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The changing shape of English General Practice: A retrospective longitudinal study using national datasets examining organisational structure, workforce and appointment activity

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All authors contributed to the planning, conduct and reporting of the study. LP undertook the analysis and drafting of the article. IP and DC provided technical expertise to enable the analysis of the data. IP, NM and DC provided feedback on various drafts of the article. LP is the guarantor of the study. LP attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. PPI input and feedback from NHS Digital, OHID and the CQC are outlined in the acknowledgements.

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Competing interests declaration

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/disclosure-of-interest/ and declare: LP is funded as a NIHR Doctoral Research Fellow (DRF-2017-10-088); no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Abstract

Objective

To describe the trends in the organisational structure, workforce and appointments by role in English general practice over the past decade.

Design

Retrospective longitudinal study.

Setting

English General Practice.

Data sources & Participants

National administrative general practice datasets from NHS Digital (now NHS England), Office for Health Improvement and Disparities, and Care Quality Commission covering between 2.5 and 10 years between 2013 and 2023.

Results

There has been a 20% fall in the number of general practices from 8,044 in 2013 to 6,419 in 2023, alongside a 40% rise in average practice list size from 6,967 to 9,724 patients. In 2023 partnerships, individuals (i.e., single-handed GP), organisations (i.e., incorporated companies) and NHS bodies (i.e., NHS Trusts) respectively owned 81%, 11%, 7% and 1% of practices. The estimated population covered by providers with lists over 100,000 patients increased from 0.5M to 2.3M between 2017 and 2023. In April 2023 the largest general practice provider was estimated to cover a population of 636,000 across 56 practices.

Between 2015 and 2022 there was a 20% rise in the total full-time equivalent general practice workforce from 1.97 to 2.37 FTE/1000 patients. The general practice workforce is predominantly female. There was a rise in multidisciplinary direct patient care roles and administrative roles. Nursing number were stable, whereas GP numbers fell. In September 2022 there were 0.45 qualified FTE GPs/1000 patients. This figure would place England in the quartile of OECD countries with least GPs per capita. Administrative roles represented 51% of the workforce. GPs and other

direct patient care roles represented 19% of the combined general practice and primary care network workforce in September 2022. Between September 2020 and April 2023 on average half of recorded appointments were provided by GPs.

Conclusions

Since 2013, there has been a shift in general practice towards larger practices and more multidisciplinary teams. These trends alongside the reduction in number of GPs need careful observation in relation to their impact on quality, equity and costs.

What is already known about this topic

- There is awareness of the changing structure of English general practice with frequent reports of falling GP numbers, practice closures, the introduction of multidisciplinary roles and patient dissatisfaction with access to general practice appointments.
- However, it is hard to get an overall picture because news or organisational reports often provide limited statistical analysis; reported workforce figures frequently do not accurately reflect the active qualified GP workforce; and research studies often cover short time periods or have a single domain of focus.

What this study adds

- By combining information from multiple national administrative datasets our study provides and up-to-date analysis of trends in English general practice's organisational structure, workforce and appointments over the past 2.5 to 10 years.
- We quantify the increase in practices' size and multidisciplinary roles; describe trends in practice ownership; provide detailed analysis by gender and age of the general practice workforce; and contextualise trends in general practice appointments by role.
- This study provides the basis for future research to explore the relationship between the identified trends with the quality, equity and costs of services; it enables providers to understand where they stand relative to one another; and it informs policymakers and the public regarding the changing shape of English general practice.

Background

General practices have traditionally operated as publicly funded, general practitioner (GP) owned, business partnerships. However, over the past decade questions have started to be asked about whether the partnership model is still fit for purpose[1, 2]. 'Large-scale' general practice organisations have emerged, such as GP federations and multisite providers, with some operating through limited companies[3-5]. General practices that have become part of NHS Trusts have also generated interest among policymakers[6]. In parallel, national policy has encouraged integration of health and care organisations. In 2019, all general practices were incentivised to form 'Primary Care Networks' (PCNs), resulting in around 1200 PCNs typically covering populations of 30,000-50,000[7]. In 2022, 42 Integrated Care Systems (ICSs) became statutory bodies to work with PCNs and other local health and care organisations to plan and deliver coordinated services[8].

The general practice workforce has also been moving away from the traditional model of GP partner(s) working with a practice nurse. There has been an expansion of employed ('salaried') GPs and the introduction of national programmes promoting the recruitment of pharmacists and other multidisciplinary 'Direct Patient Care' roles (DPC) into general practice[9, 10].

Despite a general awareness of these changes, it is hard to get an overall picture because information about different aspects of general practice is reported across multiple datasets. Consequently, news or organisational reports often provide limited statistical analysis of this information, and research studies often cover short time periods or have a single domain of focus[3, 11-18]. By combining information from different national data sources, this paper provides an up-to-date analysis of trends describing how the organisational structure, workforce and appointment activity of English general practice has changed over the past decade. This has been done with the aims of enabling providers to understand where they stand relative to one another; researchers to identify and address relevant research question; policymakers to understand the impact of policies; and of informing the public regarding the changing shape of English general practice.

Methods

We used national general practice databases that are regularly published by NHS Digital (NHS England since Jan 2023), Office for Health Improvement and Disparities (OHID), and Care Quality Commission (CQC)[19-24]. The period covered by the datasets ranged from 2.5 to 10 years (Appendix: Methods Table 1). We used Organisational Data Service (ODS) codes to define a practice and used these to merge the various releases of datasets. NHS Digital, OHID and CQC were consulted where uncertainties arose about the data. Full methodological guidance on the datasets can be found on their websites [19-24]. Findings are reported using RECORD guidance[25].

Population & practice metrics

The number of practices and their registered list sizes were identified using NHS Digital's 'Patients Registered at a GP Practice' datasets [19]. The proportion of patients over 65 was obtained from OHID data (April 2023 was taken from NHS Digital as OHID had not yet published it)[19, 20]. Data from April 2013 to April 2023 was used to produce a time-series using figures released each April. All practices with the variables of interest in NHS Digital's 'Patients Registered at a General Practice' datasets were included (>99%).

