Supplementary Information

Methods

Defining study measures

For each topic, clinical codes were selected using two methods. First, we selected all CTV3 codes which were mapped to relevant CTV3 concepts ("cardiovascular" and "mental health disorder", Table S1). Second, we searched CTV3 code descriptions for pre-specified keywords to identify further clinical activities related to each topic of interest; this included searching descriptions associated with the parent CTV3 codes where codes were grouped. We checked the resulting lists of codes manually and excluded certain concepts, keywords or whole descriptions where required, to remove irrelevant items unintentionally captured by the keywords, to remove concepts not of interest (e.g. administrative processes or drug prescribing), or to remove codes with very low usage which did not produce interpretable decile charts (Table S1). We additionally looked at Structured Medication Reviews separately (https://github.com/opensafely/SRO-smr).

Table S1. Definition of the study measures using CTV3 concepts and keywords.

Measure		CTV3 concept	Keywords
Cardiovascular Disease (CVD)	Included	"cardiovascular"	"cardio" , "heart" , "cvd", "pulse", "blood pressure", "bp", "systolic", "diastolic"
	Excluded	(none)	"Other congenital heart anomalies", "(Cardiovascular procedures) or (Transfusions)", "(Cong heart dis, sept/bulb) or (bulbus cord) or (septal def)"
Diabetes	Included	(none)	"diabe", "DM", "insulin", "hypoglycaem", "desmond", "a1c"
	Excluded	"Drug"	(none)
Mental health	Included	"mental health disorder"	"mental", "learning", "dementia", "deleri", "psycho", "depress", "anxi", "cogn"
	Excluded	(none)	"environment"
Female and reproductive health	Included	(none)	"breast", "smear", "cervical", "contracept", "uterine", "iud", "coil", "cystosc", "preg", "female", "women", "matern", "vagi", "gynae", "obstet", "endomet", "fibroid", "hysterect", "hysterosc", "prolaps", "incontin"
	Excluded	"Administration", "(Neoplasms) or (cancers)"	"Complications of pregnancy,childbirth or the puerperium OS", "Gynaecological appliances", "Risk factors in pregnancy", "contraceptive implant", "non-obstetric"
Screening and related procedures	Included	(none)	"screen", "smear", or "NHS health check"
	Excluded	(none)	(none)
Processes related to medication	Included	(none)	"medication", "medicine", "drug", "presc", "repeat", or "rpt", or "structured medication reviews"
	Excluded	"Drug", "Causes of injury and poisoning", "Appliances+equipment"	"Supply of drugs payment admin", "Clinical trial administration (& drug)", "NHS 111 report received","OOH report","Telemedicine consultation"

Results

Table S2a. *Cardiovascular disease codes*

The most commonly recorded grouped and individual CTV3 codes in OpenSAFELY-TPP in 2020.

	CTV3 code	**Description**	**2020 events (mill)**	**2020 Patient count (mill)**
High level grouping	24	Examination of cardiovascular system (& [vascu...	27.17	6.55
	32	Electrocardiography	1.03	0.64
	18	Cardiovascular symptoms (& [heart])	0.26	0.21
	G5	Other forms of heart disease	0.18	0.13
	G3	Ischaemic heart disease (& [arteriosclerotic])	0.02	0.02
	79	Heart procedure	0.02	0.01
	54	Contrast radiography excluding cardiovascular ...	0.01	0.01
Detailed codes	X773s	Pulse rate	4.49	3.32
	243	O/E - pulse rhythm (& [irregular])	1.66	1.40
	XaQVY	QRISK2 cardiovascular disease 10 year risk score	1.20	0.92
	XM02J	Pulse regular	1.20	1.01
	242	O/E - pulse rate	0.88	0.73
	24E	O/E periph pulses R-leg (& [dors ped][fem][pop...	0.84	0.43
	24F	O/E periph pulses L leg (& [dors ped][fem][pop...	0.84	0.43
	XaKFx	Average home systolic blood pressure	0.41	0.31
	XaKFw	Average home diastolic blood pressure	0.40	0.31

O/E = on examination

Table S2b. Diabetes codes

The most commonly recorded codes for diabetes activity by CTV3 code (January - December 2020).

