Primary care coding activity related to online consultations Exploratory analysis using OpenSAFELY

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Background

OpenSAFELY

OpenSAFELY is a new secure analytics platform for electronic health records (EHR) in the NHS, created to deliver urgent results during the global COVID-19 emergency. The platform uses a novel approach for enhanced security and timely data access that avoids the need to migrate large volumes of disclosive pseudonymised patient data outside of the secure environments managed by the EHR software companies (e.g. TPP, EMIS); instead, it relies on trusted analysts to run computations and analysis on near real-time pseudonymised patient records still held inside the data centres and secure cloud environments of EHR companies.

With the approval of NHS England (Appendix 5) we conduct a service evaluation using the NHS England OpenSAFELY Covid-19 research platform. In this particular report we look into understanding online consultation systems coding (OC) activity in general practices, via OpenSAFELY. This is being seen as a necessary pre-requirement step before scoping how primary care coded data could be used in the future to answer further analytical or research questions around online consultations. This work has used elements and learnings from the Service Restoration Observatory (SRO) and other OpenSAFELY repositories, to inform and develop the analysis.

NHSE/I Online consultations project

This particular analysis is being carried out in the context of the NHSE/I Digital First Primary Care programme, which has led the work on enabling the adoption and use of online consultation systems as a means to increase choice and flexibility for patients in accessing and receiving care and supporting practices to signpost and triage patients to the correct member of staff or service, prioritising care on need and optimising use of wider primary care roles. The NHS Long Term plan (pre Covid) committed to every patient having the right to digital first primary care by 2023/24 with a commitment in the GP contract for 21/22 for all practices to offer online and video consultations. Based on a rapid national collection [7] stood up in April 2020, as of 21st of June 2021 collection-reported OC capability stands at circa 79% of England practices, though true coverage is believed to stand closer to 95% (due to gaps in collection coverage). Utilisation stands at close to 10 weekly online consultation submissions per 1,000 England GP registered practice population (some of this may be understated due to collection coverage).[1]

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[1] Implementation supplier activity data on OC/VC collected under the Control of Patient Information notice under COVID. Figures retrieved 21/06/2021 from the *GP Online & Video Consultations Dashboard* on the FutureNHS Digital IPC Workspace [7]. The

Wider evaluations of the digital first approach, including in response to Covid-19, have been commissioned by DFPC and are underway.

OpenSAFELY was identified last year as a means of providing further rich intelligence (ranging from demographics to pathways and service use).

Given the recent and diverse nature of online consultation triages as a modality, the low maturity and guidelines around online consultation coding and the limited insight of the practice coding to date, it was agreed that the exploration should primarily focus on:

a) understanding **coding use and prevalence in the primary care record** by codes of interest, over time and in terms of national variation**.**

This loosely draws on the OpenSAFELY Service Restoration Observatory framework, though 'Online consultations' is formally a standalone approved project.

b) understanding **broad demographics and past clinical history** of those associated with online consultation-relevant codes

This draws on point 4 of the initial DFPC request brief and was also judged to be an area where OpenSAFELY could be more readily leveraged while avoiding some complications around defining 'OC consultation' as a physical unit.

These two areas are the focus of the present report and analysis. They may help inform further research questions and their feasibility.

It should also be noted that not only OpenSAFELY itself, but also the framework and procedures by which non- OpenSAFELY / DataLab researchers access and use the platform are still in active development and being trialled (Phase 2 in the OpenSAFELY project plan). As such, the present analysis project is part of a wider case study and 'Ways of working' pilot to onboard into OpenSAFELY any new approved users or researchers [9] (including NHSE/I/X analysts). Functionality and means for raising requests may evolve in the future to improve insight and facilitate project commissioning, scope and turnaround. Coverage, which up to recently had mainly covered TPP (OpenSAFELY-TPP) has now been extended to the EMIS EHR system (OpenSAFELY-EMIS) [8], though still in earlier development. Most of the outcomes in this report explore OpenSAFELY-TPP, though a more fixed-scope overall coding use and prevalence characterisation has been extended to OpenSAFELY-EMIS as well.

Methods

Using mainly OpenSAFELY-TPP, and to a more restricted extent OpenSAFELY-EMIS, which jointly cover ~96% of England's population, we have assessed coding activity in general practice in recent years (mainly from January 2019 until December 2020). The period was chosen to give us data pre- and post the first pandemic wave, and also covers the period during which online consultation systems were implemented in a widespread manner across GP practices.

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dashboard is available for NHS Organisations to use for the purposes of supporting implementation across Primary Care. Access requires authentication and authorisation.

Broad sociodemographic characterisation and clinical history of those with online consultation activity was also explored for the OpenSAFELY-TPP cohort (covering ~40% of England's population).

Methods - read codes relevant to online consultations

Coding systems

In general practice, staff record information about patients using clinical coding systems such as SNOMED-CT and dm+d.

System TPP is now fully compliant with SNOMED, with GPs using it in their front-end interactions with EHR systems having previously used CTV3. OpenSAFELY can query the records using either CTV3 or SNOMED which allows flexibility on querying some past activity that cannot be easily mapped to SNOMED-CT. A SNOMED-CT codelist has been created on OpenCodelists here and is available for inspection and re-use by anyone.

Approach to deciding read codes for interrogation

We could not ascertain the existence of a nationally recognised codelist for online consultation triages. The codelist was developed as follows:

a) browse the SNOMED CT Term Browser for relevant keywords * and children . Find its CTV3 equivalent (refset), if listed;

b) browse the "Read CTV3 to SNOMED CT Mapping Lookup (April 2020)" for relevant keywords * and children. Find its SNOMED equivalent, if listed;

c) Browse local TPP codes;

d) Pragmatically browse the literature, online resources and white publications for further code indications [1-5];

e) obtain clinical/programme input via the Digital First Primary Care programme (DFPC) on initially found codes of interest (long list from a-d), as well as further codes, to arrive at a refined list;

Keywords:

consultation (procedure); econsultation; indirect encounter; online; remote triage; telemedicine; telepractice

Table 1. SNOMED shortlist: The short-listed read codes in SNOMED (codelist builder draft here):

Code	name	ctv3/local TPP equiv.	TPP - in active use in at least one practice	EMIS - in active use in more than 5 practices
1068881000000101	eConsultation via online application (procedure)	Y1f3b	Y	Y
978871000000104	Consultation via multimedia (procedure)			
448337001	Telemedicine consultation with patient (procedure)	XaXcK	Y	Y
868184008	Telemedicine consultation with provider (procedure)			
719407002	Remote non-verbal consultation (procedure)			
763184009	Telepractice consultation (procedure)			
185320006	Encounter by computer link (procedure)	9N34. .9N34	Y	Y

1090371000000106	Referral to remote triage and advice service (procedure)			
325951000000102	Remote assessment encounter type (record artifact)			Y
325871000000103	Remote consultation encounter type (record artifact)	Y22b4	Y	Y
384131000000101	Remote encounter type (record artifact)			
325911000000101	Consultation via multimedia encounter type			Y
699249000	Alert received from telehealth monitoring system	XUman XaX2B 9G6..	Y	Y
401271004	E-mail sent to patient	Xalvi	Y	Y
325901000000103	Remote non-verbal consultation encounter type			
325981000000108	Remote non-verbal assessment encounter type			
325991000000105	Assessment via multimedia encounter type			
854891000000104	Telehealth encounter type			Y

SNOMED read code eConsultation via online application (1068881000000101, or Y1f3b in local TPP) has been explicitly linked to online consultations/triages by eConsult and NECS CSU in their SystemOne guidance, as well as code Consultation via multimedia encounter type (325911000000101) in NHSEI total triage guidance.

The two last columns give an indication, from the results in sections below, where recorded activity was eventually found in 2019-2020 in TPP and EMIS systems respectively.

For the majority of the report the analysis will query from the "lens" of SNOMED codes. The (legacy) CTV3 system shortlist can be found in Appendix 1. It is important to note that despite the different coding systems, OpenSAFELY has inbuilt mapping functionality that means that, if two codes in different coding systems have an agreed CTV3-SNOMED equivalence mapping to each other, this will be fully reflected in the activity count (*e.g. for eConsultation via online application, local CTV3 code Y1f3b has a mapping to SNOMED code 1068881000000101. Regardless of if one decides to query via the CTV3 or SNOMED one, all eConsultation coding instances will be accounted for).*

Cautions when interrogating codes and coding activity

When interpreting output charts and tables please bear in mind:

- All occurrences of codes are included and they do not necessarily indicate unique or new events (e.g. one patient encounter could generate several similar codes, one patient might have similar diagnoses recorded multiple times over time, or practices might bulk-import information).
- There might be other similar codes occurring in the data that are not included in the charts.
- Conversely, codes may not be exclusively used for the activity under study.
- Not all codes represent activity occurring in general practice and may have been passed into the patient record from other services, including third party systems.
- Some apparent changes may represent changes in coding behaviour or displaced activities.
- Coding is dependent on manual input so prone to inconsistency and gaps.

To note further on online consultations:

Coding of online consultations and interpretation of recorded activity is not straightforward. This is due to a series of reasons:

- The use of online consultation systems and its national roll-out across practices are fairly recent. These codes do not differentiate between administrative and clinical activity, route of access. They also do not differentiate between requests made using an online consultation system (route of access) and written online consultation appointments (mode of consultation with a patient/carer)

- There aren't yet specific SNOMED codes for online consultation submissions and written online consultation appointments (in development). Coding (and clinical coding system) will namely depend on the specific supplier technology and its template implementation;

- The implementation of online consultation systems can differ among practices design-wise, both in terms of the patient journey and the underlying technology. Within a practice, more than one type of patient journey (pathway, disposition) is also likely to be available. Therefore, the nature of the (series of) codes generated will differ;

- Contrary to typical SRO studies to date, we may not be departing from an existing, pre-covid baseline, where "restoration" is the lens, but rather tracking implementation and uptake that happened concurrently to the pandemic. Confounding may be exacerbated.

- Where new codes have been created recently that are relevant to online consultations, these are typically SNOMED and will tend to not have a CTV3 equivalent unless a local code is defined. Nevertheless, TPP is still quite reliant historically on CTV3 so the richness of recording will largely be in the legacy system (if using SNOMED, it may only do so via mapping to CTV3).

- Some codes, though potentially used in the scope of online consultations, may not be unique to it, i.e. they may be used as well in the context of video consultations or other remote or computer-based interventions.

- In some cases, guidance is given for new forms of consultations to be recorded in annotated free-text fields of higher-level codes. Free text querying functionality is not currently available in OpenSAFELY

Methods - Coding activity prevalence [TPP]

For OpenSAFELY-TPP, we show the number of times each code was recorded over the period from January 2019 to December 2020, at monthly intervals. Values are given per 1,000 registered population. For context, the GP consultation activity over that same period is also recorded - the latter uses a purpose-built function on OpenSAFELY rather than relying solely on counting code instances[2] [10]. Practice coverage (number of practices with at least one instance of the code over the two year period) is also calculated, at both national and regional level.

Broadly in line with the Service Restoration Observatory work, we also calculated the rate at which certain codes were recorded per 1,000 registered patients at a general practice level (among practices with any instance over the two year period) and we present this as decile charts. We display the median and interdecile range for February, April and December 2020, and, in order to aid interpretation, classify changes to the median using the following:

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[2] OpenSAFELY-TPP only. The OpenSAFELY TPP purpose-built function [10] captures GP-patient interactions, whether in person or by phone/video call. The concept of a "consultation" as captured in EHR clinical coding systems is generally broader than that captured in the GP Appointment Data (GPAD) from GP Appointment Systems. GPAD data is published by NHS Digital as experimental statistics - various caveats remain in place [11].

- **no change:** where activity has remained within 15% of the baseline level.
- **increase:** an increase by 15% from baseline;
- **decrease:**
    - **small drop:** a reduction of between 15% and 60% from baseline;
    - **large drop:** a reduction of >60% from baseline;
    - **sustained drop:** where there has been a reduction of 15% or more from baseline which has not returned to within 15% of baseline by December 2020;
    - **recovery:** where there has been a reduction of 15% from baseline, which returned to within 15% of baseline by December 2020

Cohort: For OpenSAFELY-TPP and for each month of study, the population of interest was defined as those aged 1+, alive and registered at the start of that month. Patients are assigned to the practice they are registered with that month. In turn, any activity (OC codes, GP consultations) a patient has in that month is assigned to their practice of registration.

