Changes in family medicine visits after the onset of the COVID-19 pandemic in Ontario: a retrospective cohort study

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Abstract:	Background: The COVID-19 pandemic has markedly changed the practice of family medicine. There are concerns that the pandemic may have worsened socioeconomic disparities in access to family physicians. The aim of the current study was to demonstrate the impact of COVID-19 on family physician visits and to determine how these changes related to patient demographic characteristics. Methods: Billing data for January 1, 2019-June 30, 2020 was extracted from electronic medical records of 365 family physicians (N = 372,272 patients) who are part of the University of Toronto Practice-Based Research Network (UTOPIAN) and used to study changes in family physician visits with the onset of the COVID-19 pandemic in Ontario. Results: During the pandemic (March 14-June 30, 2020), the number of individual patients seen was 35% lower (95,643 compared to 146,039 in 2019) and the number of distinct visits was 22% lower (187,392

	compared to 239,605 in 2019), with 85% of visits (159,414/187,392) occurring via telephone or video. Changes in the number of patients seen during the pandemic were unrelated to neighbourhood income, material deprivation, and ethnic conception (ps <.05). Patients from the lowest income and lowest socioeconomic status communities accessed slightly more care than other patients during the pandemic, accounting for larger proportions (ps <.05) of the total number of visits compared to the same time the year before. Interpretation: Although family physician visits were substantially reduced during the first few weeks of the COVID-19 pandemic, this did not disproportionately affect low income or low socioeconomic status communities.

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Data sharing statement:

Analytic code used for this study is archived within the UTOPIAN Data Safe Haven and is available upon request.

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Abstract

Background: The COVID-19 pandemic has markedly changed the practice of family medicine. There are concerns that the pandemic may have worsened socioeconomic disparities in access to family physicians. The aim of the current study was to demonstrate the impact of COVID-19 on family physician visits and to determine how these changes related to patient demographic characteristics.

Methods: Billing data for January 1, 2019-June 30, 2020 was extracted from electronic medical records of 365 family physicians (N = 372,272 patients) who are part of the University of Toronto Practice-Based Research Network (UTOPIAN) and used to study changes in family physician visits with the onset of the COVID-19 pandemic in Ontario.

Results: During the pandemic (March 14-June 30, 2020), the number of individual patients seen was 35% lower (95,643 compared to 146,039 in 2019) and the number of distinct visits was 22% lower (187,392 compared to 239,605 in 2019), with 85% of visits (159,414/187,392) occurring via telephone or video. Changes in the number of patients seen during the pandemic were unrelated to neighbourhood income, material deprivation, and ethnic conception (ps <.05). Patients from the lowest income and lowest socioeconomic status communities accessed slightly more care than other patients during the pandemic, accounting for larger proportions (ps <.05) of the total number of visits compared to the same time the year before.

Interpretation: Although family physician visits were substantially reduced during the first few weeks of the COVID-19 pandemic, this did not disproportionately affect low income or low socioeconomic status communities.

Introduction

The COVID-19 pandemic has had profound impacts on health care and society around the world. A major concern has been that health inequities attributed to socioeconomic disparities may be exacerbated, both in terms of the risk of developing COVID-19 (1) as well as poor outcomes among those who become infected (2–4). Supporting health equity has been an important feature of health system and primary care responses to COVID-19 (5–8). While social distancing and closure of businesses are considered important public health interventions widely recommended across jurisdictions to limit the spread of COVID-19 (9), there are concerns that these public health recommendations may also lead to worsening social disparities (10) and differential access to health care services, which could lead to poorer health outcomes both during the pandemic and in the future. The existence of socioeconomic disparities in primary care is well established across jurisdictions (11,12), however the extent to which the COVID-19 pandemic is worsening these disparities is not yet understood.

In Ontario, Canada, substantial changes occurred to health system operation with the onset of the pandemic. Ontario has a government single-payer health system through the Ontario Health Information Plan (OHIP) covering primary and hospital care for the vast majority of Ontario residents (13). At the start of the COVID-19 pandemic in mid-March 2020, non-essential hospital services were ordered to be substantially reduced (14), and family physicians were advised to switch, as much as possible, to ‘virtual’ (phone or video) visits instead of meeting patients in-person (15). This was incentivized through the introduction of virtual visit billing codes that were equivalent to those previously used to bill for in-person visits (16). Prior to this, virtual visits in primary care were not widely utilized as insured services under OHIP (17). This was an unprecedented modification to the conduct of family medicine in Ontario and occurred concurrently with public health interventions including a provincial state of emergency involving instructions to only leave home for essential purposes such as accessing health care (18). It is therefore unknown what effects these multiple interventions and recommendations may have on differential access to family physicians across socioeconomic groups. Understanding patterns of family physician visits in the context of these marked changes is essential to anticipate future needs and to plan health services going forward.

Methods

Study design

We used a retrospective cohort design in which primary care visits for a fixed cohort of patients were observed in an 18-month period that included the onset of the COVID-19 pandemic (January 1, 2019 – June 30, 2020). A fixed cohort of patients was used to minimize the impact of potential changes access to care for new patients. The STROBE and RECORD guidelines for studies using observational data were applied (19).

Data Source

Data for this study were from the University of Toronto Practice-Based Research Network (UTOPIAN) Data Safe Haven, a primary care electronic medical record (EMR) database (20). This database includes records from 88 family medicine clinics in the Greater Toronto Area and beyond. To be eligible for inclusion in this study family physicians had to have: 1) billing, medication, and lab data recorded for at least 20% of their patients, 2) at least 200 rostered patients, and 3) have started using their EMR on or before January 1, 2019. To be eligible for inclusion, patient records had to have: 1) patient sex and a valid month and year of birth recorded, 2) their first entry within the EMR on or before January 1, 2019 (unless the patient was born after this date, in which case at least one visit documented in the EMR was sufficient for inclusion), and 3) been rostered to a participating physician or have had at least one period health exam or last 2 visits with a participating physician within the past 3 years (see Supplementary Appendix). This study was approved through the University of Toronto and North York General Hospital research ethics boards.

