Inequality and COVID-19 in Sweden: Relative risks of nine negative life events, along four social gradients, in pandemic vs. pre-pandemic years

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Abstract

The COVID-19 pandemic struck societies directly and indirectly, challenging not just people's health but many aspects of life. But pandemic burdens fell more heavily on some groups than others. These different consequences of the spreading virus – and the measures to fight them – are reported and analyzed in different scientific fora, with hard-to-compare methods that largely follow disciplinary boundaries. As a result, it is hard to grasp the overall impact of the pandemic on inequality. This paper relies on individual-level, administrative data for Sweden's entire population to describe how different social groups fared in terms of nine outcomes: three types of COVID-19 incidence, as well as six other negative life events. During 2020, the population faced severe morbidity and mortality from COVID-19 and saw higher all-cause mortality, income losses and unemployment risks, as well as reduced access to medical care. In terms of relative risks, these burdens fell disproportionately on those with low income or education, and on residents born outside of Sweden. In the pandemic, all-cause mortality, unemployment, substantial income loss, poor mental health, and reduced access to health care went up for all groups in Sweden. But relative risks across social groups were strikingly similar to those in pre-pandemic years.

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1 A multidimensional crisis

During 2020, a new coronavirus swept across the world. The spread of the virus, and mitigation efforts by governments and individuals, transformed most aspects of life. The pandemic reshaped not just human health, but the economy, the health-care system, and the ways people work and socialize.

Research on the pandemic mostly focuses on one or a few outcomes at a time, and more or less follows traditional disciplinary boundaries (for overviews, see [1–4]). Of course, highly specialized scientific inquiries are essential to understand different dimensions of the pandemic. But piecewise studies of specific groups of individuals and a single outcome can suffer from selection bias and blur our sight of the bigger picture. Moreover, compiling and comparing evidence from different disciplines is difficult due to diverging measures and methodologies. To better see the broad impact of the pandemic, this paper complements conventional studies with a general account that sacrifices nuance in favor of a comprehensive view.

Social inequalities are an important aspect of a broad account. Setting aside cross-country differences, health, wealth, social positions are unequally distributed within countries. Moreover, at-risk groups are more likely suffer from several difficulties: e.g., individuals with a low education also tend to have low income, high unemployment risks and poor health. A comprehensive view should thus consider a broad set of outcomes and several sources of social stratification.

By now, we know that severe morbidity and mortality in COVID-19 was more common among vulnerable groups [5]. This was perhaps not evident at the start of the pandemic. In the US and Europe, affluent groups were the first to be infected [6–8]. Further, medical conditions may have less pronounced social gradients when less is known about prevention and treatment [9, 10]. Still, public-health scholars were early to caution that vulnerable groups were at risk of severe COVID-19, due to lacking resources, limited control of working conditions, and elevated medical risks [11].

Social inequalities are driven by long-term, interacting social, economic, and physiological processes. Some have suggested that external shocks – like wars and pandemics – can disrupt such processes [12, 13]. Almost by definition, individuals with abundant resources have more to lose [14]. And, if inequalities reflect business as usual, a disruptive event, like a pandemic, can reduce them. But large shocks may also magnify inequalities: unequally distributed resources can make some individuals resilient and others exposed. The end results in different domains depend on the relative strength of such countervailing forces, as well as on government interventions. It is thus an empirical question whether social inequalities were reduced or exacerbated during the pandemic.

This paper evaluates how the first year of the pandemic affected multiple dimensions of inequality in Sweden, a country that was significantly hit by the first wave [15].[1] The evaluation stresses two questions: (RQ1) Were the groups most severely affected by COVID-19 morbidity and mortality also more likely to experience other negative consequences of the pandemic? (RQ2) Did the pandemic magnify or reduce existing inequalities?

1. Media has often portrayed Swedish disease prevention and control policy as overly lax. It is true that Sweden's policies relied more on appeals to voluntary prevention than on mandates, but the Oxford COVID-19 Government Response Tracker still puts Swedish median stringency at 54, the 16th most stringent among the 38 OECD countries. In terms of policies to cushion the indirect effects on firms and households, Sweden made similarly rapid and generous interventions as most Western countries [16].

The analysis exploits several of Sweden's high-quality (individual and longitudinal), population-wide, administrative registers to estimate inequalities in the incidence of nine binary events. Three events concern direct health consequences: COVID-19 death, COVID-19 hospitalization and verified SARS-CoV-2 infection. Six events capture indirect consequences. Somatic and psychiatric health are measured by dying of any cause and entering a new treatment with antidepressants. The pandemic also put tremendous pressure on the medical system; reduced access is measured by the likelihoods of receiving a cancer diagnosis and of undergoing surgery. Finally, for economic hardship, the indirect consequences are measured by entering unemployment and suffering a substantial income loss. Together, the nine outcomes paint a diverse picture of direct and indirect pandemic consequences.

The outcomes are studied along social gradients in four dimensions: gender, region of birth, education, and income. Inequalities are estimated in the same population, using the same statistical methods, for all dimensions. This common approach rules out specialized methods for each outcome. However, as all nine outcomes are defined as binary events, the approach permits a consistent comparison – in terms of relative risks – of outcomes that researchers typically analyze separately and with different methods.

2 Results on inequalities

In terms of population-wide outcomes, the first year of Sweden's pandemic stands out from the four preceding years for most of the nine events under study. To illustrate this fact, Table 1 shows the population share of all individuals who experienced each negative event in 2020 and the preceding years. The crude risk of death was higher in 2020 than in 2019, breaking a declining trend. The share of individuals with a new prescription of antidepressants was lower in 2020 than in 2019, but on par with previous years.

Table 1. Yearly population averages for nine negative life events

	2016	2017	2018	2019	2020
Positive case					4.40%
Hospitalization, covid-19					0.31%
Death, covid-19					0.10%
Death, all causes	0.92%	0.92%	0.91%	0.87%	0.95%
Antidepressants	2.27%	2.27%	2.30%	2.36%	2.30%
Cancer diagnosis	0.88%	0.93%	0.95%	0.97%	0.88%
Surgical procedure	14.33%	14.56%	14.53%	14.72%	13.59%
Unemployment	4.43%	4.43%	4.48%	4.78%	6.64%
Income loss	21.58%	19.87%	19.50%	19.72%	21.57%

Notes: The table shows yearly population averages for each of the nine binary events studied in the paper. The risk of unemployment and of income loss are calculated in the population aged 25–64 years, while the other outcomes are calculated in the population of all Swedes 25 years and older.

As for health-care access, the probability to receive a cancer diagnosis went down, breaking a long-term upward trend [17]. The share of individuals going through at least one surgical procedure also declined, similarly disrupting a long-term trend [18]. While these two measures both disease incidence and society's ability to cope with disease, it is plausible to ascribe the clear trend breaks to care disruptions, rather than sudden improvements in population health. In line with this interpretation, cancer mortality in 2020 stayed on its long term trend (SI table A.1). Moreover, declines in surgical procedures reflected elective surgeries, while emergency surgeries stayed at pre-pandemic levels throughout 2020 (SI Figure A.1). Although it is hard to interpret the incidence of cancer or surgeries in different groups and a

single year (RQ1), group differences between years (RQ2) can show how the pandemic changed relative access to health care.

Finally, in the economic dimension, unemployment risk went up sharply from 2019 to 2020. The share of people who saw a substantial (more than one month's) income loss also rose in 2020, although this risk was on par with 2016.

2.1 The groups most severely affected by COVID-19 in 2020 were more likely to experience other negative events

The first major results concern the risks of experiencing the nine negative life events in 2020. These risks are estimated for each of 12 groups in four dimensions, namely gender, region of birth, education, and income. For all outcomes, the risk in each group is expressed relative to the average population risk – i.e., relative to the numbers in the final column of Table 1. A value above 1 for a particular group thus indicates a higher risk than the population average and a value below 1 a lower risk. The estimated regression coefficients behind the relative risks are presented in the Supplementary Information (Tables B.1 to B.9). The underlying regressions control for age, to account for compositional effects across groups, and include regional indicators (so-called fixed effects), to capture geographical differences in policy and infection risk. Figure 1 illustrates the relative risks, for all nine measures, in four radar plots, one for each categorization.[2]

Gender (panel 1a). Men were more likely to be hospitalized or die from COVID-19, but women were more likely to test positive for the virus. In part, this reflects that women were more likely to get tested (see [19, 20] and Table A.2). While men were more likely to die regardless of cause, women were more likely to start using antidepressants. Though women and men partly suffer from different health problems, these findings also reflect that they interact in different ways with the health system. The risks of unemployment and substantial income loss were broadly similar, the former slightly higher for women, the latter slightly higher for men.