Contextualisation: though results cannot be directly compared, we also present the trend in online consultation submissions from the dedicated national OC/VC supplier collection, narrowed down to only tally submissions from practices that have TPP as main GP system supplier (according to POMI). The OC/VC supplier collection includes utilisation data taken directly from the participating OC supplier systems. Comparison of trends and of the broad order of magnitude may help inform on whether these two sources are capturing similar OC activity behaviour. OC/VC consultations information has been taken from tab 'OC supplier practice view' from the FutureNHS dashboard [7]. This contains daily information from August 2020, derived from the daily collection files. This can be extended as a weekly trend back to April 2020 if the earlier weekly-only collection data is used. To note also that approximately 10% of practices are using an OC supplier system that currently does not contribute to the national collection. 5 of 20 suppliers are currently not submitting.

Methods - Coding activity prevalence [EMIS]

For the more newly stood up OpenSAFELY-EMIS, we show the number of times each code was recorded over the period from January 2019 to December 2020, aggregated over the 2 years. Values are given per 1,000 EMIS registered population and also per 1,000 registered population in practices where the code was recorded. To mitigate practice disclosure, results are not shown where a code was found in less than 5 practices. The more fixed-scope exploration was a compromise given current platform functionality and availability.

Cohort: For OpenSAFELY-EMIS, the population of interest was defined as those aged 1+, alive and registered as of 1 January 2019. Patients are assigned to the practice they are registered with at that date. In turn, any activity (OC codes, GP consultations) a patient has in that 2-year period is assigned to that practice of registration. This differs from the TPP approach above (namely on practice coverage), therefore a table comparing EMIS and TPP statistics under similar conditions is also presented.

Methods - cohort sociodemographics [TPP]

In a separate analysis strand to the coding prevalence information, sociodemographic characteristics were also characterised for those with any online consultation instance.

The population cohort was defined as all those registered with a single TPP GP practice between January 2019 and December 2020. The following characteristics were recorded, typically based on January 2019 status:

- Ethnicity (based on ethnicity codelists)
- Sex
- Age
- Care home status
- Household size
- Practice registered with and associated region
- Rurality of place of residence
- Disability status (learning disabilities and intellectual disabilities codelists created from the QOF register)
- Deprivation quintile

The study population in this cohort was further divided into two sub-cohorts, based on whether the patients had had any recorded online consultation instance or not (at least one match for any of the shortlisted OC codes in the July 2019-December 2020 period). As a broad contextual, a population sub-cohort based on patients that had had any GP consultation in that same period was also defined (in general rather than specific to online consultations). The constitution of these sub-cohorts is presented in summary tables.

For a given sociodemographic or geographic dimension at a time, we also computed for the two year period the:

- OC instance rate (nr of code instances, standardised per 1,000 registered population)
- OC coverage rate (portion of population with at least one code instance)
- GP consultation instance rate (nr of GP consultation instances, standardised per 1,000 registered population)
- GP consultation coverage rate (portion of population with at least one GP consultation instance).

To note that OC instances and their rates should not be equated to online consultation rates or compared directly to GP consultation figures or GPAD figures, for many of the reasons flagged further above. It may however be useful to look at relative values across levels of a given characteristic (e.g. among ethnic groups). Some sub-cohorts are small so figures and differential patterns require caution given underlying uncertainty. Tests of proportions could be conducted. All instance rates given per 1,000 registered GP population. Coverage given as percentage of population.

Methods - clinical history of those with eConsultation activity [TPP]

In further follow-up exploratory analysis, the clinical history of those patients with an eConsultation code (1068881000000101) in March 2019-February 2020 (~ "12 months pre-pandemic") or March 2020-February 2021 (~"first 12 months of pandemic") was recorded.

The clinical conditions chosen were those that broadly aligned with the top 10-15 most prevalent long-term conditions according to the NHSE&I Population and Person Insight dashboard and framework. The codelists most aligned with those were chosen (detail in study repository): hypertension, asthma, osteoarthritis, depression, diabetes, chronic heart disease, cancer, atrial fibrillation, stroke, chronic respiratory disease (excl asthma), peripheral arterial disease, heart failure, chronic kidney disease, serious mental illness. Age and gender were also captured. Clinical history flags per patient were dictated by whether each patient had any recorded occurrence from the individual codelists prior to March 2019.

Results, in terms of historic prevalence of individual clinical conditions among those with an eConsultation code in either the "pre-pandemic" or "pandemic" period were captured. Prevalence figures are also tabulated alongside those of relevant comparator sub-cohorts (within practices using the eConsultation code at all in that period):

- all the remaining practice population

- the remaining practice population with a GP consultation recorded activity in that period

A multivariate logistic regression model was also employed to assess which clinical conditions were associated with higher adjusted odds of having had an eConsultation event, among the population in those practices that had had a GP consultation or eConsultation coding activity. Age groups and gender were also included as a first order case-mix adjustment. Further confounding (whether from interactions or other omitted characteristics) may remain so interpretation requires caution.

Results and observations

Results and commentary are given below.

Coding activity prevalence [TPP]

TPP - Weekly coding activity and contextualisation with OC/VC Supplier collection

The top graph depicts the absolute instances of code eConsultation, as well as of all the SNOMED codes together. It will reflect coding activity through all TPP practices in the 6th January 2020-22nd March 2021 period. Different practices may approach online consultation triage coding differently though, especially based on the OC supplier system in place, chosen OC pathways and implementation maturity [4].

The bottom graph depicts the total online consultation submissions in the period of w/c 27th April 2020-22nd March 2021 according to the OC/VC supplier collection [7], for TPP practices (as captured by POMI data).[3]

Though both data sources cannot be compared directly, a few takeaways are:

● Broadly, the trends in coding activity and OC submissions look similar, at least in terms of peaks-and-throughs.

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[3] In financial year 2020/21 the number of TPP practices has stayed in the 2500±16 range according to POMI. Submissions are shown for these, though for ~130 there was null recorded activity over the full period (supplier data either not collected, or no OC system in that practice). Also note that between 66-132 OC practices (depending on week) had no clear GP system when matching by practice ID to POMI. These were not included.

- If one were to assume as hypothesis that each OC submission should generate at least one read code in primary care systems, then it'd look like the current coding activity captured is not fully tracking all activity. This may however relate to a range of reasons including: codes such as eConsultation only being triggered downstream from what is considered a submission in an OC consultation journey; certain practices or OC systems not yet using dedicated codes; certain practices or OC systems using codes that are different or broader than those studied here; how an OC submission is defined within the supplier collection.

Figure 1. Top: absolute weekly online consultation code instances in TPP System (source: OpenSAFELY-TPP). Bottom: weekly OC submissions for practices that have TPP as main GP system (source: national rapid collection)
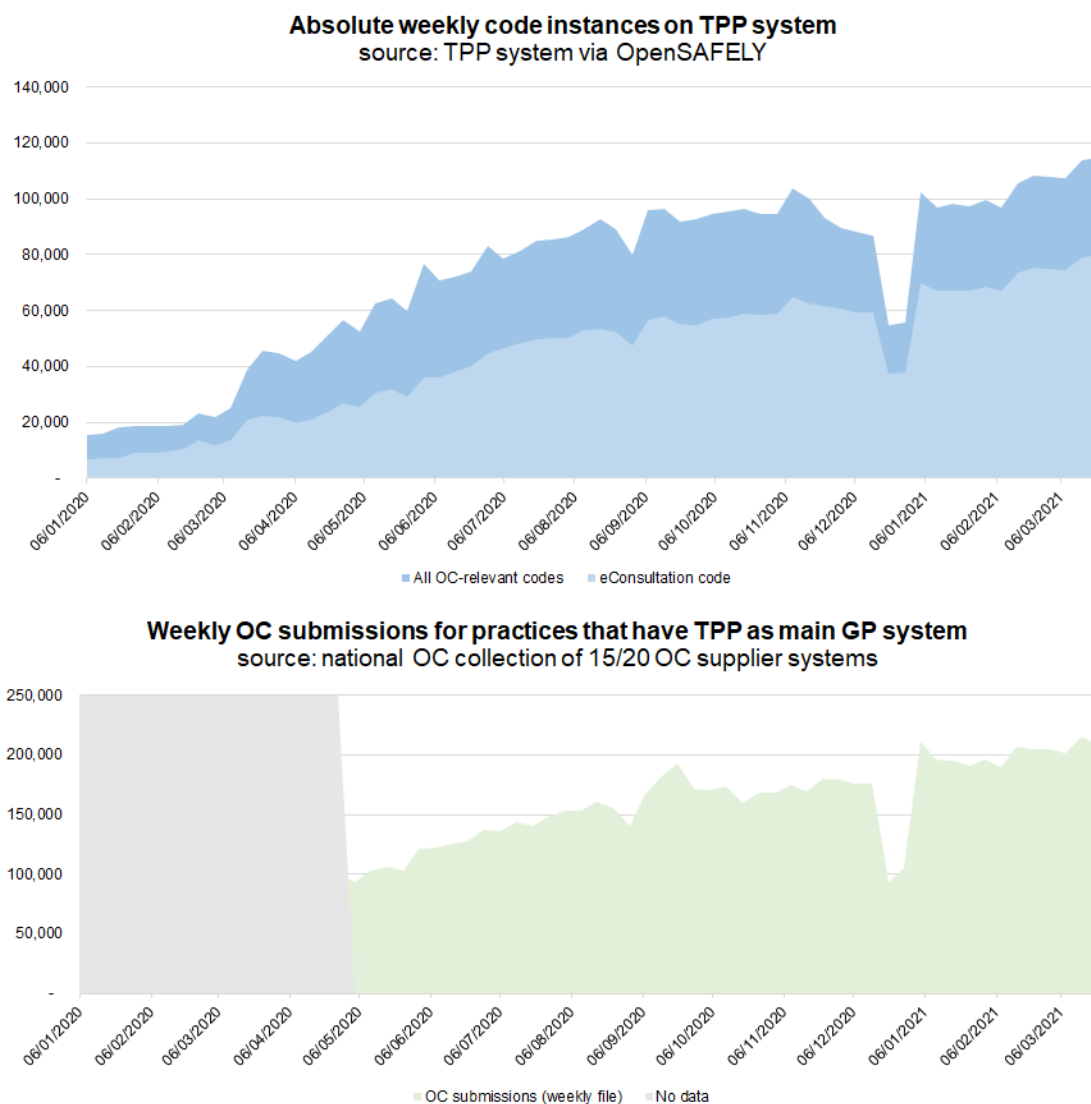
TPP - Codes in use and Practice coverage

The graph below shows the portion of practices that had at least one instance of the respective SNOMED code, over the two year period. Breakdowns by region are given in Annex 2.

Figure 2. Portion of TPP practices with *any* **recorded activity for online consultation relevant codes** *in general practice* *(January 2019 - December 2020).* Codes with no activity at all omitted.

