openheart Impact of COVID-19 on recorded blood pressure screening and hypertension management in England: an analysis of monthly changes in the quality and outcomes framework indicators in OpenSAFELY

Milan Wiedemann ⁽¹⁾, ¹ Victoria Speed, ¹ Christine Cunningham ⁽¹⁾, ¹ Rose Higgins, ¹

Christopher T Rentsch ^(D),² Viyaasan Mahalingasiyam,² Laurie Tomlinson ^(D),³ Caroline Morton ¹, ¹ Miriam Samuel,⁴ Amelia Green,¹ Christopher Wood,¹ Andrew D Brown,¹ Jon Massey,¹ Caroline Walters,¹ Rebecca M Smith,¹

Helen J Curtis ^(D), ¹ Colm Andrews ^(D), ¹ Louis Fisher, ¹ Lisa Hopcroft, ¹

Peter Inglesby,¹ David Evans ^(b), ⁵ Steven Maude,¹ Iain Dillingham,¹ Alex J Walker ^(b), ⁵ Jessica Morley,¹ Amir Mehrkar ^(b), ¹ Seb Bacon ^(b), ¹ Chris Bates ^(b), ⁶ Jonathan Cockburn ^(b), ⁶ John Parry,⁶ Frank Hester,⁶ Richard J McManus,¹ Ben Goldacre ^(b), ¹ Brian MacKenna ^(b) Additional supplemental ABSTRACT material is published online only. To view, please visit the journal online (https://doi.org/10.1136/

To cite: Wiedemann M, Speed V, Cunningham C, et al. Impact of COVID-19 on recorded blood pressure screening and hypertension management in England: an analysis of monthly changes in the quality and outcomes framework indicators in OpenSAFELY. Open Heart 2024;11:e002732. doi:10.1136/ openhrt-2024-002732

openhrt-2024-002732).

Received 1 May 2024 Accepted 7 June 2024

Check for updates

C Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Milan Wiedemann; milan. wiedemann@phc.ox.ax.uk

Background The COVID-19 pandemic disrupted cardiovascular disease management in primary care in England.

Objective To describe the impact of the pandemic on blood pressure screening and hypertension management based on a national quality of care scheme (Quality and Outcomes Framework, QOF) across key demographic, regional and clinical subgroups.

Methods With NHS England approval, a populationbased cohort study was conducted using OpenSAFELY-TPP on 25.2 million NHS patients registered at general practices (March 2019 to March 2023). We examined monthly changes in recorded blood pressure screening in the preceding 5 years in patients aged \geq 45 years and recorded the hypertension prevalence and the percentage of patients treated to target (<140/90 mmHg for patients aged \leq 79 years and \leq 150/90 mmHg for patients aged \geq 80 years) in the preceding 12 months.

Results The percentage of patients aged \geq 45 years who had blood pressure screening recorded in the preceding 5 years decreased from 90% (March 2019) to 85% (March 2023). Recorded hypertension prevalence was relatively stable at 15% throughout the study period. The percentage of patients with a record of hypertension treated to target in the preceding 12 months reduced from a maximum of 71% (March 2020) to a minimum of 47% (February 2021) in patients aged ≤79 years and from 85% (March 2020) to a minimum of 58% (February 2021) in patients aged ≥80 years before recovery. Blood pressure screening rates in the preceding 5 years remained stable in older people, patients with recorded learning disability or care home status.

WHAT IS ALREADY KNOWN ON THIS TOPIC

 \Rightarrow The COVID-19 pandemic disrupted cardiovascular disease management in primary care in England.

WHAT THIS STUDY ADDS

- \Rightarrow We have reported monthly QOF outcomes for blood pressure monitoring and hypertension control across key demographic, regional and clinical subgroups during the COVID-19 pandemic.
- \Rightarrow We have translated the QOF business rules for blood pressure monitoring and hypertension control from text descriptions into a reusable and modifiable code.

HOW THIS STUDY MIGHT AFFECT RESEARCH, **PRACTICE OR POLICY**

 \Rightarrow The OpenSAFELY platform could be used to report current and future indicators of clinical care and to identify health inequalities among regional, demographic or clinical sub-populations in near real-time.

Conclusions The pandemic substantially disrupted hypertension management QOF indicators, which is likely attributable to general reductions of blood pressure measurement including screening. OpenSAFELY can be used to continuously monitor changes in national quality-of-care schemes to identify changes in key clinical subgroups early and support prioritisation of recovery from care disrupted by COVID-19.





INTRODUCTION

The COVID-19 pandemic disrupted healthcare services globally.¹ Cardiovascular disease (CVD) management in primary care in England was impacted $^{2-4}$ with an estimated 2175 non-COVID excess deaths attributed to hypertensive diseases between March 2020 and December 2021.⁵ CVD is associated with a higher risk of morbidity and mortality from COVID-19, emphasising the importance of maintaining good routine care.⁶⁷ High blood pressure is the leading risk factor for CVD⁸ and one of the top three risk factors for global disease burden.⁹ Since 1994, there has been an improvement in the management of high blood pressure in England¹⁰ and a reduction of the negative impact of social deprivation on blood pressure management.¹¹ Delayed management of hypertension is associated with worse clinical outcomes, for example, stroke.¹² Recent results from annual national audits of England's population on CVD have also suggested that blood pressure management was disrupted by the pandemic.¹³

In 2004, the Quality and Outcomes Framework (QOF) was introduced in England as one of the largest initiatives worldwide to improve the quality of care in general practice. General practitioners (GPs) and their staff are measured on indicators of good clinical care and receive financial incentives based on their achievement of certain thresholds.^{14 15} To monitor the indicators and thresholds, NHS Digital publishes text descriptions of analytic rules and logic, commonly referred to as 'business rules', which are taken by software providers and implemented in GP electronic health record systems. GPs can review their delivery of care against these rules and indicators for their practice throughout the financial year; however, national data for all practices are only available annually. At the end of every NHS financial year on March 31, NHS Digital calculates each practice's achievement against set thresholds for individual indicators. Between 1 April 2020 and 31 March 2023, amendments were made to QOF, and some preventative indicators were suspended, including hypertension management, to support the COVID-19 response and support roll out of the national COVID-19 vaccination programme.¹⁶¹⁷

OpenSAFELY is a secure analytics platform for electronic patient records built by our group on behalf of NHS England to deliver urgent academic⁶ and operational research² during the pandemic. Using Open-SAFELY-TPP, we therefore aimed to describe trends and variations in these indicators before and during the COVID-19 pandemic and assess recovery of the indicators to pre-pandemic levels across key clinical and demographic subgroups.

METHODS

Data source

Primary care records managed by the GP software provider TPP were accessed through OpenSAFELY (https://opensafely.org). OpenSAFELY is a secure analytics platform for electronic patient records built by our group with the approval of NHS England to deliver urgent academic⁶ and operational NHS service research² on the direct and indirect impacts of the pandemic.