Region of birth (panel 1b). Foreign-born individuals (about 20 percent of the population) had a higher relative risk of hospitalization or death due to COVID-19, especially if born outside Europe (about half the foreign-born). However, migrants from outside Europe had a lower relative risk for all-cause mortality. Far-away migrants tend to have a health advantage over natives, probably because of positive health selection [21, 22]. While this advantage remained during the pandemic, absolute death risk went up more among migrants than natives (Figure C.2). Notably, natives had a much higher risk of cancer diagnosis than migrants, while the native-migrant difference in the risk of cancer death was smaller (see Table A.1). This is similar to the pattern observed for COVID-19: natives had a much lower risk of severe COVID-19 than migrants, but the verified-infection difference was smaller. Both the cancer and COVID-19 imbalances indicate that natives used more health care, given their true health status, than did migrants. Finally, migrants faced higher relative risks of major income loss and unemployment, the latter especially for the out-of-Europe born.

2. Because of the difficulties in interpreting single-year indicators of health-care access, these are not interpreted in this section. They are still presented in Figure 1 for consistency and for a more comprehensive view of how different groups fared in the pandemic.

Figure 1. Multidimensional inequality

(a) Gender

(b) Region of birth

(c) Level of education

(d) Income quartile

Notes: The figure shows relative risks for each of nine negative life events in each of four inequality dimensions, gender (panel a), region of birth (panel b), education (panel c), and income (panel d). In each graph, different colors represent different social groups as explained in the legend. The risks presented are estimated in regressions that include controls for age and region. The figure presents these estimates (reported in SI Tables B.1 to B.9) as predictive margins compared to the population average. Thus, a value of, say, 1.5 for a group means that this group is 50 percent more likely to suffer from the negative event, compared to the population at large. The measures of relative unemployment risk and of relative income-loss risk are calculated in the total population aged 25–64 years, while the other measures are calculated in the population of all individuals 25 years and older.

Education (panel 1c). Individuals with lower education (15 and 40 percent of the population, respectively, have only compulsory school and upper secondary school) had a higher relative risk of severe COVID-19, but a lower risk of testing positive. The less educated faced higher-than-average, all-cause-death risk, new antidepressant use, income loss, and unemployment risk. Conversely, higher-educated individuals had a lower relative risk of severe COVID-19 and death. We note a similar imbalance as for migrants and natives: while the less-educated have lower relative risk of being diagnosed with cancer, they were at a higher relative risk of cancer death (see Table A.1 and the discussion in Section 3). The more-educated used fewer new antidepressants. As expected, they were also less likely hit by unemployment or substantial income loss.

Income (panel 1d). Low-income households had a higher relative risk to suffer severe morbidity and mortality in COVID-19, and to die from any cause. The contrast between reported positive cases and risk of severe COVID is drastic: the bottom-income quartile was the most likely to be hospitalized, but the least likely to test positive. Income was also inversely related to unemployment risk. But the association between income and income loss is U-shaped, with higher relative risks at the top and bottom of the distribution (though, the effects of a month's income loss are likely to be more severe for the groups with the lowest incomes).

To summarize, members of groups more likely to suffer from severe COVID-19 were more likely to run into other health problems and economic problems in 2020. Migrants (natives), and those with low (high) education and income, saw higher (lower) relative risks of negative life events. Gender patterns were more complex, with men at higher relative risk of severe negative health events. Almost paradoxically, the groups that were the most likely to experience severe COVID-19, were the least likely to test positive for SARS-CoV-2.

Of course, individual group belonging – especially, region of birth, education, and income – are correlated. Individuals in one worse-off groups are also more likely to be part of other worse-off groups. SI Tables B.1 to B.9) include regressions where all effects are estimated jointly. For example, the group-level estimates for region of birth, now hold the levels of education, income quartile, and gender constant. The main patterns are similar to those displayed in Figure 1, though most group differences are smaller in the joint model. A notable exception concerns the relative risks for all-cause mortality by birth region: the mortality advantage of migrants is more pronounced when gender, education, and income are held constant.

These results reflect the incidence of negative events in 2020 by group. With individual-level data, one can also estimate the joint incidence of severe COVID-19 and other negative events by individual. The SI Section D studies two interacted events: COVID-19 hospitalization together with either income loss or unemployment. Individual members of disadvantaged groups are more likely to experience a combination of severe COVID-19 as well as an adverse labor-market event.[3] These patterns could capture omitted variables; people more vulnerable to negative health events may exhibit characteristics (either personal or socio-economic) that also make them more vulnerable to negative labor-market events.

2.2 The pandemic did not substantially alter pre-pandemic relative risks

Table 1 showed that negative life events related to health and economic status were more common in 2020 than earlier years. Furthermore, Figure 1 showed that groups with higher relative risk of hospitalization and death from COVID-19 were more likely to suffer from these events. But did the pandemic reduce

3. These analyses do not include mortality, as dying removes an individual from the at-risk population.

or magnify existing inequalities? To answer that question, we use the same statistical models as before to calculate relative risks also for the period 2016–2019 and compare these to the risks for 2020. Naturally, a comparison with the past is impossible for the three COVID-19 outcomes.

Inspired by earlier research by [23], Figure 2 plots relative risks in 2020 (y-axis) against their 2016–2019 average (x-axis). Markers above the diagonal thus indicate higher risks in 2020 than in the preceding four years, while markers below the line indicate lower risks in the pandemic. The four graphs rely on the same group divisions as Figure 1, by gender, region of birth, education, and income. Each graph reports the relative risks for the six events of interest for all the groups that make up a particular social dimension. Strikingly, nearly all markers in all four graphs show risk ratios very close to the diagonal. Despite the profound impact of the pandemic on most of the negative life events, the relative risk of experiencing them almost did not change at all. The following discussion points to a few exceptions to this salient pattern.

Gender (panel 2a). Generally, the relative risks for men and women were very similar in 2020 and previous years. A slight exception is that the drop in cancer diagnoses in 2020 relative to 2016-19 was a somewhat more pronounced for men.

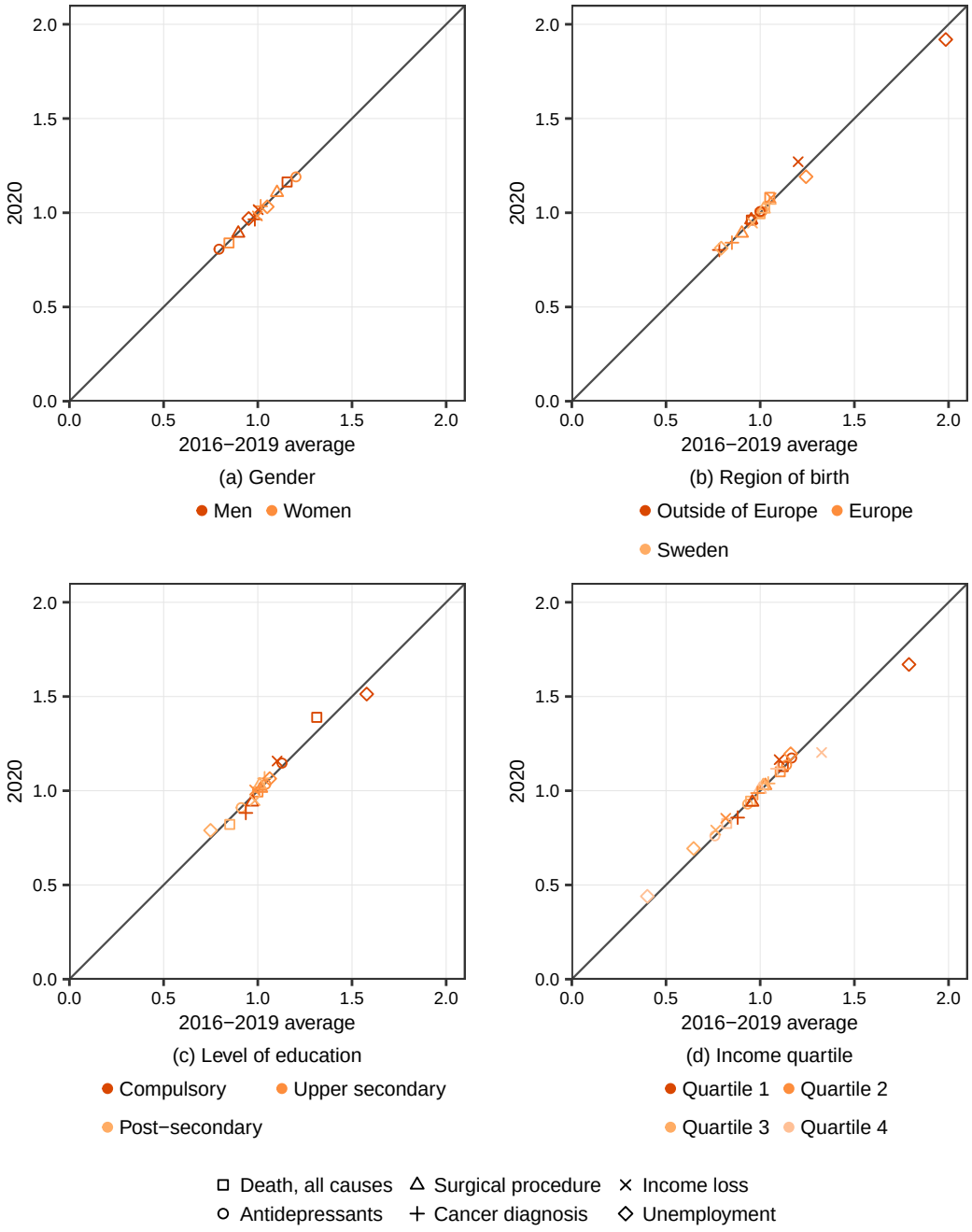
Region of birth (panel 2b). Migrants have been identified as especially vulnerable to both direct and indirect consequences of the pandemic [24]. As already noted, in most high-income countries far-away migrants tend to experience lower mortality rates than natives [21]. While migrants suffered from a higher death rate in COVID-19, the difference is not large enough to visibly influence the change in all-cause death risk. Indeed, the relative all-cause death risks across both natives and migrants, were stable. In the labor market, the relative risk of unemployment for migrants – especially far-away migrants – went down slightly from its high pre-pandemic level, while the risk of major income loss went up slightly. The relative risks for other negative life events were similar in 2020 and 2016–2019.