Organisational structure

We used the CQC's archive of 'HSCA Active Locations' every April between 2017 and 2023 as the source of the practice site ('Location ID') and the provider ('Provider ID') that owns the practice, to identify providers with more than one practice site ('multisite providers')[21]. The CQC's classification of ownership type, available from 2018, uses the following four categories: 'Partnership', 'Individual' (i.e. single-handed GP), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). The identification of multisite providers was only possible from 2017 due to how active practice locations are archived by the CQC prior to this. The CQC also identifies clusters of providers operated by an overarching 'Brand'. We labelled providers, or where it existed the overarching 'Brand', with a total list size exceeding 100,000 patients as 'mega-providers'. We merged CQC and list size datasets to calculate a 'mega-provider's' list size, however for on average 7% of associated practices' a corresponding list size could not be matched, resulting a likely underestimate in the total list size of 'mega-providers'. Between 9 and 87 practice ODS codes were found to be used across two CQC practice 'locations' depending on the year, therefore their merged list sizes were adjusted to avoid double counting when calculating 'mega-provider' list size.

Workforce

Workforce information was obtained from the revised NHS Digital 'General Practice Workforce' dataset every September between 2015 and 2022, reflecting the period during which data definitions were stable. General practice workforce categories include GPs, nurses, other DPC roles (e.g. pharmacists, social prescribers, physician associates, paramedics)[26] and administrators.

We use the label 'qualified GPs' to mean GP partners, salaried GPs, GP locums and GP retainers (GPs re-entering the workforce after a period out-of-practice). We use the label 'GP trainees' to include GP trainees (ST1-4), and exclude Foundation Years doctors reported in the 'General Practice Workforce' dataset. Practice level GP trainee figures were only available for time-series analysis from 2018 due to changes in data collection methods[22, 27]. Locum figures exclude 'ad-hoc' locums that only work briefly to cover short-term or unexpected absences.

We grouped GPs' country of qualification into three categories: UK, high-income country region, low- or middle-income country region. We use 'female', 'male' and 'other/unknown' to classify gender as per the original dataset. We group workforce roles by age (<35, 35-49, 50-64, 65+).

Individual staff data aggregated by NHS Digital at national level, excluding values estimated by NHS Digital where no value was reported by the practice, were used to calculate total national headcount (HC) and FTE by age, gender and GPs' country of qualification. National FTE/HC proportions were calculated by role to examine trends in FTE working hours. For GPs these were also broken down by male and female gender. Practice level data was used to calculate full-time-equivalents (FTE) per 1000 patients values and to report on p10-p90 distributions. Per 1000 patients figures by gender and age were calculated by dividing each practice's workforce values by the its patient list size on the same date.

Practices with missing workforce data were automatically excluded from the denominator; this proportion varied by year and by role between 0.4%-2.5%. Practices that had a list size of ≤1000 registered patients in September of the year of analysis were excluded from FTE/1000 patients analyses, on the basis that they were likely to be atypical (e.g., closing or delivering care to a sub-segment of the population) and workforce to population ratios would not be comparable. On average 97% of practices were included in the practice level workforce per 1000 patient analyses (Appendix: Methods Table 2).

As General Practice workforce figures exclude DPC and administrative roles contracted at PCN level who are likely working for practices, we estimated PCN FTE roles per 1000 patients by dividing the national FTE total of NHS Digital's 'PCN Workforce' figures, each September between 2020 and 2022, with the total number of patients registered in England in the corresponding month from NHS

Digital's 'Patients Registered at a General Practice'[19, 23]. As not all PCNs submitted workforce figures during this period, this will have resulted in an underestimate of figures, further details are described in the limitations.

Appointments

NHS Digital's 'Appointments in General Practice' data is based on total national figures[24]. Appointments by role were converted to appointments/week/1000 patients using the number of registered patients in the practices included in the same dataset. Monthly data was available from September 2020 and reported here to April 2023, with disaggregated nursing and DPC role appointments available from August 2021. While these are official statistics NHS Digital still refers to them as 'experimental', further details are described in the limitations[24].

Analysis

Analysis was based on statistically testing and describing the patterns across the variables outlined above. The number of practices in the datasets from each source were similar but not always in agreement due to variation in collection dates and methods.

Descriptive statistics are used to provide a summary of trends, with the mean and spread of the practice level values reported using 10th and 90th centiles. The absolute change per year coefficient or incidence rate-ratio (IRR) providing the relative change for the full time period, with 95% confidence intervals, are respectively reported for Linear and Poisson regression analyses undertaken. STATA 17 and 18 was used for analysis and Excel for graphs.

Results

Organisational Structure

Population growth, practice number and list size

The total population registered with a general practice in England grew by 11% from 56,042,361 to 62,418,295 between April 2013 and April 2023 (640,816/yr [95%CI 604,260-677,372]), with a temporary slow-down in 2020/21 during the COVID pandemic (Figure 1a).

Alongside this population growth, the mean proportion of patients aged 65 and over increased from 16.3% to 17.9% (IRR 1.09 [95% CI 1.08-1.10]). The variation between practices across the time period saw a similar increase with 10th and 90th percentiles being 7.7% and 24.1% in April 2013 and 8.2% and 27.1% in April 2023.

Meanwhile, the total number of practices fell from 8,044 in April 2013 to 6,419 in April 2023, an average loss of 178 practices/yr [95%CI -193 to -163]. This represents a 20% reduction in the number

of practices over ten years (Figure 1a)[19]. In keeping, the total number of unique practice postcodes fell from 7,163 to 5,849, representing the loss of 18% unique locations over this period. In contrast, 16% of practices still shared a postcode in 2023, a slight reduction from 19% in 2013 (IRR 0.84 [95%CI 0.78-0.91)[19].

Between April 2013 and April 2023, the mean practice list size increased by 40% from 6,967 to 9,724 patients (291/yr [95%CI 279-303]). The spread of practice list size remained wide throughout this period with the 10th and 90th percentiles being 2,329 and 12,582 in April 2013, and 3,617 and 16,765 in April 2023 (Figure 1b)[19].