Outcome Measures

Two outcome measures were used: 1) the number of different individual patients seen during a fixed period of time (patient volume), and 2) the number of distinct family physician visits that occurred during a fixed period of time (visit volume). The occurrence of a family physician visit was defined based on OHIP service billing codes recorded within the EMR. A detailed description of the codes used to indicate a family physician office visit is provided in the Appendix. A maximum of one in-person visit and one virtual visit via telephone or video was counted per patient per day.

Sociodemographic Measures

Measures of neighbourhood income, material deprivation, and ethnic concentration were derived based on the patient's postal code. These were mapped to previously defined quintiles for neighbourhood income (21) and the material deprivation and ethnic concentration dimensions of the Ontario Marginalization Index (22). Material deprivation refers to inability for individuals and communities to access and attain basic material needs and is a useful proxy for an individual's socioeconomic status (22, 23). Ethnic concentration refers to the area-level concentration of people who are recent immigrants and/or members of a “visible minority” group (defined by Statistics Canada as “persons, other than aboriginal peoples, who are non-Caucasian in race or non-white in colour”) (22). It provides measure of race/ethnicity that has been used to study health equalities, including COVID-19 epidemiology (24).

Analytic approach

Descriptive statistics were used to evaluate changes in patient volume and visit volume over time. A series of comparisons were made between groups using chi-square tests to evaluate differences in family medicine visits based on patient sex, age, and neighbourhood-level income, material deprivation, and ethnic concentration. When a significant difference was observed, we examined standardized residuals and used the Holm’s procedure to adjust for the effect of multiple comparisons (25).

Patients were first compared based on whether they visited their family physician at least once during the study period (visitors) or had no visits recorded (non-visitors). Next, the patient volume and visit volume was computed for each week in the observation period, and aggregated for key time periods: January 1, 2020-March 13, 2020 (pre-pandemic period) and March 14 – June 30, 2020 (pandemic period) and the corresponding periods covered by the same dates in 2019. We then computed estimates of year-over-year change in patient and visit volumes and compared the magnitude of these changes across patient age, sex, and socioeconomic groups. The proportion of patients in each age, sex, and socioeconomic groups during the pandemic period in 2020 was compared to the corresponding proportion for the same time the year before.

Comparing the pandemic period in 2020 to the same dates in 2019 was done to account for potential seasonality effects in patient and visit volumes.

Results

A total of 365 family physicians and 372,272 patients met criteria for inclusion in the research cohort. From January 1, 2019 to June 30, 2020, there were 1,115,691 distinct visits and 952 instances when a patient had both an in-person visit and a virtual visit within the same day. Across the 18-month observation period, 276,144 (74.2%) patients had at least one family physician visit and 96,128 (25.8%) patients did not have any visits with their UTOPIAN family physician. Patients who did not see their family physician during the study period were younger, more likely to be male and more likely to be from neighbourhoods with the lowest income, most material deprivation and most ethnic diversity (Table 1).

Weekly patient counts and visits volumes for the full observation period are summarized in Figures 1 and 2. Data from the first half of the year in 2019 and 2020 were used to make year-over-year comparisons in patient volume (Table 2) and visit volume (Table 3). From January to mid-March 2020 (pre-pandemic period), patient volume and visit volume remained nearly identical to the year before (235 or 0.22% fewer individual patients and 1228 or 0.80% fewer visits). From mid-March to the end of June (pandemic period) patient volume and visit volume was substantially lower in 2020 compared to the year before, with 50,396 (34.5%) fewer individual patients visiting their family physician and 52,213 (21.8%) fewer patient visits. During the 2020 pandemic period 85.1% of patient visits (N = 159,415) occurred virtually, via telephone or video.

The magnitude of pandemic-related changes in patient volume and visit volume was not the same for all patient groups, as shown in Figures 1 and 2. The largest absolute changes in patient and visit volumes were observed for females, people over age 65, and patients from the highest income, least materially deprived, and most ethnically diverse communities. However, these are the groups with the greatest representation in the UTOPIAN cohort and the highest service use in 2019. Based on relative measures of year-over-year change, male patients and patients aged 18 and younger showed the largest decreases during the pandemic.

As shown in Table 4, relative change in patient volume varied significantly based on patient sex and age categories, but not with respect to neighbourhood income, material deprivation, and ethnic concentration quintiles. Relative change in visit volume was significantly associated with patient age and sex, as well as neighbourhood income, material deprivation, and ethnic concentration. Patients who were female, from the middle age categories, or from neighbourhoods with the lowest income, lowest or highest material deprivation, or moderate ethnic concentration (4th quintile) accounted for a larger proportion of the total visit volume during the 2020 pandemic period than they did the year before.

Interpretation

This study of data from 365 family physicians in Ontario, Canada demonstrated a substantial drop in the number of individual patients seen and total volume of visits during the first few months of the COVID-19 pandemic. More than a third fewer individual patients were seen at UTOPIAN sites from mid-March through the end of June in 2020, compared to the same time period in 2019. Although the corresponding drop in the total number of family physician visits was not as large, it was still over 20% lower than in 2019. The format of care delivery also changed, with a substantial reduction in the number of in-person visits and a corresponding increase in virtual visits conducted via telephone or video. This is consistent with public health recommendations and recent reports of changes in family physicians' services in other parts of Canada (26,27) and internationally (28,29).

Despite concerns of worsening socioeconomic disparities in health care, we did not find any evidence that access to family physician visits after the onset of the COVID-19 pandemic differed based on neighbourhood income, material deprivation, or ethnic concentration. The proportion of patients from each socioeconomic quintile seen in primary care did not change as a result of the COVID-19 pandemic onset. However, there were differences in total visit volume as a function of neighbourhood characteristics. The reasons for these differences warrant further investigation and may reflect differences in how and when multiple distinct visits occurred for the same patient (e.g., a telephone visit followed by a visit in-person). Nevertheless, the pattern of change in visit volumes is not consistent with worsening socioeconomic disparities. Patients from the most disadvantaged neighbourhoods (i.e., lowest income / highest material deprivation) did not experience disproportionate decreases in visit volume; in fact, this group accounted for a larger proportion of total visit volume in the 2020 than it did in 2019. It is possible that the increased availability of services provided via telephone may have reduced some barriers to accessing family physician services and increased the number of visits for some patients.