Education (panel 2c). Relative inequalities along the educational gradient in 2020 were close to those in earlier years. The exceptions are that, in the pandemic, the least educated saw a small cut in their elevated relative risk of unemployment, but a small rise in their elevated risks of all-cause mortality and major-income loss. Inequalities in access to health care by education were roughly stable.

Income (panel 2d). In this dimension too, relative risks were basically constant. The main exception concerns unemployment risk, which went up slightly in the pandemic for the two highest quartiles, but went down for the poorest. By contrast, the relative risk of income loss declined slightly for the top quartile. In contrast to the other income quartiles, the pandemic entailed a drop in the absolute risk of substantial income loss for top income earners (see Table A.3).

To summarize, Figure 2 clearly shows that relative risks of negative life events in the pandemic were very stable, compared to pre-pandemic relative risks. However, when interpreting these results, it is important to recall from Table 1 that the aggregate risk of all negative events went up in 2020. As relative risks stayed more or less constant, absolute risks – by definition – went up by more in disadvantaged than in advantaged groups (SI Figures C.1–C.4 show absolute risks over time). In this sense, the pandemic was

Figure 2. 2020 relative risk compared to 2016–2019 average



Notes: The figure shows relative risks for suffering each of the indirect negative events (where a 2016–2019 average can be calculated) in each of the four social dimensions. Each panel compares the risk for 2020 (on the y-axis) to the average risk over the period 2016–2019 (on the x-axis). For points on the diagonal, the relative risk before the onset of the pandemic is equal to the relative risk during the first pandemic year. The relative risks of unemployment and of income loss are calculated in the total population aged 25–64 years, while the other relative risks are calculated in the full population of individuals 25 years and older.

associated with more excess deaths, larger economic burdens, and less available health care in Sweden's most vulnerable groups.

3 Discussion

This paper presents unique multidimensional evidence on inequality in Sweden's first pandemic year and a comparison with inequality before the pandemic. It covers outcomes different enough to rarely be considered in the same framework, given existing disciplinary boundaries. With few exceptions, direct and indirect burdens of the COVID-19 pandemic fell heavier upon more vulnerable social groups. But the relative risks of being hit by negative events across social groups were strikingly similar to those in the four years preceding the pandemic. While the results paint a comprehensive picture of pandemic and pre-pandemic inequalities among different socio-economic groups, the broad-brush strokes conceal five facets of important details.

First, estimated inequalities refer to nation-wide groups and yearly data. While the groups reflect important sources of stratification, the within-group risk variance is still larger than that the between-group variance. Similarly, risks vary across regions geographically and across time of year, in particular with the reach and severity of SARS-CoV-2 infections. More granular analyses would likely add important nuance to the broad picture presented here.

Second, some measurements are crude. Cancer diagnoses and surgeries may be complementary and high-quality indicators of care availability, but they do give an incomplete view. Gauging mental-health problems by new antidepressant prescriptions is, at best, a rough approximation. That being said, it is unclear which way mental health might have gone (see [25, 26]). Mental problems have multiple drivers, with some becoming more forceful (unemployment and social isolation) and others less forceful (work stress and being away from family) in the pandemic. One can argue similarly for other measurements. As the pandemic was a big shock, relying on normal-time evidence may be hazardous.

Third, the positive-test measure mixes disease prevalence and test frequency. The propensity to order a test was lowest among those most hit by severe disease (SI Table A.2). As noted in connection with Figure 1, such inverted health behavior is also seen in cancer (SI Table A.1), where groups with higher risk of death are less likely to get diagnosed. Therefore, the same decline in health-care access may have hit vulnerable groups harder, due to more undetected health complications already before the pandemic. The inverse patterns also underscore the problems with using detected cases to measure contagion or calculate case-fatality rates.

Fourth, the nine events considered in the paper may capture important direct and indirect effects of the pandemic. But they leave out crucial and potentially unequal outcomes. Examples include lower subjective well-being, limited care for those needing daily assistance, and forfeited human capital due to restricted schooling.

The schooling example illustrates a fifth limitation of the study tied to its focus on short-term inequality. Long-term footprints of negative events – say, cancelled doctor's appointments, unexpected unemployment spells, or sudden income losses – may be more grave for groups with fewer resources to utilize as insurance. Going forward, how societies and individuals are able to recover may increasingly shape post-pandemic social inequalities. Understanding the resulting challenges calls for scientific collaboration across disciplines, drawing on rich data and complementary insights from medical and social sciences.

4 Methods

We use Swedish administrative register data with longitudinal information on the demographic, geographic, social, economic and health characteristics of each individual in the population. We obtained ethical permission to conduct this research from the Swedish Ethical Review Authority (permit 2020-06492 / 2021-01115 / 2022-01355-02).

4.1 Population definition

The analysis is based on the full population aged 25 years and older that were registered as residing in Sweden on the last day of 2015, 2016, 2017, 2018 or 2019, which comprises 7,804,277 unique individuals. For each year of study, we use the registered population at the end of the previous year. For the two labor-market outcomes, the population is further limited to those between the ages of 25 and 65, comprising 5,848,395 unique individuals.

4.2 Group definitions

We divide the population into groups by four different categorizations. The data used to create them comes from Statistics Sweden's longitudinal database, LISA, which includes harmonized yearly information about all individuals in Sweden. Different group categories reflect information from the year before an event of interest regarding each individual's registered gender, highest attained level of education, and region of birth. Disposable-income quartiles are calculated separately from information by birth cohort.

4.3 Outcome definitions

We study nine negative direct and indirect events. The outcomes are created from individual-level register data from Statistics Sweden, the Public Health Agency of Sweden, the National Board of Health and Welfare and the Swedish Unemployment Service. We use binary events in order to ensure comparability across domains. We limit events to the year 2020 in order to abstract from vaccinations. The Swedish COVID-19 vaccination program started in the first month of 2021. Since vaccine uptake also exhibits a clear socio-economic gradient, it will influence many of the other measures. By studying the first year (and the first two waves) of the pandemic, we can abstract from such differences.

Positive cases are defined by laboratory (PCR) confirmed infections of SARS-CoV-2. During the pandemic, COVID-19 was classified as a socially dangerous disease and all confirmed cases of such a disease must, by law, be reported to the Swedish Public Health Authority and registered in the SmiNet register. However, this data set does, of course, not contain infections that were not confirmed by a test or a doctor. During 2020, testing capacity varied, both across regions and time, as did the official priorities for using scarce capacity. The testing behavior also varied across groups. In general, groups that were the most likely to develop a serious infection were the least likely to order a test (SI Table A.2).

Hospitalizations in COVID-19 are defined by at least one episode of inpatient care, with COVID-19 as the main diagnosis for admission, according to the inpatient care register kept by the National Board

of Health and Welfare. We include patients with both laboratory-confirmed tests (denoted by U07.1 in ICD-10) and those diagnosed by a physician without a test (U07.2). Physician-diagnosed cases were more prevalent in the first wave of the pandemic, when testing capacity was limited also in hospitals.

Deaths by COVID-19, as well as deaths from all causes, were identified from the Cause of Death register kept by the National Board of Health and Welfare. According to WHO guidelines, COVID-19 should only be recorded as a cause of death when the disease played a casual role in the events leading to death. Deaths from COVID-19 were defined by any deaths that included U07.1 or U07.2 as either the underlying (89.8 percent of cases) or contributing (10.2 percent of cases) cause of death. Deaths from any cause are defined as the individual dying during the specific year.

