COVID-19 and Mental Health: a Longitudinal Population Study from Norway[1]

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Abstract

Existing research has found negative short-term consequences of the COVID-19 pandemic on mental health problems, but longer-term effects have been less documented. Using newly released register data on all general practitioner consultations in Norway through 2020 (about 14 million consultations in total), we find that during the spring and early summer 2020, the number of psychological cases initially increased relative to prior years, but then fell back towards the level of prior years during the summer 2020. In early September 2020, the number of cases accelerated, a pattern that held up through December 2020, so that the gap between 2020 and prior years became largest end-of-year. Our findings suggest that the accumulated effects of the COVID-19 pandemic on mental health far exceeds the short-term effects. The effects were particularly strong for females and for residents in urban areas.

Keywords: primary care, mental health, psychological disorder, psychological symptoms

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Introduction

Many researchers have investigated the short-term consequences of the COVID-19 pandemic on mental health problems. Survey evidence from several countries suggest that the fear of infection and death from COVID-19, income insecurities, and limit to personal freedoms led to an increase in depression, anxiety, and substance abuse in the spring and early summer of 2020. (1,2,3,4). Evidence on the longer-term effects is scarce (5). People may have developed better coping strategies, but the accumulated effects of stress may take its toll. We use near real-time register data covering the universe of general practitioner (GP) consultations in Norway until the end of 2020 to address this issue.

Materials and methods

The KUHR register data form the basis of the analysis (8). The KUHR data we use cover all patient encounters with general practitioners in Norway in the years 2017-2020. Each row in the KUHR data consist of a single encounter and includes one or more codes classifying the patient's condition. In addition, the KUHR data contain the date, time, and type of encounter.

From the KUHR data we selected the GP consultations.[4] The total number of GP consultations in 2020 was about 14 million, and about 1.8 million (14%) resulted in at least one P-diagnosis. The percentage of the population that consulted a GP in 2020 was 75%, identical to the prior years (see Table S1). Due to a fast transition to electronic consultations, the Norwegian GP system did not experience a large drop in encounters in the months after the COVID-19 outbreak in March 2020, quite different from e.g., the UK and the US (see the Supplementary Appendix).

The diagnostical codes assigned in KUHR are according to the ICPC-2 classification system (International Classification of Primary Care) developed by WONCA (World Organization of Family Doctors) in 1987. ICPC-2 is a classification method for primary care encounters that includes codes both for the patient's reason for encounter and for diagnoses. The psychological codes P01-P99 are divided into symptoms and complaints (P01-P29) and diagnoses (P70-P99). For example, P03 "Feeling depressed" is a symptom/complaint and P76 "Depressive disorder" is a diagnosis.[5]

We merged the KUHR with sociodemographic registers (also covering the whole population) using the unique person ID. The ID is an anonymized version of an individual's social security number. This allows us to merge in gender, age, and municipality of residence variables for each patient.

As outcome variable, we focus on the number of weekly GP consultations from January 1 to December 31, 2020 that resulted in a psychological diagnosis under ICPC-2, which we for convenience refer to as P-cases. We use the years 2017-2019 as comparison group. We analyzed

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[4] These are encounter codes 2a and 2e. The other GP encounters include tests without patient visits, extra time needed for a consultations (this extra time will be added as a separate row in the KUHR data), writing of prescriptions and doctor's certificates without consultation etc. These encounter types are usually not included in the official statistics by Statistics Norway.

[5] https://ehelse.no/kodeverk/icpc-2e--english-version contains more information on ICPC-2, including a mapping to ICD-10.

both percentage increases and increases per capita, population-wide and for subpopulations. We also analyzed the increase in cases for the eight most common psychological diagnoses in 2019, i.e., pre-pandemic.

Poisson regressions were used to assess statistical significance. We regressed average number of weekly cases in week 40-51 on a dummy for year 2020. The coefficients of the regressions can be interpreted as percentage increases from 2017-2019 to 2020.

All analysis has been performed using Stata version 16.1. To define weeks, we use Stata's inbuilt time functions, the egen command with its week extension. As week 52 in Stata has different length in different years, it has been excluded from the analysis (the gap between 2020 and 2017-2019 is larger in week 52 than in prior weeks). By "population" (capita) in Figure 2 we mean the individuals that attended their GP during the year. The figures use three-week moving averages for the outcome variables.