Portion of practices with code recorded
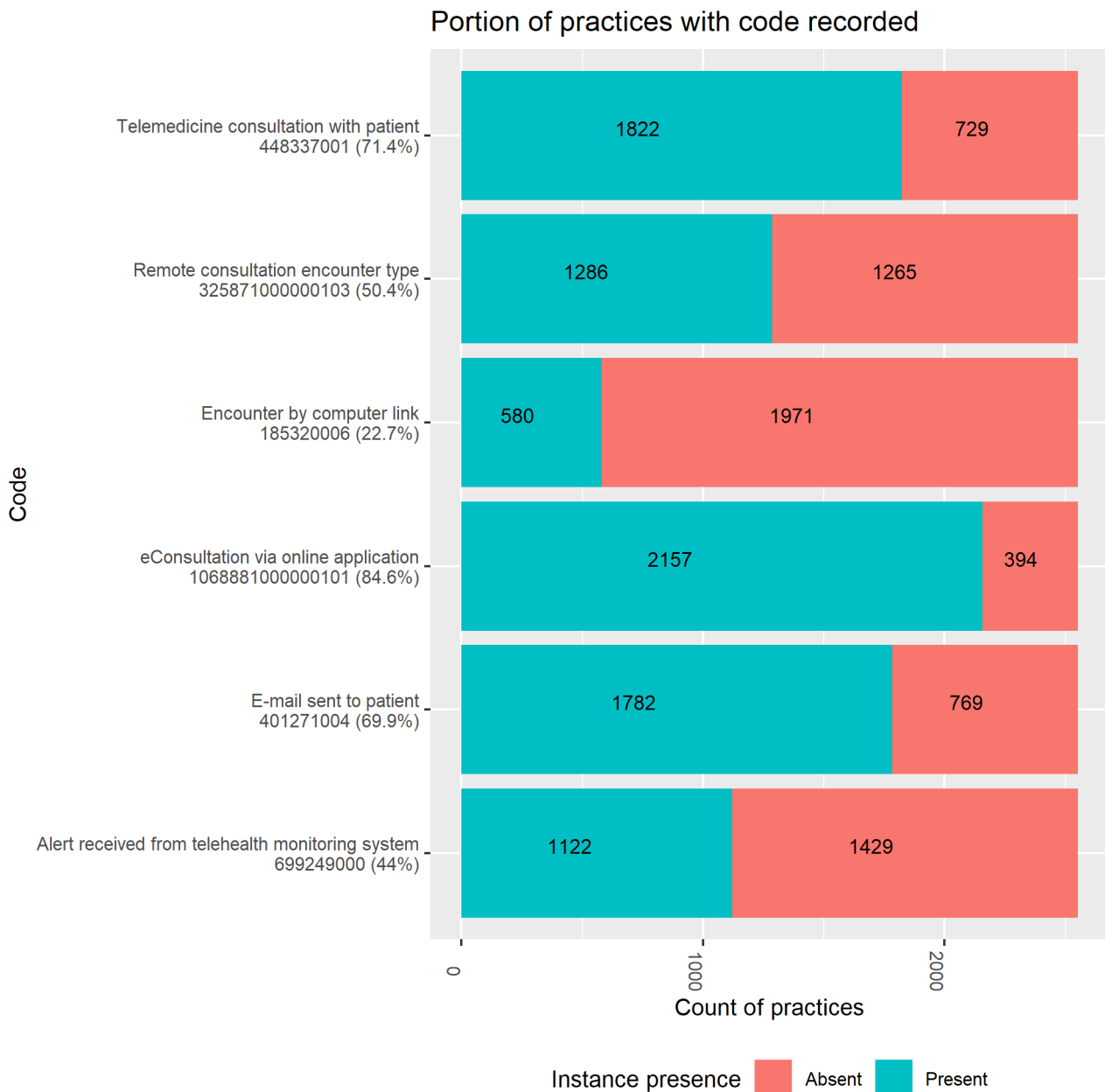
As discussed previously, 12 of 18 codes actually returned no results in TPP. The SNOMED codes for which instances *were* found also correspond to those where both: a) a CTV3 mapping was available when specifying the codelists; b) CTV3-querying had activity recorded (not shown). The practice coverage was, in decreasing order:

- eConsultation via online application (1068881000000101) - 85% of practices
- Telemedicine consultation with patient (448337001) - 71% of practices
- E-mail sent to patient (401271004) - 70% of practices
- Remote consultation encounter type (325871000000103) - 50% of practices
- Alert received from telehealth monitoring system (699249000) - 44% of practices
- Encounter by computer link (185320006) - 23% of practices

TPP Coding activity - monthly trends

While the previous plots focussed on coverage, the graph below shows the monthly prevalence of the various codes (coding activity) over the period from January 2019 to December 2020. Values are given as a rate (per 1,000 cohort population). The entire cohort population is considered, rather than just those in practices where each code has been recorded. The rate of GP consultation events is also given, for context (its practice coverage is near complete at over 99%, as expected).

Figure 3. *Monthly code instance rates per 1,000 registered population of SNOMED codes in TPP general practice (January 2019 - December 2020).* March 2020 indicated in pink. Figure with absolute counts given in Appendix 1.
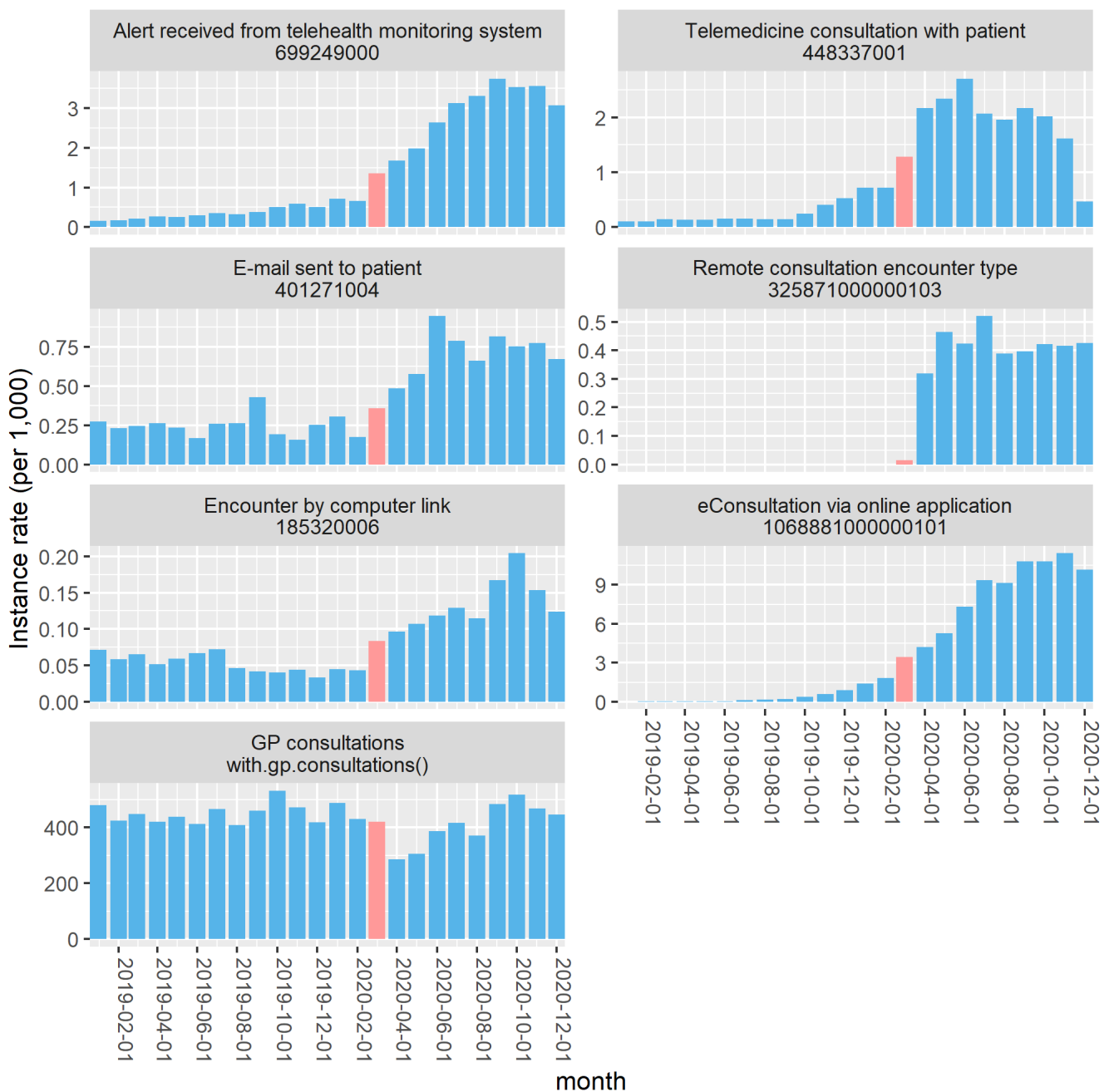
The codes with highest activity were, in order of highest monthly peak:

- eConsultation via online application (1068881000000101) - a peak of over 10 monthly coding events per 1,000 registered population in November 2020. This has increased rapidly from virtually none in early 2019.

- Alert received from telehealth monitoring system (699249000) - a peak of over 3.5 events per 1,000 registered population in September 2020. This has increased rapidly compared to 2019. A first step-change is seen around the start of the pandemic (from February to March 2019).

- Telemedicine consultation with patient (448337001) - a peak of over 2.5 events per 1,000 registered population in June 2020. Step changes from February to March and March to April 2020 are noticeable.

- E-mail sent to patient (401271004) - a peak of close to 1 event per 1,000 registered population in June 2020. Step changes from February to March and March to April 2020 are noticeable.

- Remote consultation encounter type (325871000000103) - a peak of over 0.5 events per 1,000 registered population in July 2020. This is likely a new code - its use appears to be first recorded in March 2020. This may relate to TPP introducing a [local-TPP](#) dedicated code that maps to this SNOMED code (Y22b4).

- Encounter by computer link (185320006) - a peak of over 0.2 events per 1,000 in October 2020. Its use seemed to be in slight decline in 2019 and then got a step increase from March 2020.

- We have also plotted the monthly rate of (overall) GP consultations in the TPP practices. This stood broadly above 400 consultations per 1,000 patients in 2019. The dip is seen around April 2020. Recovery occurred, with October 2020 registering the second highest monthly rate, after October 2019.

TPP Coding activity - monthly trends by deciles of practices

To better convey the prevalence of activity over time and in terms of inter-practice variation, decile graphs were created for a couple of the relevant codes.

Figure 4. *Recording of results from eConsultation via Online Application ("1068881000000101" ~ "Y1f3b") in general practice* (January 2019 - December 2020)

eConsultation via online application

Practices included: 2157 (84.6%); 2020 events: 2022.6k

Feb median: <0.05 (IDR 0.2), April median: <0.05 (IDR 6),
September median: 0.3 (IDR 29.7), December median: 0.3 (IDR 28)
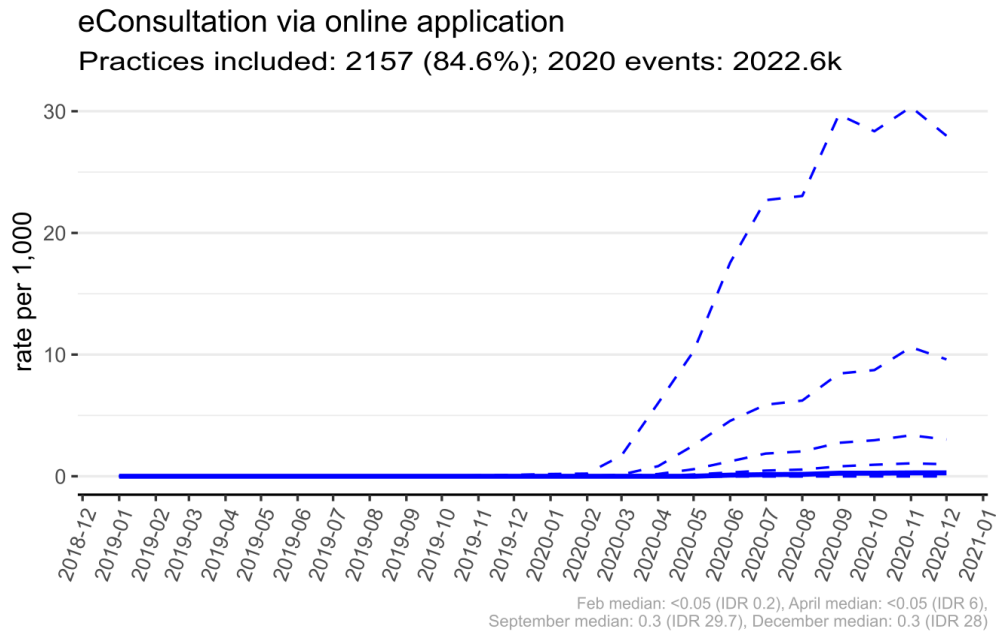
Figure 5. *Recording of results from Telemedicine consultation with patient ("448337001" ~ "XaXcK") in general practice* (January 2019 - December 2020)