Antidepressant use is defined from the Medical Drug Register kept by the National Board of Health and Welfare, specifically, from individuals who made at least one purchase of prescription anti-depressants (ATC: N06A). To capture new instances of poor mental health, as opposed to ongoing spells, the definition includes only those individuals who made no such purchase in the previous calendar year. Access to health care was made more difficult during the pandemic, in part because individuals purposefully avoided to seek care out of fear of getting infected. Those experiencing fear and anxiety, and thereby at an increased risk of needing psychiatric care, are also more likely to avoid contact with the medical system. While the analysis focuses on the first wave, mental problems may have expanded as the pandemic progressed. Further, the pandemic made it more difficult to see a physician, and thus to obtain prescription drugs. For these reasons, the use of antidepressants likely reflects both mental health and access to mental health services and should therefore by interpreted with care.

Whatever the quality of the measure, it is not clear that the pandemic has had an impact on population-level mental health. Findings in the literature have so far been mixed (see e.g. [25, 26]). The multiple ways in which the pandemic hit may give some clue as to why. While some risk factors may have increased, such as unemployment and social isolation, others may have decreased, such as work stress and being away from family

Cancer diagnoses were defined by at least one new cancer diagnosis (ICD C00-D48) being reported to the National Cancer Register, kept by the National Board of Health and Welfare. Other national registers on health care consumption only cover inpatient care and visits to physicians in specialized outpatient care. There is no national register on primary care, with represents the bulk of Swedish health care. In contrast, every health-care provider is obliged to report any diagnosed cancer to the cancer register, regardless of where and how it is detected. Even though it includes only one type of disease, the cancer register thus provides a comprehensive indicator of the medical system's diagnostic capability, which is not available for other diagnoses. Diagnosed cancers reflect both the incidence of the disease in the population and the ability to detect the disease of the medical system, which in turn reflect the organization of care and health-care seeking behavior of the population. In Table A.1, we present probabilities of diagnosis and cancer death. The group-specific cancer death rate is indicative of the burden of cancer morbidity, relying less on interaction with the medical system. It is striking that the groups most likely to die from cancer are the least likely to get diagnosed. Further, while there is a drop in diagnoses in 2020, relative to previous years, there is no similar drop in cancer deaths.

Surgical procedures are defined by someone having at least one surgery performed, either in inpatient care or in specialized outpatient care. These episodes are identified by the KVÅ (classification of care measures) coding standard used in the Swedish patient register. Each procedure is classified as either medical or surgical and registered by the day it is performed. In the patient registers, it is not possible to distinguish between elective surgeries and emergency surgeries. Weekly aggregated numbers of elective and emergency surgeries during have been published elsewhere [18]. We present these and the weekly number of ongoing COVID-19 hospitalization spells in Figure A.1. The number of elective surgeries

dropped during periods with a high number of COVID-19 patients while the number of emergency surgeries remained stable throughout the year. Aggregate performed surgeries in 2020 may thus be interpreted as the medical system's reduced treatment ability, rather than as a substantial improvement of population health.

Unemployment is defined by being registered as unemployed at least once at the Swedish Unemployment Service. It is necessary to register as unemployed in order to claim unemployment benefits, including private unemployment insurance (A-kassa).

Income loss is defined by having an annual disposable income, which is at least 8.3 percent lower than the year before, equivalent to losing one month's pay. Disposable income is defined as the individual income after taxes and transfers as declared on the individual tax statement and reported to the tax-and-income-register kept by Statistics Sweden.

4.4 Statistical models

All estimates are based on OLS regressions, the results of which are reported in SI B. For non-COVID-19 outcomes, the regressions include individual-year observations for each year between 2016 and 2020. Group membership is then interacted with a dummy variable for the year 2020 – producing the difference between this year and the 2016-2019 average. Each regression includes binary indicators (fixed effects) for Swedish administrative regions as well as age categories. The standard errors were clustered with each unique individual defined as a culster. Where applicable, the same procedure was used to produce supplementary analyses (Tables A.1 and A.2).

From these OLS regressions, predictive margins were calculated for every group in the population using Stata's "margins" command. This procedure generates the average predicted probability for a member of a certain group to experience a certain event, and is calculated by letting all observations belong to the group (keeping other covariates at their observed levels), using the estimated model to predict the outcome, and then average over these predictions. Relative risks are calculated by dividing the predictive margins for each group with the population average.

4.5 Data and code availability

The data used in this study was retrieved from Swedish registers and is covered by public secrecy. It cannot be publicly shared for both legal and ethical reasons. All code used to process and analyze this data is available at <URL>, however, and interested researchers can (after ethical review) order the same material from the registers to verify our analysis.

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Supplementary Information

A Summary statistics

Table A.1. Probability of cancer death and cancer diagnosis by population group, 2020 and 2016-2019

	Cancer death		Cancer diagnosis	
	2016-2019	2020	2016-2019	2020
Gender				
Men	0.38%	0.36%	0.45%	0.41%
Women	0.28%	0.27%	0.86%	0.84%
Region of birth				
Sweden	0.33%	0.32%	1.35%	1.26%
Europe	0.34%	0.33%	1.09%	1.01%
Other	0.31%	0.30%	1.01%	0.96%
Education				
Compulsory	0.40%	0.40%	1.21%	1.05%
Upper secondary	0.34%	0.32%	1.30%	1.20%
Tertiary	0.29%	0.27%	1.33%	1.27%
Income				
Q1	0.36%	0.35%	1.13%	1.03%
Q2	0.36%	0.34%	1.27%	1.18%
Q3	0.32%	0.30%	1.34%	1.24%
Q4	0.29%	0.27%	1.40%	1.34%

Notes: Cancer death identified in the cause of death register an was defined as all deaths where cancer (ICD C00-D48) was the underlying cause of death. Cancer diagnosis was identified in the cancer register. The probabilities were calculated using a fixed-effects model that adjusted for age and region of residence.

Figure A.1. Performed elective and emergency surgeries relative to the maximum capacity

Notes: The numbers of elective and emergency surgeries per week is are reproduced from the numbers reported by Svenskt Perioperativt Register. They are reported in relation to the maximum capacity (8400 elective and 2900 emergency surgeries) which is set to 100. The number of ongoing COVID-19 hospitalizations were calculated using the inpatient care register and give an indication of the burden of COVID-19 on the medical system.

Table A.2. The probability of having ordered at least one PCR test.

	Probability
Gender	
Men	19.75%
Women	25.37%
Region of birth	
Sweden	25.35%
Europe	16.27%
Other	11.12%
Education	
Compulsory	16.80%
Upper secondary	21.84%
Tertiary	26.74%
Income	
Q1	14.31%
Q2	23.42%
Q3	25.68%
Q4	26.87%

Notes: The data was collected from the local administrative system. Only regions that use the 1177 system and consented to the use of data are included. These comprise 13 out of 21 county councils (Stockholm, Södermanland, Kalmar, Gotland, Blekinge, Skåne, Värmland, Örebro, Västmanland, Dalarna, Västernorrland, Jämtland and Norrbotten). Adjusted for age and region of residence.

Table A.3. Excess risk for experiencing negative events in 2020 compared to the average risk in 2016-2019 (percentage points).

	Unemployment	Income loss	Cancer diagnosis	Surgery	Antidepressant use	Death
Gender						
Men	2.10	1.68	−0.11	−1.18	0.02	0.06
Women	2.07	1.05	−0.07	−1.26	−0.05	0.03
Region of birth						
Sweden	1.69	0.91	−0.09	−1.23	−0.02	0.04
Europe	2.12	1.80	−0.08	−1.29	−0.02	0.09
Other	3.50	3.01	−0.04	−1.00	0.00	0.05
Education						
Compulsory	2.93	2.73	−0.15	−1.71	0.05	0.17
Upper secondary	2.27	1.81	−0.10	−1.35	−0.03	0.04
Tertiary	1.87	0.57	−0.06	−0.91	−0.01	0.01
Income						
Q1	2.94	2.90	−0.11	−1.50	0.00	0.06
Q2	2.65	1.92	−0.09	−1.26	−0.03	0.04
Q3	1.66	1.64	−0.10	−1.08	−0.03	0.03
Q4	1.09	−0.82	−0.07	−1.08	−0.01	0.04

Notes: The table reports differences in risks for experiencing negative events in 2020 compared to the 2016–2019 average, in absolute terms (percentage points). These differences are reported as arrows in Figures C.1 to C.4.