Results

Figure 1 depicts the population-wide weekly P-cases for 2020 (red line) using the 2017-2019 average (black line) for comparison. After the Covid-19 outbreak in March 2020 (vertical dashed line), the number of P-cases in 2020 became larger than the 2017-2019 in late spring, but more similar during summer. In early September, the gap between 2020 and 2017-2019 started increasing, a pattern that held up through December 2020.

Table 1 reports the number of cases in September-December 2020 (weeks 40-51), compared to the same period in 2017-2019. Panel A shows that the increase in P-cases in 2020 was about 17% [95% CI, 0.16-0.19] relative to 2017-2019. For non-severe diagnoses the increase in P-cases in 2020 was about 22% (95% CI, 0.20-0.24), while for severe diagnoses the corresponding increase was about 13% (95% CI, 0.11-0.15).

Panel B of Table 1 shows that the largest percentage increase was for age 11-17 (0.22; 95% CI, 0.16-0.29), age 65+ (0.24; 95% CI, 0.20-0.28), for females (0.19; 95% CI, 0.18-0.21) and for urban (0.22; 95% CI, 0.18-0.25), the latter being inhabitants of the four main cities (Oslo, Bergen, Trondheim, Stavanger).

Panel C of Table 1 shows the percentage increase in cases in September-December 2020 relative to the same period in 2017-2019 for the eight most common (in 2019) psychological diagnoses. All eight increase substantially, especially hyperkinetic disorder (ADHD) and PTSD, about 36% [95% CI, 0.30-0.43] and about 33% [95% CI, 0.26-0.40].

Figure 2 shows weekly increase of P-cases in 2020 compared to the 2017-2019 average (the shaded area in the top panel of Figure), at a per capita level. The bold line depicts a population-wide weekly

increase of about 1 per 1000 capita in June-August, which doubled to about 2 end-of-year. Females, age 31-64, and urban areas experienced the larger per capita increases.

Discussion

The number of psychological cases in Norway was high relative to prior years in late spring and early summer 2020, consistent with evidence from other countries (1,2,3,4), but then fell back towards pre-2020 levels during July and August, as depicted in Figure 1. Our main finding is the acceleration of cases starting September 2020 and still present end-of-year, also depicted in Figure 1 and Table 1. At a per-capita level, the increase in weekly cases relative to prior years was about 1 per 1000 capita in July-August and doubled to 2 per 1000 capita in December, as depicted in Figure 2. The acceleration of psychological cases during fall 2020 suggests that the accumulated effects of stress in the fall of 2020 outweighed the development of better coping strategies in the population.

As Norway had low incidence of Covid-19 cases and deaths during fall 2020 compared to many other countries it seems plausible that the acceleration in cases during fall was due to accumulated effects of lockdowns and movement restrictions (rather than stress due to fear of infection).[6] As lockdowns and movement restrictions have been a policy response to the pandemic worldwide, our findings should be of interest to policy makers in many countries, who contemplate the difficult trade-offs of continued lockdown policies. Our findings also have broader interest, in providing detailed population-level documentation of the mental health effects of prolonged shutdowns and limits to social interaction.

The main cities have been hubs for Covid-19 cases and lockdowns, as many metropolitan areas globally, and experienced larger increases during September-December than more rural areas, both at a per-capita and percentage level. The increases were also large for females. The adolescents (11-17 age) experienced a large percentage increase relative to other groups (but a lower per-capita increase).

As can be seen in Figure 1, the number of psychological cases in Norway were unusually high in January 2020. We are not aware of institutional changes in 2020 that could explain the spike in January 2020. One explanation could be that the unusually foul weather in January 2020 led to a "lockdown" created by nature.[7] In Table 1 we control for a possible "2020 effect" unrelated to COVID-19 by comparing the increase in average weekly cases during weeks 40-51 in 2020 to the corresponding increase during weeks 1-10 of 2020 (i.e., prior to the outbreak). The estimate from this approach (Panel A of Table 1) implies that the extra increase in P-cases during weeks 40-51 in 2020 was 9%, i.e., substantial.