There are several important features of the current study to consider when contextualizing the findings within the broader literature on socioeconomic disparities and health care changes due to COVID-19. For patients in the current study, access to family physician services was provided at no cost to the patient through a government funded insurance plan. Access to health insurance was not affected by disparities in loss of employment that occurred during the pandemic (30), thus our findings may not generalize to contexts where access to health insurance is provided through employment-based insurance programs. The UTOPIAN research cohort was limited to patients who had recently visited or were currently ‘rostered to’ a family physician (‘rostering’ is a process in Ontario where a patient-physician relationship is formally established, and physicians are compensated through a blended-capitation payment model). Past research has found that patients without a regular family physician are more likely to be male, younger, or a recent immigrant (31). Disparities in who becomes a ‘rostered’ patient were outside the scope of the current study; the extent to which these disparities in access to a regular family physician have worsened during the COVID-19 pandemic is an area for further research. It is also important to consider the potential for disparities in the effectiveness of family physician care during the pandemic. Although we found that patients from different socioeconomic groups were equally likely to be seen by their family physician during the pandemic, this does not necessarily mean that the care they received, largely via telephone, was equally effective or appropriate for all patients. Further research is needed to evaluate which types of services can be delivered effectively via telephone and video, and for which patients. Services such as childhood immunizations cannot be delivered virtually and may have been delayed given the decreased visit volumes observed for children.

There are several limitations, including that our analysis was limited to events that occurred in 2019 and the first half of 2020 for a convenience (non-probability) sample of family physicians. The effects of the COVID-19 pandemic are ongoing and UTOPIAN practices are not necessarily representative of the experience across Ontario. Furthermore, neighbourhood level measures of income, socioeconomic status, and ethnic concentration were used; these measures derived from postal codes provide a useful proxy for individual level measures (22,23). However, it is possible that there are disparities in family physician visits within neighbourhoods or communities that could not be observed in the current study. Reasons for visiting a family physician were not considered in the current analysis. These may vary based on underlying health risks (e.g., disease comorbidities) and patient demographics such as age and sex. Further investigation is needed to understand if health services provided during the pandemic are reaching those with the greatest needs.

Overall, our findings show that family physician visits changed substantially during the first few months of the COVID-19 pandemic in Ontario, Canada. There were fewer patients accessing services, fewer office visits, and more services being provided via telephone or video. Fortunately, the swift response to the COVID-19 pandemic in primary care appears to have been successful in maintaining access to care across socioeconomic groups in our study setting. Nevertheless, efforts to assess and minimize socioeconomic disparities in health care will need to continue as the effects of the COVID-19 pandemic continue to evolve.

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Tables

Table 1. Characteristics of patients with and without a family physician visit between January 1, 2019 and June 30, 2020

	All patients		**Patients with one or more visits during observation period (visitors)**		**Patients without any visits during observation period (non-visitors)**		**Significant difference between visitors and non-visitors**
	N	**% of total**	**N**	**% of total**	**N**	**% of total**	
Total	372,272		276,144		96,128		
Mean age (SD)	43.07 (23.18)		44.95 (23.38)		37.66 (21.71)		*p* <.001
Age groups							*p* <.001
18 years and under	67,481	18.1	46,150	16.7	21,331	22.1	NV
19-34 years	71,168	19.1	46,386	16.8	24,782	25.8	NV
34-49 years	78,217	21.0	55,997	20.3	22,220	23.1	NV
50-64 years	80,885	21.7	64,434	23.3	16,451	17.1	V
65 years and over	74,521	20.0	63,177	22.9	11,344	11.8	V
Sex							*p* <.001
female	205,877	55.3	160,171	58.0	45,706	47.6	V
male	166,395	44.7	115,973	42.0	50,422	52.5	NV
Income quintiles							*p* <.001

	All patients		**Patients with one or more visits during observation period (visitors)**		**Patients without any visits during observation period (non-visitors)**		**Significant difference between visitors and non-visitors**
	N	**% of total**	**N**	**% of total**	**N**	**% of total**	
Q1 = poorest	68,948	18.5	49,622	18.0	19,326	20.1	NV
Q2	58,900	15.8	43,892	15.9	15,008	15.6	V
Q3	61,686	16.6	46,214	16.7	15,472	16.1	V
Q4	72,723	19.53	54,506	19.7	18,217	19.0	V
Q5 = richest	100,665	27.0	76,048	27.5	24,617	25.6	V
Missing	9,350	2.5	5,862	2.1	3,488	3.6	
Material deprivation quintiles							*p* <.001
Q1 = least deprived	95,042	25.5	72,057	26.1	22,985	23.9	V
Q2	86,220	23.2	64,671	23.4	21,549	22.4	V
Q3	68,833	18.5	51,536	18.6	17,297	18.0	V
Q4	56,648	15.2	42,270	15.3	14,378	15.0	V
Q5 = most deprived	55,117	14.8	39,054	14.2	16,063	16.7	NV

	All patients		Patients with one or more visits during observation period (visitors)		Patients without any visits during observation period (non-visitors)		Significant difference between visitors and non-visitors
	N	**% of total**	**N**	**% of total**	**N**	**% of total**	
Missing	10,412	2.8	6,556	2.4	3,856	4.0	NV
Ethnic concentration quintiles							*p* <.001
Q1 = least ethnic diversity	35,638	9.6	26,918	9.8	8,720	9.1	V
Q2	48,074	12.9	35,979	13.0	12,095	12.6	V
Q3	68,546	18.4	51,473	18.6	17,073	17.8	V
Q4	96,757	26.0	72,948	26.4	23,809	24.8	V
Q5 = most ethnic diversity	112,845	30.3	82,270	29.8	30,575	31.8	NV
Missing	10,412	2.8	6,556	2.4	3,856	4.0	NV

NV = statistically significant comparison (p<.05) with proportion among non-visitors greater than proportion among visitors. V = statistically significant comparison (p<.05) with proportion among visitors greater than proportion among non-visitors.