B Tables of regression results

Table B.1. Anti depressants

	(1)	(2)	(3)	(4)	(5)
Quartile 2	−0.07***				−0.14***
	(0.01)				(0.01)
×2020	−0.03				−0.01
	(0.02)				(0.02)
Quartile 3	−0.64***				−0.54***
	(0.01)				(0.01)
×2020	−0.03				−0.02
	(0.02)				(0.02)
Quartile 4	−1.12***				−0.84***
	(0.01)				(0.01)
×2020	−0.01				−0.02
	(0.02)				(0.02)
Upper secondary		−0.24***			−0.17***
		(0.01)			(0.01)
×2020		−0.07***			−0.07***
		(0.02)			(0.02)
Post-secondary school		−0.60***			−0.49***
		(0.01)			(0.01)
×2020		−0.05*			−0.05*
		(0.02)			(0.02)
Women			1.12***		1.01***
			(0.01)		(0.01)
×2020			−0.07***		−0.07***
			(0.01)		(0.01)
Europe				0.03**	−0.05***
				(0.01)	(0.01)
×2020				−0.01	0.00
				(0.02)	(0.02)
Outside of Europe				0.00	−0.22***
				(0.01)	(0.01)
×2020				0.02	0.01
				(0.02)	(0.02)
2020	0.00	0.05*	0.02**	−0.02*	0.10***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Constant	3.21***	3.10***	2.18***	2.74***	2.93***
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
Adjusted R2	0.00	0.00	0.00	0.00	0.00
Observations	35 772 524	35 772 528	35 772 528	35 772 528	35 772 524

Notes: Anti depressants (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.2. Cancer diagnosis

	(1)	(2)	(3)	(4)	(5)
Quartile 2	0.14***				0.08***
	(0.01)				(0.01)
×2020	0.02†				0.02†
	(0.01)				(0.01)
Quartile 3	0.21***				0.15***
	(0.01)				(0.01)
×2020	0.01				0.01
	(0.01)				(0.01)
Quartile 4	0.27***				0.21***
	(0.01)				(0.01)
×2020	0.04**				0.04**
	(0.01)				(0.01)
Upper secondary		0.09***			0.03***
		(0.01)			(0.01)
×2020		0.05***			0.05***
		(0.01)			(0.01)
Post-secondary school		0.13***			0.04***
		(0.01)			(0.01)
×2020		0.09***			0.08***
		(0.01)			(0.02)
Women			0.04***		0.07***
			(0.00)		(0.00)
×2020			0.04***		0.04***
			(0.01)		(0.01)
Europe				−0.26***	−0.20***
				(0.01)	(0.01)
×2020				0.01	0.01
				(0.01)	(0.01)
Outside of Europe				−0.34***	−0.26***
				(0.00)	(0.01)
×2020				0.05***	0.06***
				(0.01)	(0.01)
2020	−0.11***	−0.15***	−0.11***	−0.09***	−0.19***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Constant	1.13***	1.21***	1.27***	1.35***	1.16***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
Adjusted R2	0.01	0.01	0.01	0.01	0.01
Observations	35 772 524	35 772 528	35 772 528	35 772 528	35 772 524

Notes: Cancer diagnosis (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.3. Covid-19 death

	(1)	(2)	(3)	(4)	(5)
Quartile 2	0.02***				0.03***
	(0.00)				(0.00)
Quartile 3	0.00				0.01**
	(0.00)				(0.00)
Quartile 4	−0.02***				−0.02***
	(0.00)				(0.00)
Upper secondary		−0.02***			−0.01*
		(0.01)			(0.01)
Post-secondary school		−0.05***			−0.03***
		(0.01)			(0.01)
Women			−0.07***		−0.07***
			(0.00)		(0.00)
Europe				0.06***	0.05***
				(0.01)	(0.01)
Outside of Europe				0.04***	0.04***
				(0.00)	(0.00)
Constant	0.14***	0.17***	0.18***	0.13***	0.18***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Adjusted R2	0.01	0.01	0.01	0.01	0.01
Observations	7 336 150	7 336 150	7 336 150	7 336 150	7 336 150

Notes: Covid-19 death (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.4. Covid-19 hospitalization

	(1)	(2)	(3)	(4)	(5)
Quartile 2	−0.08***				0.01
	(0.01)				(0.01)
Quartile 3	−0.13***				−0.03***
	(0.01)				(0.01)
Quartile 4	−0.21***				−0.10***
	(0.01)				(0.01)
Upper secondary		−0.16***			−0.08***
		(0.01)			(0.01)
Post-secondary school		−0.25***			−0.14***
		(0.01)			(0.01)
Women			−0.19***		−0.20***
			(0.00)		(0.01)
Europe				0.27***	0.25***
				(0.01)	(0.01)
Outside of Europe				0.61***	0.57***
				(0.01)	(0.01)
Constant	0.53***	0.59***	0.52***	0.33***	0.55***
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
Adjusted R2	0.00	0.00	0.00	0.01	0.01
Observations	7 336 150	7 336 150	7 336 150	7 336 150	7 336 150

Notes: Covid-19 hospitalization (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.5. Death, all causes

	(1)	(2)	(3)	(4)	(5)
Quartile 2	−0.02***				−0.02*
	(0.01)				(0.01)
×2020	−0.02				0.00
	(0.01)				(0.01)
Quartile 3	−0.22***				−0.27***
	(0.01)				(0.01)
×2020	−0.02				0.00
	(0.01)				(0.01)
Quartile 4	−0.38***				−0.46***
	(0.01)				(0.01)
×2020	−0.01				0.02
	(0.01)				(0.01)
Upper secondary		−0.40***			−0.35***
		(0.01)			(0.01)
×2020		−0.13***			−0.13***
		(0.02)			(0.02)
Post-secondary school		−0.59***			−0.43***
		(0.01)			(0.01)
×2020		−0.17***			−0.16***
		(0.02)			(0.02)
Women			−0.39***		−0.46***
			(0.00)		(0.00)
×2020			−0.03***		−0.02*
			(0.01)		(0.01)
Europe				0.07***	−0.02**
				(0.01)	(0.01)
×2020				0.05**	0.04**
				(0.02)	(0.02)
Outside of Europe				−0.06***	−0.24***
				(0.00)	(0.00)
×2020				0.02†	0.00
				(0.01)	(0.01)
2020	0.06***	0.17***	0.06***	0.04***	0.17***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Constant	1.43***	1.67***	1.47***	1.27***	2.03***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
Adjusted R2	0.08	0.08	0.08	0.08	0.08
Observations	35 772 524	35 772 528	35 772 528	35 772 528	35 772 524

Notes: Death, all causes (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.6. Surgical procedure

	(1)	(2)	(3)	(4)	(5)
Quartile 2	1.24***				0.86***
	(0.02)				(0.02)
×2020	0.24***				0.29***
	(0.04)				(0.04)
Quartile 3	1.05***				1.17***
	(0.02)				(0.02)
×2020	0.42***				0.39***
	(0.04)				(0.04)
Quartile 4	0.72***				1.37***
	(0.02)				(0.03)
×2020	0.42***				0.28***
	(0.04)				(0.04)
Upper secondary		0.85***			0.48***
		(0.03)			(0.03)
×2020		0.36***			0.33***
		(0.04)			(0.04)
Post-secondary school		0.72***			−0.13***
		(0.03)			(0.03)
×2020		0.80***			0.71***
		(0.04)			(0.04)
Women			3.70***		3.90***
			(0.02)		(0.02)
×2020			−0.08**		−0.09**
			(0.03)		(0.03)
Europe				−2.10***	−1.54***
				(0.03)	(0.03)
×2020				−0.06	0.02
				(0.05)	(0.05)
Outside of Europe				−1.20***	−0.47***
				(0.03)	(0.03)
×2020				0.23***	0.32***
				(0.04)	(0.04)
2020	−1.50***	−1.71***	−1.18***	−1.23***	−1.87***
	(0.03)	(0.04)	(0.02)	(0.02)	(0.05)
Constant	17.24***	17.46***	16.13***	18.34***	15.31***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)
Adjusted R2	0.04	0.04	0.04	0.04	0.04
Observations	35 772 524	35 772 528	35 772 528	35 772 528	35 772 524

Notes: Surgical procedure (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.7. Positive case

	(1)	(2)	(3)	(4)	(5)
Quartile 2	1.67***				1.84***
	(0.02)				(0.02)
Quartile 3	1.69***				2.08***
	(0.02)				(0.02)
Quartile 4	1.44***				2.00***
	(0.02)				(0.02)
Upper secondary		0.35***			0.27***
		(0.02)			(0.02)
Post-secondary school		0.52***			0.17***
		(0.02)			(0.02)
Women			0.73***		0.92***
			(0.02)		(0.02)
Europe				0.05†	0.60***
				(0.03)	(0.03)
Outside of Europe				1.36***	2.16***
				(0.03)	(0.03)
Constant	3.70***	4.59***	4.54***	4.74***	2.51***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Adjusted R2	0.01	0.01	0.01	0.01	0.01
Observations	7 336 150	7 336 150	7 336 150	7 336 150	7 336 150