OpenSAFELY provides a secure software interface allowing the analysis of pseudonymised primary care patient records from England in near real-time within the EHR vendor's highly secure data centre, avoiding the need for large volumes of potentially disclosive pseudonymised patient data to be transferred off-site. The dataset analysed within OpenSAFELY is based on 25 million people currently registered with GP surgeries using TPP SystmOne software. It includes pseudonymised data such as coded diagnoses, medications and physiological parameters. No free text data are included. Further details on our information governance and ethics can be found in the in the online supplemental file 1.

Study design and population

We conducted a retrospective cohort study from March 2019 to March 2023 using primary care EHR data from all GP practices in England supplied by the EHR vendor TPP, a cohort that is broadly representative of the population in England.¹⁸ Following the QOF business rules, we included all patients who were alive and registered with an OpenSAFELY-TPP practice for the QOF hypertension prevalence and management indicators (HYP001, HYP003, HYP007). For the QOF blood pressure screening indicator (BP002), we included only those aged \geq 45 years.

Implementation of QOF business rules in analytic code

OOF indicators for blood pressure screening in the preceding 5 years (BP002), hypertension register (HYP001) and hypertension management in the preceding 12 months (HYP003, HYP007) were specified in analytic code replicating the QOF business rules for 2021/22 (Version 46)¹⁹ using the OpenSAFELY framework (table 1). All QOF indicators are formed by specifying rules and logic, which determine aggregate counts of patients. Percentages are then calculated using numerator and denominator pairs. In addition to QOF indicators, we also applied the same clinical rules for blood pressure screening (BP002) to all patients with a record of an unresolved hypertension diagnosis using a 12-month lookback period to match the timeframe used in the hypertension management indicators (HYP003 and HYP007).

Higher indicator percentages represent a higher percentage of patients receiving indicated clinical care. Patients can be excluded from the denominator according to QOF rules, such as those who declined treatment (for more details, see online supplemental tables 1–4. For the two hypertension control indicators (HYP003 and HYP007), patients with hypertension who did not have their blood pressure recorded in the last year are counted as not being treated to target as per the QOF business rules.

Table 1	Descriptions of the Qu	ality and Outcomes Framework indicators for blood pressure (BP) ar	nd hypertension (HYP)
Indicator	Domain/category	Indicator description	Population of interest
BP002	Public health	The percentage of patients aged 45 years or over who have a record of blood pressure in the preceding 5 years .	All registered patients aged ≥45 years
HYP001*	Clinical/records	The contractor establishes and maintains a register of patients with established hypertension.	All registered patients
HYP003†	Clinical/ongoing management	The percentage of patients aged 79 years or below, with hypertension, in whom the last blood pressure reading (measured in the preceding 12 months) is 140/90 mmHg or less.	Hypertension register (HYP001*)
HYP007	Clinical/ongoing management	The percentage of patients aged 80 years or over, with hypertension, in whom the last blood pressure reading (measured in the preceding 12 months) is 150/90 mmHg or less.	Hypertension register (HYP001*)

*Indicator HYP001 refers to the hypertension register (HYP_REG) defined as 'Patients with an unresolved diagnosis of hypertension'. †For the purpose of this analysis, this is the treatment target. The population that meets the blood pressure target will be described as *treated to target*. More details on the specific selection and exclusion rules and the codelists are available in the online supplemental tables 1–5.

Data were analysed for each month between 1 March 2019 and 31 March 2023 covering five financial years. Each monthly cohort replicated the yearly reporting of each QOF business rule. Thus, the data presented for each March in this study align with the reporting period of the corresponding annual QOF reports published by NHS Digital.

Monthly changes in QOF indicators across demographic, regional and clinical subgroups

Trends and variations in QOF indicators were reported across demographic (10-year age bands, sex, ethnicity in 5 and 16 categories), regional (practice level deciles, Indices of Multiple Deprivation quintiles derived from patient's postcode at lower super output area, region) and key clinical subgroups (record of learning disability and care home status) highlighted in the NHS long-term plan as priority groups.²⁰

Software and reproducibility

Data management and analyses were performed using the OpenSAFELY software libraries with Python (Version 3.8.10) and R (Version 4.0.2). Codes replicating the QOF business rules are available at https://github.com/opensafely/hypertension-sro and https://github.com/opensafely/blood-pressure-sro alongside all analytic code and codelists. The GitHub repository https://github.com/ opensafely/qof-utilities contains reusable code developed for implementing QOF rules in OpenSAFELY.

Patient and public involvement

For transparency purposes, we have developed a public website (https://opensafely.org/) that provides a detailed description of the platform in language suitable for a lay audience; we have participated in two citizen juries exploring public trust in OpenSAFELX.²¹ To ensure the patient voice is represented, we are working closely with appropriate medical research charities; however, there was no patient or public involvement in this specific research question.

RESULTS

Calculating monthly trends in QOF indicators

Detailed demographic characteristics of all patients considered for the blood pressure (n=11 195 670) and hypertension indicators (n=25 287 730) during the reporting period of the NHS financial year 21/22 are presented in table 2.

Changes in blood pressure screening and hypertension management rates in the total population

In the total population, the percentage of patients aged \geq 45 years (BP002) with recorded blood pressure in the preceding 5 years decreased steadily from its maximum of 90.4% in March 2019 to a minimum of 87.2% in March 2023 (figure 1A).

Recorded hypertension prevalence (HYP001) was relatively stable throughout the entire study period (14.7% in March 2019 to 14.9% in March 2023, figure 1B). Blood pressure screening in the preceding 12 months in patients identified as having hypertension decreased from its peak of 88% in March 2019 to its lowest value of 68% in April 2021 and subsequently improved steadily to 85% in March 2023.

Of those aged \leq 79 years identified as having hypertension, the percentage of patients with blood pressure treated to target (HYP003) varied from 67.5% in March 2019 to 70.1% in March 2023, with a peak of 70.6% in March 2020 and a lowest value of 47.2% in February 2021 (figure 1C). Of those aged \geq 80 years, the percentage of patients with blood pressure treated to target (HYP007) reduced from 85.3% in March 2019 (the peak value) to 79.9% in March 2023, with a lowest value of 57.8% in February 2021 (figure 1D). For both hypertension management indicators (HYP003 and HYP007) as well as blood pressure screening in patients identified as having hypertension, the results indicated a steady improvement between March 2021 and March 2023.

