2.4) | 0.072 | (1.8) |
| Household type: (Ref.: multiple adults) | | | | |
| Single parents | 0.129 | (1.6) | 0.039 | (0.7) |
| Single household | 0.049 | (0.9) | 0.004 | (0.1) |
| Nb pre-school children | -0.028 | (-0.6) | -0.032 | (-0.9) |
| Nb. School children | -0.080** | (-2.9) | -0.065** | (-3.0) |
| *Life events* | | | | |
| Negative life events | 0.013 | (0.7) | 0.003 | (0.2) |
| Chronic disease (Ref.: none) | 0.022 | (0.7) | 0.003 | (0.1) |
| *Socioeconomic status* | | | | |
| Education: (Ref.: low) | | | | |
| Upper secondary | -0.016 | (-0.3) | -0.000 | (-0.0) |
| Tertiary | -0.004 | (-0.1) | 0.005 | (0.1) |
| Household income before pandemic | -0.005 | (-0.8) | -0.006 | (-1.1) |
| Change in financial situation | 0.008 | (0.6) | -0.002 | (-0.2) |
| *Work-related variables* | | | | |
| Working status (Ref.: employed) | | | | |
| Self-employed | -0.092 | (-1.6) | -0.060 | (-1.3) |
| Unemployed | -0.450** | (-2.7) | -0.229 | (-2.0) |
| In education | 0.025 | (0.3) | -0.004 | (-0.1) |
| Not economically active | -0.171** | (-2.8) | -0.152** | (-3.1) |
| Temporary contract before pandemic | -0.051 | (-0.7) | -0.020 | (-0.4) |
| Unemployent risk | -0.001 | (-0.1) | -0.003 | (-0.5) |
| Working from home | 0.027 | (0.7) | 0.026 | (0.8) |
| Working hours before pandemic | -0.003* | (-2.0) | -0.001 | (-1.0) |
| Work intensity before pandemic | -0.040*** | (-5.5) | -0.036*** | (-6.1) |
| Decision power before pandemic | 0.021 | (0.5) | -0.002 | (-0.1) |
| *Resources* | | | | |
| Conflict work-private life | 0.037*** | (4.9) | 0.029*** | (4.8) |
| Phyical activity | -0.007 | (-1.0) | -0.004 | (-0.7) |
| Satisfaction with personal relations | -0.020 | (-1.8) | -0.016 | (-1.9) |

*Table A4 Continued*
*Control variables*

| | | | | |
|---|---|---|---|---|
| Stringency index | -0.005 | (-1.7) | -0.001 | (-0.4) |
| Linguistic region (Ref.: German speaking) | | | | |
| French speaking | 0.040 | (1.1) | 0.036 | (1.3) |
| Italian speaking | -0.167* | (-2.2) | -0.139* | (-2.5) |
| Time: Interview date | 0.002* | (2.4) | 0.000 | (0.5) |
| Interview mode: change to CAWI | 0.025 | (0.3) | 0.124 | (1.7) |
| Constant | -47.817* | (-2.4) | -8.816 | (-0.5) |
| | | | | |
| Observations | 4,409 | | 7,199 | |
| R-squared | 0.026 | | 0.015 | |

*Note.* Robust t-statistics in parentheses; *** p<0.001, ** p<0.01, * p<0.05; Source: SHP.

**Table A6.** Cross-sectional OLS models spring 2020 (t1) and autumn (t2)

| | Pandemic Spring 2020 | | | | Autumn 2020 Participated in Spring 2020 | | | | Autumn 2020 Larger Sample | |
|---|---|---|---|---|---|---|---|---|---|---|
| | reduced | | full | | reduced | | full | | full | |
| *Sociodemographic variables* | | | | | | | | | | |
| Age (Ref.: 36-55) | | | | | | | | | | |
| 18-25 | 0.145 | (1.7) | 0.207* | (2.5) | 0.161* | (2.0) | 0.357*** | (4.7) | 0.242*** | (4.4) |
| 26-35 | 0.185*** | (3.6) | 0.225*** | (4.6) | 0.186*** | (3.4) | 0.221*** | (4.3) | 0.202*** | (5.1) |
| 56-65 | -0.160*** | (-3.8) | -0.103* | (-2.5) | -0.223*** | (-5.1) | -0.072 | (-1.7) | -0.133*** | (-3.8) |
| 66-75 | -0.367*** | (-6.3) | -0.268*** | (-4.7) | -0.468*** | (-8.1) | -0.136* | (-2.4) | -0.257*** | (-5.4) |
| 76+ | -0.329*** | (-4.9) | -0.202** | (-3.1) | -0.506*** | (-7.4) | -0.183** | (-2.8) | -0.306*** | (-5.7) |
| Female (Ref.: Male) | 0.298*** | (10.9) | 0.350*** | (12.9) | 0.298*** | (10.4) | 0.356*** | (12.5) | 0.320*** | (13.9) |
| Foreigner (Ref.: Swiss) | -0.001 | (-0.0) | -0.006 | (-0.1) | 0.125 | (1.8) | 0.106 | (1.6) | 0.125** | (2.7) |
| Partner (Ref.: no partner) | 0.052 | (1.1) | 0.108* | (2.4) | 0.044 | (0.9) | 0.049 | (1.0) | 0.048 | (1.3) |
| Single parents (Ref.: Multiple adults) | 0.126 | (1.8) | 0.116 | (1.7) | 0.115 | (1.5) | 0.051 | (0.7) | 0.012 | (0.2) |
| Single household (Ref.: Multiple adults) | 0.021 | (0.5) | -0.006 | (-0.1) | 0.038 | (0.8) | -0.011 | (-0.2) | -0.030 | (-0.8) |
| Nb. pre-school children | 0.064 | (1.5) | 0.039 | (1.0) | -0.026 | (-0.6) | -0.019 | (-0.5) | 0.016 | (0.5) |
| Nb. School children | 0.078** | (3.2) | 0.064** | (2.7) | 0.024 | (0.9) | 0.020 | (0.8) | 0.014 | (0.7) |
| *Life events* | | | | | | | | | | |
| Nb. negative events | 0.110*** | (7.0) | 0.090*** | (5.9) | 0.137*** | (8.1) | 0.105*** | (6.6) | 0.100*** | (7.8) |
| Chronic disease (Ref.: none) | 0.205*** | (7.2) | 0.172*** | (6.2) | 0.213*** | (7.1) | 0.193*** | (6.9) | 0.173*** | (7.5) |
| *Socioeconomic status* | | | | | | | | | | |
| Upper secondary education (Ref.: low) | -0.058 | (-1.2) | -0.059 | (-1.2) | 0.061 | (1.1) | 0.043 | (0.9) | 0.021 | (0.6) |
| Tertiary education (Ref.: low) | 0.014 | (0.3) | -0.008 | (-0.2) | 0.169** | (3.0) | 0.089 | (1.7) | 0.062 | (1.6) |
| Household income | 0.001 | (0.1) | 0.001 | (0.3) | 0.007 | (1.2) | 0.002 | (0.4) | 0.001 | (0.3) |
| Change of financial situation | -0.057*** | (-4.6) | -0.052*** | (-4.2) | -0.007 | (-0.6) | -0.011 | (-1.0) | -0.029*** | (-3.4) |