Figures 1a&b

The number of practices with lists exceeding 20,000 patients has notably risen; in 2013 these only represented 1% of practices (n=81) compared to 6% in 2023 (n=355) (IRR 5.5 [95%CI 4.3-7.0]). The largest practice list doubled from 52,386 to 106,308 patients. Some of these large practices operate over various practice sites, although this is not clear in the NHS Digital datasets as they operate under an individual ODS code [28]. Providers also exist that operate multiple practice sites under various ODS codes, 'multisite providers', so their true organisational list size is larger than that captured under individual ODS codes (see below).

Practice ownership, multisite providers and mega-providers

Ownership

CQC data on practice ownership was available between April 2018 and April 2023. During this period, the total number of practice sites registered with the CQC fell from 7,441 to 6,446 and their respective providers fell from 6,769 to 5,863. Practice sites managed by 'Individual' GPs (i.e., single-handed ownership) fell in number from 975 to 724 (-51/yr [95%CI -62 to -40]), which corresponds to a statistically significant change in the proportion of practices they represent out of all practices from 13% to 11% (IRR 0.86 [95%CI 0.77-0.94]). In contrast, as a proportion, 'Partnerships', 'Organisations' and 'NHS bodies' respectively hovered around 80.3%, 6.9% and 0.7% of practice sites, and 83.6%, 3.3% and 0.3% of providers. The proportion of practice sites which 'Organisations' and 'NHS bodies' owned was higher than the proportion of providers they represent as most are multisite providers. In April 2023 partnerships, individuals, organisations and NHS bodies respectively owned 81%, 11%, 7% and 1% of practices (Appendix: Results Figures 1a&b). [21]

Twenty-six NHS bodies provided general practice services between April 2018 and April 2023. Seventeen remained active in 2023. The number of practice sites run by each NHS body across these years ranged between one and ten(mean=2.5). In April 2023, the largest NHS Trust GP provider ran eight practice sites (Appendix: Results Figure 2)[21].

Multisite and Mega-providers

Between April 2017 and 2023, the proportion of multisite providers and their associated practices registered with the CQC has remained stable, representing on average 4% of providers and 13% of practice sites[21]. Examining providers and 'Brands' with >100,000 patients across all sites, 'mega-providers', there were three in 2017 compared with 11 in 2023. Their estimated total registered population has increased from 0.5M to 2.3M. The number of practices under these mega-providers ranged between one and 42(mean=27). The largest mega-provider registered with the CQC in April 2023 covered an estimated 452,097 patients (Appendix: Results Figure 3). However, examining organisational websites, two 'mega-providers' registered separately under the CQC merged in 2021 with an estimated total population of 635,979 over 56 practice in sites April 2023[29].

Workforce

General practice workforce

General practitioners

Figures on the general practice workforce were analysed from September 2015 to September 2022, during which the number of practices in the practice level datasets changed from 7,623 to 6,456. During this period, the total qualified GP headcount in England increased from 34,474 to 36,492. In contrast the total FTE qualified GPs fell from 27,948 to 27,321. The average number of qualified GPs FTE/1000 fell from 0.53 to 0.45, representing a 15% fall (IRR 0.86 [95%CI 0.84-0.87]). Similarly, the 10th and 90th percentiles fell from 0.32 and 0.73 FTE/1000 in 2015 to 0.24 and 0.66 FTE/1000 in 2022. (Figure 2a).

Figures 2a-d

The fall in qualified FTE GPs/1000 was associated with a 26% drop in GP partners from 0.39 to 0.29 FTE/1000 (IRR 0.70 [95%CI 0.69-0.72]). Meanwhile there was a rise in the average number of salaried GPs from 0.12 (p10-p90, 0-0.30) to 0.15 (p10-p90, 0-0.32) FTE/1000 (IRR 1.31 [95%CI 1.27-1.35]). The proportion of FTE salaried GPs out of all qualified FTE GPs increased from 23% to 36%; as a HC proportion it increased from 28% (n=9817) to 42% (n=15,297). In 2015 61% of practices reported having salaried GPs; in 2022 this had increased to 74%.

There was no clear trend in the use of regular GP locums. The proportion of practices reporting regular locum use averaged around 17% since 2015, with annual mean regular locum figures around 0.019 (p10-p90, 0-0.064) FTE/1000. The number of GP retainers, although rising, remained very small, being 0.001 in 2015 and 0.004 FTE/1000 in 2022 (IRR 3.12 [95%CI 2.4-4.1]). Between 2015 and 2022 the proportion of qualified GPs who qualified in the UK remained around 73% (Appendix: Results Figure 4). The mean number of GP trainees increased from 0.06 (p10-p90, 0-0.21) to 0.12

(p10-p90, 0-0.34) FTE/1000 between 2018 and 2022 (IRR 1.75 [95%CI 1.68-1.81]). The proportion of practices reporting a GP trainee (ST1-4) increased from 35% to 50% during the same period.

As a proportion of all qualified FTE GPs, the female to male ratio shifted from 46:54 to 52:48 between 2015 and 2022 (Figure 3a). The loss of qualified FTE GPs/1000 was steeper among male GPs from 0.30 to 0.23 FTE/1000 (IRR 0.76 [95%CI 0.75-0.78]), compared with female GPs from 0.23 to 0.22 FTE/1000 (IRR 0.97[95%CI 0.95-0.99]). The age distribution of qualified GPs has remained relatively stable, with 35-49-year-olds representing on average 49% of the total (Appendix: Results Figure 5a).

Figures 3a-d

The percentage of total FTE out of total HC fell for GP partners (89%-86%) and salaried GPs (67%-64%). The FTE/HC percentage for GP locums, retainers and trainees (since 2018) did not change significantly. Across all GP roles females were more likely to report working less FTE hours than male GPs (Appendix: Results Table 1a&b).

Nurses and other Direct Patient Care roles

The mean number of FTE nurses remained relatively stable between 2015 and 2022 at around 0.26 FTE/1000 (IRR 1.05 [95%CI 1.03-1.08]), with on average 97% of practices reporting employing a nurse. Across practices, there was typically four-fold variation in nurses between the 10th and 90th percentile of practices, with values of 0.10 and 0.44 FTE/1000 in 2022 (Figure 2b).