Telemedicine consultation with patient

Practices included: 1821 (71.4%); 2020 events: 480.5k

Feb median: <0.05 (IDR 0), April median: <0.05 (IDR 1.7),
September median: <0.05(IDR 1.4), December median: <0.05 (IDR 0.5)
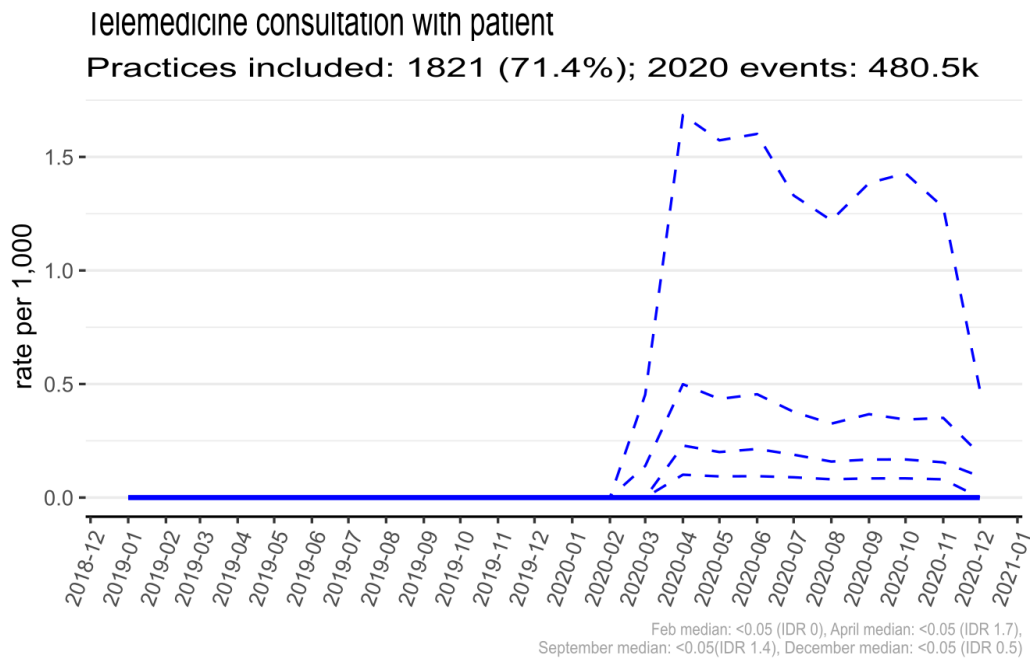
Figure 6. *Recording of results from any of the shortlisted SNOMED online consultations codes (six of eighteen in practice) in general practice* (January 2019 - December 2020)

OC-relevant snomed codes
Practices included: 2484 (97.4%); 2020 events: 3497.1k

Feb median: <0.05 (IDR 1.6), April median: 0.3 (IDR 15.6),
September median: 0.9 (IDR 39.9), December median: 0.9 (IDR 36.4)
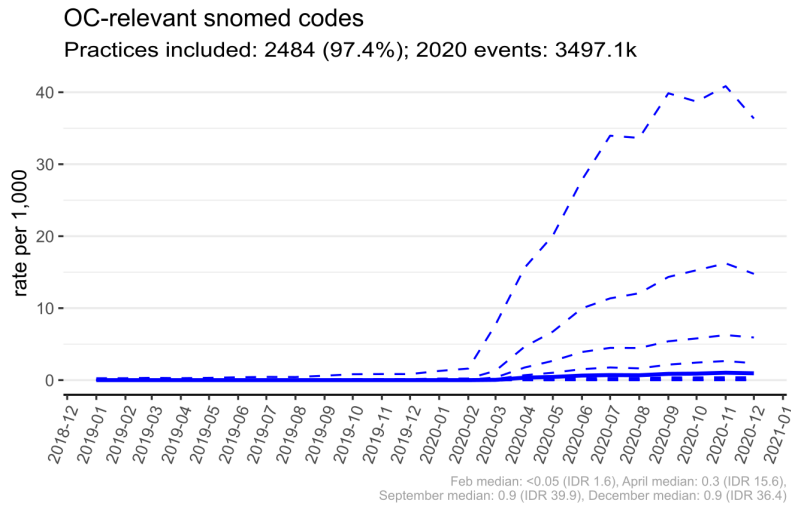
Figure 7. *Recording of results from any of the shortlisted SNOMED online consultations codes in general practice* (January 2019 - December 2020). **Previous figure, Log Scale.**

OC-relevant snomed codes
Practices included: 2484 (97.4%); 2020 events: 3497.1k

Feb median: 0 (IDR 1.6), April median: 0.3 (IDR 15.6),
September median: 0.9 (IDR 39.9), December median: 0.9 (IDR 36.4)
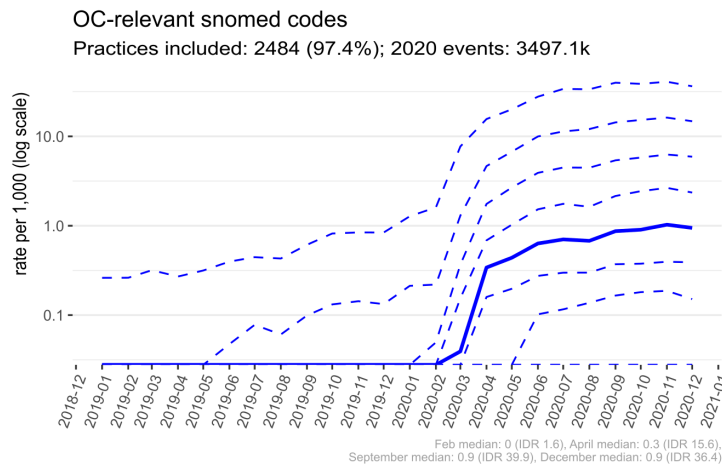
Figure 8. Contextual - *Recording of results from GP Consultations (any modality) in general practice* (January 2019 - December 2020)

GPconsult
Practices included: 2548 (99.9%); 2020 events: 119394.3k

Feb median: 426.7 (IDR 280.1), April median: 281.7 (IDR 228.4),
September median: 482.7 (IDR 338.2), December median: 445.5 (IDR 307.3)
Change in median from 2019: April -33.5% (drop); September 5.7% (no change); December 7.7% (no change);
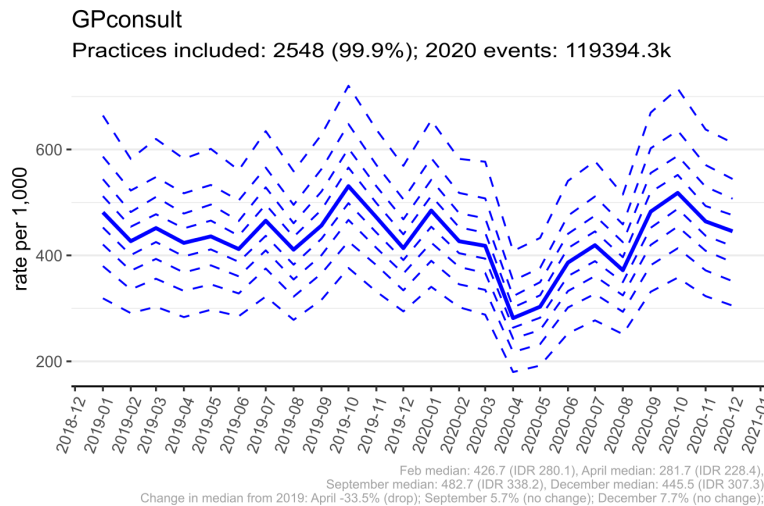
Coding activity prevalence [EMIS]

Given the recent extension of OpenSAFELY to EMIS as well, a more fixed-scope overview of OC-related code use in EMIS in 2019-2020 was conducted, including: the individual codes in use, the coding activity volumes and population-adjusted rates.

All six codes in use in TPP were also in use in EMIS. Additionally, the following three codes were also found in at least five practices: Remote assessment encounter type (325951000000102) in five practices, Consultation via multimedia encounter type (325911000000101) in 271 (7%) of practices and Telehealth encounter type (854891000000104) in eight practices.

The three most prevalent codes in terms of instances over two years per 1,000 EMIS population were in order: E-mail sent to patient (401271004) - 174.0 per 1,000, ; eConsultation via online application (1068881000000101) - 41.1 per 1,000; Alert received from telehealth monitoring system (699249000) - 37.5 per 1,000.

Table 3 provides a comparison of the findings for TPP and EMIS in terms of instance rates and the number of practices (based on patient January 2019 registration) where patients activity for that code in 2019-2020 (note that for TPP this differs from Figure 2 'practice coverage', where patients are tracked month-by-month in terms of practice of registration).

Table 2. EMIS cohort over 2019-2020 (two-year period): code-by-code proportion practices with code, number of instances over two-year period, and population rates given both by 1,000 EMIS cohort population and covered practice population respectively. Practices as of 1 January 2019 (n=3,872). 30,542,038 patients were in scope.

Code	Practices of Jan19 registration for patients with code (2019-2020)	% Practices	Number of instances (2019-2020)	Instance rate (per 1,000 EMIS pop.)	Instance rate (per 1,000 covered practice pop.)
eConsultation via online application (1068881000000100)	1977	51.1%	1,255,076	41.1	74.8
Referral to remote triage and advice service (1090371000000100)	*	*	*	*	*
Encounter by computer link (185320006)	298	7.7%	118,022	3.9	36.7
Remote consultation encounter type (325871000000103)	278	7.2%	10,565	0.3	3.6
Remote non-verbal consultation encounter type (325901000000103)	*	*	*	*	*
Consultation via multimedia encounter type (325911000000101)	271	7.0%	119,163	3.9	43.9
Remote assessment encounter type (325951000000102)	5	0.1%	20	0.0	0.3
Remote non-verbal assessment encounter type (325981000000108)	*	*	*	*	*
Assessment via multimedia encounter type (325991000000105)	*	*	*	*	*
Remote encounter type (384131000000101)	*	*	*	*	*
E-mail sent to patient (401271004)	3062	79.1%	5,314,194	174.0	205.4
Telemedicine consultation with patient (448337001)	15	0.4%	82	0.0	0.4
Alert received from telehealth monitoring system (699249000)	504	13.0%	1,145,020	37.5	239.8
Remote non-verbal consultation (719407002)	*	*	*	*	*
Telepractice consultation (763184009)	*	*	*	*	*
Telehealth encounter type (854891000000104)	8	0.2%	12	0.0	0.1
Telemedicine consultation with provider (868184008)	*	*	*	*	*
Consultation via multimedia (978871000000104)	*	*	*	*	*

| Any of the codes (OCall) | 3427 | 88.5% | 7,962,694 | 260.7 | 282.2 |

italic *redacted as less than five or no practices had the code*

Table 3. EMIS and TPP cohort over 2019-2020 (two-year period): code-by-code proportion practices with code, number of instances over two-year period, and population rates given per respective 1,000 EHR cohort population. Practices as of 1 January 2019, with patient activity within the 2019-2020 period assigned to their practice of registration on 1 January 2019 (for TPP this will therefore differ from Figure 2 'coverage', where patients are tracked month-by-month registration-wise)

Code	Practices of Jan19 registration for patients with code (2019-2020) tices (% of Jan19 practices)		Instance rate (per 1,000 EHR population)	
	EMIS	TPP	EMIS	TPP
eConsultation via online application (1068881000000100)	51.1%	98.0%	41.1	82.9
Referral to remote triage and advice service (1090371000000100)	*	*	*	*
Encounter by computer link (185320006)	7.7%	38.0%	3.9	4.2
Remote consultation encounter type (325871000000103)	7.2%	63.3%	0.3	28.8
Remote non-verbal consultation encounter type (325901000000103)	*	*	*	*
Consultation via multimedia encounter type (325911000000101)	7.0%	*	3.9	*
Remote assessment encounter type (325951000000102)	0.1%	*	0.0	*
Remote non-verbal assessment encounter type (325981000000108)	*	*	*	*
Assessment via multimedia encounter type (325991000000105)	*	*	*	*
Remote encounter type (384131000000101)	*	*	*	*
E-mail sent to patient (401271004)	79.1%	89.4%	174.0	11.7
Telemedicine consultation with patient (448337001)	0.4%	88.5%	0.0	23.2
Alert received from telehealth monitoring system (699249000)	13.0%	85.2%	37.5	34.2
Remote non-verbal consultation (719407002)	*	*	*	*
Telepractice consultation (763184009)	*	*	*	*
Telehealth encounter type (854891000000104)	0.2%	*	0.0	*
Telemedicine consultation with provider (868184008)	*	*	*	*
Consultation via multimedia (978871000000104)	*	*	*	*
Any of the codes (OCall)	88.5%	100%	260.7	152.1

italic *redacted as less than five or no practices had the code*

Patterns in demographics [TPP]

Broadly, it can be seen that the cohort with at least one online consultation coding instance:

- Has a higher preponderance of female patients;
- Has a higher relative preponderance of those aged 18-40, followed by those aged 40-50 and 50-60;
- Skews more towards white patients;
- Skews more towards those least deprived

Patterns by gender and age are broadly in line with those found in a previous pilot in the South West, using 'eConsult' [13].