By March 2023, the differences compared with March 2019 were a 3.1% decrease (90.4% to 87.2%) in patients

	BP002 (Age: Public healtl	>=45) h domain		HYP001 (to clinical do	otal populai main	tion)	HYP003 (age vlinical dom	≤79) ain		HYP007 (Ag clinical don	je ≥80) nain	
	Numerator	Denominator	Receiving indicated care	Register	List size	Prevalence	Numerator	Denominator	Receiving indicated care	Numerator	Denominator	Receiving indicated care
Population												
	9587610	11 195670	85.6%	3672870	25287730	14.5%	1 607 520	2664840	60.3%	554240	764960	72.5%
Sex												
Female	5115540	5736940	89.2%	1848910	12621240	14.7%	782460	1 268 720	61.7%	326560	463200	70.5%
Male	4472070	5458730	82.0%	1823960	12666500	14.4%	825060	1396110	59.1%	227680	301 760	75.5%
Age band												
0-19	I	I	I	2180	5547410	0.04%	1010	1780	56.7%	I	1	I
20-29	I	I	I	11 400	3139340	0.4%	4790	9120	52.5%	I	1	I
30-39	I	I	I	60 680	3629760	1.7%	25760	50520	51.0%	I	1	I
40-49	1124490	1 548 870	72.6%	220760	3 246 940	6.8%	00266	191 390	52.1%	I	I	I
50-59	2751360	3415030	80.6%	615040	3 458 290	17.8%	308270	555420	55.5%	I	1	I
60-69	2 407 340	2752690	87.5%	887 520	2 774 540	32.0%	506800	828 700	61.2%	1	I	1
70-79	2079410	2215190	93.9%	1 079 680	2 224 430	48.5%	661 200	1 027 890	64.3%	I	I	I
80+	1 225 010	1 263 890	96.9%	795620	1 267 020	62.8%	I	I	I	554240	764960	72.5%
Ethnicity												
Asian or Asian British												
Any other Asian background	106280	126810	83.8%	39 230	412650	9.5%	21570	33220	64.9%	2250	3080	73.1%
Bangladeshi	27 800	30490	91.2%	11 860	124 500	9.5%	0069	10060	68.6%	570	820	69.5%
Indian	209490	239700	87.4%	91 540	710370	12.9%	47230	74360	63.5%	8100	11 090	73.0%
Pakistani	123280	136790	90.1%	48 560	513040	9.5%	25980	40 040	64.9%	3530	4900	72.0%
Black or Black British												
African	90 470	108040	83.7%	40 280	385 090	10.5%	18710	34270	54.6%	1000	1620	61.7%
Any other Black background	29 650	34290	86.5%	11 700	103910	11.3%	5340	9760	54.7%	570	840	67.7%
Caribbean	55 000	61340	89.7%	27 660	115680	23.9%	11410	19970	57.1%	4160	5900	70.5%
Mixed												
Any other mixed background	22 820	28270	80.7%	7480	141140	5.3%	3600	6150	58.5%	450	630	71.4%
White and Asian	12 650	15320	82.6%	3970	81 280	4.9%	1980	3270	60.6%	240	340	70.6%
White and Black African	13620	16600	82.1%	5660	70890	8.0%	2590	4770	54.3%	150	250	%0.09
White and Black Caribbean	15690	17 990	87.2%	6710	84870	8.0%	2840	5160	55.0%	069	970	71.1%
Other ethnic groups												
Any other ethnic group	69430	89460	77.6%	21 420	330160	6.5%	10320	17140	60.2%	1610	2210	72.9%
												Continued