	CTV3 code	Description	2020 events (mill)	2020 Patient count (mill)
Detailed codes	XaPbt	Haemoglobin A1c level - IFCC standardised	6.22	4.55
	66A	Diabetic monitoring	1.47	0.66
	X772q	Haemoglobin A1c level	1.08	0.84
	XaIeH	O/E - Right diabetic foot at low risk	0.88	0.61
	XaIeL	O/E - Left diabetic foot at low risk	0.88	0.61
	XaERp	HbA1c level (DCCT aligned)	0.51	0.41
	XaIIj	Diabetic retinopathy screening	0.42	0.35
	XaKSn	Diabetes care plan agreed	0.34	0.26
	9OL	Diabetes administration: [monitoring] or [clinic]	0.31	0.23
	XaIuE	Diabetic foot examination	0.24	0.23
	X40J5	Type II diabetes mellitus	0.24	0.17

O/E = on examination

Table S2c. Mental Health codes

The most commonly recorded codes for mental health activity by CTV3 code (January - December 2020).

	CTV3 code	Description	2020 events (mill)	2020 Patient count (mill)
High level grouping	E2	Neurotic, personality and other nonpsychotic d...	0.35	0.27
	Eu	[X]Mental and behavioural disorders	0.06	0.05
	28	Nervous system and mental state general examin...	0.06	0.05
	3A	Assessment: [mental disability] or [memory] or...	0.05	0.03
	E1	Non-organic psychoses	0.02	0.02
	9H	Mental health administration (& patient "secti...	0.01	0.01
	E	Mental health disorder	0.01	0.01
	8G	Psychotherapy &/or sociotherapy	0.01	0.01
	d5	Antipsychotic depot injections	0.01	<0.01
	E0	Organic psychotic condition	0.01	0.01
	Ez	Mental disorders NOS	<0.01	<0.01
	E3	Mental retardation	<0.01	<0.01

	d4	Antipsychotic drug	<0.01	<0.01
	da	Other antidepressant drugs	<0.01	<0.01
Detailed codes	XaK6f	Depression interim review	0.29	0.23
	E20	Neurotic disorder	0.24	0.19
	XE0re	Depressed mood	0.22	0.18

NOS = Not otherwise specified

Table S2d. Female and reproductive health codes

The most commonly recorded codes related to female and reproductive activity by CTV3 code (January - December 2020).

	CTV3 code	**Description**	**2020 events (mill)**	**2020 Patient count (mill)**
High level grouping	61	Contraception	1.25	0.76
	15	[Gynaecological] or [obstetric] history	0.62	0.47
	64	(Child health care)(inf feed meth)(breast/oth ...	0.57	0.17
	62	(Patient pregnant) or (pregnancy care [& anten...	0.51	0.31
	K5	Other female genital tract disorders	0.28	0.25
	27	Obstetric examination	0.18	0.04
	26	Examination: [genitourinary] or [urinary] or [...	0.12	0.11
	K3	Disorder of breast	0.09	0.07
	ga	Progesterone - only contraceptives	0.08	0.04
	7E	Upper female genital tract operation	0.07	0.06
	L1	Pregnancy complications	0.06	0.04
	7F	Obstetric procedure (& puerperal)	0.04	0.04
	L0	Pregnancy with abortive outcome	0.04	0.03
	7D	Lower female genital tract operation	0.02	0.01
	71	Endocrine system &/or breast operations	0.02	0.02
	K4	Female pelvic inflammatory disease	0.01	0.01
	gg	Vaginal lubricants	0.01	0.01
Detailed codes	Xa8Pl	Cervical smear	1.11	1.06
	XaKTi	Liquid based cervical cytology screening	1.00	0.93
	XaKd4	Cervical cytology test	0.84	0.44
	XaPnn	Advice about long acting reversible contraception	0.76	0.54
	XaXfc	UK medical eligib criteria for contraceptive u...	0.75	0.17
	XE278	Cervical smear - negative	0.49	0.48

	614	Oral contraception	0.43	0.28
	611	General contraceptive advice	0.43	0.32
	XaagX	Cervical smear - human papillomavirus negative	0.32	0.32
	621	Patient currently pregnant	0.32	0.22
	X76Qu	Not pregnant	0.27	0.21

Table S2e. Screening codes

The most commonly recorded codes related to screening activity by CTV3 code, January - December 2020, annotated with the screening type (bowel, cervical, diabetes, etc).