In comparison, the mean number of other DPC roles employed by practices grew from 0.15 (p10-p90, 0-0.34) to 0.25 (p10-p90, 0-0.53) FTE/1000. This corresponds to an increase of 67% (IRR 1.67 [95%CI 1.63-1.71]) (Figure 2c). The proportion of practices that reported employing any DPC roles increased from 72% to 89% between 2015 and 2022.

The majority of staff in nursing (>96% annually) and DPC roles (>87% annually) were women (Figures 3b&c). The nursing workforce was older than DPC roles (Appendix: Results Figures 5b&c). The FTE/HC increased for nurses (65%-69%) and DPC roles employed at practice level (63%-71%) (Appendix: Results Table 1a).

Administrative roles

Administrative roles increased by 14% from a mean of 1.05 (p10-p90, 0.17-1.56) to 1.19 (p10-p90, 0.73-1.67) FTE/1000 between 2015 and 2022 (IRR 1.16 [95%CI 1.14-1.17]) (Figure 2d). Within administrative roles, the mean number of managers remained around 0.19 (p10-p90, 0.06-0.34) FTE/1000 (IRR 1.03 [95%CI 1.00-1.06]).

The majority of the administrative workforce were women (>93% annually; Figure 3d), and 50-64-age-group made up the majority of the FTE administrative workforce never falling <43% annually (Appendix: Results Graph 5d). The FTE/HC increased from 68% to 72% (Appendix: Results Table 1a).

Combined general practice and PCN workforce

Using 'PCN Workforce' data, we estimated that since the inception of PCNs in 2019 there were at least a further 0.21 DPC and 0.02 administrative FTE roles/1000 contracted via PCNs by September 2022[23] (Figure 4).

Figure 4

The combined general practice and PCN workforce increased from 1.97 to 2.37 FTE/1000 patients between 2015 and 2022 (0.047/yr [95%CI 0.024-0.069]). A 20% rise, or in other words, from one member of staff per 508 patients to one per 422. These combined figures suggests that FTE/1000 DPC roles in 2022 represented around 19% of the general practice workforce, the same proportion as qualified FTE GPs. Nurses represented 11% and administrative roles 51%, the largest proportion.

Appointment Activity

The number of practices in the total monthly 'Appointments in General Practice' was 6,574 in September 2020 and 6,359 in April 2023. Appointments include face-to-face, telephone, video consultation/online appointments and home visits. Using the associated total registered patients each month across the included practices we estimated that during this period between 85-119(mean=101) appointments/week/1000 patients were being reported across England. Peaks were seen between September and November, and again in March in the years of available data. There was no clear upwards or downwards trend.

GP appointments ranged from 42-56(mean=49)/week/1000, with no clear trend over time despite the fall in qualified GP FTEs/1000. Where reported, nurse appointments range between 18-28(mean=22)/week/1000. DPC appointments ranged between 17-26(mean=21)/week/1000. DPC appointments show an upwards trend from when first reported in August 2021 (0.25 more appt/wk/1000 [95%CI 0.09-0.40]). Between 3-11%(mean=8%) of appointments have data quality issues or roles delivering appointments are unknown (Graph 5).

Figure 5

Discussion

Our analysis shows how in the last decade, within the context of a growing and aging population, there has been a shift in English general practice towards fewer but larger organisations and more multidisciplinary teams with fewer FTE GPs per 1000 patients.

The move towards larger scale organisations has been encouraged by government policy and professional bodies, as a route to generate economies of scale around shared back-office functions, joint service delivery and standardised processes[3, 5, 30]. However, the evidence regarding whether larger organisations deliver better quality care or are more cost-effective is mixed[4, 31-35]. The diversification of the general practice workforce has also been driven by national policy and proposed as a solution to GP shortages[13, 36, 37]. However, concerns have been raised by GPs, researchers and the media about the training needs of a broader multi-disciplinary team, the effect on relational continuity of care, their cost-effectiveness, equity in distribution and the safety of using such roles without sufficient GP oversight[13, 38-46].

While it was not possible to determine whether practices which closed did so with list dispersion or merged with another local practice, analysis shows a reduction of 18% unique practice postcodes in the past decade. This is likely to affect equity of access and has been shown to have a negative effect on remaining local practices that absorb the population[47, 48]. In contrast 16% of practices still share a postcode. While this may enhance patient choice, it may also result in inefficiencies where practices operate in parallel.

Operating a practice as a partnership continues to be the dominant model of ownership. While absolute numbers of single-handed practices are falling at a faster rate than other forms of general practice ownership, they still represent 11% of practices. Despite government and research interest in practices run by incorporated organisations and NHS bodies, these run a minority of practices [5, 6]. Notably over one third of NHS Trusts that have run practices over the past five years no longer do so. This may suggest they are transitional arrangements or challenges in their ability or desire to do so.

To date practices, unlike hospitals, have been allowed to close when they were no longer financially viable or made to close where there were regulatory concerns[48, 49]. However, with increasing organisational size, including 13% of practices being part of a multisite provider and the expansion of 'mega-providers', mitigating the risks of providers becoming 'too big to fail' merits regulatory consideration.

While GP trainee figures are rising there is no guarantee that they will work full-time, nor remain in general practice. GP figures reported elsewhere often include trainees, are calculated by headcount

or as full-time equivalents without adjusting for population size, and therefore do not accurately reflect the active qualified workforce[18, 22]. Our analysis demonstrates a 15% reduction in FTE qualified GPs/1000 since 2015, with 0.451522 FTE qualified GPs/1000 in September 2022 - in other words one FTE GP per 2215 patients. This is well below the figure reported by the OECD for the UK (0.81/1000 patients - calculated by headcount and including trainees) which if revised would place England in the quartile of OECD countries with the lowest number of GPs per population[50].

There is a stable reliance on doctors who qualified outside the UK, representing around a quarter of GPs - most from low- or middle-income country regions. Their contribution, in particular to underserved populations, is well documented, but the challenges of doing so often under-recognised and undervalued[51-54]. Ongoing NHS reliance on doctors from overseas raises questions around ethical international recruitment[55].

The majority of the workforce is made up of administrative roles, yet they receive little attention[56, 57]. As practices become larger and more complex, and because of the importance of these roles for general practices' public facing and back-office functions greater research and policy focus on the administration and management of general practice would be of value. The majority of the workforce is female which has implications to ensure parity of income and working conditions with male counterparts[58]. It also has implications for workforce planning as analysis of GP FTE/HC suggests that female GPs are likely to work less FTE hour than males.