Useful to note that these differential patternsn are also present in GP consultation rates and coverage, but they are not as pronounced. To contextualise these with the population with any sort of GP consultation (as opposed to not), results for this are given in Appendix 3. Further breakdowns per sociodemographic characteristic, coding coverage and instance rates are also given.

Table 4. *Characteristics of the studied cohort, both overall and by a) patients without a recorded online consultation related code instance; b) patients with such an instance. The p-value indicates significance for the difference in distributions at the 99.9% confidence level.*

| Characteristic | Overall, N = 20,651,036[1] | Had any OC-relevant coding instance | | p-value[2] |
		NO, N = 19,563,117[1]	**YES**, N = 1,087,919[1]	
sex				<0.001
Female	10,260,731 **(50%)**	9,599,496 (49%)	661,235 **(61%)**	
Male	10,389,976 (50%)	9,963,322 (51%)	426,654 (39%)	
Other/Unknown	329 (<0.1%)	299 (<0.1%)	30 (<0.1%)	
age	41 (22, 59)	41 (21, 59)	43 (27, 58)	<0.001
Age group				<0.001
(0,18]	4,298,691 (21%)	4,151,378 (21%)	147,313 (14%)	
(18,40]	5,738,142 (28%)	5,388,980 (28%)	349,162 (32%)	
(40,50]	2,842,130 (14%)	2,665,869 (14%)	176,261 (16%)	
(50,60]	2,913,528 (14%)	2,735,067 (14%)	178,461 (17%)	
(60,70]	2,269,212 (11%)	2,144,742 (11%)	124,470 (12%)	
(70,80]	1,673,588 (8.2%)	1,598,702 (8.2%)	74,886 (6.9%)	
(80,Inf]	746,742 (3.6%)	716,706 (3.7%)	30,036 (2.8%)	
Unknown	169,003	161,673	7,330	
ethnicity				<0.001
Asian	1,252,414 (6.1%)	1,209,218 (6.2%)	43,196 (4.0%)	
Black	412,399 (2.0%)	398,242 (2.0%)	14,157 (1.3%)	
Mixed	249,470 (1.2%)	238,762 (1.2%)	10,708 (1.0%)	
Other	6,026,577 (29%)	5,737,108 (29%)	289,469 (27%)	
White	12,710,176 **(62%)**	11,979,787 (61%)	730,389 **(67%)**	
living alone	5,783,003 (28%)	5,466,461 (28%)	316,542 (29%)	<0.001
region				<0.001
East	4,823,404 (23%)	4,623,066 (24%)	200,338 (18%)	
East Midlands	3,618,902 (18%)	3,458,477 (18%)	160,425 (15%)	
London	1,340,024 (6.5%)	1,277,438 (6.5%)	62,586 (5.8%)	
North East	963,807 (4.7%)	960,313 (4.9%)	3,494 (0.3%)	
North West	1,843,088 (8.9%)	1,722,626 (8.8%)	120,462 (11%)	
South East	1,357,871 (6.6%)	1,236,531 (6.3%)	121,340 (11%)	
South West	2,838,383 (14%)	2,586,842 (13%)	251,541 (23%)	
West Midlands	861,670 (4.2%)	840,558 (4.3%)	21,112 (1.9%)	
Yorkshire & The Humber	2,997,813 (15%)	2,851,255 (15%)	146,558 (13%)	
Unknown	6,074	6,011	63	

deprivation quintile				<0.001
Q1 (most)	4,157,772 **(20%)**	3,989,883 (21%)	167,889 **(16%)**	
Q2	4,032,329 (20%)	3,822,954 (20%)	209,375 (20%)	
Q3	4,259,619 (21%)	4,023,228 (21%)	236,391 (22%)	
Q4	4,052,737 (20%)	3,817,032 (20%)	235,705 (22%)	
Q5 (least)	3,796,821 (19%)	3,577,294 (19%)	219,527 (21%)	
Unknown	351,758	332,726	19,032	
rural urban				<0.001
Other	328,860 (1.6%)	310,706 (1.6%)	18,154 (1.7%)	
Rural	4,113,110 (20%)	3,896,532 (20%)	216,578 (20%)	
Urban	16,209,066 (78%)	15,355,879 (78%)	853,187 (78%)	
care home				<0.001
Yes	37,137 (0.2%)	34,545 (0.2%)	2,592 (0.2%)	
Non	20,613,899 (100%)	19,528,572 (100%)	1,085,327 (100%)	

[1] n (%); Median (IQR)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test

Patterns in clinical history for those with patients with 'eConsultation' activity [TPP]

The cohort of patients that in March 2020 - February 2021 had eConsultation activity coded in their records was characterised overall by a lower prevalence (clinical history) of most long-term conditions compared to the remaining population with GP-consultation recorded activity that year (Table 5).[4] Notable exceptions were asthma and depression, where respectively 20% and 23% of eConsultation patients had a clinical history of these, against 17% and 19% for other patients with general GP-patient interactions.

The comparison against the full population in those practices (rather than just patients therein with GP-consultation recorded activity) is given in Annex (Table A4.1), producing a more stark difference for asthma and depression but a more homogenous profile otherwise (indicating that online consultation patients resemble more the general population, clinical history-wise). The tabulation for the "pre-pandemic" eConsultation activity is also given (Table A4.2).

In part, this overall lower prevalence may reflect the inherent nature of the intended online consultation submissions themselves, which may not necessarily revolve around the need for a traditional GP consultation but reflect more general population needs (e.g. rather admin tasks, digitally-enabled routine checks, queries).

Despite the profiling above, it is important to note that the OC systems user profile may not be generalisable and may be very dependent on the practice-by-practice model. Namely, user profile may be influenced by how the OC system has been implemented, who and for what conditions practices have promoted OCs to, the type of OC system, ease of finding and navigating the OC system, staff confidence in using digital tools. There may also be differences in user profile in high compared to low using OC practices.

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[4] The OpenSAFELY TPP purpose-built function [10] captures GP-patient interactions, whether in person or by phone/video call. The concept of a "consultation" as captured in EHR clinical coding systems is generally broader than that captured in the GP Appointment Data (GPAD) from GP Appointment Systems. GPAD data is published by NHS Digital as experimental statistics - various caveats remain in place [11]. Note also that the function might - but will not necessarily - capture interactions from online consultation related events.

From the previous section, we have also seen that activity skews to a younger and female-tilted profile, which may be masking some of the clinical history profile characteristics.

Table 5. Clinical history *characteristics of the cohort with eConsultation code recorded in March 2020-February 2021. Comparison against population in those practices that had GP consultation recorded.*

| Clinical history (pre-March 2019)# | Overall, N = 9,835,747[1] | Had eConsultation code instance in Mar20-Feb21 (among those with an eConsult/GP consultation) | | p-value[2] |
		No, N = 9,018,200[1]	Yes, N = 817,547[1]	
history_hypertension	2,166,059 (22%)	2,035,381 (23%)	130,678 (16%)	<0.001
history_asthma	1,716,492 (17%)	1,551,624 (17%)	164,868 (**20%**)	<0.001
history_osteoarthritis	1,519,293 (15%)	1,426,313 (16%)	92,980 (11%)	<0.001
history_depression	1,941,426 (20%)	1,754,903 (19%)	186,523 (**23%**)	<0.001
history_diabetes	996,641 (10%)	938,575 (10%)	58,066 (7.1%)	<0.001
history_chronic_heart_disease	617,213 (6.3%)	583,834 (6.5%)	33,379 (4.1%)	<0.001
history_cancer	531,640 (5.4%)	497,628 (5.5%)	34,012 (4.2%)	<0.001
history_atrial_fibrillation	282,954 (2.9%)	268,036 (3.0%)	14,918 (1.8%)	<0.001
history_stroke	197,873 (2.0%)	188,013 (2.1%)	9,860 (1.2%)	<0.001
history_chronic_respiratory_disease	404,974 (4.1%)	381,487 (4.2%)	23,487 (2.9%)	<0.001
history_peripheral_arterial_disease	89,347 (0.9%)	85,317 (0.9%)	4,030 (0.5%)	<0.001
history_heart_failure	152,507 (1.6%)	144,499 (1.6%)	8,008 (1.0%)	<0.001
history_chronic_kidney_disease	13,393 (0.1%)	12,426 (0.1%)	967 (0.1%)	<0.001
history_serious_mental_illness	114,139 (1.2%)	106,557 (1.2%)	7,582 (0.9%)	<0.001
Econsult_pre_had [3]	53,521 (0.5%)	15,335 (0.2%)	38,186 (4.7%)	<0.001
Gp_consult_pre_had [3]	8,541,965 (87%)	7,829,178 (87%)	712,787 (87%)	<0.001
Gp_consult_post_had [3]	9,811,243 (100%)	9,018,200 (100%)	793,043 (97%)	<0.001

[1] n (%)

[2] Pearson's Chi-squared test (univariate tests)

[3] 'Pre' refers to Mar19-Feb20. 'Post' refers to Mar20-Feb21

When considering all clinical history conditions simultaneously, while also factoring in age and gender (first order), the clinical characteristics that were *more* prevalent among those with eConsultation activity expanded to (odds ratio (OR) >1 and significant) :

- Hypertension (OR: 1.015 [1.008-1.023])
- Asthma (OR: 1.131 [1.124-1.137])
- Osteoarthritis (OR: 1.048 [1.040-1.057])
- Depression (OR: 1.144 [1.138-1.151])
- Cancer (OR: 1.080 [1.068-1.093])
- Atrial fibrillation (OR: 1.119 [1.099-1.139])
- Heart failure (OR: 1.015 [1.018-1.069])

Other characteristics were mainly *less* prevalent with these adjustments.

Table 6. Adjusted odds of having had an online consultation in March 2020-February 2021 given past clinical history, age and gender. Odds ratio (OR) considered against the remaining population in those practices that had any GP consultation (GP-patient interaction) recorded during that period.

Adjusted odds of having had an online consultation in Mar20-Feb21
Cohort: those in practices with eConsultation code activity, patients with either GP interaction or eConsultation

Characteristic	Odds ratio	Pr(>|z|)	LCI95	UCI95 s.s.
(Intercept)	0.058	<0.001	0.057	0.058 *
sexFemale	1.206	<0.001	1.200	1.211 *
sexOther/Unknown	1.490	0.068	0.971	2.288
history_hypertension	1.015	<0.001	1.008	1.023 *
history_asthma	1.131	<0.001	1.124	1.137 *
history_osteoarthritis	1.048	<0.001	1.040	1.057 *
history_depression	1.144	<0.001	1.138	1.151 *
history_diabetes	0.858	<0.001	0.851	0.866 *
history_chronic_heart_disease	0.965	<0.001	0.953	0.977 *
history_cancer	1.080	<0.001	1.068	1.093 *
history_atrial_fibrillation	1.119	<0.001	1.099	1.139 *
history_stroke	0.914	<0.001	0.895	0.933 *
history_chronic_respiratory_disease	0.928	<0.001	0.915	0.941 *
history_peripheral_arterial_disease	0.897	<0.001	0.868	0.926 *
history_heart_failure	1.043	0.001	1.018	1.069 *
history_chronic_kidney_disease	0.967	0.312	0.905	1.033
history_serious_mental_illness	0.725	<0.001	0.708	0.742 *
age_group(0,18]	1.308	<0.001	1.295	1.321 *
age_group(18,40]	1.940	<0.001	1.923	1.957 *
age_group(40,50]	1.665	<0.001	1.650	1.681 *
age_group(50,60]	1.381	<0.001	1.369	1.394 *
age_group(60,70]	ref			
age_group(70,80]	0.681	<0.001	0.673	0.689 *
age_group(80,Inf]	0.533	<0.001	0.524	0.542 *

Recommendations and Next Steps

The report above aimed to perform an initial exploratory analysis into the primary care coding activity relating to online consultation systems and the coding landscape. It also provided initial insights around online consultation related activity (i.e. online submissions or written online appointments) trends over time and by cohort characteristics. Useful feedback and review includes:

- Review the coding prevalence information in context with further data sources and evidence, to better assess its coverage and consistency;
- Relay results to OC systems suppliers. In turn, try and understand a) how online triages/consultations are and could better be coded into primary care systems (which codes

are used, with which frequency, under which conditions or pathways; based on which primary care system); b) how to develop OC submission codes that align with OC submission specifications from the rapid and enhanced OC collection submissions; c) how coding guidelines and new SNOMED codes can be created and mandated to maximise value for operational, research and evaluation purposes.