CTV3 code	**Description**	**2020 events (mill)**	**2020 Patient count (mill)**	**Screening type**
XaPVj	Bowel cancer screening programme: faecal occul...	1.29	1.28	bowel
Y00e7	Advice given - cervical smear	1.12	0.56	cervical
Xa8Pl	Cervical smear	1.11	1.06	cervical
XaKTi	Liquid based cervical cytology screening	1.00	0.93	cervical
Y0384	Smear Under GMS	0.99	0.97	cervical
Y3562	Smear consent given	0.90	0.88	cervical
Y0385	Smear Slide Number	0.83	0.82	cervical
Y0390	Smear Reason: Routine Recall	0.66	0.66	cervical
XE278	Cervical smear - negative	0.49	0.48	cervical
XaIIj	Diabetic retinopathy screening	0.42	0.35	diabetes
9O8	Cervical smear screening administration	0.41	0.32	cervical
XaPf6	No response to bowel cancer screening programm...	0.40	0.37	bowel
68N	Immunisation status: [screen] or [consent status]	0.33	0.27	unspecified
XaagX	Cervical smear - human papillomavirus negative	0.32	0.32	cervical
XaRBT	NHS Health Check invitation first letter	0.27	0.26	health check
XaZJJ	Cervical smear screening SMS message text	0.25	0.17	cervical
Y0389	Smear Reason: Routine Call	0.24	0.24	cervical
XaaPs	Human papillomavirus screening	0.23	0.22	cervical
Y0387	Smear Clinical Data	0.23	0.22	cervical
XaMwb	Alcohol screen - AUDIT C completed	0.21	0.20	alcohol
XaRBQ	NHS Health Check completed	0.21	0.18	health check

GMS = General Medical Services

Table S2f. Medication Processes codes

The most commonly recorded codes for processes related to medication by CTV3 code. (January - December 2020)

CTV3 code	Description	2020 events (mill)	2020 Patient count (mill)
XaF8d	Medication review done	7.25	5.12
8B3	Drug therapy	3.55	1.98
XaZ08	Has authorisation for medication under PSD	2.48	2.06
XaQA7	Administration of medication under patient gro...	1.81	1.49
XaVvz	Administration of medication under patient spe...	0.51	0.21
XaJKW	Patient understands why taking all medication	0.49	0.43
XaIoW	Medication review done by pharmacist	0.48	0.39
Xa2yC	Able to manage medication	0.40	0.37
XaJKn	Drug compliance checked	0.39	0.33
XaIfK	Asthma medication review	0.30	0.27
XaJCO	Medication review with patient	0.30	0.28
XaJHr	Has shown no side effects from medication	0.28	0.26
XaMhk	Dispensing review of use of medicines	0.23	0.20
XaJCN	Medication review of medical notes	0.23	0.18
XaIVl	Medication review without patient	0.23	0.17
XaJJx	Indication for each drug checked	0.23	0.21
Y20a8	Medication review done by clinical pharmacist	0.22	0.18
XaF8c	Medication review due	0.22	0.16

Codes related to patient group direction or patient specific direction (PSD) represent legal frameworks for administering medications such as vaccines.

Figure S1. Antidepressant prescribing in primary care in England by month, Nov 2017 - Oct 2021

(source: https://openprescribing.net/bnf/0403/)