Although other DPC roles, including PCN roles, and qualified GPs now both represent around a fifth of the FTE workforce, data suggests that GPs still provide around half of appointments, whereas DPC roles provide around a fifth. Contributory factors to this discrepancy could include issues with the data collection process, that DPC role appointments are longer and/or more of their time is spent on non-patient facing activity or at PCN level, and therefore not captured in general practice appointments[23]. Appointment data indicates peaks of activity around financially incentivised flu vaccination season and before the end of the financial year. The provision of an estimated 101 appointments/week/1000 equates to 5.3 appointments/year/patient. This figure, although similar to values reported in 2014 and in 2022 using the same data, is below 2019 estimates and should be interpreted with caution[11, 59, 60].

Trends point to a changing role for the GP partner from a self-managing owner of a small business, to holding responsibility for the governance of a much larger organisation and its associated multidisciplinary team. Circumstances under which this is happening are associated with falling numbers of GPs, where both partners and salaried GP are reducing their FTE hours. This would suggest the need to prioritise the retention of the existing GP workforce. Falling patient satisfaction

captured in the national general practice patient survey is a warning that this period of transition is proving challenging, particularly within the context of a growing and aging population, alongside post-COVID pandemic and secondary care pressures[61, 62].

Limitations

The requirement to capture appointment data is relatively new to general practice therefore not all appointment activity may be captured[63]. Appointment data also does not capture other activities including managing correspondence, prescriptions, reviewing results, supervision, management and quality improvement work. Workforce FTE figures are also unlikely to be capturing overtime, which is common in general practice[59, 64-66].

Appointment data during the COVID pandemic should be interpreted with particular caution as COVID initially resulted in reduced access and demand for appointments when many practices limited face-to-face access and patients avoided healthcare settings. This is reflected in the slowing of patient registrations between April 2020 and April 2021 (Graph 1a). Therefore, while there is no clear trend in total appointments/1000 patients since September 2020, this may be hiding a regression to the mean or falling appointment numbers due to the atypical nature of appointments in 2020/21.

We checked with NHS Digital that that General Practice and PCN workforce datasets were not double counting roles. However, not all PCNs contributed to national PCN workforce figures, with 50.3% responding in September 2020 and 87.5% by September 2022[67]. A small proportion (<1%) of practices are also not part of a PCN[7]. Therefore, using national registered patient numbers will have underestimated the PCN workforce/1000 patients, particularly for the initial years. The total registered population in general practice in England is also around 7% higher than Office of National Statistics figures. NHS Digital is aware of this discrepancy and attributes a range of factors to this including delayed de-registrations and duplicate records[68]. This has implications when reporting any values relative to population size.

Strengths and opportunities for future research and policy

This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments over the past decade. It provides a comprehensive overview of the temporal trends of general practice workforce and appointment activity relative to population size. Our analysis offers a benchmark for providers and commissioners, as well as for international comparison. However, further research to understand what represents warranted versus unwarranted variation is important as the provision of care should vary subject to the needs of local populations.

While the data used in this paper is openly available and interactive data dashboards are emerging[69], making access more user-friendly, in particular ensuring NHS Digital ODS codes consistently align with CQC location and provider data, and that they are matched with indices of deprivation, would improve the ability of this data to inform policy and practice. The capture of data such as demand for appointments and workforce time spent on non-appointment related activities would also enhance understanding of how general practice is functioning.

Importantly, the relationship between the trends reported here and quality, equity or costs were beyond the scope of this paper and is an area for future research. Work by others in these areas is already underway, in particularly flagging inequities in workforce distribution[12, 44, 45, 47, 60, 70-72].

Conclusions

Over the past decade the organisational structure and workforce of general practice in England demonstrates a clear shift towards larger practices and more multidisciplinary teams, with a predominantly female workforce. The implications of these changes alongside the fall in the number of practices and FTE qualified GPs needs careful observation in relation to their impact on quality, equity and costs.

Ethical approval

All data used is publicly available. No ethical approval was required for this study

Transparency Statement

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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CQC data is made available under the Open Government Licence.