Table 2. Year-over-year change in patient volume from 2019 to 2020, before and after pandemic onset

		January 1 to March 13				March 14 to June 30			
		Number of patients in 2019	Number of patients in 2020	Absolute change year over year	Percent change year over year	Number of patients in 2019	Number of patients in 2020	Absolute change year over year	Percent change year over year
Total number of individual patients		108,560	108,325	-235	-0.22	146,039	95,643	-50,396	-34.5
By patient sex	Female	65,178	64,774	-404	-0.62	87,509	58,757	-28,752	-32.9
	Male	43,382	43,551	169	0.39	58,530	36,886	-21,644	-37.0
By patient age	18 years and under	15,751	16,077	326	2.1	20,314	11,383	-8,931	-44.0
	19-34 years	16,366	16,133	-233	-1.4	21,722	15,264	-6,458	-29.7
	34-49 years	21,319	21,150	-169	-0.79	27,553	18,655	-8,898	-32.3
	50-64 years	26,532	26,561	29	0.11	35,137	23,331	-11,806	-33.6
	65 years and over	28,592	28,404	-188	-0.66	41,313	27,010	-14,303	-34.6
By income quintile	Q1 = poorest	21,156	21,041	-115	-0.54	27,837	18,608	-9,229	-33.2
	Q2	17,644	17,630	-14	-0.08	23,861	15,774	-8,087	-33.9
	Q3	18,185	18,123	-62	-0.34	24,436	16,023	-8,413	-34.4
	Q4	20,842	21,024	182	0.87	28,008	18,075	-9,933	-35.4
	Q5 = richest	28,488	28,392	-96	-0.34	38,930	25,184	-13,746	-35.3
	Missing	2,245	2,115	-130	-5.8	2,967	1,979	-988	-33.3

		January 1 to March 13				March 14 to June 30			
		Number of patients in 2019	**Number of patients in 2020**	**Absolute change year over year**	**Percent change year over year**	**Number of patients in 2019**	**Number of patients in 2020**	**Absolute change year over year**	**Percent change year over year**
By material deprivation quintile	Q1 = least deprived	27,685	27,405	-280	-1.0	37,564	24,556	-13,008	-34.6
	Q2	24,544	24,731	187	0.76	33,332	21,514	-11,818	-35.5
	Q3	20,088	20,210	122	0.61	27,120	17,714	-9,406	-34.7
	Q4	17,075	17,115	40	0.23	22,922	15,054	-7,868	-34.3
	Q5 = most deprived	16,661	16,489	-172	-1.0	21,763	14,594	-7,169	-32.9
	Missing	2,507	2,375	-132	-5.3	3,338	2,211	-1,127	-33.8
By ethnic concentration quintile	Q1 = least ethnic diversity	10,217	10,238	21	0.21	14,282	9,579	-4,703	-32.9
	Q2	13,744	13,845	101	0.73	18,589	12,287	-6,302	-33.9
	Q3	19,740	19,782	42	0.21	26,449	17,497	-8,952	-33.9
	Q4	28,421	28,583	162	0.57	38,557	25,123	-13,434	-34.8
	Q5 = most ethnic diversity	33,931	33,502	-429	-1.3	44,824	28,946	-15,878	-35.4
	Missing	2,507	2,375	-132	-5.3	3,338	2,211	-1,127	-33.8

Table 3. Year-over-year change in visit volume from 2019 to 2020, before and after pandemic onset

		January 1 to March 13				March 14 to June 30			
		Number of visits in 2019	**Number of visits in 2020**	**Absolute change year over year**	**Percent change year over year**	**Number of visits in 2019**	**Number of visits in 2020**	**Absolute change year over year**	**Percent change year over year**
Total number of distinct patient visits		153,896	155,124	1,228	0.80	239,605	187,392	-52,213	-21.8
By patient sex	Female	93,797	94,266	469	0.50	147,185	118,509	-28,676	-19.5
	Male	60,099	60,858	759	1.26	92,420	68,883	-23,537	-25.5
By patient age	18 years and under	21,329	22,420	1,091	5.12	30,962	19,713	-11,249	-36.3
	19-34 years	23,307	22,955	-352	-1.51	35,204	30,018	-5,186	-14.7
	34-49 years	30,555	30,158	-397	-1.30	44,448	36,767	-7,681	-17.3
	50-64 years	37,364	37,429	65	0.17	56,840	45,312	-11,528	-20.3
	65 years and over	41,341	42,162	821	1.99	72,151	55,582	-16,569	-23.0
By income quintile	Q1 = poorest	31,569	31,497	-72	-0.23	49,299	39,230	-10,069	-20.4
	Q2	25,307	25,628	321	1.27	40,164	31,664	-8,500	-21.2
	Q3	25,623	25,730	107	0.42	39,713	31,200	-8,513	-21.4
	Q4	29,087	29,536	449	1.54	44,849	34,274	-10,575	-23.6
	Q5 = richest	39,037	39,515	478	1.22	60,498	47,142	-13,356	-22.1
	Missing	3,273	3,218	-55	-1.68	5,082	3,882	-1,200	-23.6