Notes: Positive case (sample includes all Swedes age 25 and up). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.8. Unemployment

	(1)	(2)	(3)	(4)	(5)
Quartile 2	−2.85***				−2.22***
	(0.02)				(0.02)
×2020	−0.29***				−0.19***
	(0.04)				(0.04)
Quartile 3	−5.19***				−4.23***
	(0.02)				(0.02)
×2020	−1.28***				−1.07***
	(0.03)				(0.04)
Quartile 4	−6.30***				−5.06***
	(0.01)				(0.02)
×2020	−1.84***				−1.60***
	(0.03)				(0.04)
Upper secondary		−2.33***			−0.76***
		(0.02)			(0.02)
×2020		−0.66***			0.09*
		(0.04)			(0.04)
Post-secondary school		−3.76***			−1.71***
		(0.02)			(0.02)
×2020		−1.06***			−0.09*
		(0.04)			(0.04)
Women			0.45***		−0.04***
			(0.01)		(0.01)
×2020			−0.03		−0.27***
			(0.02)		(0.02)
Europe				2.05***	1.05***
				(0.02)	(0.02)
×2020				0.43***	0.57***
				(0.04)	(0.04)
Outside of Europe				5.43***	3.72***
				(0.02)	(0.02)
×2020				1.81***	1.65***
				(0.04)	(0.04)
2020	2.94***	2.93***	2.10***	1.69***	2.67***
	(0.03)	(0.04)	(0.02)	(0.01)	(0.05)
Constant	8.12***	7.15***	4.32***	3.61***	7.92***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Adjusted R2	0.02	0.01	0.01	0.02	0.03
Observations	25 741 224	25 741 224	25 741 224	25 741 224	25 741 224

Notes: Unemployment (sample includes all working-age Swedes age 25–64). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table B.9. Income loss

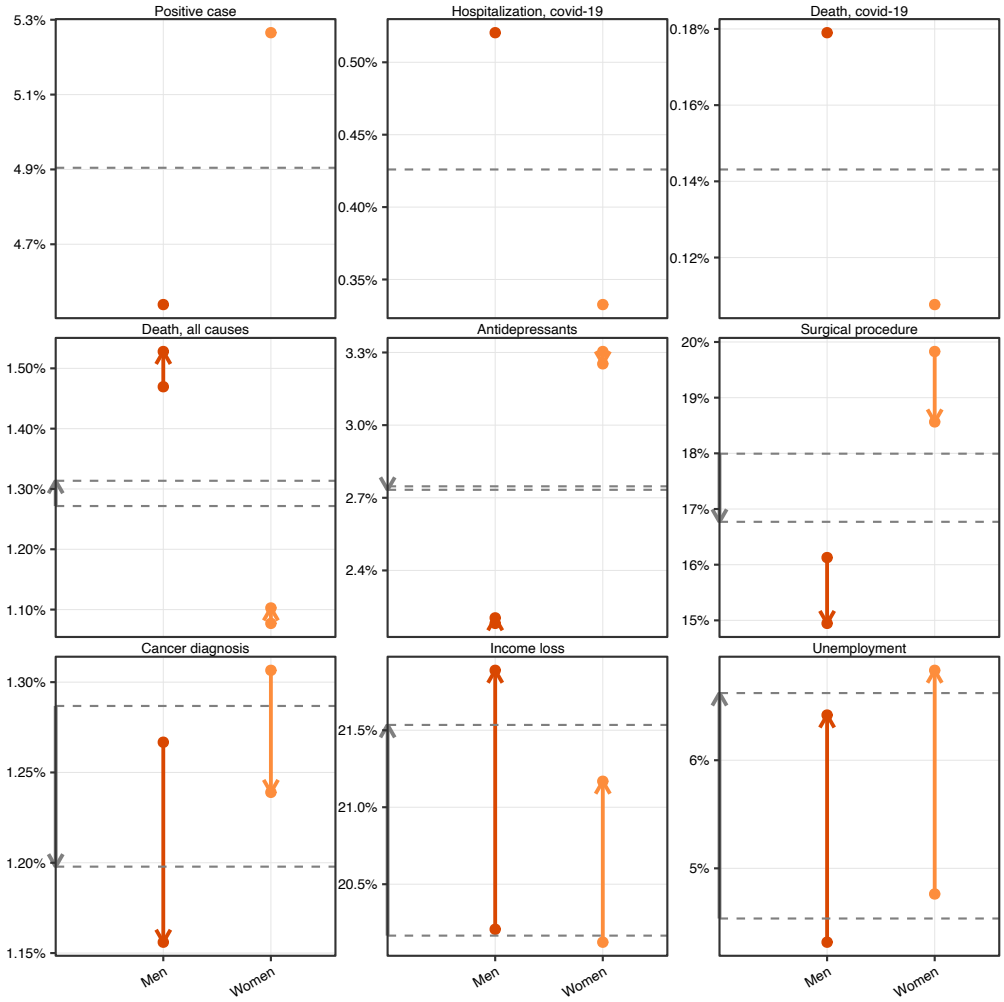
	(1)	(2)	(3)	(4)	(5)
Quartile 2	−5.72***				−4.86***
	(0.03)				(0.03)
×2020	−0.98***				−0.73***
	(0.06)				(0.06)
Quartile 3	−6.79***				−5.19***
	(0.03)				(0.03)
×2020	−1.26***				−0.93***
	(0.06)				(0.06)
Quartile 4	4.54***				6.84***
	(0.03)				(0.03)
×2020	−3.72***				−3.38***
	(0.06)				(0.06)
Upper secondary		−2.39***			−1.56***
		(0.03)			(0.03)
×2020		−0.92***			0.01
		(0.07)			(0.07)
Post-secondary school		−2.36***			−3.17***
		(0.03)			(0.03)
×2020		−2.16***			−0.73***
		(0.07)			(0.07)
Women			−0.08***		1.61***
			(0.02)		(0.02)
×2020			−0.64***		−1.09***
			(0.04)		(0.04)
Europe				1.99***	2.42***
				(0.03)	(0.03)
×2020				0.88***	0.59***
				(0.07)	(0.07)
Outside of Europe				4.89***	5.25***
				(0.03)	(0.03)
×2020				2.09***	1.48***
				(0.06)	(0.06)
2020	2.90***	2.73***	1.68***	0.91***	3.21***
	(0.04)	(0.06)	(0.03)	(0.02)	(0.07)
Constant	22.20***	22.23***	20.21***	19.36***	21.36***
	(0.02)	(0.03)	(0.01)	(0.01)	(0.04)
Adjusted R2	0.02	0.01	0.00	0.01	0.02
Observations	25 243 600	25 243 600	25 243 600	25 243 600	25 243 600

Notes: Income loss (sample includes all working-age Swedes age 25–64). Coefficients and standard errors are reported in percentage points. The sample of analysis includes one individual-level observations for each year 2016–2020. Base levels (income quartile 1, compulsory school, men, born in Sweden) are not reported. Missing values, coded as distinct categories, as well as region and age category fixed effects, are also excluded from the table. Standard errors are clustered at the individual level.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