- DFPC to consider sharing report for review with contacts to understand whether patterns are as expected based on coding practice de-facto online consultation implementation trends and other analysis and evidence strands (e.g. Health Foundation / Improvement Analytics Unit CPRD-based work);

- Based on programme/Policy experience, relay to OpenSAFELY team further strategic OpenSAFELY querying functionality that could be added to the development pipeline. Examples of opportunities identified include: a) future functionality to separately identify submission of request via OC systems (online consultation triage) and mode of response (i.e. appointment type: written online consultation, video, telephone, F2F) - this may in large part be subject to improved SNOMED codes themselves; b) facilitate pathway analysis, e.g. 'has an A&E attendance occurred within a certain number of days after an online consultation coding event' or 'had a GP consultation of any type occurring within two weeks after an online consultation coding event'; c) simplified ability for external collaborators to input a list of 'pilot' practices to define treatment and control sub-cohort within OpenSAFELY, while complying with information governance and data protection[5].

- Consider the role of OpenSAFELY and other EHR database access routes as options for strands informing continuous improvement and evaluation in the medium/long-term and where each brings the most value-add (against each other and broader options). Review the initial scope document and establish which quick-gain analysis strands could be potentially explored in future commissions to answer (a) key priority research question(s), e.g. illustratively:

    - Medication history of online consultation system users with eConsultation code;

    - Pathway analysis: any that may be outlined in impact evaluation protocols e.g. illustratively A&E admissions, secondary care referrals, GP appointment flags in a (30 day) period after eConsultation or OC coding activity [13];

    - Inequalities observatory: potentially aligned with SRO -, where a strategic metric is chosen for tracking and broken down by key protected characteristics (e.g. ethnicity, deprivation);

    - Analyses that leverage insight brought by new upcoming SNOMED codes or from CPRD tailored queries that better define OC triage submissions and online written consultations; that differentiate triage in terms of triage outcome (clinical and admin), mode of consultation (written online consultation, video, telephone, F2F) or professional type;

    - More 'England-representative' (e.g. EMIS + TPP) analysis [8] - current OpenSAFELY-EMIS querying was kept limited in scope but will foreseeably be more easily extended and be made more interoperable with TPP (method- and output-wise) as the platform develops;

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[5] Outputs with disclosive practice ID's cannot be extracted and querying on practice ID is not straightforward given pseudonymisation. There is though an ongoing cluster RCT project where such matching is being done in the background by TPP, so this functionality - with appropriate processes, controls and safeguards in place - could in future be extended to external collaborators.

In Appendix 5, we have included an Information Governance notice.

References

[1] NECS CSU, SystmOne - Receiving & Processing eConsult Guide, page 5, published 11 June 2020

[2] @econsult_thinks, eConsult tweet on new eConsultation code, published 18 May 2020

[3] NHS England, Advice on how to establish a remote 'total triage' model in general practice using online consultations, published 15 September 2020

[4] NHS England, Using online consultations in primary care: implementation toolkit, published 26 September 2019

[5] Biobank, TPP Local Codes (Data-Coding 8708)

[6] The OpenSAFELY Collaborative, OpenSAFELY NHS Service Restoration Observatory 1: describing trends and variation in primary care clinical activity for 23.3 million patients in England during the first wave of COVID-19, medRxiv 2021.01.06.21249352; doi: https://doi.org/10.1101/2021.01.06.21249352

[7] NHS England, OC/VC National Supplier Collection FutureNHS dashboard *[requires authentication and authorisation to NHSEI Digital IPC workspace]*

[8] The OpenSAFELY Collaborative, Trends and clinical characteristics of COVID-19 vaccine recipients: a federated analysis of 57.9 million patients' primary care records in situ using OpenSAFELY, medRxiv 2021.01.25.21250356; doi: https://doi.org/10.1101/2021.01.25.21250356.

[9] OpenSAFELY, *Onboarding new users to OpenSAFELY,* accessed 6 May 2021

[10] OpenSAFELY documentation, Variable reference: with_gp_consultations(), accessed 6 May 2021

[11] NHS Digital, Appointments in General Practice - Experimental statistics publication, accessed 6 May 2021

[12] Schultze A, Bates C, Cockburn J et al. Identifying Care Home Residents in Electronic Health Records - An OpenSAFELY Short Data Report [version 1; peer review: awaiting peer review], Wellcome Open Res 2021, 6:90, doi: https://doi.org/10.12688/wellcomeopenres.16737.1

[13] Edwards HB, Marques E, Hollingworth W, et al. Use of a primary care online consultation system, by whom, when and why: evaluation of a pilot observational study in 36 general practices in South West England, BMJ Open 2017; 7:e016901. doi: 10.1136/bmjopen-2017-016901

Project documents

- [Draft codelist for online consultations (ctv3)](#)

- [Draft codelist for online consultations (SNOMED)](#)

- [OpenSAFELY Online Consultations GitHub repository](#) *[to be made public]*

- [Project Information Document- DFPC Online Consultations](#) *[to be made public]*

- [Digital First Primary Care: Evaluation of a digital first approach in response to Covid-19 | OpenSAFELY initial request brief](#) (commented) *[limited access]*

Appendix 1. CTV3 shortlist

A CTV3 shortlist was also defined, for a few reasons:

- At the time of the ask, TPP servers had to be interrogated with CTV3 codes - any SNOMED codes needed mapping into CTV3 (if existent). This has since been updated though.
- Initial method for finding codes relied on a two-pronged CTV3 and SNOMED approach, with subsequent cross-mapping - as such, for completion the relevant codes are logged.

The short-listed codes in CTV3 were as given in the table below (codelist builder draft [here](#)). Those filled yellow are those for which activity was found within the TPP records, in 2019-2020.

Table A1.1.

Code	names	notes	type
Y1f3b	eConsultation via online application (procedure)	Local TPP code	local-tpp
XUkjp	Telemedicine consultation with patient (procedure)	SnomedCTbrowser refset	ctv3
XaXcK	Telemedicine consultation with patient	CTV3 snomed lkp	ctv3
XVCTw	Telemedicine consultation with provider (procedure)	SnomedCTbrowser refset	ctv3
XUuWQ	Remote non-verbal consultation (procedure)	SnomedCTbrowser refset	ctv3
XV1pT	Telepractice consultation (procedure)	SnomedCTbrowser refset	ctv3
9N34. .9N34	Encounter by computer link	CTV3 snomed lkp CTV3 snomed lkp	ctv3
XUman XaX2B 9G6..	Alert received from telehealth monitoring system	SnomedCTbrowser refset CTV3 snomed lkp CTV3 snomed lkp	ctv3
Y22b4	Remote consultation	Local TPP code	local-tpp

Appendix 2. Further data - coding coverage and prevalence

The graph below provides information on TPP coverage (code ever used over two year period) broken down by region. Focussing on the eConsultation code, TPP practice coverage-wise, its coverage of use has been higher in the East and South East and lowest in the North East and Midlands. There may be considerations around practices with changed or multiple systems.

Figure A2.1. Portion of TPP practices with *any* recorded activity for online consultation relevant codes *in general practice* (January 2019 - December 2020). Broken down by region.