		January 1 to March 13				March 14 to June 30			
		Number of visits in 2019	**Number of visits in 2020**	**Absolute change year over year**	**Percent change year over year**	**Number of visits in 2019**	**Number of visits in 2020**	**Absolute change year over year**	**Percent change year over year**
By material deprivation quintile	Q1 = least deprived	38,554	38,773	219	0.57	59,950	47,903	-12,047	-20.1
	Q2	34,150	34,793	643	1.88	52,820	40,873	-11,947	-22.6
	Q3	28,083	28,595	512	1.82	43,878	33,628	-10,250	-23.4
	Q4	24,621	24,616	-5	-0.02	38,708	29,849	-8,859	-22.9
	Q5 = most deprived	24,751	24,714	-37	-0.15	38,439	30,855	-7,584	-19.7
	Missing	3,737	3,633	-104	-2.78	5,810	4,284	-1,526	-26.3
By ethnic concentration quintile	Q1 = least ethnic diversity	14,197	14,551	354	2.49	23,117	17,910	-5,207	-22.5
	Q2	19,306	19,651	345	1.79	29,937	22,547	-7,390	-24.7
	Q3	27,459	27,785	326	1.19	42,070	33,356	-8,714	-20.7
	Q4	39,860	40,637	777	1.95	62,115	49,089	-13,026	-21.0
	Q5 = most ethnic diversity	49,337	48,855	-482	-0.98	76,556	59,284	-17,272	-22.6
	Missing	3,737	3,633	-104	-2.78	5,810	4,269	-1,541	-26.5

Table 4. Proportion total patient volume and total visit volume by age, sex, and socioeconomic group from March 14 – June 30 in 2019 and 2020

		Proportion of total patient volume			Proportion of total visit volume		
Factor	**Comparison**	**2019**	**2020**	**Difference test**	**2019**	**2020**	**Difference test**
Sex	Female (vs Male)	59.9%	61.4%	*p* <.001	61.4%	63.2%	*p* <.001
Age groups				*p* <.001			*p* <.001
	Ages 0-18	13.9%	11.9%	-	12.9%	10.5%	-
	Ages 19-34	14.9%	16.0%	+	14.7%	16.0%	+
	Ages 35-49	18.9%	19.5%	+	18.6%	19.6%	+
	Ages 50-64	24.1%	24.4%		23.7%	24.2%	+
	Ages 65+	28.3%	28.2%		30.1%	29.7%	-
Income				*p* = .059			*p* = .001
	Q1 = poorest	19.1%	19.5%		20.6%	20.9%	+
	Q2	16.3%	16.5%		16.8%	16.9%	
	Q3	16.7%	16.8%		16.6%	16.7%	
	Q4	19.2%	18.9%		18.7%	18.3%	-
	Q5 = richest	26.7%	26.3%		25.2%	25.2%	
	Missing	2.0%	2.1%		2.1%	2.1%	
Material deprivation				*p* = .155			*p* <.001
	Q1 = least deprived	25.7%	25.7%		25.0%	25.5%	+
	Q2	22.8%	22.5%		22.0%	21.8%	

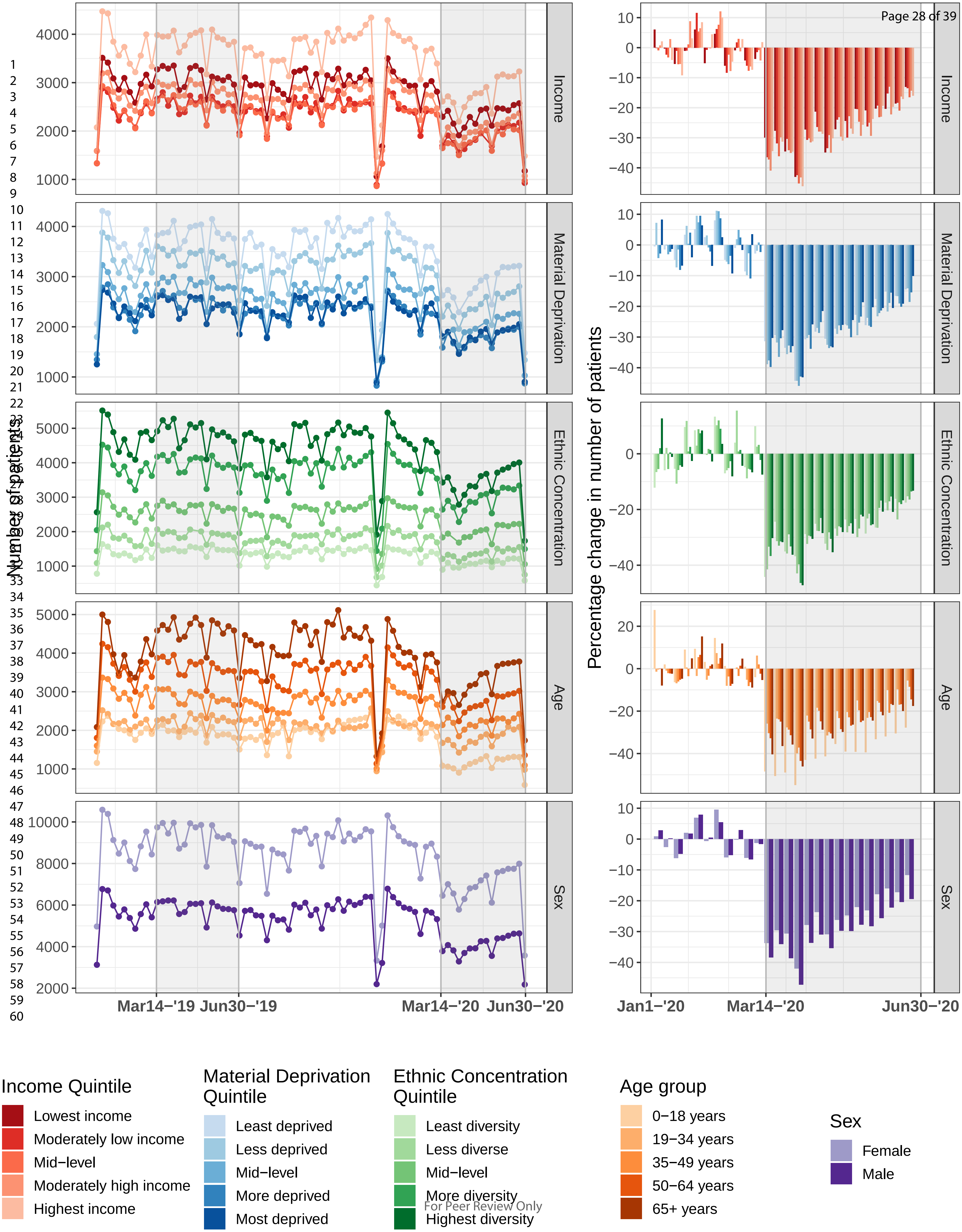
		Proportion of total patient volume			Proportion of total visit volume		
Factor	**Comparison**	**2019**	**2020**	**Difference test**	**2019**	**2020**	**Difference test**
	Q3	18.6%	18.5%		18.3%	17.9%	-
	Q4	15.7%	15.7%		16.2%	15.9%	
	Q5 = most deprived	14.9%	15.3%		16.0%	16.5%	+
	Missing	2.3%	2.3%		2.4%	2.3%	-
Ethnic concentration				*p* = .109			*p* <.001
	Q1 = least ethnic diversity	9.8%	10.0%		9.64%	9.56%	
	Q2	12.7%	12.8%		12.5%	12.0%	-
	Q3	18.1%	18.3%		17.6%	17.8%	
	Q4	26.4%	26.3%		25.9%	26.2%	+
	Q5 = most ethnic diversity	30.7%	30.3%		32.0%	31.6%	
	Missing	2.3%	2.3%		2.4%	2.3%	-