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[6] Our World in Data (2021). Norway: Coronavirus Pandemic Country Profile. Retrieved on 22.04.2021 from https://ourworldindata.org/coronavirus/country/norway

[7] January 2020 was the wettest January ever in Norway. See e.g., https://kommunikasjon.ntb.no/pressemelding/januar-2020-ble-den-vateste-noen-gang?publisherId=17846853&releaseId=17878908

As can be seen from Figure 1 (black line), Norway is characterized by a "long winter" effect, in that the number of P-cases are typically increasing during the fall months (9), possibly due to lack of sun exposure (10). To investigate whether the "long winter" effect possibly interacts with the COVID-19 effects, in Panel B of Table 1 we analyze the increases in P-cases for the three northern-most counties (Nordland, Troms, and Finnmark) where the population live close to or above the arctic circle. The percentage increase, about 9% (95% CI, 0.04-0.15), is lower than the increase for the overall population (the first row), which suggest that the long winter effects are not driving our results.

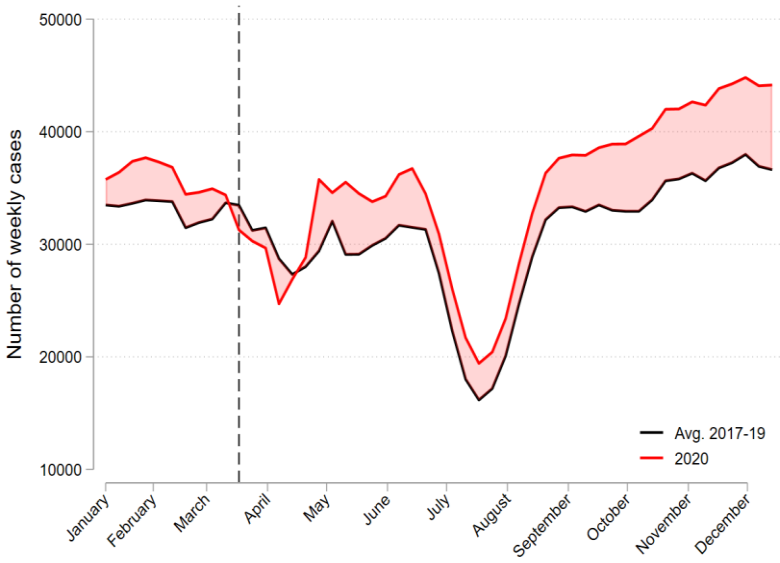

Figure 1. Weekly number of P-cases in 2020 (red line) vs. 2017-2019 average (black line).
Note: A "P-case" is a GP consultation that resulted in a psychological diagnosis based on the ICPC-2 classification system (P00-P99). The Figure uses three-week moving averages for the outcome variables.

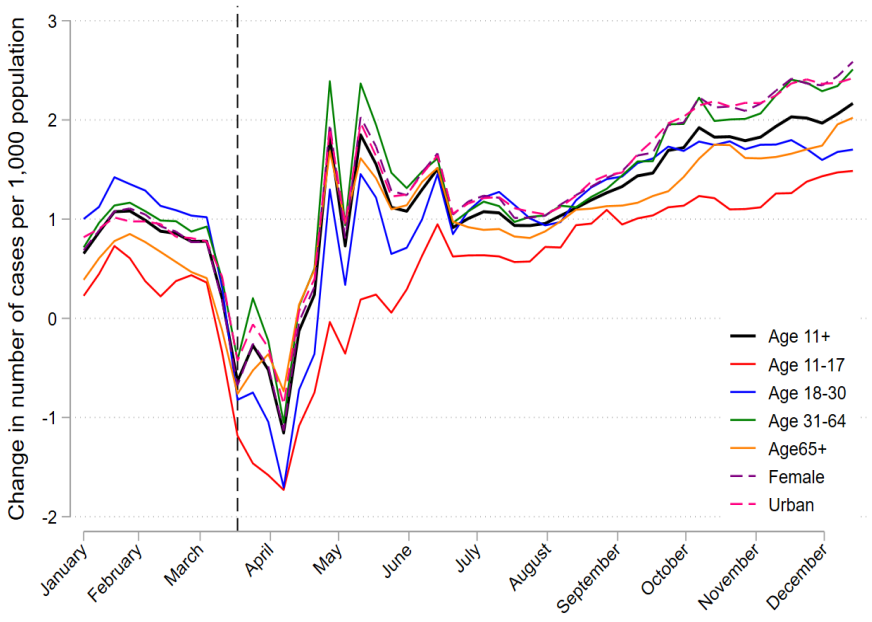

Figure 2. The increase in weekly number of P-cases in 2020 vs. 2017-2019 average for subpopulations, per 1000 capita subpopulation.