Competing interests

The authors declare no competing interests

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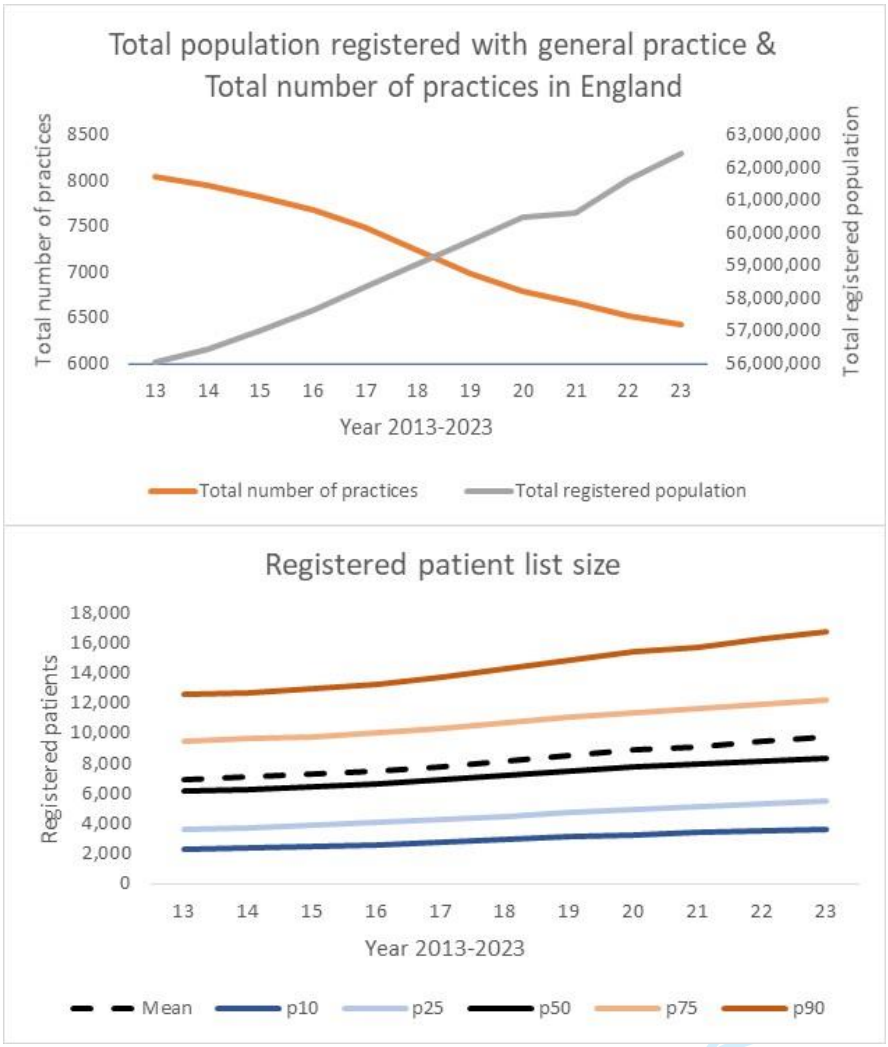
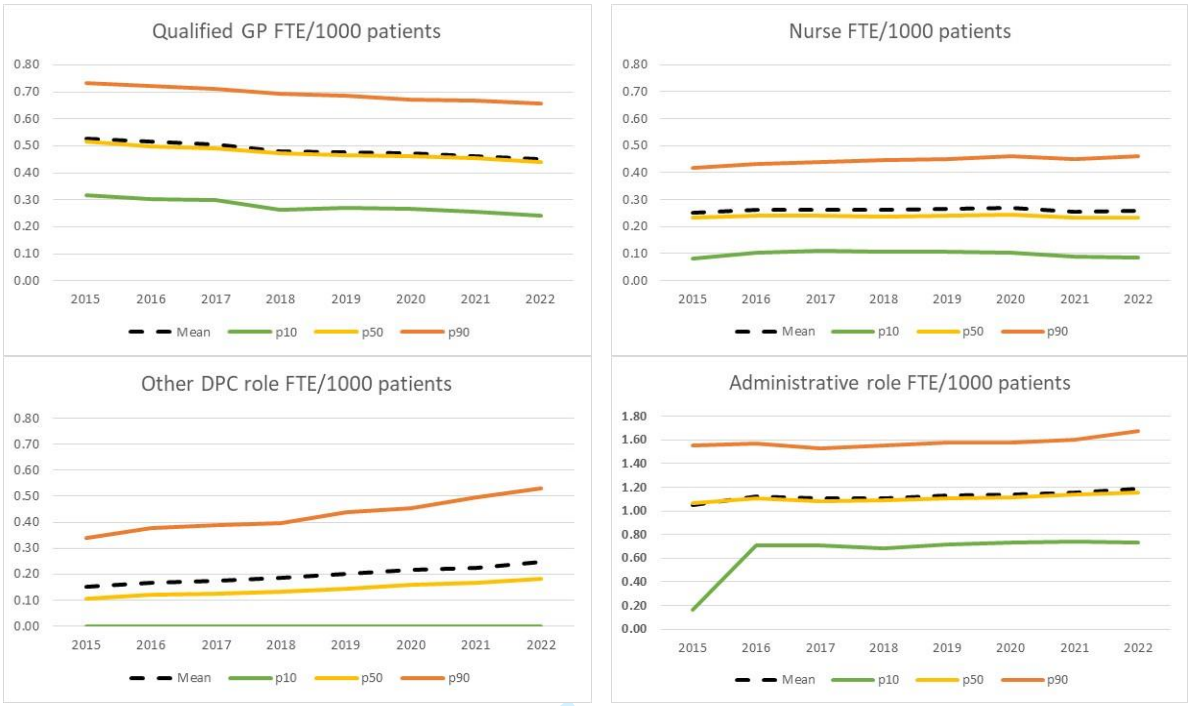
Figures 1a&b



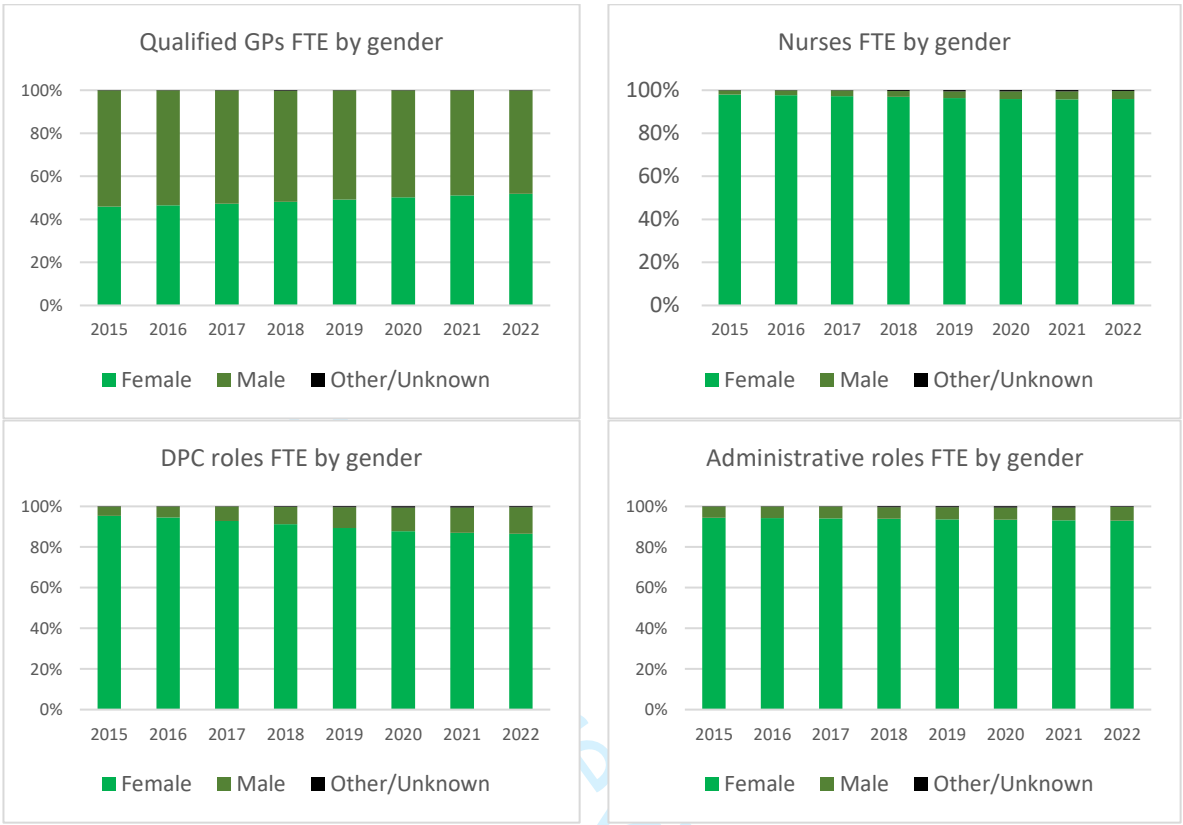
Figures 1a&b: (1a) Total number of general practices in England and total population registered with general practice; (1b) Practice list size by registered patients. Every April 2013- 2023. [19]