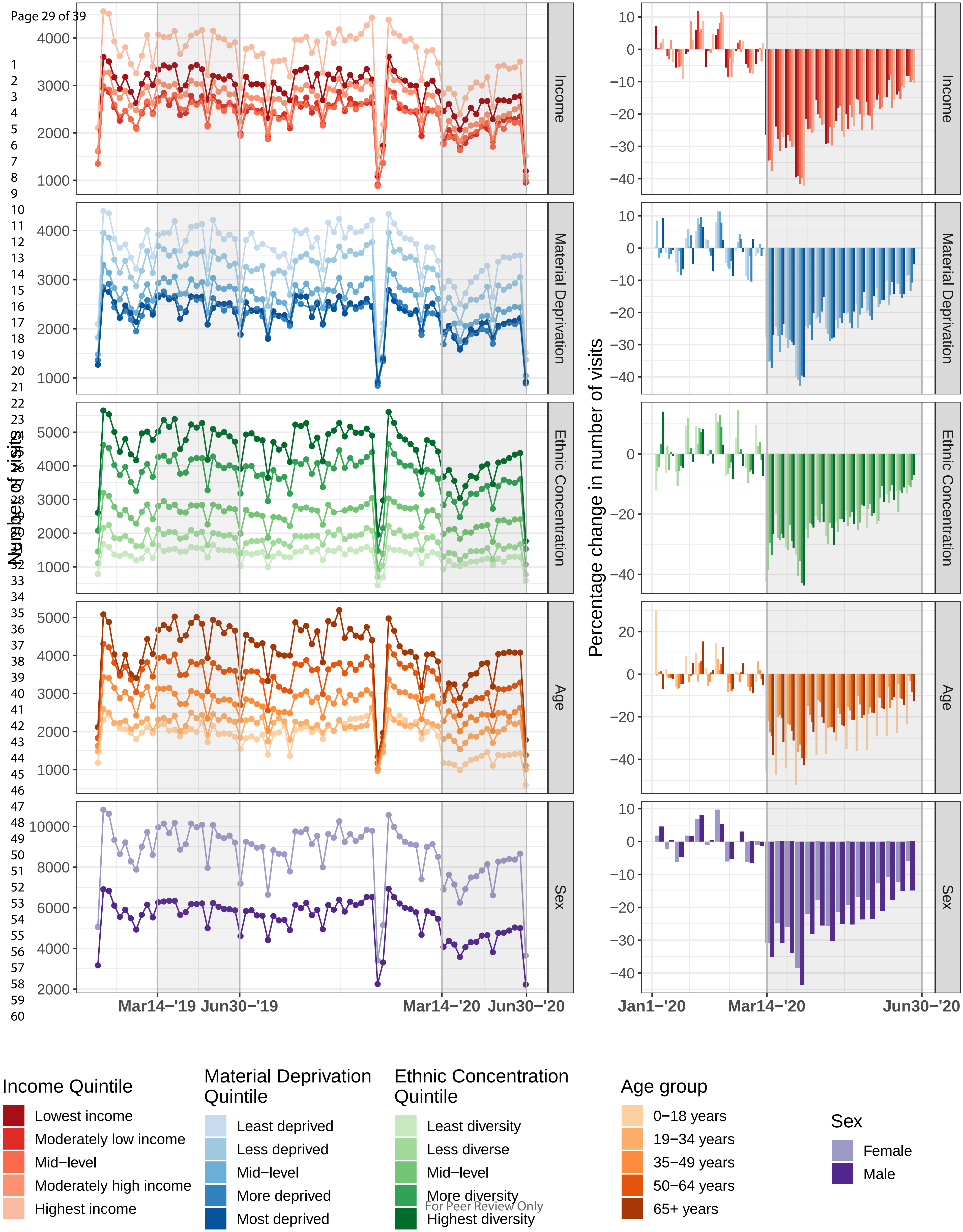
+ = statistically significant comparison (p<.05), with proportion in 2020 greater than proportion in 2019; - = statistically significant comparison (p<.05), with proportion in 2020 less than proportion in 2019.

Figure Captions

Figure 1. Change in number of unique patients visiting their family physician each week (patient volume), by patient characteristics. The shaded grey area indicates the 2020 pandemic period (March 14 – June 30) and corresponding period in 2019.

Figure 2. Change in number of unique patient visits each week (visit volume), by patient characteristics. The shaded grey area indicates the 2020 pandemic period (March 14 – June 30) and corresponding period in 2019.