6

Open Heart: first published as 10.1136/openhrt-2024-002732 on 30 August 2024. Downloaded from https://openheart.bmj.com on 11 June 2025 by guest.
Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Heread formation		BP002 (Age>	-46)										
Remaining International Control of the cont		Public health	r domain		HYP001 (to clinical dor	otal populat nain	tion)	HYP003 (age vlinical doma	e ≤79) ain		HYP007 (Ag clinical dom	je ≥80) ∩ain	
Chimese 3160 4510 751 266 600 600 600 600 600 600 600 7	-	Numerator	Denominator	Receiving indicated care	Register	List size	Prevalence	Numerator	Denominator	Receiving indicated care	Numerator	Denominator	Receiving indicated care
With And Serve of the serv	Chinese	31 660	43 510	72.8%	9030	182 960	5.0%	4520	7100	63.7%	720	1030	69.9%
Any other while background 58110 75520 7510 71543 71543 71543 Any other while background 58110 75520 5730 1443100 87354 1443100 87354 144310 87354 243730 5139 263730 7533 243730 7534 243700 7534 24370 7534 24370 7534 24370 7534 24360 7534 24360 7534 24360 25340 <td>White</td> <td></td>	White												
British 6561160 7355620 88% 200730 14431100 81540 181400 612% 608400 56440	Any other White background	589110	755220	78.0%	220 030	2320120	9.5%	92 240	163970	56.3%	26690	37150	71.84%
(h) (600) (614) (713) (7200) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (173) (1240) (126	British	5951180	7855620	88.5%	2607310	14450100	18.0%	1151190	1 881 440	61.2%	409870	559430	73.27%
Misring 1114.00 1596.50 549.56 549.50 549.57 56.66 69.00 126.860 69.00 126.860 69.00 126.860 69.00 126.860 69.00 126.860 69.00 126.860 69.00 126.860	Irish	58 040	66 660	87.1%	22 080	112460	19.6%	8790	14600	60.2%	4360	6020	72.43%
Interfact A B A B A B A B A B A B A B A B A B A B	(Missing)	1 181 420	1569530	75.3%	498350	5148500	9.7%	192300	339570	56.6%	89 300	128 680	69.40%
1 - Matterprised 154100 173820 654600 4936300 14,% 206100 61.3% 72.40 102.200 72.3% 2 173400 2157500 65.7% 680707 485300 14,% 307600 55.3% 739300 55.4% 739300 55.4% 739300 55.4% 739300 55.4% 739300 55.4% 739300 55.4% 739300 75.4% 55.4% 739300 75.4% <td< td=""><td>IMD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	IMD												
2 172400 2015760 85.% 68600 485.860 14% 307600 50.% 636.00 50.% 50.00 50.% 50.00 50.% 50.00 50.% 50.00 50.% 70.00 70.% 70.00 70.% 70.00 70.% 70.00 70.%	1 - Most deprived	1541010	1 793 920	85.9%	634660	4 993 420	12.7%	298170	486270	61.3%	74240	102 320	72.6%
3 2073(0) 2433(0) 55.% 739(0) 55.% 739(0) 55.% 734(0)		1728400	2015760	85.7%	688 070	4 885 930	14.1%	307 680	509 890	60.3%	94540	130 790	72.3%
4 205.06 210900 55.5% 76900 55.7% 76900 157400 157600	ç	2078700	2425360	85.7%	799 060	5 203 780	15.4%	344130	573440	60.0%	126130	173430	72.7%
5 - Least deprived 177 820 2313780 855% 709070 450310 550% 597 50 59.960 59.960 59.960 59.960 59.960 59.960 59.960 59.960 59.360 <	4	2 062 080	2410990	85.5%	769580	4 892 080	15.7%	327280	545 930	60.0%	126760	175140	72.4%
(Misrig) 19590 23660 64% 7240 80330 53300 619% 1940 12420 7356 Rejon 1<	5 - Least deprived	1 977 820	2313780	85.5%	020 070	4 503 140	15.8%	297 250	496 010	59.9%	123440	170860	72.3%
Regin Regin Explore S856 <th colspan="6</td> <td>(Missing)</td> <td>199590</td> <td>235860</td> <td>84.6%</td> <td>72 440</td> <td>809380</td> <td>9.0%</td> <td>33 000</td> <td>53300</td> <td>61.9%</td> <td>9140</td> <td>12420</td> <td>73.6%</td>	(Missing)	199590	235860	84.6%	72 440	809380	9.0%	33 000	53300	61.9%	9140	12420	73.6%
East 2190210 555650 65.8% 28390 573610 13.4% 349120 56660 68.5% 126900 176300 173360 East Midlands 1689470 1966690 85.9% 668520 4391220 5.0% 295620 481870 61269 73260 73560 London 467680 581050 85.9% 173291 179310 81720 61307 613670 735260 73530 Nuth test 44680 56160 85.9% 175280 149% 71200 129440 65.9% 55300 75520 Nuth test 657640 755260 85.9% 175200 147% 10500 159% 7100 553% 735 Nuth test 657640 757500 86.9% 175201 1647190 147% 10500 157690 55300 5530 5530 5530 5530 5530 5530 5530 5534 5540 5540 5540 5540 5540 5540 5540	Region												
East Midlands $1600 + 70$ 166660 859% 685520 439120 51.0% 296600 61.2% 97460 51260 73260 73560 London 467660 581050 80.7% 174910 1798010 97% 87120 138270 61.2% 9930 27610 72.2% London 467660 516940 516940 857640 81720 138270 63.7% 89460 2756 8766 8766 1372190 85764 87660 85764 236720 87710 85720 87670 87670 87710 85720 87670 87670 87670 87710 85720 87710 87710 85720 87710 <	East	2190210	2552650	85.8%	828930	5785610	14.3%	349 120	596 850	58.5%	126920	178030	71.3%
London 467 680 581 050 80.5% 174 910 178 910 377 10 138 270 63.0% 1930 276 10 72.3% North East 444 680 516 940 86.0% 175 280 1176 200 14.9% 81 040 25.940 55.540 74 55 North East 657 640 516 940 86.0% 175 280 14.9% 81 040 129 640 65.3% 55.30 74 35 North West 657 640 755 60 86.0% 175 200 14.9% 81 040 15.9% 51 640 55.340 53 57 0 53 40 53 57 0 53 40 53 50 <	East Midlands	1689470	1 966 690	85.9%	658520	4 391 220	15.0%	295 020	481 870	61.2%	97 480	132650	73.5%
North East 44680 516940 80.0% 175280 176200 149% 81040 129640 62.% 56460 35520 74.5% North West 896960 103710 86.% 355940 185660 16.3% 172190 53.3% 51580 69400 74.3% North West 657640 775260 84.% 355940 185660 16.3% 712190 53.3% 51.5% 51.5% 51.5% 51.5% 51.5% 51.4% 71.0% South West 148430 1733370 86.3% 14.5% 219820 51.5% 51.5% 51.5% 51.9% 51.4% 71.0% 51.5% 51.4% 51.5%	London	467 680	581 050	80.5%	174910	1 798 910	9.7%	87120	138270	63.0%	19930	27610	72.2%
North West 896960 1034710 86.7% 355340 183660 6.3% 153810 65.3% 51580 69400 74.3% South East 657640 775260 84.8% 238870 14.5% 91050 167610 54.3% 37710 55340 86.1% South East 657640 775260 84.8% 238870 14.5% 91050 167610 54.3% 37710 55340 86.1% South West 148430 73580 54.3% 37580 54.3% 3710 55.3% 80.9% 73.6% West Midlands 355330 412660 86.1% 144560 14.7% 246450 397970 61.9% 76.9% 73.6% West Midlands 355330 153520 86.3% 53616 14.7% 246450 397970 61.9% 76.9% 73.8% West Midlands 153520 86.3% 514610 74.4% 246450 397970 61.9% 76.9% 76.9% 76.9% 76.9% <td< td=""><td>North East</td><td>444 680</td><td>516940</td><td>86.0%</td><td>175280</td><td>1176200</td><td>14.9%</td><td>81 040</td><td>129640</td><td>62.5%</td><td>26460</td><td>35520</td><td>74.5%</td></td<>	North East	444 680	516940	86.0%	175280	1176200	14.9%	81 040	129640	62.5%	26460	35520	74.5%
South East 657640 775 260 84.8% 23870 1647190 15.5% 91050 167610 54.3% 37710 55340 88.1% South West 148430 1733970 85.6% 547440 356860 15.6% 219820 85.9% 94190 129810 75.6% West Midands 355330 412660 86.1% 144560 1041080 13.9% 61510 108300 56.8% 20180 75.6% 75.0% 75.6%	North West	396 960	1 034 710	86.7%	355940	2185660	16.3%	172190	263 81 0	65.3%	51580	69400	74.3%
South West 1484430 1733970 85.6% 547440 3508660 15.6% 219820 58.5% 94190 129810 72.6% West Midlands 355330 412660 86.1% 144560 15.6% 108300 56.8% 94190 129810 72.6% West Midlands 355330 412660 86.1% 144560 13.9% 61510 108300 56.8% 20180 28890 69.9% West Midlands 1374980 159320 86.3% 538010 3666360 14.7% 246450 397970 61.9% 78570 106420 73.8% Verk ine and The Humber 1374980 156360 14.7% 246450 397970 61.9% 78570 106420 73.8% Care home status 11049600 85.5% 3617810 13.7% 1599120 2652850 60.3% 727500 74.5% No 9443510 14060 98.7% 55060 112640 83890 11980 70.0% 77500 74.5%	South East	557 640	775 260	84.8%	238870	1647190	14.5%	91 050	167610	54.3%	37 710	55340	68.1%
West Midlands 355 330 412 660 86.1% 144 560 104 1080 13.9% 61 510 108 300 56.8% 20 180 28 890 69.9% Vorkshire and The Humber 1374 980 1593 520 86.3% 538 010 366 360 14.7% 246 450 397 70 61.9% 78 70 106 420 73.8% Care home status 1374 980 1593 520 86.3% 516 112 640 366 360 14.37% 1599 120 265 2650 60.3% 72.60 73.4% Care home status 9443 510 11049600 85.5% 3617 810 265 350 60.3% 70.0% 73.60 73.4% Vest 144100 146060 85.5% 55060 112640 48.8% 8390 11980 70.0% 70.0% 73.60 74.5% No 9542000 1149060 85.6% 35640 1458740 265360 60.3% 70.0% 75.8% 7460 75.5% No 9542000 114960 85.6% 358810	South West	1 484 430	1 733 970	85.6%	547440	3 508 660	15.6%	219820	375 880	58.5%	94190	129810	72.6%
Vorkshire and The Humber 1374 980 1593520 86.3% 538010 3666 360 14.7% 246450 397970 61.9% 78570 106420 73.8% Care home status 2.43510 11049600 85.5% 3617810 25175090 14.37% 1599120 2652850 60.3% 526530 727500 72.4% Ves 144100 146060 98.7% 55060 112640 48.88% 8390 11980 70.0% 27890 7460 74.5% Record or learning disability 1 110 146060 85.6% 3658810 244.720 14.55% 1598740 265320 60.3% 7460 74.5% Record or learning disability 1 1 14.55% 14.56% 14.58740 265320 60.3% 76410 75.5% No 9542000 114960 85.6% 368810 24.55% 76410 70.5% 76410 75.5% No 9542000 114960 85.6% 36810 245870 60.3%	West Midlands	355 330	412 660	86.1%	144560	1 041 080	13.9%	61510	108300	56.8%	20 180	28890	69.9%
Care home status 0443510 11049600 85.5% 3617810 25175090 14.37% 1599120 2652850 60.3% 526350 727500 72.4% Ves 144100 146060 85.5% 3617810 251660 14.37% 1599120 2652850 60.3% 526350 727500 72.4% Yes 144100 146060 98.7% 55060 112.640 48.8% 8390 11980 70.0% 27890 7450 74.5% Record or learning disability 1 1 1 1 1 1 952200 114900 60.3% 553820 60.3% 70.0% 75380 75.5% No 9542000 1149060 85.6% 3544720 14.55% 158740 2652360 60.3% 563820 764410 70.5% 75.5% Ves 9542000 1149060 85.6% 14.55% 158740 2652360 60.3% 70.4% 70.4% 70.5% 75.5% No 9542000 97.6% 14060 983% 8780 70.4% 70.4% 70.4%	Yorkshire and The Humber	1374980	1 593 520	86.3%	538010	3666360	14.7%	246450	397 970	61.9%	78 570	106420	73.8%
No 943510 11049600 85.5% 3617810 21.7500 14.37% 1599120 2652850 60.3% 526350 727500 72.4% Ves 144100 146060 98.7% 55060 112640 48.88% 8390 11980 70.0% 27890 7450 74.5% Record relaring disability 1 14.100 146060 85.6% 355810 2514720 14.55% 1598740 2652360 60.3% 573820 7461 75.5% No 9542000 11149060 85.6% 3658810 2514720 14.55% 1598740 2652360 60.3% 53820 76410 75.5% Ves 45610 97.6% 14060 14.3010 9.83% 8780 12.480 70.4% 420 550 76.4%	Care home status												
Ves 144100 146060 98.7% 55060 112640 48.8% 8390 11980 70.0% 27 890 37460 74.5% Record or learning disability 9542000 11149060 85.6% 3658810 2514720 14.55% 1598740 2652360 60.3% 553820 764410 72.5% No 9542000 11149060 85.6% 3658810 2514720 14.55% 1598740 2652360 60.3% 553820 764410 72.5% Ves 45610 97.6% 14060 143010 9.83% 8780 12480 70.4% 420 550 76.4%	No	9443510	11049600	85.5%	3617810	25175090	14.37%	1 599 120	2 652 850	60.3%	526350	727 500	72.4%
Record or learning disability No 9542000 11149060 85.6% 3658810 2514720 14.55% 1598740 2652360 60.3% 553820 764410 72.5% Ves 45610 4610 97.6% 14000 9.83% 8780 12.480 70.4% 420 550 76.4%	Yes	144100	146060	98.7%	55060	112640	48.88%	8390	11 980	70.0%	27 890	37 460	74.5%
No 9542000 1149060 85.6% 3658810 25144720 14.55% 1598740 2652360 60.3% 553820 764410 72.5% Yes 45610 46610 97.6% 14060 143010 9.83% 8780 12480 70.4% 420 550 76.4%	Record or learning disability												
Yes 45610 46610 97.6% 14060 143010 9.83% 8780 12480 70.4% 420 550 76.4%	No	9542000	11149060	85.6%	3658810	25144720	14.55%	1 598 740	2 652 360	60.3%	553820	764410	72.5%
	Yes	45610	46610	97.6%	14060	143010	9.83%	8780	12480	70.4%	420	550	76.4%