Portion of practices with code recorded
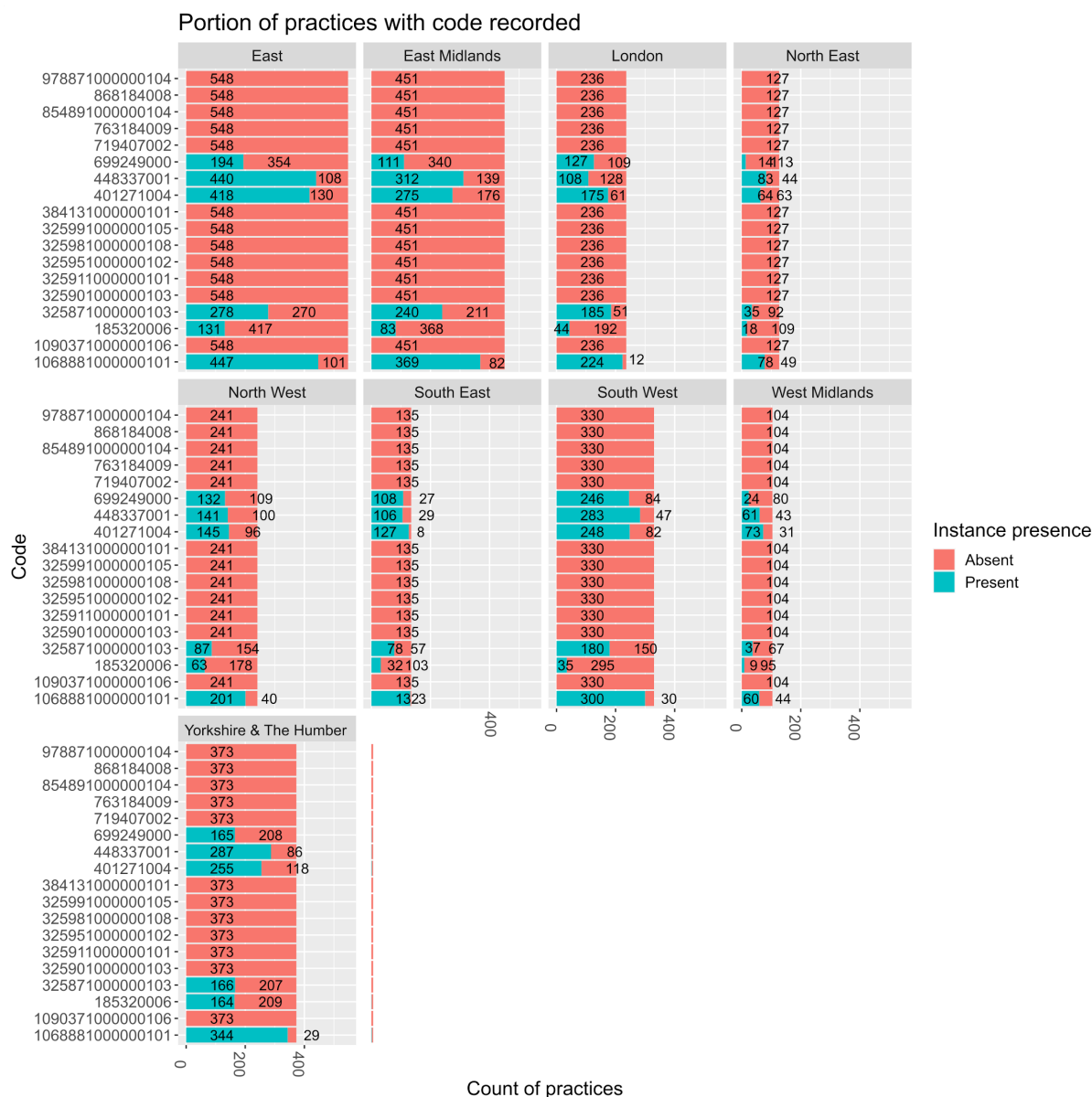
Figure A2.2. Portion of TPP practices by region with *any* recorded activity for eConsultation code *in general practice (January 2019 - December 2020). Numbers in white show absolute count of practices.*
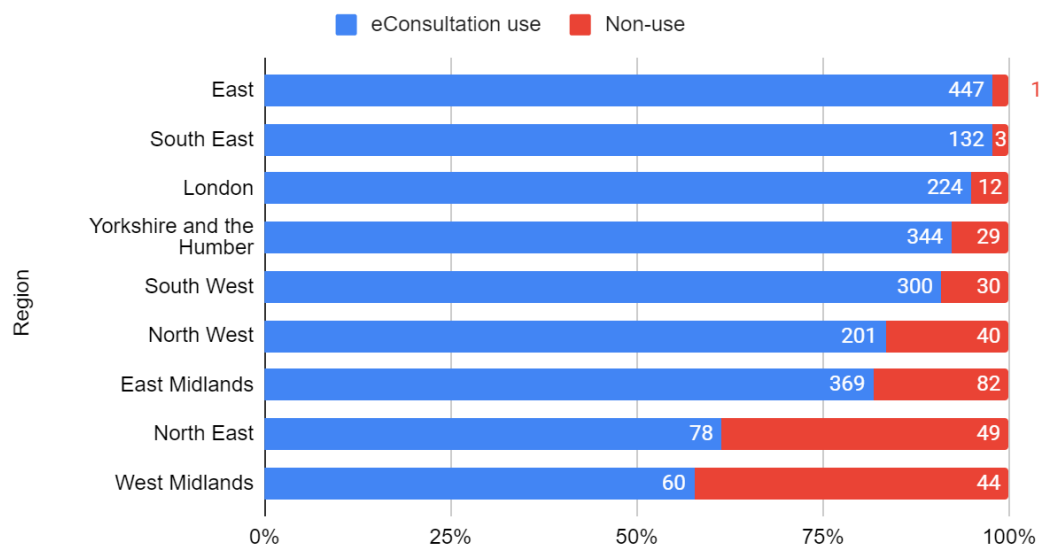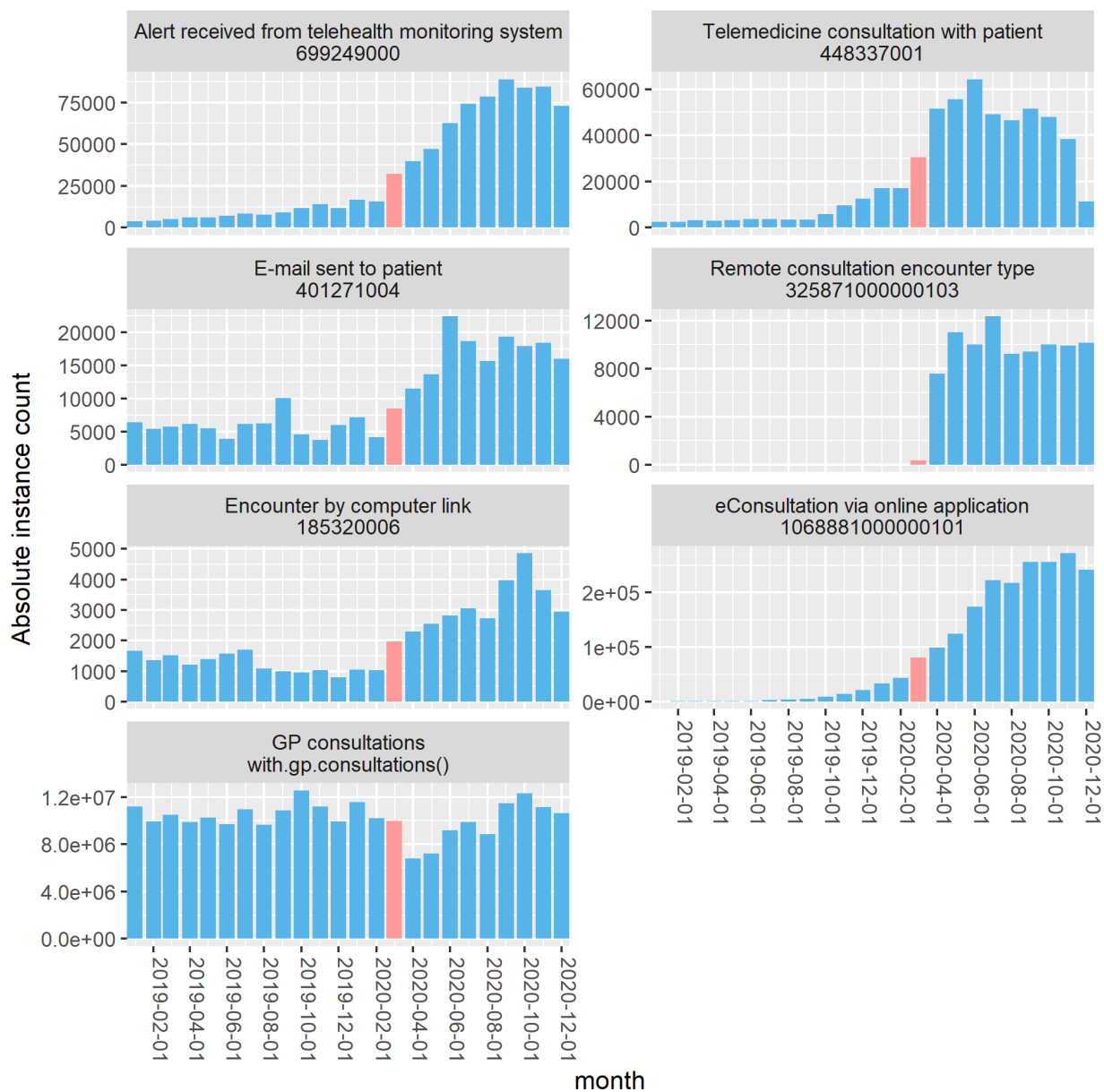
eConsultation code use - practice coverage

Figure A2.3. *Monthly absolute counts of SNOMED codes in TPP general practice (January 2019 - December 2020).* March 2020 indicated in pink. Note the different y axes (each plot scaled individually)

Appendix 3. Further data - TPP cohort sociodemographic characteristics

Table A3.1 *Characteristics of the studied cohort, both overall and by a) patients without a GP consultation in 2019-2020; b) patients with a consultation.*

Characteristic	Overall, N = 20,651,036[1]	Had any GP consultation		p-value[2]
		NO, N = 3,484,271[1]	**YES**, N = 17,166,765[1]	
sex				<0.001
Female	10,260,731 (50%)	1,087,898 (31%)	9,172,833 (53%)	
Male	10,389,976 (50%)	2,396,331 (69%)	7,993,645 (47%)	
Other/Unknown	329 (<0.1%)	42 (<0.1%)	287 (<0.1%)	
age	41 (22, 59)	30 (15, 43)	44 (24, 61)	<0.001
age group				<0.001
(0,18]	4,298,691 (21%)	1,019,206 (29%)	3,279,485 (19%)	
(18,40]	5,738,142 (28%)	1,442,431 (41%)	4,295,711 (25%)	
(40,50]	2,842,130 (14%)	488,196 (14%)	2,353,934 (14%)	
(50,60]	2,913,528 (14%)	336,154 (9.7%)	2,577,374 (15%)	
(60,70]	2,269,212 (11%)	131,588 (3.8%)	2,137,624 (13%)	
(70,80]	1,673,588 (8.2%)	46,058 (1.3%)	1,627,530 (9.6%)	
(80,Inf]	746,742 (3.6%)	17,458 (0.5%)	729,284 (4.3%)	
Unknown	169,003	3,180	165,823	
ethnicity				<0.001
Asian	1,252,414 (6.1%)	256,846 (7.4%)	995,568 (5.8%)	
Black	412,399 (2.0%)	93,541 (2.7%)	318,858 (1.9%)	
Mixed	249,470 (1.2%)	60,171 (1.7%)	189,299 (1.1%)	
Other	6,026,577 (29%)	1,251,395 (36%)	4,775,182 (28%)	
White	12,710,176 (62%)	1,822,318 (52%)	10,887,858 (63%)	
living alone	5,783,003 (28%)	1,049,450 (30%)	4,733,553 (28%)	<0.001
region				<0.001
East	4,823,404 (23%)	809,148 (23%)	4,014,256 (23%)	
East Midlands	3,618,902 (18%)	581,969 (17%)	3,036,933 (18%)	
London	1,340,024 (6.5%)	399,214 (11%)	940,810 (5.5%)	
North East	963,807 (4.7%)	151,347 (4.3%)	812,460 (4.7%)	
North West	1,843,088 (8.9%)	255,636 (7.3%)	1,587,452 (9.2%)	
South East	1,357,871 (6.6%)	238,663 (6.9%)	1,119,208 (6.5%)	
South West	2,838,383 (14%)	427,567 (12%)	2,410,816 (14%)	
West Midlands	861,670 (4.2%)	161,955 (4.6%)	699,715 (4.1%)	
Yorkshire & The Humber	2,997,813 (15%)	457,756 (13%)	2,540,057 (15%)	
Unknown	6,074	1,016	5,058	

deprivation quintile				<0.001
Q1 (least)	4,157,772 (20%)	781,369 (23%)	3,376,403 (20%)	
Q2	4,032,329 (20%)	735,329 (21%)	3,297,000 (20%)	
Q3	4,259,619 (21%)	714,307 (21%)	3,545,312 (21%)	
Q4	4,052,737 (20%)	642,990 (19%)	3,409,747 (20%)	
Q5 (most)	3,796,821 (19%)	558,209 (16%)	3,238,612 (19%)	
Unknown	351,758	52,067	299,691	
rural urban				<0.001
Other	328,860 (1.6%)	47,257 (1.4%)	281,603 (1.6%)	
Rural	4,113,110 (20%)	535,061 (15%)	3,578,049 (21%)	
Urban	16,209,066 (78%)	2,901,953 (83%)	13,307,113 (78%)	
care home				<0.001
Yes	37,137 (0.2%)	2,057 (<0.1%)	35,080 (0.2%)	
Non	20,613,899 (100%)	3,482,214 (100%)	17,131,685 (100%)	

[1] n (%); Median (IQR)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test

Ethnicity

OC coding activity is lower for non-white patients, both in terms of coverage and instance rates. Asian and Black patients register the lowest rates and coverage. Though these differential patterns are also present in GP consultation rates and coverage, they are not as pronounced.

It should be noted that about 6M patients had no ethnicity recorded, or an explicit 'Other' ethnicity, based on GP clinical coding.

Table 3.2. Ethnicity breakdown. Online consultation *coding* instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

ethnicity	Cohort *	GP consultation rate		GP consultation coverage		OC instance rate		OC instance coverage	
Asian	1,252,400	11.15	0.91	79.5%	0.93	0.09	0.53	3.4%	0.60
Black	412,400	10.06	0.82	77.3%	0.90	0.09	0.53	3.4%	0.60
Mixed	249,500	8.92	0.73	75.9%	0.89	0.12	0.71	4.3%	0.75
Other	6,026,600	8.72	0.71	79.2%	0.92	0.14	0.82	4.8%	0.84
White	12,710,200	12.2	1.00	85.7%	1.00	0.17	1.00	5.7%	1.00

* rounded to nearest 100

Gray figures are ratio vs White

Deprivation

OC coding activity is lower for the most deprived patients, both in terms of coverage and 2019-2020 instance rates. This deprivation pattern (direction-wise) is also seen in terms of GP

consultation coverage, but not for GP consultation rates. Overall GP consultation rates are higher among the most deprived.

Table A3.3. Deprivation breakdown. Online consultation *coding* instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

deprivation	Cohort *	GP consultation rate		GP consultation coverage		OC instance rate		OC instance coverage	
1 (most)	4,157,800	11.32	1.06	81.2%	0.95	0.12	0.75	4.0%	0.70
2	4,032,300	11.05	1.04	81.8%	0.96	0.15	0.94	5.2%	0.90
3	4,259,600	11.13	1.05	83.2%	0.98	0.15	0.94	5.5%	0.96
4	4,052,700	10.94	1.03	84.1%	0.99	0.17	1.06	5.8%	1.01
5 (least)	3,796,800	10.64	1.00	85.3%	1.00	0.16	1.00	5.8%	1.00

* rounded to nearest 100

Gray figures are ratio vs least deprived

Age-Sex

OC coding activity and coverage has been higher for female patients. Coverage and coding activity has been highest for females aged 18-40 (8.6% with an instance, at 0.29 coding events per 1,000 over 2 years), followed by females aged 40-50, 50-60 and 60-70, in this order.