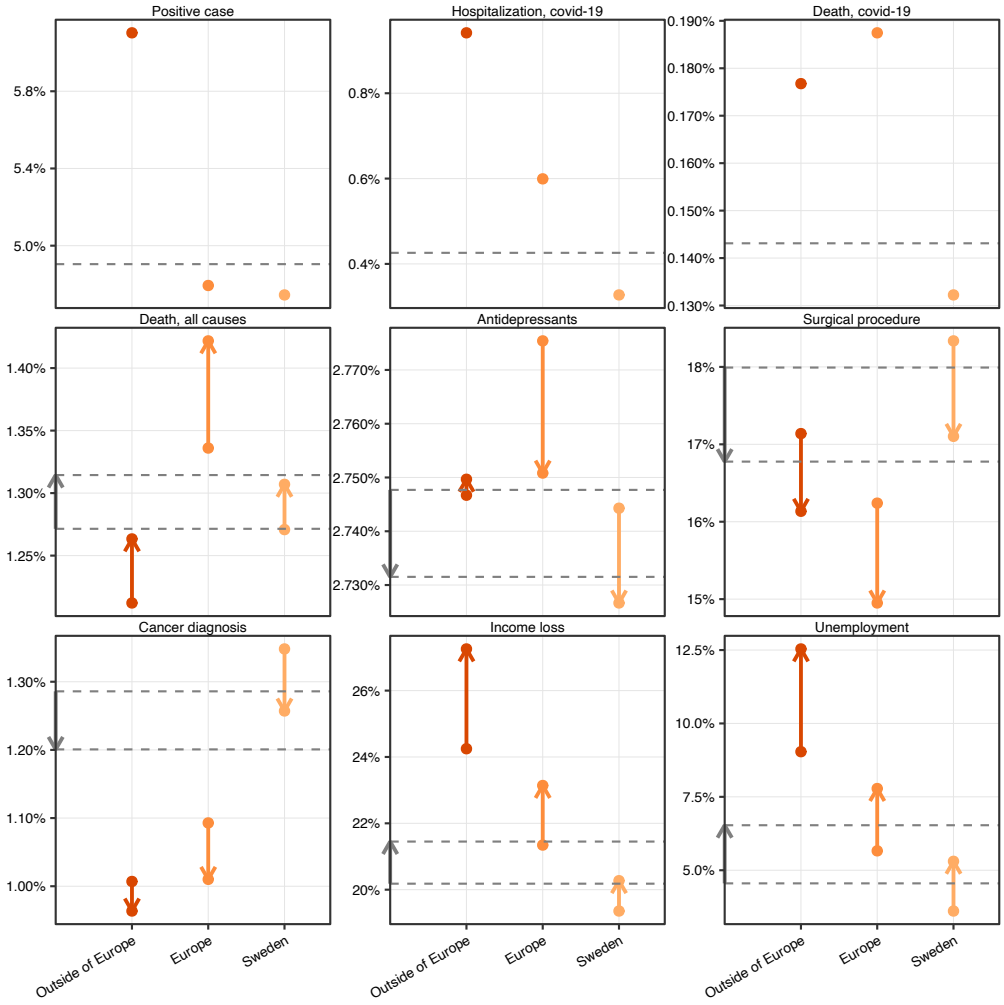
C Absolute differences

Figure C.1. Absolute differences - Gender



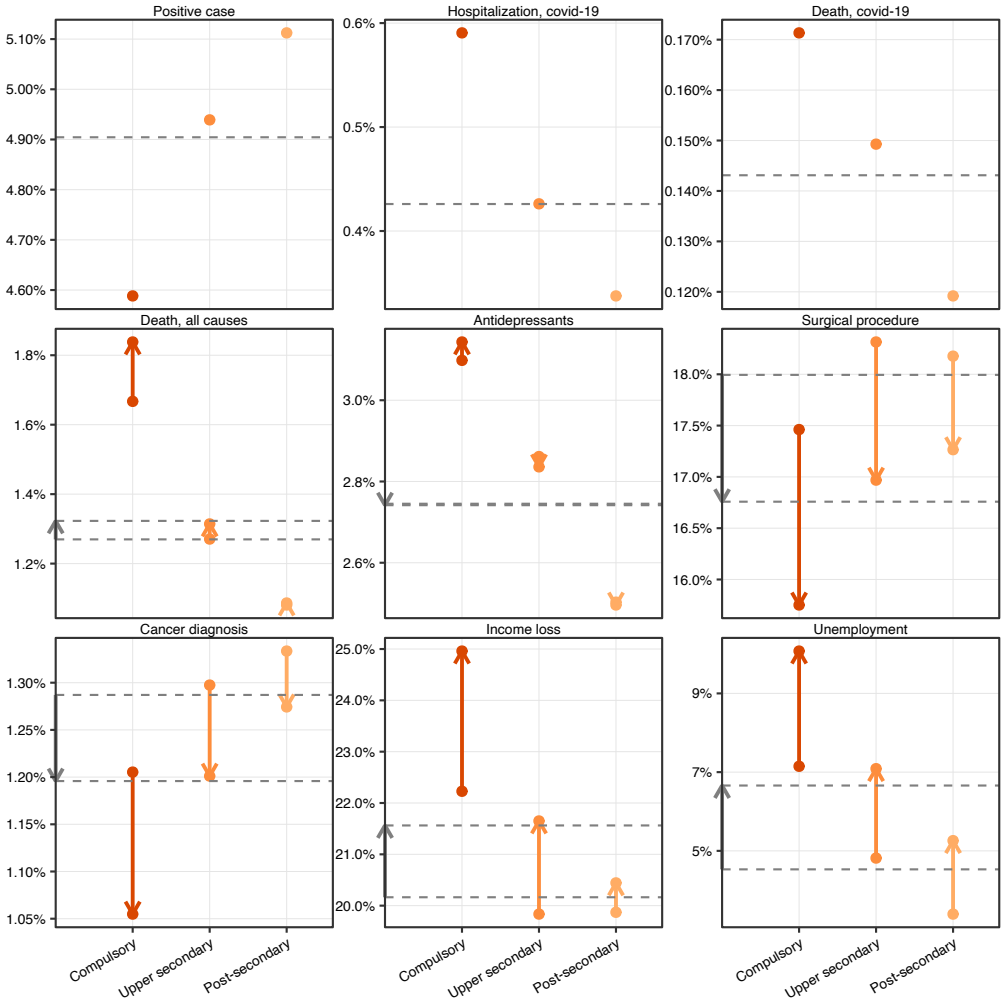
Notes: The plots shows absolute levels for the nine outcomes, by gender. Arrows highlight change from the 2016–2019 average to 2020. The dashed lines indicate population averages. The relative risk presented in the main paper are calculated by dividing the group effect with the population mean. Note that y-axis scales differ. Y-axis scales vary by plot. The measures of risk of unemployment and of income loss are calculated on the population of 25–64 year olds, while the other outcomes are calculated using all individuals 25 years and older.

Figure C.2. Absolute differences - Region of birth



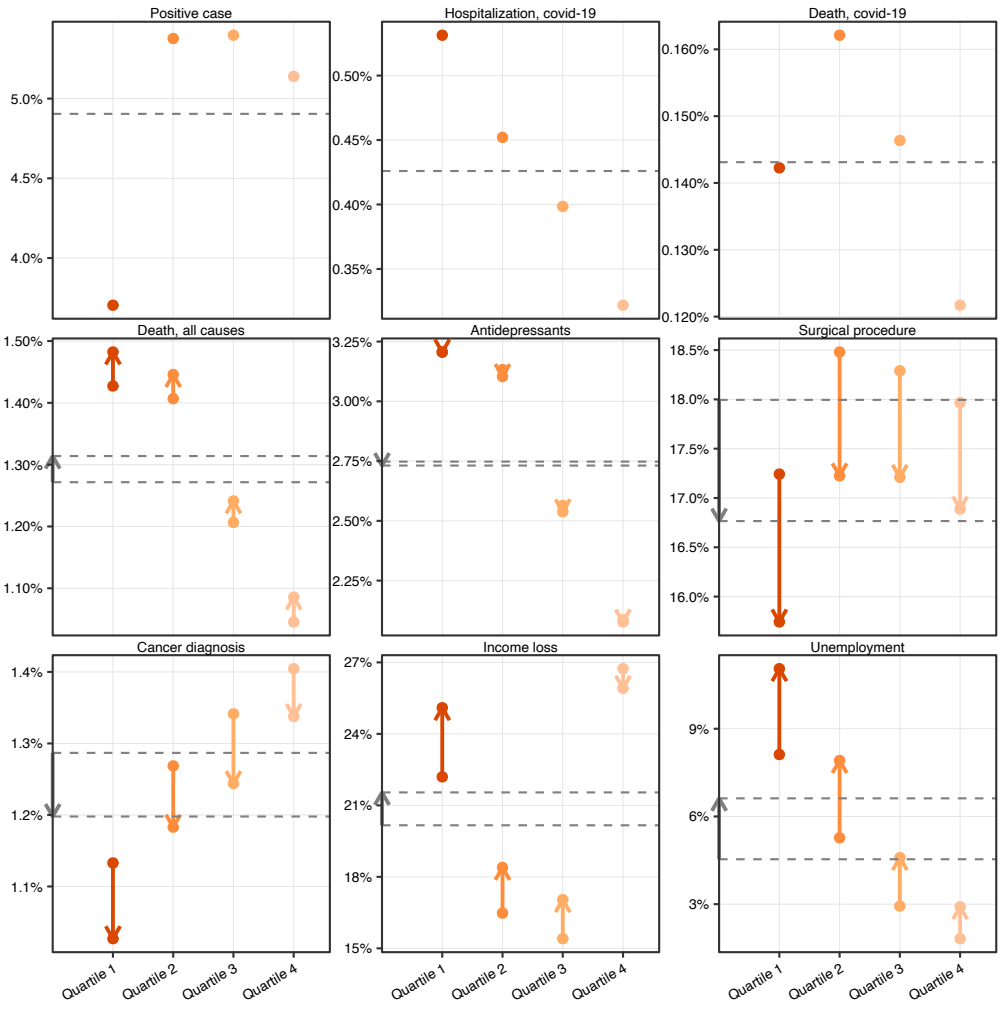
Notes: The plots shows absolute levels for the nine outcomes, by region of birth. Arrows highlight change from the 2016–2019 average to 2020. The dashed lines indicate population averages. The relative risk presented in the main paper are calculated by dividing the group effect with the population mean. Note that y-axis scales differ. Y-axis scales vary by plot. The measures of risk of unemployment and of income loss are calculated on the population of 25–64 year olds, while the other outcomes are calculated using all individuals 25 years and older.