Note: A "P-case" is a GP consultation that resulted in a psychological diagnosis based on the ICPC-2 classification system (P00-P99). "Population" on the y-axis refers to the number of individuals in the subpopulation that attended a GP during 2020. The Figure uses three-week moving averages for the outcome variable.

Table 1. P-cases in week 40-51, 2020, vs. average P-cases week 40-51 in 2017-19

	Avg. number of weekly cases			Output from Poisson regression		
	2017-19	2020	Difference	Coeff.	95% CI	p-value
Panel A. All (age 11+)						
P-cases	35,610	42,387	6,777	0.17	0.16-0.19	<0.001
Non-severe P-cases	16,276	20,359	4,083	0.22	0.20-0.24	<0.001
Severe P-cases	20,060	22,912	2,852	0.13	0.11-0.15	<0.001
P-cases, controlling for week 1-10				0.09	0.07-0.11	<0.001
Panel B. Subgroup P-cases						
Age 11-17	1,444	1,807	363	0.22	0.16-0.29	<0.001
Age 18-30	7,253	8,356	1,103	0.14	0.11-0.17	<0.001
Age 31-64	21,909	25,872	3,963	0.17	0.15-0.18	<0.001
Age 65+	5,004	6,352	1,348	0.24	0.20-0.28	<0.001
Male	13,631	15,682	2,051	0.14	0.12-0.16	<0.001
Female	21,979	26,705	4,726	0.19	0.18-0.21	<0.001
Urban	5,002	6,219	1,217	0.22	0.18-0.25	<0.001
Rural	25,605	29,949	4,344	0.16	0.14-0.17	<0.001
Northern-most counties	2,498	2,737	239	0.09	0.04-0.15	0.001
C. 8 most common psychological diagnoses/symptoms						
P01 Feeling anxious	2,657	3,194	537	0-18	0.13-0.24	<0.001
P02 Acute stress reaction	3,945	4,724	779	0.18	0.14-0.22	<0.001
P03 Feeling depressed	1,570	2,023	453	0.25	0.19-0.32	<0.001
P06 Sleep disturbance	3,380	4,406	1,026	0.27	0.22-0.31	<0.001
P29 Psych. symptom other	3,608	4,321	713	0.18	0.14-0.22	<0.001
P73 Affective psychosis	1,225	1,453	228	0.17	0.09-0.25	<0.001
P74 Anxiety disorder	2,963	3,677	714	0.22	0.17-0.26	<0.001
P76 Depressive disorder	8,980	10,235	1,255	0.13	0.10-0.16	<0.001
P81 Hyperkinetic disorder	1,420	2,044	624	0.36	0.30-0.43	<0.001
P82 PTSD	1,263	1,761	498	0.33	0.26-0.40	<0.001

Notes: A "P-case" is a GP consultation that resulted in a psychological diagnosis based on the ICPC-2 classification system. In row 4, we used four observations: average weekly cases for week 1-10 in 2017-19, average weekly cases for week 40-51 in 2017-19, average weekly cases for week 1-10 in 2020, and average weekly cases for week 40-51 in 2020. Using this sample, we ran a Poisson regression, regressing average number of weekly cases on a dummy for year 2020, a dummy for week 40-51, and the interaction of year 2020 and week 40-51. We report the coefficient of this interaction, which can be interpreted as the extra percentage increase in average weekly cases from 2017-19 to 2020 compared to the increase in average weekly cases from 2017-19 to 2020 for the pre-Covid part of the calendar year.

References

1. McGinty E. E. et al., (2020). Psychological distress and loneliness reported by US adults in 2018 and april 2020. JAMA, 324(1):93–94. doi:10.1001/jama.2020.9740

2. Pierce. M. et al., (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. Lancet Psychiatry; 7: 883–92. https://doi.org/10.1016/ S2215-0366(20)30308-4.

3. Pan, K. Y. et al., (2021). The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: a longitudinal study of three Dutch case-control cohorts. Lancet Psychiatry; 8(2), 121-129. https://doi.org/10.1016/S2215-0366(20)30491-0.