Number of patients
Percentage change in number of patients
Income
Material Deprivation
Ethnic Concentration
Age
Sex
Mar14−'19
Jun30−'19
Mar14−'20
Jun30−'20
Jan1−'20
Income Quintile
Lowest income
Moderately low income
Mid−level
Moderately high income
Highest income
Material Deprivation Quintile
Least deprived
Less deprived
Mid−level
More deprived
Most deprived
Ethnic Concentration Quintile
Least diversity
Less diverse
Mid−level
More diversity
Highest diversity
Age group
0−18 years
19−34 years
35−49 years
50−64 years
65+ years
Sex
Female
Male


Number of visits
Percentage change in number of visits
Income
Material Deprivation
Ethnic Concentration
Age
Sex
4000
3000
2000
1000
5000
10000
8000
6000
10
0
−10
−20
−30
−40
20
Mar14−'19
Jun30−'19
Mar14−'20
Jun30−'20
Jan1−'20
Income Quintile
Lowest income
Moderately low income
Mid−level
Moderately high income
Highest income
Material Deprivation Quintile
Least deprived
Less deprived
Mid−level
More deprived
Most deprived
Ethnic Concentration Quintile
Least diversity
Less diverse
Mid−level
More diversity
Highest diversity
Age group
0−18 years
19−34 years
35−49 years
50−64 years
65+ years
Sex
Female
Male

Supplementary Appendix

Methodological details for: Changes in family medicine visits after the onset of the COVID-19 pandemic in Ontario: a retrospective cohort study (Stephenson et al. 2020)

Data Source

The 2020 Q2 data extract from the University of Toronto Practice-Based Research Network (UTOPIAN) Data Safe Haven was the data source used in the current study. This is the most recent data extract currently available. The cut-off date for inclusion in this data extract was June 30, 2020. The UTOPIAN Data Safe Haven includes electronic medical records collected from 88 family medicine clinics in the Greater Toronto Area and other parts of Ontario, Canada. Eligibility for inclusion in the data analysis was based on the following criteria.

Physician level: Family physicians were eligible to contribute to the research cohort if their EMR data met the following criteria:

1. The percentage of rostered patients[1] with a billing record in the year prior to the cut-off date (i.e., June 30, 2020) was greater than or equal to 20%.
2. The percentage of rostered adult patients with a *'selected' lab test* in the year prior to the cut-off date (i.e., June 30, 2020) was greater than or equal to 20%.
3. The percentage of rostered adult patients with a medication record in the year prior to the cut-off date (i.e., June 30, 2020) was greater than or equal to 20%.
4. The physician had at least 200 rostered patients.
5. The earliest date on which the physician had least 10 family physician visits[2] recorded in the EMR (i.e., the EMR start date) was January 1, 2019 or earlier.

Patient level: EMR data from patients who met all of the following criteria were included.

1. The patient had their sex and a valid month and year of birth recorded in the EMR.
2. The patient's EMR start date[3] must be at least 18 months prior to the cut-off date for data extraction (June 30, 2020), unless age <1.5 years at the cut-off date. If age < 1.5 years, then the patient must be rostered or have at least 1 Ontario Health Insurance Plan (OHIP) billing service code that is classified as a family physician office visit.[2]
3. The patient must:
    a. Be rostered to a participating physician
    OR
    b. Have documentation of a periodic health exam (OHIP billing service code K017, K130, K131, K132) in the past 3 years
    OR
    c. Have had at least two encounters in the past 3 years in which an OHIP service code was billed for a family physician office visit
    OR
    d. Have had at least two encounters in the past 3 years in which an OHIP service code was billed for a special or focused practice office visit, hospital visit (including hospital palliative care visit), emergency room visit, home visit, or long-term care visit AND have a populated cumulative patient profile.

Notes:

1. **Rostered patients:** Patient rostering is a process by which patients register with a family practice, family physician, or team. Patient rostering defines a population for which the primary care organization or provider is responsible and facilitates an ongoing relationship between the patient and provider. Patients are formally enrolled and enrolment records are updated through the submission of the Per Patient Rostering Fee (PPRF) Codes: Q200A or Q202A. Patients can be formally de-rostered if physicians submit one of the following PPDR Q codes: Q401A (De-Roster – Member Deceased); Q402A (De-Roster – Ended by Provider); Q403A (De-Roster – Patient Left Province). These Q codes were used to identify the number of rostered patients per physician.
2. **Family physician services: OHIP billing service codes** with a frequency of 50 or more were classified into family physician office visits, special or focused practice office visits, specialist visits, hospital visits, hospital or office prenatal or obstetrical care visits, hospital or home palliative care visits, emergency room visits, home visits, long term care visits, telephone consultations, nurse practitioner visits, add on/premium codes, tracking codes and miscellaneous billing codes.
3. **Patient EMR Start Date:** EMR start date for each patient is defined as the earliest date of a:
   a. of a family physician office visit
   OR
   b. a special or focused practice office visit, hospital visit (including hospital palliative care visit), emergency room visit, home visit or long-term care visit with a populated cumulative patient profile in the EMR AND a family physician office visit less than 1 year prior to the cut-off date for data extraction.

Measures

Family physician visits

OHIP service codes billed between January 1, 2019 and June 30, 2020 were used to select family physician visits that occurred via telephone, video, or in-person. Billing records for eligible patients containing any of the following service codes were counted as family physician visits.

“Visitors” were patients for whom any of these codes were billed between January 1, 2019 and June 30, 2020; “Non-visitors” were patients for whom none of these codes were billed between January 1, 2019 and June 30, 2020.