Health care delivery, economics and global health care

5



Figure 1 Monthly trends from March 2019 to March 2023 in (A) the percentage of patients aged \geq 45 years with blood pressure screening in the preceding 5 years (BP002); (B) the hypertension register (HYP001); (C) the percentage of patients diagnosed with hypertension and recorded blood pressure in the preceding 12 months. Demographic, regional and clinical subgroups for panel C are presented in online supplemental figure 2); (D) the percentage of patients diagnosed with hypertension and treated to target (HYP003 and HYP007) in the preceding 12 months. BP, Blood pressure; HYP, Hypertension. The end of the NHS financial years (March) is highlighted with orange dashed vertical lines. Counts of patients in the numerator and denominator pair are presented in online supplemental figures 1C and 2C).

aged \geq 45 years (BP002) with recorded blood pressure in the preceding 5 years, a 0.2% increase (14.7% to 14.9%) in recorded hypertension prevalence (HYP001), a 2.6% increase (67.5% to 70.1%), and a 5.4% decrease (85.3% to 79.9%) in patients identified as having hypertension with blood pressure treated to target aged \leq 79 and \geq 80 years, respectively (HYP003 and HYP007). Counts of patients in the numerator and denominator are presented in online supplemental figure 1.

Changes in blood pressure screening and hypertension management rates in demographic, regional and clinical subgroups

Subgroups for blood pressure screening in the preceding 5 years in patients aged \geq 45 years (BP002)

Figure 2 shows the trends in subgroups for blood pressure screening in the preceding 5 years in patients aged \geq 45 years (BP002). Preexisting differences in blood pressure screening rates between younger and older age groups increased over the study period, with a reduction in screening observed in younger adults (eg, for age category 45 to 49: 81.9% in March 2019 to 74.9% in March 2023) but not older adults (blood pressure screening was preserved at around 97% in adults aged 80+, figure 2C). Blood pressure screening

was also maintained in those with a record of care home status (99.2% in March 2019 to 98.7% in March 2023) or learning disability (98.0% in March 2019 to 98.3% in March 2023, figure 2G,H). From December 2022 to March 2023, results indicate an improvement in recorded blood pressure screening across all demographic and clinical subgroups.

Subgroups for hypertension prevalence (HYP001)

Grouping by demographic subgroups revealed prepandemic differences in hypertension recording (figure 3). In March 2019, the national median by practice was 15.0%; however, this was considerably lower in London (10.4%) and in those with an ethnicity record of 'Mixed' (6.1%) or 'Chinese or Other Ethnic Groups' (6.9%). Hypertension was also less frequently recorded in those living in the most deprived areas (12.8%) compared with those living in the least deprived areas (15.6%). Hypertension was more often recorded in those living in care homes (48.8%) and less frequently in those with learning difficulties (9.6%). The differences observed at pre-pandemic remained similar throughout the study period across most subgroups (figure 3).