4. Wang, Y. et al., (2021). The impact of quarantine on mental health status among general population in China during the COVID-19 pandemic. Molecular Psychiatry. Published online January 2021. doi: 10.1038/s41380-021-01019-y.

5. Salanti, G. et al., (2021). An efficient way to assess the effect of COVID-19 on mental health in the general population. Lancet Psychiatry, Published Online March 16, 2021. https://doi.org/10.1016/ S2215-0366(21)00067-5.

6. Øverland, S., et al., (2020). Seasonality and symptoms of depression: A systematic review of the literature. Epidemiology and psychiatric sciences, 29. doi:10.1017/S2045796019000209

7. Lambert, G. W., et al., (2002). Effect of sunlight and season on serotonin turnover in the brain. The Lancet, 360(9348), 1840-1842. doi: 10.1016/s0140-6736(02)11737-5.

8. Gunnes, N. et al., (2020). Seasonal and pandemic influenza during pregnancy and risk of fetal death: A Norwegian registry-based cohort study. European Journal of Epidemiology, 35:371–379

9. Mansfield, K. E., et al., (2021). Indirect acute effects of the COVID-19 pandemic on physical and mental health in the UK: a population-based study. The Lancet Digital Health, 3(4), e217-e230.

10. Holland, K. M. et al., (2021). Trends in US emergency department visits for mental health, overdose, and violence outcomes before and during the COVID-19 pandemic. JAMA psychiatry. Published online February 03, 2021. https://doi.org /10.1001/jamapsychiatry.2020.4402.

Supplementary appendix

Table S1 shows the fraction of the Norwegian population with at least one GP consultation in 2020, and in prior years, broken down on subpopulations.[8] As shown in **Figure S1**, The Norwegian GP system did not experience a large drop in encounters around the outbreak of the Covid-19 pandemic, relative to prior years, very different from other countries (see Mansfield et al., 2021, for the UK, and Holland et al., 2021, for the US). The reason was a fast transition to electronic encounters. **Figure S2** plots the fraction of consultations that were electronic through 2020.[9]

Table S1. GP Coverage rates in Norway 2017-2020.

	Fraction of Norwegian population with at least one GP consultation in given year			
	2017	2018	2019	2020
Age 11+	0.76	0.75	0.75	0.75
Age 11-17	0.68	0.67	0.67	0.65
Age 18-30	0.70	0.70	0.69	0.68
Age 31-64	0.75	0.75	0.75	0.74
Age 65+	0.87	0.86	0.86	0.86
Male	0.69	0.69	0.69	0.69
Female	0.82	0.82	0.81	0.80
Urban	0.82	0.83	0.83	0.79
Rural	0.73	0.73	0.72	0.73
Population size (million)	4.57	4.61	4.65	4.70

[8] The Norwegian population totals are from Statistics Norway (www.ssb.no).
[9] The homepage of The Norwegian Medical Association contains additional information on the GP refund arrangement, and the transition to electronic consultations during 2020 in Norway. https://normaltariffen.legeforeningen.no/book/Fastlegetariffen-2020/m-02.