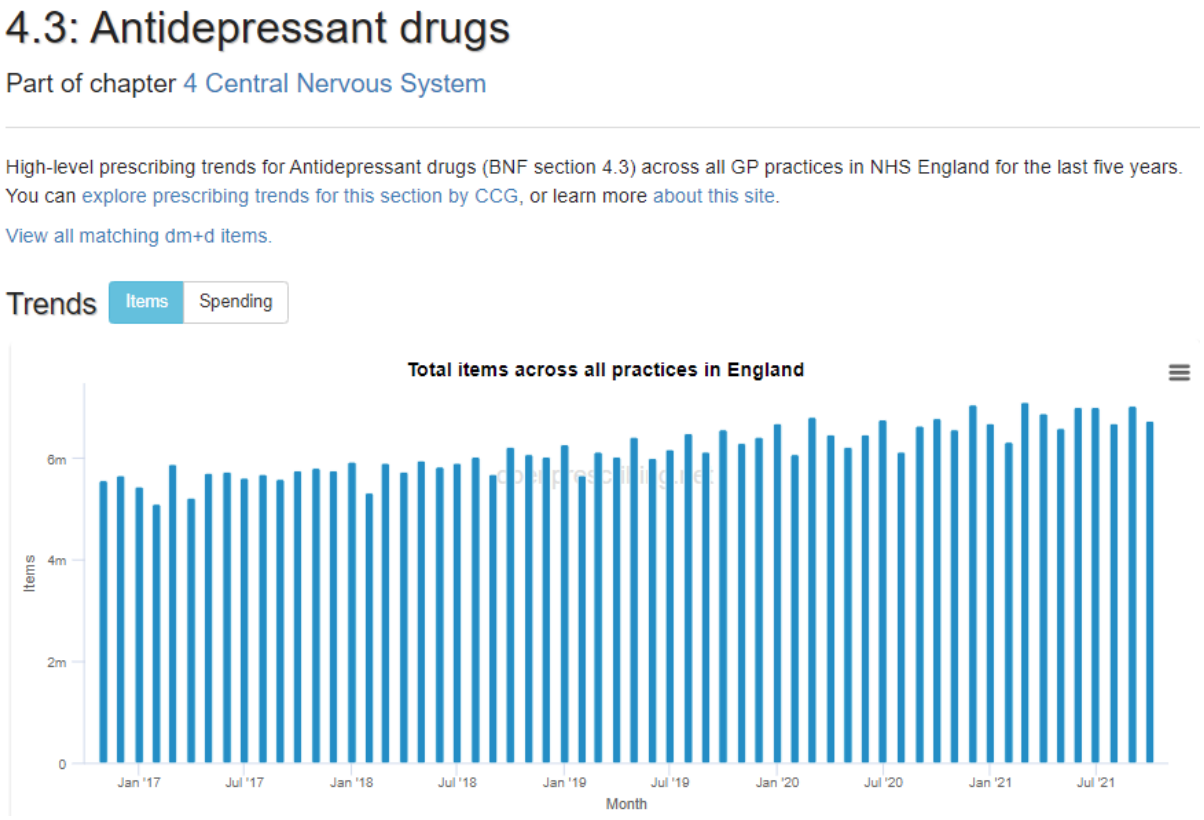
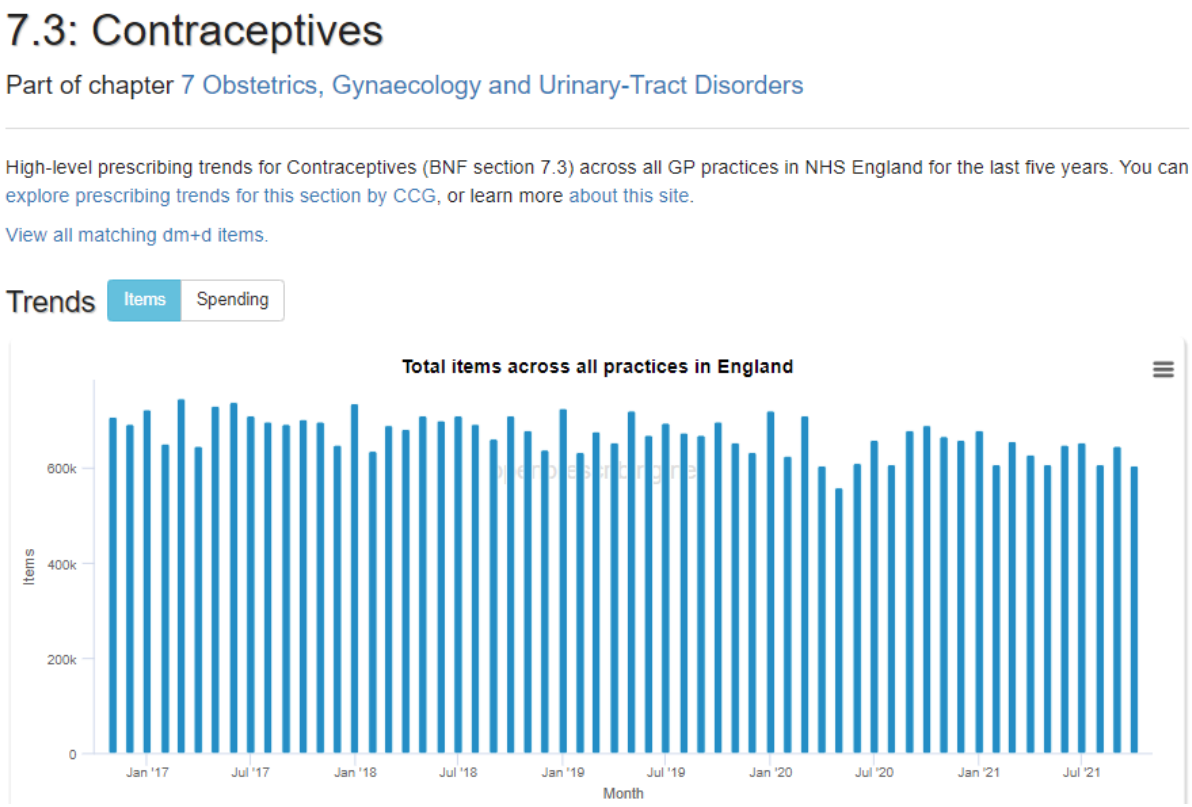