Figures 2a-d



Figures 2a-d: Full time equivalent per 1000 patients general practice workforce roles: mean, p10, p50 and p90 (a)Qualified GPs, (b)Nurses, (c)Other DPC roles, (d) Administrative roles. Note: different scale on y-axis for administrative roles. Every September 2015-2022. [22]

Figures 3a-d



Figures 3a-d: Total full time equivalent general practice workforce roles by gender: (a)Qualified GPs (b)Nurses (c)Other Direct Patient Care roles (d)Administrative roles. Every September 2015-2022. [22]

Figure 4

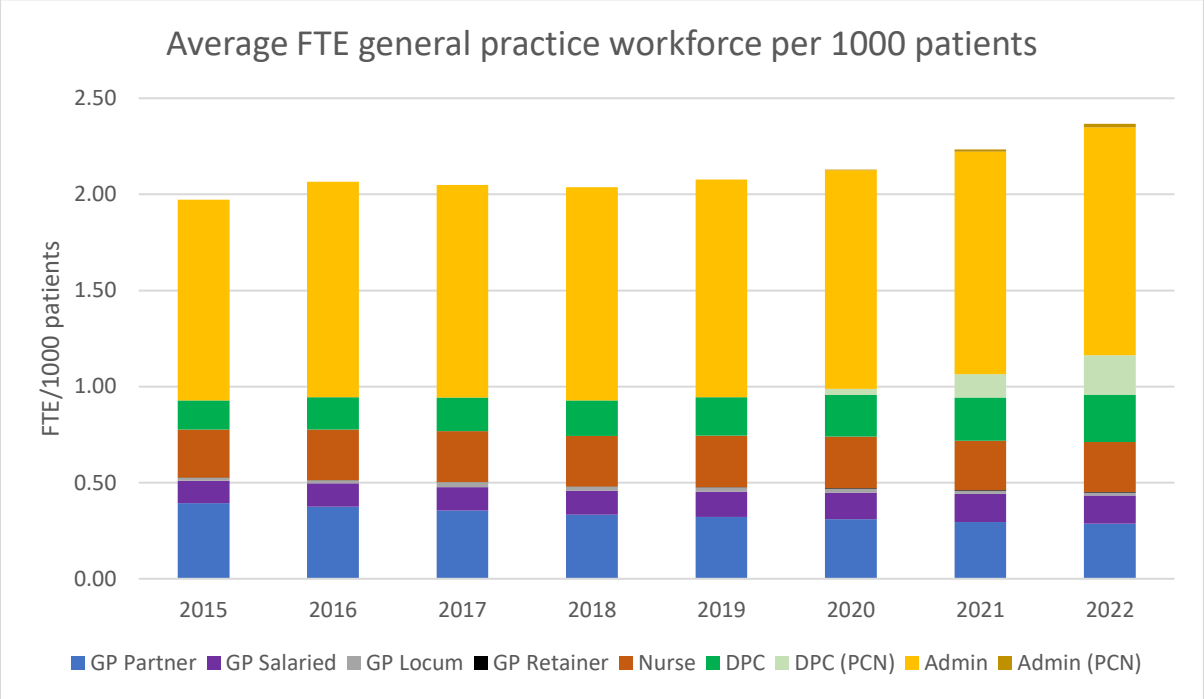


Figure 4: Average full time equivalent general practice (exc. GP trainees) workforce/1000 patients, including PCN other DPC and administrative roles. Every September 2015-2022. [22, 23]

Figure 5

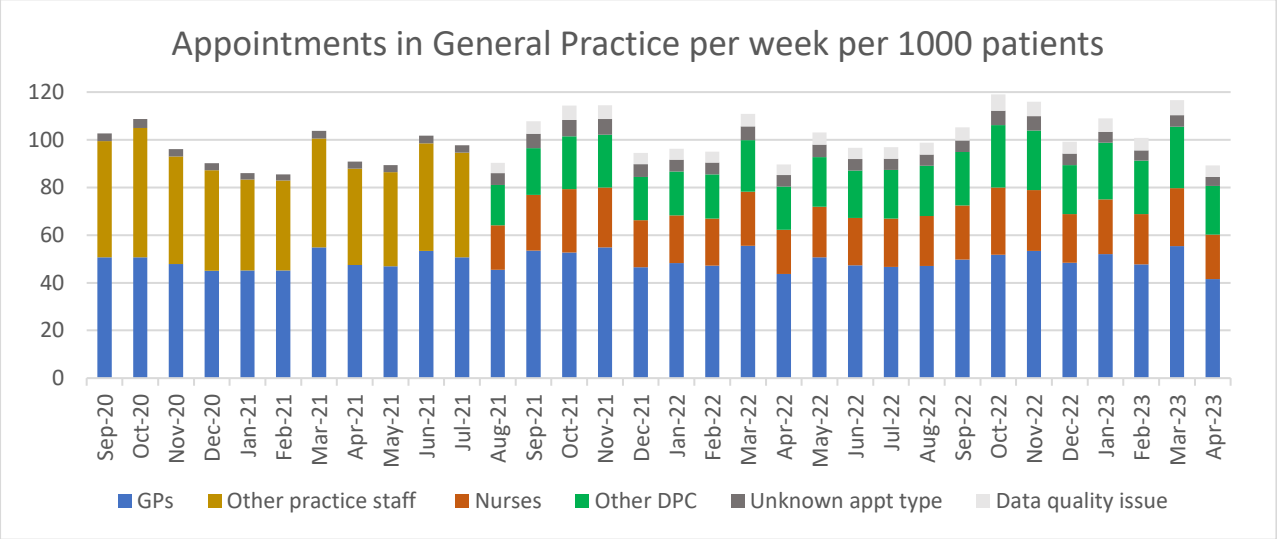


Figure 5: Average number of appointments by role per week per 1000 patients in England. Presented by month between September 2020 and April 2023. [24]