Table A3.4. Age and sex breakdown. Online consultation coding instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

Age group	Sex	Cohort *	GP consultation rate	GP consultation coverage	OC instance rate	OC instance coverage
(0,18]	Female	2,079,900	5.64	78.9%	0.10	3.9%
(0,18]	Male	2,218,700	4.21	73.8%	0.07	3.0%
(18,40]	Female	2,774,900	13.82	87.5%	0.29	8.6%
(18,40]	Male	2,963,100	5.08	63.0%	0.10	3.8%
(40,50]	Female	1,388,200	13.50	91.8%	0.26	8.1%
(40,50]	Male	1,453,900	7.55	74.3%	0.12	4.4%
(50,60]	Female	1,440,400	14.09	92.9%	0.22	7.3%
(50,60]	Male	1,473,200	10.20	84.1%	0.13	5.0%
(60,70]	Female	1,157,800	16.23	95.4%	0.16	5.7%
(60,70]	Male	1,111,400	14.71	92.9%	0.14	5.3%
(70,80]	Female	889,400	20.47	97.5%	0.12	4.3%
(70,80]	Male	784,200	19.61	97.0%	0.12	4.7%
80+	Female	447,700	23.71	97.9%	0.11	4.0%
80+	Male	299,100	24.49	97.4%	0.11	4.1%

* rounded to nearest 100

Learning and intellectual disabilities

OC coding activity coverage is similar for those with and without disability, at about 5% (though slightly higher for those without disability). This contrasts with GP consultation coverage, which

was higher for those with disability than those without (87.7% vs 83.0%). Patterns may not be statistically significant.

For this work, the presence of a disability was defined by identifying patients with codes from codelists related to QOF register learning disabilities and intellectual disabilities. Physical disabilities were not covered.

Table A3.5. Disability flag breakdown. Online consultation coding instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

Disability	Cohort *	GP consultation rate	GP consultation coverage	OC instance rate	OC instance coverage
No	20,281,600	11.0	83.0%	0.15	5.3%
Yes	369,500	12.4	87.7%	0.15	5.1%

* rounded to nearest 100

Region and Rurality

A breakdown by Region and rurality is given below (areas classed as 'Other' rurality-wise were excluded).

Table A3.6. Region and rurality breakdown. Online consultation coding instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

Region	Rurality #	Cohort *	GP consultation rate	GP consultation coverage	OC instance rate	OC instance coverage
East	Rural	1,202,300	11.76	86.3%	0.10	4.1%
	Urban	3,560,900	10.56	82.2%	0.10	4.2%
East Midlands	Rural	799,700	12.26	87.9%	0.24	5.1%
	Urban	2,779,200	11.21	82.8%	0.17	4.2%
London	Rural	1,400	10.05	64.4%	0.09	5.0%
	Urban	1,323,800	9.15	70.2%	0.11	4.7%
North East	Rural	97,400	12.59	87.5%	<0.01	0.4%
	Urban	858,300	11.35	83.9%	<0.01	0.4%
North West	Rural	417,600	12.71	88.7%	0.16	6.1%
	Urban	1,395,000	10.79	85.3%	0.19	6.7%
South East	Rural	265,000	10.94	85.8%	0.18	7.8%
	Urban	1,070,200	10.12	81.6%	0.26	9.2%
South West	Rural	887,400	11.94	86.5%	0.17	6.9%
	Urban	1,913,200	10.98	84.2%	0.31	9.7%
West Midlands	Rural	21,100	9.47	81.5%	<0.01	0.2%
	Urban	834,800	9.43	81.2%	0.06	2.5%

* rounded to nearest 100
# excludes 'Other'

Care home status

As with GP consultation rates and coverage, OC coding activity coverage and instance rates are higher for care home residents than the remaining population. About 8,700 OC coding instances have been identified for care home residents. Subsequent analysis could potentially explore these patterns focussing only on the elderly population.

Care home status was assessed using TPP's functionality and the full detail on this methodology, its strengths and limitations can be read in the OpenSAFELY short data report published on Wellcome Open Research [12].

Table A3.7. Breakdown for care home residency. Online consultation coding instance rates (per 1,000 registered population) and population coverage, considering the period of 2019-2020 and patients registered with a single practice. Figures for GP consultations are also given for context.

Care home	Cohort *	GP consultations *	GP consultation rate	GP consultation coverage	OC instances *	OC instance rate	OC instance coverage
Yes	37,100	827,500	22.28	94.5%	8,700	0.23	0.07
Non	20,613,900	227,134,200	11.02	83.1%	3,137,100	0.15	0.05

* rounded to nearest 100

Appendix 4. Further plots - TPP cohort clinical history (eConsultation)

Table A4.1. Clinical history *characteristics of the cohort with eConsultation code recorded in March 2020-February 2021. Comparison against remaining population in those practices.*

Clinical history (pre-March 2019)	Overall, N = 14,677,783[1]	Had eConsultation code instance in Mar20-Feb21		p-value[2]
		No, N = 13,860,236[1]	Yes, N = 817,547[1]	
history_hypertension	2,349,943 (16%)	2,219,265 (16%)	130,678 (16%)	0.5
history_asthma	2,153,773 (15%)	1,988,905 (14%)	164,868 (**20%**)	<0.001
history_osteoarthritis	1,634,638 (11%)	1,541,658 (11%)	92,980 (11%)	<0.001
history_depression	2,266,604 (15%)	2,080,081 (15%)	186,523 (**23%**)	<0.001
history_diabetes	1,054,747 (7.2%)	996,681 (7.2%)	58,066 (7.1%)	0.003
history_chronic_heart_disease	661,437 (4.5%)	628,058 (4.5%)	33,379 (4.1%)	<0.001
history_cancer	577,276 (3.9%)	543,264 (3.9%)	34,012 (**4.2%**)	<0.001
history_atrial_fibrillation	294,501 (2.0%)	279,583 (2.0%)	14,918 (1.8%)	<0.001
history_stroke	209,562 (1.4%)	199,702 (1.4%)	9,860 (1.2%)	<0.001
history_chronic_respiratory_disease	423,574 (2.9%)	400,087 (2.9%)	23,487 (2.9%)	0.5
history_peripheral_arterial_disease	93,554 (0.6%)	89,524 (0.6%)	4,030 (0.5%)	<0.001
history_heart_failure	157,763 (1.1%)	149,755 (1.1%)	8,008 (1.0%)	<0.001
history_chronic_kidney_disease	14,087 (<0.1%)	13,120 (<0.1%)	967 (0.1%)	<0.001
history_serious_mental_illness	127,592 (0.9%)	120,010 (0.9%)	7,582 (0.9%)	<0.001
econsult_pre_had [3]	60,082 (0.4%)	21,896 (0.2%)	38,186 (4.7%)	
gp_consult_pre_had [3]	10,592,688 (72%)	9,879,901 (71%)	712,787 (87%)	
gp_consult_post_had [3]	9,811,243 (67%)	9,018,200 (65%)	793,043 (97%)	

[1] n (%)

[2] Pearson's Chi-squared test

[3] 'Pre' refers to Mar19-Feb20. 'Post' refers to Mar20-Feb21

Table A4.2. Clinical history *characteristics of the cohort with eConsultation code recorded in March 2019-February 2020. Comparison against remaining population in those practices that had GP consultation recorded.*

Clinical history (pre-March 2019)#	Overall, N = 3,329,385[1]	Had eConsultation code instance in Mar19-Feb20 (among those with an eConsultation/GP consultation)		p-value[2]
		No, N = 3,269,239[1]	**Yes**, N = 60,146[1]	
history_hypertension	692,860 (21%)	683,048 (21%)	9,812 (16%)	<0.001
history_asthma	561,217 (17%)	548,600 (17%)	12,617 (21%)	<0.001
history_osteoarthritis	482,702 (14%)	475,669 (15%)	7,033 (12%)	<0.001
history_depression	642,643 (19%)	626,765 (19%)	15,878 (26%)	<0.001
history_diabetes	300,541 (9.0%)	296,013 (9.1%)	4,528 (7.5%)	<0.001
history_chronic_heart_disease	195,284 (5.9%)	192,640 (5.9%)	2,644 (4.4%)	<0.001
history_cancer	168,067 (5.0%)	165,543 (5.1%)	2,524 (4.2%)	<0.001
history_atrial_fibrillation	89,142 (2.7%)	88,042 (2.7%)	1,100 (1.8%)	<0.001

history_stroke	61,494 (1.8%)	60,818 (1.9%)	676 (1.1%)	<0.001
history_chronic_respiratory_disease	130,723 (3.9%)	128,830 (3.9%)	1,893 (3.1%)	<0.001
history_peripheral_arterial_disease	29,255 (0.9%)	28,924 (0.9%)	331 (0.6%)	<0.001
history_heart_failure	46,687 (1.4%)	46,117 (1.4%)	570 (0.9%)	<0.001
history_chronic_kidney_disease	4,034 (0.1%)	3,964 (0.1%)	70 (0.1%)	0.7
history_serious_mental_illness	35,964 (1.1%)	35,367 (1.1%)	597 (1.0%)	0.036
econsult_post_had [3]	358,272 (11%)	320,086 (9.8%)	38,186 (63%)	
gp_consult_pre_had [3]	3,328,479 (100%)	3,269,239 (100%)	59,240 (98%)	
gp_consult_post_had [3]	2,676,230 (80%)	2,623,722 (80%)	52,508 (87%)	

[1] n (%)

[2] Pearson's Chi-squared test

[3] 'Pre' refers to Mar19-Feb20. 'Post' refers to Mar20-Feb21

Appendix 5 - Information Governance

NHS England is the data controller; EMIS and TPP are the data processors; and the key researchers on OpenSAFELY are acting on behalf of NHS England. This implementation of OpenSAFELY is hosted within the EMIS and TPP environments which are accredited to the ISO 27001 information security standard and are NHS IG Toolkit compliant;[1,2] patient data has been pseudonymised for analysis and linkage using industry standard cryptographic hashing techniques; all pseudonymised datasets transmitted for linkage onto OpenSAFELY are encrypted; access to the platform is via a virtual private network (VPN) connection, restricted to a small group of researchers; the researchers hold contracts with NHS England and only access the platform to initiate database queries and statistical models; all database activity is logged; only aggregate statistical outputs leave the platform environment following best practice for anonymisation of results such as statistical disclosure control for low cell counts.[3] The OpenSAFELY research platform adheres to the obligations of the UK General Data Protection Regulation (GDPR) and the Data Protection Act 2018. In March 2020, the Secretary of State for Health and Social Care used powers under the UK Health Service (Control of Patient Information) Regulations 2002 (COPI) to require organisations to process confidential patient information for the purposes of protecting public health, providing healthcare services to the public and monitoring and managing the COVID-19 outbreak and incidents of exposure; this sets aside the requirement for patient consent.[4] Taken together, these provide the legal bases to link patient datasets on the OpenSAFELY platform. GP practices, from which the primary care data are obtained, are required to share relevant health information to support the public health response to the pandemic, and have been informed of the OpenSAFELY analytics platform.

1 BETA – Data Security Standards - NHS Digital. NHS Digital.
https://digital.nhs.uk/about-nhs-digital/our-work/nhs-digital-data-and-technology-standards/framework/beta---data-security-standards (accessed 30 Apr 2020).

2 Data Security and Protection Toolkit - NHS Digital. NHS Digital.
https://digital.nhs.uk/data-and-information/looking-after-information/data-security-and-information-governance/data-security-and-protection-toolkit (accessed 30 Apr 2020).
3 ISB1523: Anonymisation Standard for Publishing Health and Social Care Data - NHS Digital. NHS Digital.
https://digital.nhs.uk/data-and-information/information-standards/information-standards-and-data-collections-including-extractions/publications-and-notifications/standards-and-collections/isb1523-anonymisation-standard-for-publishing-health-and-social-care-data (accessed 30 Apr 2020).
4 Secretary of State for Health and Social Care - UK Government. Coronavirus (COVID-19): notification to organisations to share information. 2020.
https://web.archive.org/web/20200421171727/https://www.gov.uk/government/publications/coronavirus-covid-19-notification-of-data-controllers-to-share-information