Figure 2 Monthly, unstandardised trends from March 2019 to March 2023 in the percentage of patients aged \geq 45 years with recorded blood pressure in the preceding 5 years in (BP002) broken down by (A) practice level deciles, (B) sex, (C) age band, (D) region, (E) ethnicity, (F) IMD, Indices of Multiple Deprivation, (G) learning disability and (H) care home status for hypertension. The end of the NHS financial years (March) is highlighted with orange dashed vertical lines.



Figure 3 Monthly, unstandardised trends from March 2019 to March 2023 in hypertension prevalence (HYP001) broken down by (A) practice level deciles, (B) sex, (C) age band, (D) region, (E) ethnicity, (F) IMD, Indices of Multiple Deprivation, (G) learning disability and (H) care home status for hypertension. The end of the NHS financial years (March) is highlighted with orange dashed vertical lines. Note that the range of the y-axis varies by breakdown category to highlight differences between groups.

Subgroups for hypertension management in the preceding 12 months in patients aged \leq 79 (HYP003) and \geq 80 (HYP007) years Figures 4 and 5 show the trends in subgroups for hypertension management. Preexisting regional differences between subgroups in blood pressure management in patients diagnosed with hypertension aged \leq 79 years (HYP003) increased during the study period (figure 4A). In March 2021, the regions South-East and West Midlands

had the lowest proportion of patients treated to target, with 39.4% and 41.8%, respectively (figure 5A), compared with the national median by practice of 49.4% and other regions. A similar trend was observed for patients aged \geq 80 years (HYP007, figures 4B and 5B).

Later in the analysis period, between March 2021 and March 2023, a higher proportion of patients in older age groups (60–69 and 70–79 years) were reported as having



Figure 4 Monthly, unstandardised trends from March 2019 to March 2023 in the percentage of patients diagnosed with hypertension treated to target in the preceding 12 months aged \leq 79 years (HYP003) and \geq 80 years (HYP007) broken down by (A, B) practice level deciles, (C, D) sex, (E, F) age band and (G, H) ethnicity. The end of the NHS financial years (March) is highlighted with orange dashed vertical lines.



Figure 5 Monthly, unstandardised trends from March 2019 to March 2023 in the percentage of patients diagnosed with hypertension treated to target in the preceding 12 months aged \leq 79 years (HYP003) and \geq 80 years (HYP007) broken down by (A, B) region, (C, D) IMD, Indices of Multiple Deprivation, (E, F) record of learning disability and (G, H) care home status. The end of the NHS financial years (March) is highlighted with orange dashed vertical lines.

their hypertension treated to target than younger age groups.

Between March 2020 and March 2021, the proportion of patients in care homes with hypertension treated to target reduced by 17.4% in those aged \leq 79 years (HYP003) and by 18.6% in those aged \geq 80 years (HYP007). In March 2023, the proportion of patients with hypertension treated to target had nearly returned to pre-pandemic levels.

DISCUSSION

Summary

These results suggested that the pandemic had a substantial impact on the percentage of patients in whom hypertension was classified as not treated to target within the preceding 12 months. Our analyses suggest that this may be attributed to a reduction in blood pressure measurement in the preceding 12 months. We did not observe a substantial impact of the pandemic on the public health QOF standard for blood pressure screening, which is assessed within the preceding 5 years, or on the register for hypertension prevalence.

Strengths and limitations

This study has a range of strengths. The OpenSAFE-LY-TPP platform runs analyses across the full raw, pseudonymised, dataset for 25.2 million patients at 2540 practices in England using TPP software. In this study, we have reported monthly QOF measures in near real-time.

We acknowledge several limitations in our analyses. Results within regional and demographic subgroups need to be interpreted carefully because we report unstandardised results and did not account for sociodemographic factors (eg, age differences between subgroups). A recent study found that OpenSAFELY-TPP was largely representative of the general population of England in terms of IMD, age, sex, ethnicity and causes of death, although with relative underrepresentation of practices in London.¹⁷

We have implemented QOF business rules as described in the text description published by NHS Digital; however, we would expect our ascertainment of specific patients to deviate from other sources of QOF data for two reasons: (1) as described above OpenSAFELY-TPP has access to the full raw GP record, which many not be the case for all other sources of QOF data; and (2) when translating information from the QOF business rules we had to make pragmatic decisions to resolve some ambiguity.

Finally, we also note that our data will only include clinical codes for blood pressure recording that were carried out in primary care, by a patient at home and correctly captured in a GP system or in secondary care and returned to GPs as structured data. In this study, where blood pressure results are not recorded or correctly captured within a GP system, individuals were counted as not being treated to target, which is consistent with the QOF business rules. The correct capture of clinical coding is a limitation of all EHR analytic work.

Findings in context

Blood pressure screening and hypertension management are national priorities²² as a modifiable strong risk factor for CVD globally.²³ Hypertension management has been incentivised by QOF for primary care since 2005, and advances in the detection and management of patients with hypertension have been gradually observed.¹⁰ This progression was disrupted by the COVID-19 pandemic. In response to the unparalleled pressure on the health service in the pandemic, some QOF indicators were suspended, including hypertension management in order to support prioritisation of clinical workload.²⁴ Practices may have rightly deprioritised some care described here to focus on more urgent care needs during the COVID-19 pandemic.

We have reported a prevalence of hypertension that is consistent with the latest available official annual report by NHS Digital covering NHS financial year 2021/22 (see online supplemental table 6) and with the second annual audit from the CVDPRE-VENT initiative (covering data up to March 2021) in England.¹³ Furthermore, our results are consistent with the most recent quarterly data published by CVDPREVENT including data up to June 2022.²⁵ A consistent finding across our work, CVDPREVENT and official QOF publications was the reduction in the proportion of patients with hypertension treated to target in March 2020 and March 2021; however, our study reveals continued recovery of care beyond this period, particularly during the first months of 2023. CVDPREVENT also reported a reduction of 21.4% in the proportion of patients recorded as having their blood pressure treated and meeting the NICE guideline target between March 2020 and March 2021.¹³ It is likely that the combination of the factors contributed to this observation. Those without a blood pressure recording in the preceding 12 months were reported as not having their hypertension treated to target (see online supplemental figure 2). This finding is likely due to a 42% reduction of recorded blood pressure measurement activity between April 2019 and April 2021.³ Furthermore, services may have re-prioritised those with poorly controlled blood pressure during the pandemic.