Figure C.3. Absolute differences - Level of education



Notes: The plots shows absolute levels for the nine outcomes, by level of education. Arrows highlight change from the 2016–2019 average to 2020. The dashed lines indicate population averages. The relative risk presented in the main paper are calculated by dividing the group effect with the population mean. Note that y-axis scales differ. Y-axis scales vary by plot. The measures of risk of unemployment and of income loss are calculated on the population of 25–64 year olds, while the other outcomes are calculated using all individuals 25 years and older.

Figure C.4. Absolute differences - Income quartile

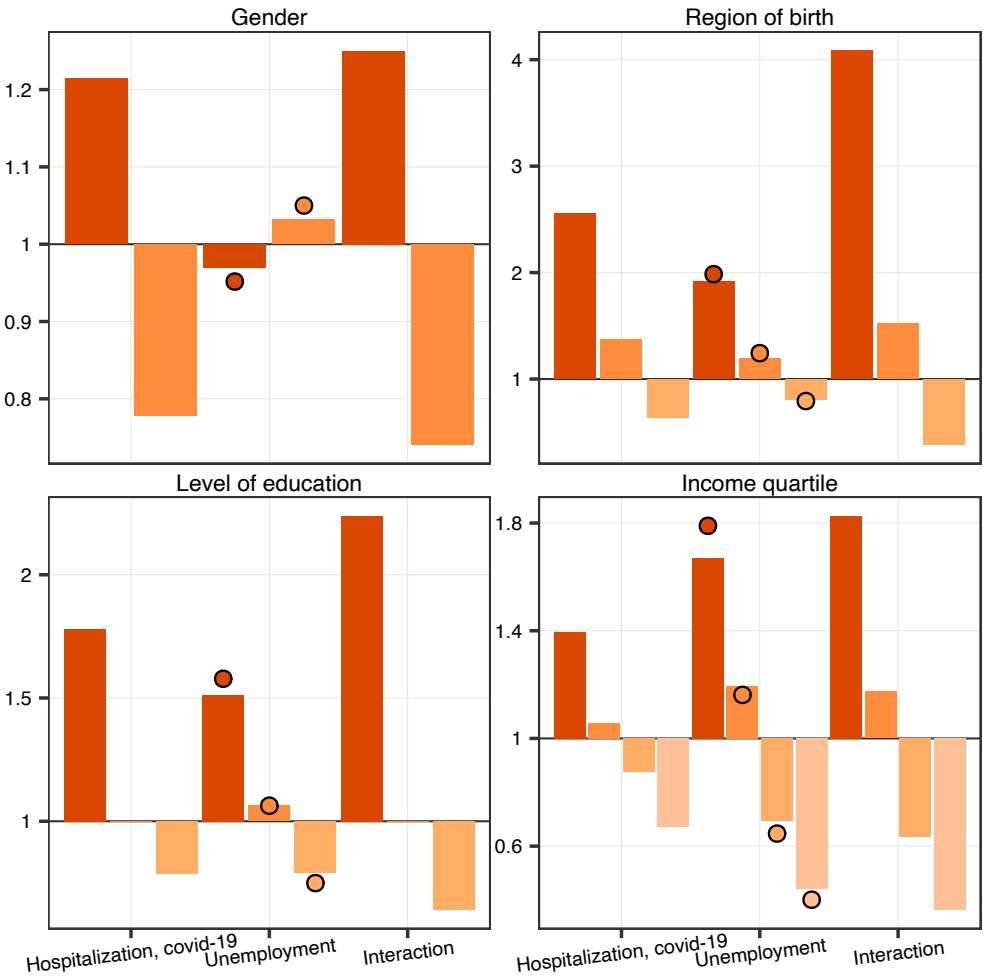


Notes: The plots shows absolute levels for the nine outcomes, by income quartile. Arrows highlight change from the 2016–2019 average to 2020. The dashed lines indicate population averages. The relative risk presented in the main paper are calculated by dividing the group effect with the population mean. Note that y-axis scales differ. Y-axis scales vary by plot. The measures of risk of unemployment and of income loss are calculated on the population of 25–64 year olds, while the other outcomes are calculated using all individuals 25 years and older.

D Interactions

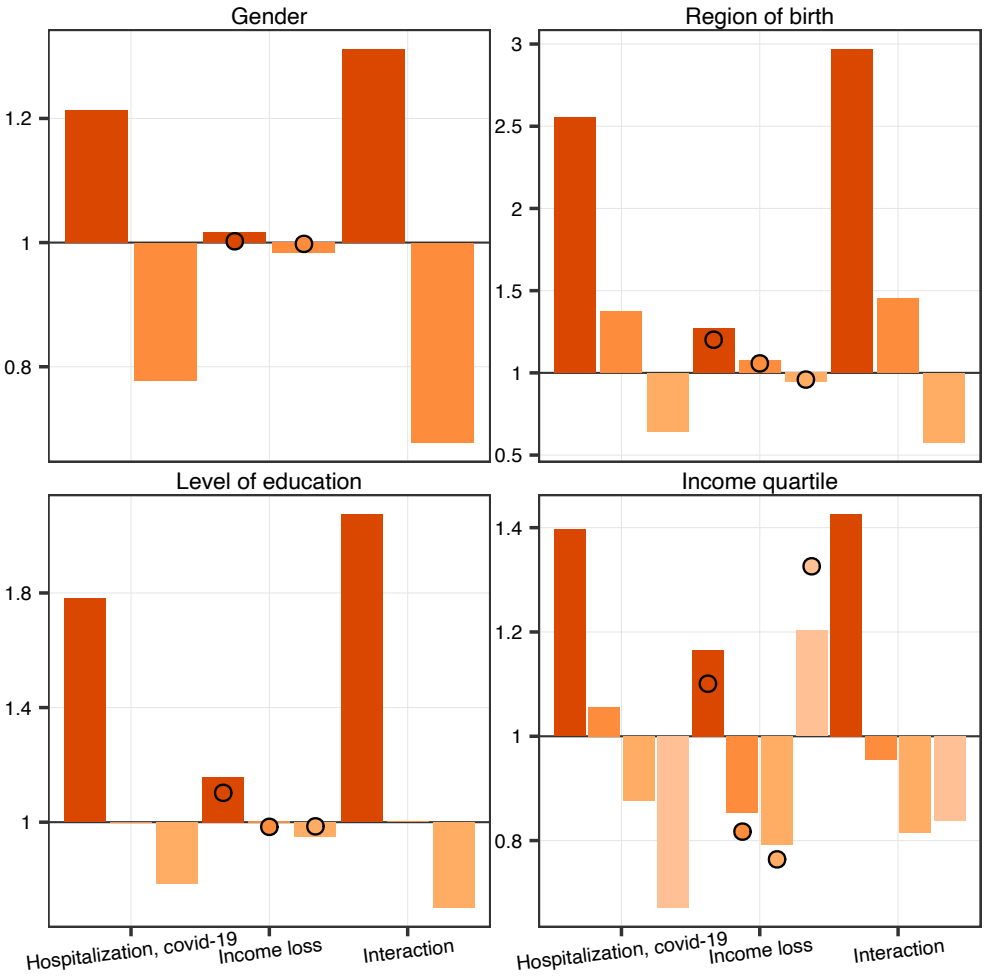
In Figures D.1 and D.2 the risk of suffering from multiple negative events are displayed. Here we study hospitalization risk and either unemployment or income risk. Each panel shows the gradient of one of the four dimensions, and the two leftmost bar groups in each plot show the same relative risks as in the main radar plots. The third bar group however shows the relative risk for the interacted outcome — that the same individual suffers from both events. To understand what it means that these interacted effects are always larger for the worst-off groups consider the following example. If only exactly those who are hospitalized for COVID-19 became unemployed all gradients would look the same. If instead there was no overlap between hospitalizations and unemployment, there would be no gradient at all visible in the third bar group. What we see is that the relative risks for the worst-off groups are usually higher. This means that it is more common in these groups that COVID-19 hospitalization and unemployment or income loss go together. While this happens in all groups, those worst-off have a weaker connection to the labor market and their hospitalization is more likely to cause further negative shocks.

Figure D.1. Individual interaction: Hospitalization and unemployment



Notes: The two left most bar groups show the same relative risks as in the radar charts. The third group shows the relative risk for suffering from both a COVID-19 hospitalization and unemployment. Colored points show the 2016–2019 relative unemployment risk.

Figure D.2. Individual interaction: Hospitalization and income loss



Notes: The two left most bar groups show the same relative risks as in the radar charts. The third group shows the relative risk for suffering from both a COVID-19 hospitalization and unemployment. Colored points show the 2016–2019 relative income loss risk.