*Table A5 Continued*

*Work-related variables*

Working status (Ref.: employed)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Self-employed | -0.030 | (-0.5) | 0.029 | (0.5) | -0.118* | (-2.3) | -0.029 | (-0.5) | -0.031 | (-0.7) |
| Unemployed | 0.119 | (1.1) | 0.534*** | (4.6) | -0.423** | (-2.8) | 0.240 | (1.6) | 0.341** | (3.2) |
| In education | 0.208* | (2.4) | 0.412*** | (4.8) | 0.118 | (1.7) | 0.302*** | (4.5) | 0.322*** | (6.3) |
| Not economically active | -0.215*** | (-4.6) | 0.248*** | (3.8) | -0.389*** | (-8.1) | 0.151* | (2.5) | 0.179*** | (3.6) |
| Fixed-term contract | | | | | -0.146* | (-2.2) | -0.116* | (-2.2) | -0.146* | (-2.2) |
| Unemployent risk | | | 0.010 | (1.3) | | | 0.009 | (1.3) | 0.008 | (1.5) |
| Working from home | | | -0.046 | (-1.3) | | | 0.021 | (0.6) | 0.044 | (1.5) |
| Working hours | | | 0.004*** | (4.7) | | | 0.000 | (0.1) | -0.001 | (-0.7) |
| Work intensity | | | | | | | 0.073*** | (10.3) | 0.073*** | (12.5) |
| Decision power | | | | | | | -0.021 | (-0.6) | -0.025 | (-0.8) |
| *Resources* | | | | | | | | | | |
| Conflict work-private | | | 0.066*** | (9.3) | | | 0.087*** | (12.3) | 0.074*** | (12.8) |
| Phyical activity | | | -0.009 | (-1.6) | | | -0.013* | (-2.1) | -0.010* | (-2.0) |
| Satisfaction with personal relations | | | -0.114*** | (-15.0) | | | -0.109*** | (-10.9) | -0.107*** | (-13.6) |
| *Control variables* | | | | | | | | | | |
| Stringency index | -0.002 | (-1.3) | -0.002 | (-1.1) | -0.002 | (-0.7) | -0.002 | (-0.7) | 0.001 | (0.4) |
| French speaking (Ref.: German-speaking) | 0.239*** | (7.6) | 0.220*** | (7.2) | 0.432*** | (13.1) | 0.345*** | (10.9) | 0.342*** | (13.5) |
| Italian speaking (Ref.: German-speaking) | 0.327*** | (4.8) | 0.326*** | (5.0) | 0.131 | (1.9) | 0.081 | (1.2) | 0.205*** | (4.1) |
| Time trend (interview date) | 0.001 | (0.8) | 0.002 | (1.5) | 0.003*** | (3.3) | 0.002** | (2.7) | 0.001 | (1.4) |
| Interview mode: cati (Ref.: Cawi) | -0.261 | (-0.4) | -0.106 | (-0.2) | -0.094 | (-1.6) | -0.080 | (-1.4) | -0.104* | (-2.3) |
| Constant | 2.632*** | (16.8) | 3.098*** | (18.2) | 2.511*** | (13.8) | 3.070*** | (16.0) | 3.160*** | (20.5) |
| Observations | 4,763 | | 4,763 | | 4,431 | | 4,431 | | 7,252 | |
| R-squared | 0.157 | | 0.221 | | 0.233 | | 0.328 | | 0.295 | |

*Note.* Robust t-statistics in parentheses, *** p<0.001, ** p<0.01, * p<0.05, Source: SHP.