Interestingly, there is a sex- and age-dependent difference in the proportion of patients with hypertension treated to target. The proportion of female patients with hypertension treated to target was consistently greater than male patients aged \leq 79 years (figure 4C). However, in patients \geq 80 years, this is reversed, with a greater proportion of male patients having their hypertension treated to target (figure 4D). The cause of this trend is beyond the scope of this study, but similar patterns have been observed elsewhere.²⁶ Similarly, the unstandardised

results suggest that there is a trend towards a lower proportion of black ethnic patients with hypertension treated to target (figure 4G,H); however, this is likely influenced by age differences between ethnicity groups. Variation in hypertension control according to ethnicity has been described widely elsewhere and the cause of which is likely to be multi-faceted.²⁷

Implications for policy and future research

It is possible that the observed results represent prioritisation of other clinical areas, and the results of this study should not be interpreted as criticism of GPs. The issue has already been recognised, and new NHS services were rapidly established in response (eg, NHS Community Pharmacy Blood Pressure Check Service and BP@home Service).^{22,28}

In this study, we observed that patients from the most deprived areas had the lowest proportion of patients on the hypertension register (HYP001), and this decreased further during the pandemic (figure 3F). There was also a trend towards a lower proportion of black ethnic patients with hypertension treated to target, which has also been observed prior to the pandemic in other elements of CVD care.²⁹ Future research is needed to help understand the reasons for the observed reductions in hypertension management and to further understand the health inequalities to find effective solutions to best address them. The Core20PLUS5, a national NHS England approach to support the reduction of health inequalities at both national and system level, is a new well-placed initiative designed to tackle the management of high blood pressure in these important patient groups.

The OpenSAFELY platform could be used to analyse NHS England, National Institute of Clinical Excellence and Care Quality Commission on current indicators of clinical care and has the technical ability to prototype new ones. The additional demographic and clinical data securely accessible through the OpenSAFELY tools also has a number of advantages to current published reports of QOF. It can be used to identify health inequalities among regional, demographic or clinical sub-populations (eg, ethnicity or record of learning disability) in near real-time for new policies and clinical recommendations. Further, all code used in OpenSAFELY is reusable and modifiable and is available under open source licences, which provides opportunities for a more transparent future for operational analysis in the NHS and research using EHR data.

CONCLUSION

Although hypertension management indicators were disrupted substantially during the pandemic, this can likely be attributed to a general reduction of blood pressure measurement. Reassuringly, hypertension management indicators have been improving steadily since March 2021 and are now approaching those seen pre-pandemic. While resources were stretched during the pandemic, blood pressure screening was prioritised by GPs in older age groups and patients with a record of learning disability or care home status. OpenSAFELY can be used to continuously monitor monthly changes in quality of care indicators to identify significant changes in key clinical subgroups early.

Author affiliations

 $^1\mbox{Nuffield}$ Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

²Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, UK

³Epidemiology and Population Health, London School of Hygiene and Tropical Medicine Faculty of Epidemiology and Population Health, London, UK

 $^{\rm 4}\!Wolfson$ Institute of Population Health, Queen Mary University of London, London, UK

⁵The DataLab, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

⁶TPP, Leeds, UK

X Christopher T Rentsch @DarthCTR

Acknowledgements We are very grateful for all the support received from the TPP Technical Operations team throughout this work and for generous assistance from the information governance and database teams at NHS England and the NHS England Transformation Directorate.

Contributors MW, VS, CC, RH, BG and BM conceptualised the study. MW, VS, CC, RH, HJC, CA, LF, LH, RMS, PI, DE, SM, ID, AJW, JM, AM, SB, CB, JC, JP, FH and SH curated the data. MW, VS, CC, RH, HJC, CA, LF and LH did formal analysis.BG acquired funding. MW, VS, CC, RH, HJC, CA, LF, LH, CTR, VM, LT, CM, MS, AG, CW, ADB, JM and CW did the investigation. MW, VS, CC, RH, HJC, CA, LF and LH created the method. MW, VS, CC, RH and HJC used the software. BG and BMK provided the supervision. MW, VS, CC, RH, BMK, CTR, VM, LT, CM, MS, AG, CW, ADB, JD, E, SM, ID, AJW, JM, AM and SB wrote the review and provided edits. BMK is the guarantor.

Funding BG's work on better use of data in healthcare more broadly is currently funded in part by the Wellcome Trust, NIHR Oxford Biomedical Research Centre, NIHR Applied Research Collaboration Oxford and Thames Valley, the Mohn-Westlake Foundation; all DataLab staff are supported by BG's grants on this work. BMK is also employed by NHS England working on medicines policy and clinical lead for primary care medicines data. RJM is supported by NIHR Oxford and Thames Valley Applied Research Consortium and is an NIHR Senior Investigator. The views expressed are those of the authors and not necessarily those of the NIHR, NHS England, Public Health England or the Department of Health and Social Care. The views expressed are those of the authors and not necessarily those of the NIHR, NHS England, Public Health England or the Department of Health and Social Care. Funders had no role in the study design, collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

Competing interests All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare the following: BG has received research funding from the Laura and John Arnold Foundation, the NHS National Institute for Health Research (NIHR), the NIHR School of Primary Care Research, the NIHR Oxford Biomedical Research Centre, the Mohn-Westlake Foundation, NIHR Applied Research Collaboration Oxford and Thames Valley, the Wellcome Trust, the Good Thinking Foundation, Health Data Research UK, the Health Foundation, the World Health Organisation, UKRI, Asthma UK, the British Lung Foundation and the Longitudinal Health and Wellbeing strand of the National Core Studies programme; he also receives personal income from speaking and writing for lay audiences on the misuse of science.

Patient consent for publication Not applicable.

Ethics approval This study was approved by the Health Research Authority (REC reference 20/L0/0651) and by the LSHTM Ethics Board (reference 21863).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data were linked, stored and analysed securely within the OpenSAFELY platform (https://opensafely.org/). Data include pseudonymised data such as coded diagnoses, drugs and physiological parameters. No free text data were included. All code is shared openly for review

Health care delivery, economics and global health care

and reuse under MIT open license (https://github.com/opensafely/blood-pressuresro and https://github.com/opensafely/hypertension-sro). Detailed pseudonymised patient data are potentially re-identifiable and therefore not shared.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution 4.0 Unported (CC BY 4.0) license, which permits others to copy, redistribute, remix, transform and build upon this work for any purpose, provided the original work is properly cited, a link to the licence is given, and indication of whether changes were made. See: https://creativecommons.org/ licenses/by/4.0/.