Code	Description	Code	Description
A001	minor assessment	K017	periodic health visit-child aft. 2nd birthday
A002	enhanced 18-month well baby visit	K022	hiv prim care individ care 1/2 hr or major part
A003	major assessment	K028	sexually transmitted disease (std) counseling
A004	general re-assessment	K030	diabetic management fee
A007	intermediate assessment	K032	gp-specific neurocognitive assessment
A008	mini assessment	K033	counselling - 1 pt/yr/unit
A071	complex medical specific re-assessment	K039	smoking cessation follow-up visit
A131	complex medical specific re-assessment	K130	periodic health visit - adolescent
A134	medical specific re-assessment	K131	periodic health visit - adult aged 18 to 64 inclusive
A624	medical specific re-assessment	K132	periodic health visit - adult 65 years of age and older
A888	partial assessment	K680	substance abuse - extended assessment
A903	pre-op assessment	P003	obs.-prenatal care-gen.assess-major prenatal visit
A920	medical management of early pregnancy, initial visit	P004	obs.-prenatal care-minor prenatal assess.-subseq.prenat.vis.
K005	primary mental health	P005	antenatal health screen
K007	ind. psychotherapy per half hour - gp	P008	obs.-post-natal care in office
K013	counselling-one or more people-per 1/2hr	K037	fibromyalgia/chronic fatigue syndrome care

K080	Minor assessment of patient by telephone or video	K081	Intermediate assessment including psychotherapy by telephone or video
K082	Psychotherapy, psychiatric or mental health counselling by telephone or video	K087	Minor assessment of an uninsured by telephone or video
K088	Intermediate assessment of an uninsured patient including psychotherapy by telephone or video	K089	Psychotherapy, psychiatric or mental health counselling of an uninsured patient by telephone or video

Visit format

Two visit formats were defined: ***virtual*** (i.e., telephone or video) and ***in-person***.

Virtual visits were defined based on the use of virtual visit billing codes introduced specifically in response to the COVID-19 pandemic or based on the use of codes for billing services to the Ontario Telehealth Network (a virtual care service that was implemented prior to the COVID-19 pandemic).

A ***virtual visit*** was counted for any date on which any of the following conditions were met:

1) A service code for a family physician visit was billed (as defined above) and an applicable Virtual Care Program (OTN) service code was billed (B099, B101, B102, B103, B201, B202, B203).
2) Any of the OHIP codes for family physician visits by telephone or video were billed: K080, K081, K082, K087, K088, K089.

An ***in-person visit*** was counted for any date on which any of the following criteria were met:

1) A service code for a family physician visit was billed (as defined above excluding visits by telephone or video -- K080, K081, K082, K087, K088, K089) AND no Virtual Care Program (OTN) service code was billed (B099, B101, B102, B103, B201, B202, B203).
2) A Virtual Care Program (OTN) service code and 2 or more service codes for a family physician visit (as defined above excluding visits by telephone or video -- K080, K081, K082, K087, K088, K089) were billed on the same date.

Patient sex. Sex is extracted from the EMR.

Patient age. Year and month of birth are extracted from the EMR. Each patient's age is calculated as of the cut-off date for data extraction (i.e., June 30, 2020), using the middle of the birth month as the day of birth.

Income quintile. Statistics Canada's Postal Code^{OM} Conversion File Plus (PCCF+) tool was used to assign an income quintile to each participant based on their postal address. The PCCF+ tool assigns postal codes to standard census geographic areas that have corresponding area-level equity stratifiers such as income quintiles and geographic location (urban and rural/remote). The Neighbourhood Income Quintile (CMA/CA) Before Tax (QABTIPPE) was used in the current study. This variable is constructed by using the distribution of incomes within census metropolitan areas (CMAs), census agglomerations (CAs) and provincial residual areas within a province to categorize these areas into income quintiles. Missing data on this variable could occur if no postal code was available in the EMR or is the corresponding income quintile was unknown/undefined.

Material deprivation quintile. The material deprivation dimension of the Ontario Marginalization Index uses 6 indicators that come from Statistics Canada and are extracted by the Ontario Agency for Health Protection and Promotion. Quintiles defined for each census dissemination area (DA) are available through Public Health Ontario and were used in the current study (i.e., variable "deprivation_q_DA16"). Statistics Canada's Postal Code^{OM} Conversion File Plus (PCCF+) tool was used to identify the appropriate dissemination area to each patient based their postal code.

Ethnic concentration quintile. The ethnic concentration dimension of the Ontario Marginalization Index uses 2 indicators that come from Statistics Canada and are extracted by the Ontario Agency for Health Protection and Promotion. Quintiles defined for each census dissemination area (DA) are available through Public Health Ontario and were used in the current study (i.e., variable "ethniccon_q_DA16"). Statistics Canada's Postal Code^{OM} Conversion File Plus (PCCF+) tool was used to identify the appropriate dissemination area to each patient based their postal code.

The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

Completed for manuscript titled: Changes in family medicine visits after the onset of the COVID-19 pandemic in Ontario: a retrospective cohort study (Stephenson et al., 2020)

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title (page 1) Abstract (page 3)	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	1.1 Abstract (page 3) 1.2 Title (page 1) 1.3 N/A
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction (page 5)		
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction (page 6)		
Methods					
Study Design	4	Present key elements of study design early in the paper	Study Design (page 6)		
Setting	5	Describe the setting, locations, and relevant dates, including	Data source (Page 6)		

		periods of recruitment, exposure, follow-up, and data collection			
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	Data source (Page 6-7)	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	Supplementary appendix
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Outcome measures (page 7) Sociodemographic measures (page 7-8)	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Supplementary appendix
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	Outcome measures (page 7) Sociodemographic measures (page 7-8)		

		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	Study design (page 6)		
Study size	10	Explain how the study size was arrived at	Data source (page 6)		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Outcome measures (page 7) Sociodemographic measures (page 7-8)		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Analytic Approach (page 8)		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	Supplementary Appendix

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Supplementary Appendix
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Results (page 9)	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Results (page 9); Supplementary Appendix
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Table 1 (page 18-20)		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time	Table 2 (page 21-22) Table 3 (page 23-24)		

		Case-control study - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Table 4 (page 25-26)		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses			
Discussion					
Key results	18	Summarise key results with reference to study objectives	Interpretation (page 10)		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Interpretation (page 12)	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Interpretation (page 11-12)

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Interpretation (page 13)		
Generalisability	21	Discuss the generalisability (external validity) of the study results	Interpretation (page 11-12)		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Funding statement (page 2)		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Data sharing statement (page 2)

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.