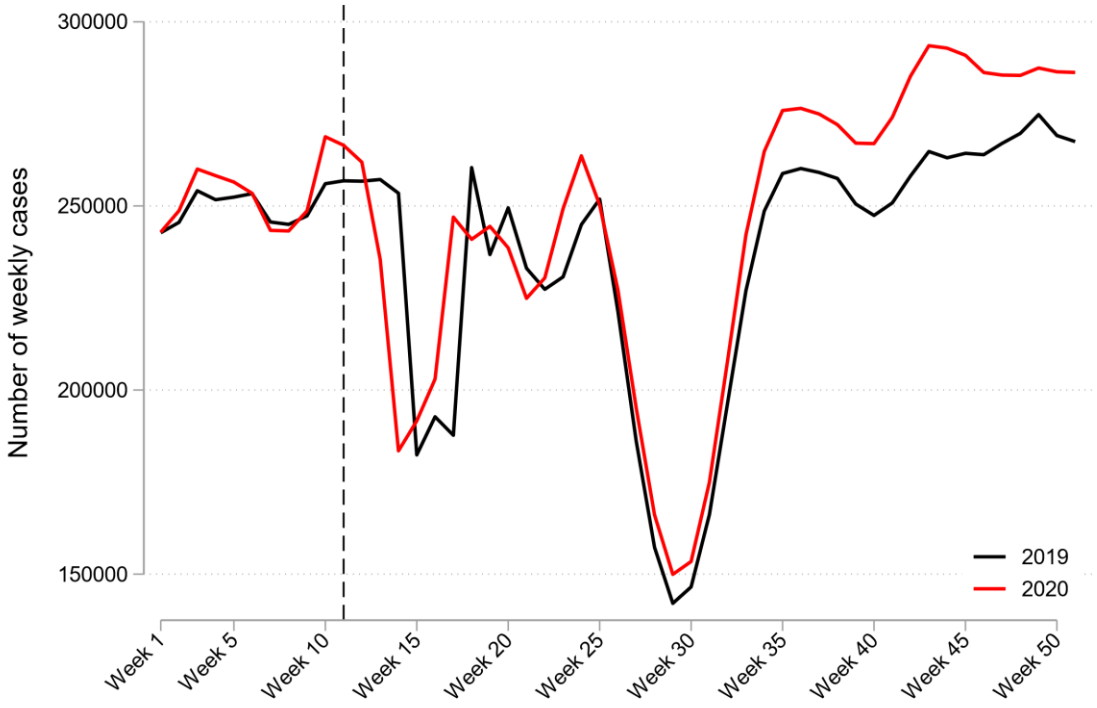

Fig S1. Number of weekly GP consultations in 2020 (red) versus 2019 (black)

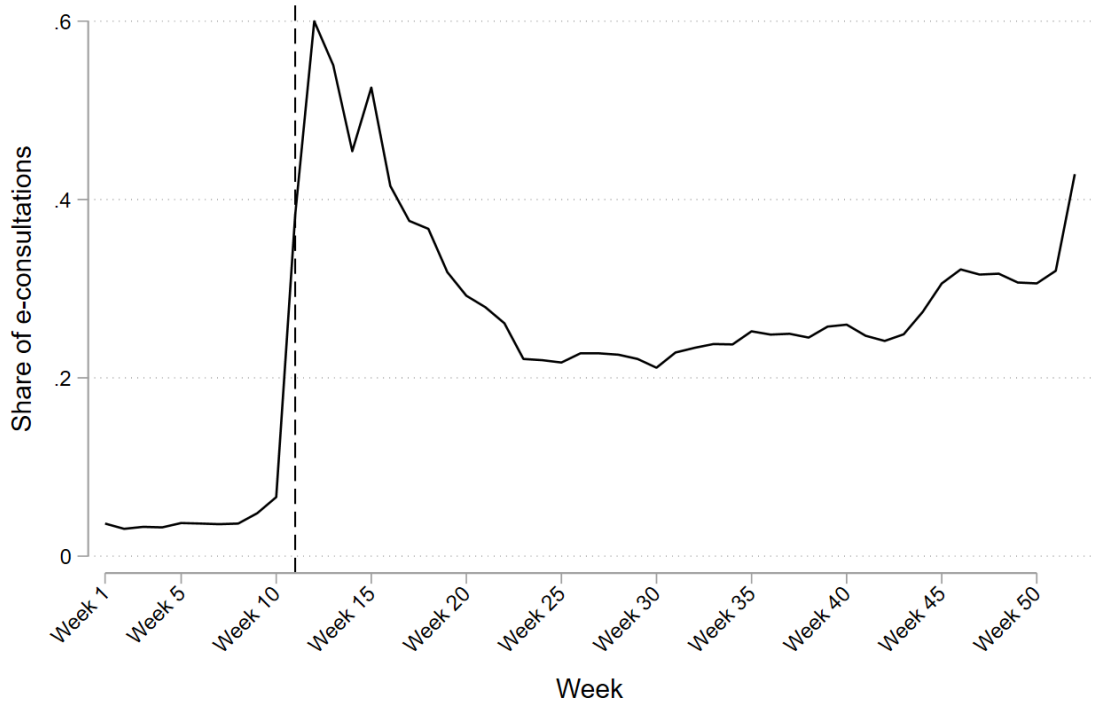

Fig S2. E-consultations as fraction of all consultations, by week of 2020