Figure S2. Contraceptive prescribing in England by month, Nov 2017 - Oct 2021

(source: https://openprescribing.net/bnf/0703/)



Future research recommendations

CVD Further research

We identified several areas of interest for further research:

1. Codes could be analysed separately in people with and without prior diagnoses to establish the varying impacts on diagnosis and monitoring.
2. Blood pressure monitoring could be broken down into more granular groups such as those with established hypertension and those on contraceptives, to establish the impact on care of each group.
3. The level of "backlog" could be analysed to establish whether those people who missed out on routine monitoring have later had their appointment and whether there are some groups waiting long than others.

4. The level of clinical events such as hospitalisations could be measured to establish any impact of routine monitoring being reduced.

Diabetes Further research

We identified several areas of interest for further research:

1. The proportion of patients with diabetes receiving the appropriate monitoring and how this has been impacted by the pandemic.
2. The impact on the condition of those with diabetes could be investigated, for example whether HbA1C levels have generally worsened.
3. The rate of new diagnoses could be monitored.

Mental Health Further research

The potential for further research in this topic is limited due to the lack of access to data from mental health trusts and other services. However, a few areas were identified:

1. Additional conditions could be investigated such as personality disorders, eating disorders and ADHD.
2. Medications and histories could be used to give more context to the patterns of diagnosis coding.
3. The level of self harm incidents in hospital records (emergency attendances and admissions) could be investigated to establish any impact of routine monitoring or access being reduced. Similarly, alcohol misuse and associated violence-related injuries.

Female and Reproductive Health Further research

We identified several areas of interest for further research:

1. Impact on cancer referrals related to breast symptoms and bleeding.
2. Use of hormone-replacement therapy (HRT) and codes relating to the menopause.

Screening Further research

We identified several areas of interest for further research:

1. Cervical screening may be a potential candidate for ongoing monitoring.
2. The level of "backlog" could be analysed to establish whether those people who missed out on screening have later had their test and whether there are some groups waiting longer than others.
3. The rate of cancer diagnoses being made at more advanced stages could be investigated and any potential impact from missed screening (however, patients not choosing or not being able to consult for mild symptoms may also be a contributing factor).

Medication processes Further research

We identified several areas of interest for further research:

1. Medication reviews could be broken down into more granular groups such as those with dementia or asthma, to establish the impact on care of each group.
2. The level of "backlog" could be analysed to establish whether those people who missed out on routine monitoring have later had a review and whether there are some groups waiting longer than others.
3. The level of polypharmacy and adverse events associated with it (e.g. falls) could be measured to establish any impact of routine monitoring being reduced during the pandemic.