ORCID iDs

Milan Wiedemann http://orcid.org/0000-0003-1991-282X Christine Cunningham http://orcid.org/0000-0001-6802-7355 Helen J Curtis http://orcid.org/0000-0003-3429-9576 Colm Andrews http://orcid.org/0000-0003-2715-0562 Christopher T Rentsch http://orcid.org/0000-0002-1408-7907 Laurie Tomlinson http://orcid.org/0000-0003-0783-0042 David Evans http://orcid.org/0000-0003-0783-0042 David Evans http://orcid.org/0000-0002-1100-079X Alex J Walker http://orcid.org/0000-0002-4032-6135 Amir Mehrkar http://orcid.org/0000-0002-2098-1278 Seb Bacon http://orcid.org/0000-0002-6354-3454 Chris Bates http://orcid.org/0000-0003-0113-2593 Jonathan Cockburn http://orcid.org/0000-0002-5127-4728 Brian MacKenna http://orcid.org/0000-0002-3786-9063

REFERENCES

- Moynihan R, Sanders S, Michaleff ZA, et al. Impact of COVID-19 pandemic on utilisation of healthcare services: a systematic review. BMJ Open 2021;11:e045343.
- 2 Curtis HJ, MacKenna B, Wiedemann M, et al. OpenSAFELY NHS service restoration Observatory 2: changes in primary care activity across six clinical areas during the COVID-19 pandemic. Br J Gen Pract 2023;73:e318–31.
- Fisher L, Curtis HJ, Croker R. Eleven key measures for monitoring general practice clinical activity during COVID-19 using federated analytics on 48 million adults' primary care records through OpenSAFELY. *Primary Care Research* [Preprint] 2022.
 Dale CE, Takhar R, Carragher R, *et al.* The impact of the COVID-19
- 4 Dale CE, Takhar R, Carragher R, *et al.* The impact of the COVID-19 pandemic on cardiovascular disease prevention and management. *Nat Med* 2023;29:219–25.
- 5 Office for National Statistics. Excess deaths in England and Wales. 2022. Available: https://www.ons.gov.uk/peoplepopulationandc ommunity/birthsdeathsandmarriages/deaths/articles/excessdeaths inenglandandwales/march2020todecember2021 [Accessed 07 Jul 2022].
- 6 Williamson EJ, Walker AJ, Bhaskaran K, et al. Factors associated with COVID-19-related death using OpenSAFELY. Nature New Biol 2020;584:430–6.
- 7 Silverio A, Di Maio M, Citro R, *et al.* Cardiovascular risk factors and mortality in hospitalized patients with COVID-19: systematic review and meta-analysis of 45 studies and 18,300 patients. *BMC Cardiovasc Disord* 2021;21:23.
- Fuchs FD, Whelton PK. High blood pressure and cardiovascular disease. *Hypertension* 2020;75:285–92.
- 9 Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the global burden of disease study 2010. Lancet 2012;380:2224–60.
- 10 Falaschetti E, Mindell J, Knott C, *et al.* Hypertension management in England: a serial cross-sectional study from 1994 to 2011. *Lancet* 2014;383:1912–9.

- 11 Ashworth M, Medina J, Morgan M. Effect of social deprivation on blood pressure monitoring and control in England: a survey of data from the guality and outcomes framework. *BMJ* 2008;337:a2030.
- 12 Xu W, Goldberg SI, Shubina M, et al. Optimal systolic blood pressure target, time to intensification, and time to follow-up in treatment of hypertension: population based retrospective cohort study. BMJ 2015;350:h158.
- 13 Office for Health Improvement & Disparities. CVDPREVENT second annual audit - using data to drive cardiovascular disease prevention. 2021.
- 14 National Institute for Health and Care Excellence. Hypertension in adults: diagnosis and management [NICE]. 2019. Available: https:// www.nice.org.uk/guidance/ng136 [Accessed 24 Jun 2022].
- 15 NHS Digital. Quality and outcomes framework, 2020-21. 2021. Available: https://digital.nhs.uk/data-and-information/publications/ statistical/quality-and-outcomes-framework-achievementprevalence-and-exceptions-data/2020-21 [Accessed 12 Apr 2022].
- 16 NHS England. JCVI advice in response to the emergence of the B.1.1.529 (Omicron) variant: next steps for deployment. 2022. Available: https://www.england.nhs.uk/coronavirus/wp-content/ uploads/sites/52/2021/12/C1468-jvci-advice-in-response-tothe-emergence-of-the-b.1.1.529-omicron-variant-next-steps-fordeployment.pdf [Accessed 16 Aug 2022].
- 17 NHS England and NHS Improvement. Update on quality outcomes framework changes for 2022/23. 2022. Available: https://www. england.nhs.uk/gp/investment/gp-contract/quality-on-outcomesframework-qof-changes-for-2022-23-and-qof-guidance/
- 18 Andrews C, Schultze A, Curtis H, et al. OpenSAFELY: representativeness of electronic health record platform OpenSAFELY-TPP data compared to the population of England. Wellcome Open Res 2022;7:191.
- 19 NHS Digital. Quality and outcomes framework (QOF) business rules V46.0 2021-2022 baseline release. 2021. Available: https:// digital.nhs.uk/data-and-information/data-collections-and-data-sets/ data-collections/quality-and-outcomes-framework-qof/quality-andoutcome-framework-qof-business-rules/qof-business-rules-v46. 0-2021-2022-baseline-release [Accessed 20 Jul 2022].
- 20 NHS. The NHS long term plan. 2019. Available: https://www. longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-termplan-version-1.2.pdf [Accessed 28 Jul 2021].
- 21 Oswald M, Laverty L. Data sharing in a pandemic: three citizens' juries – juries report. 2021. Available: https://arc-gm.nihr.ac.uk/ media/Resources/ARC/Digital%20Health/Citizen%20Juries/12621_ NIHR_Juries_Report_ELECTRONIC.pdf
- 22 NHS England. Case study: NHS community Pharmacy blood pressure check service. 2021. Available: https://web.archive.org/ web/20220707071627/https://www.england.nhs.uk/primary-care/ pharmacy/pharmacy-integration-fund/pharmacy-integration-fundcase-studies/community-pharmacy-blood-pressure-check-service/ [Accessed 07 Jul 2022].
- 23 Yusuf S, Joseph P, Rangarajan S, et al. Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *Lancet* 2020;395:795–808.
- 24 NHS England. Temporary GP contract changes to support COVID-19 vaccination programme. 2021. Available: https://www. england.nhs.uk/coronavirus/documents/temporary-gp-contractchanges-to-support-covid-19-vaccination-programme/ [Accessed 19 Jul 2022].
- 25 NHS Benchmarking Network. CVDPREVENT quarterly reporting now available [NHS Benchmarking Network]. 2022. Available: https://www.nhsbenchmarking.nhs.uk/news/cvdprevent-quarterlyreporting-coming-soon [Accessed 25 Jan 2023].
- 26 NHS England. Report of the review of the quality and outcomes framework in England. 2018. Available: https://www.england.nhs.uk/ wp-content/uploads/2018/07/quality-outcome-framework-report-ofthe-review.pdf [Accessed 19 Jul 2022].
- 27 Marshall IJ, Wolfe CDA, McKevitt C. Lay perspectives on hypertension and drug adherence: systematic review of qualitative research. *BMJ* 2012;345:e3953.
- 28 NHS England. Home blood pressure monitoring. 2021. Available: https://web.archive.org/web/20230417064030/https://www. england.nhs.uk/ourwork/clinical-policy/cvd/home-blood-pressuremonitoring/ [Accessed 15 Jun 2023].
- 29 Eastwood SV, Mathur R, Sattar N, et al. Ethnic differences in guideline-indicated statin initiation for people with type 2 diabetes in UK primary care, 2006–2019: a cohort study. *PLOS Med* 2021;18:e1003672.