Supplementary Material – Methods Appendices

Appendix: Methods Table 1

Time trend variables	Source (practice / national level)	Time trend period (total time period and frequency of data used)	Percentage range (mean) of observations reported after removal of missing data and omissions
Organisational Structure			
Total registered population; Total number of practices; Practice list size; Practice postcode	NHS Digital -Patients Registered at a GP Practice [19] **(Practice)**	Apr 2013-Apr 2023 **(10 yrs, annual)** Postcode Jul 2013-Apr 2023 **(9.75 yrs, annual)**	Registered patients 99.2%-100% (99.9%) Postcode 99.8%-100% (99.99%)
Proportion of registered patients >65 years old	OHID -'Fingertips Public Health Data'(2013-2022) [20] & NHS Digital-Patients Registered at a GP Practice (2023) [19] **(Practice)**	Apr 2013-Apr 2023 **(10 yrs, annual)**	100%
Ownership of practice and provider	CQC - Archive of 'HSCA Active Locations with 'Primary Inspection Location' filtered to 'GP practice' [21] **(Practice)**	Apr 2018-Apr 2023 **(5 yrs, annual)**	100%
Multisite providers	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice' [21] **(Practice)**	Apr 2017-Apr 2023 **(6 yrs, annual)**	100%
Mega-provider list size	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice'. [21] CQC's 'Location ID' mapped to ODS code using CQC's 'GP Practice Locations for providers registered or previously registered under the Health and Social Care Act' dated 28.7.23. ODS code merged with NHS Digital Patients Registered at a GP Practice [19] **(Practice)**	Apr 2017-Apr 2023 **(6 yrs, annual)**	'Mega-providers' associated practices' registered patient list sizes 90%-96% (93%)
Workforce & Appointment			
General Practice Workforce at practice	NHS Digital – General Practice Workforce [22] ('Practice-Level CSV)	Sep 2015-Sep 2022 **(7 yrs, annual)**	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%)

level (FTE/1000 patients)	Data included practice list size for the corresponding month to calculate FTE/1000 patient figures. Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. **(Practice)**	Trainee GPs Sep 2018-Sep 2022 **(4 yrs, annual)**	Administrative roles: 97%-99% (98%) GP trainees: 100% NB: September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
General Practice Workforce at national level (total HC; total FTE; total FTE by age, sex and qualified GP by country of qualification)	NHS Digital – General Practice Workforce [22] ('Individual-Level CSV) Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. Where no data was submitted by a practice for a staff group (i.e. GP, nurses, DPC, Admin), 'Estimated' figures provided by NHS Digital are excluded. **(National)**	Sep 2015-Sep 2022 **(7 yrs, annual)**	GP: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%) GP trainees: 100% NB: September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
Primary Care Network (PCN) Workforce mean FTE per 1000 patients	NHS Digital – Primary Care Network Workforce [23] with mean FTE / 1000 patients calculated by dividing national FTE totals with the the total number of registered patients in England in the corresponding month from NHS Digital -Patients Registered at a GP Practice [19] **(National)**	Sep 2020- Sep 2022 **(2.5 yrs, annual)**	Percentage of PCNs that submitted data September 2020: 50.3% September 2021: 78.4% September 2022: 87.5%
Appointments by role per week per 1000 patients	NHS Digital- Appointment in General Practice [24] with appointments per week per 1000 patients calculated using 'Registered patients at included practices' figures from the same dataset **(National)**	Sep 2020- Apr 2023 **(2.6 yrs, monthly)** Spine Directory Service 'SDS' role from Aug 2021	Practice coverage: 98.1%-99% (98.6%) Total patients in included practices coverage: 99.1%-99.9% (99.6%)

Appendix Methods Table 1: Organisational structure, workforce and appointment variables: source, level of data, frequency used, time period used, percentage of original data reported after removal of missing observations and exclusions [19-24].

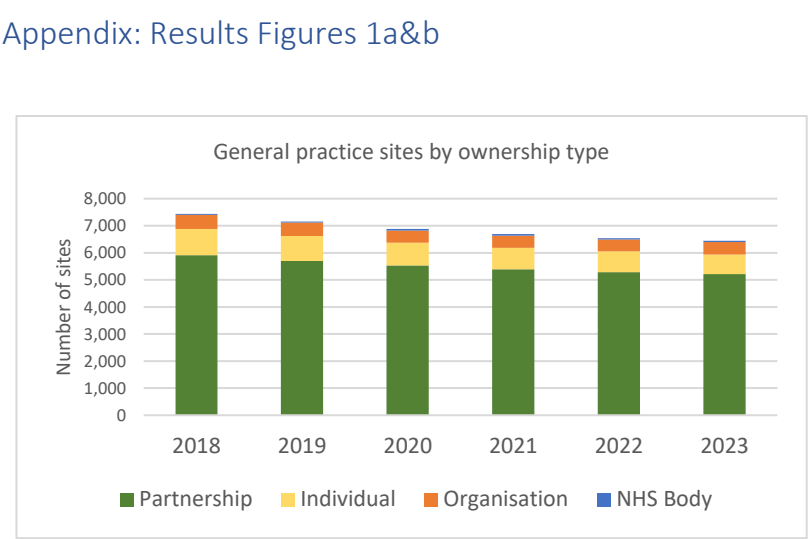
Appendix: Methods Table 2

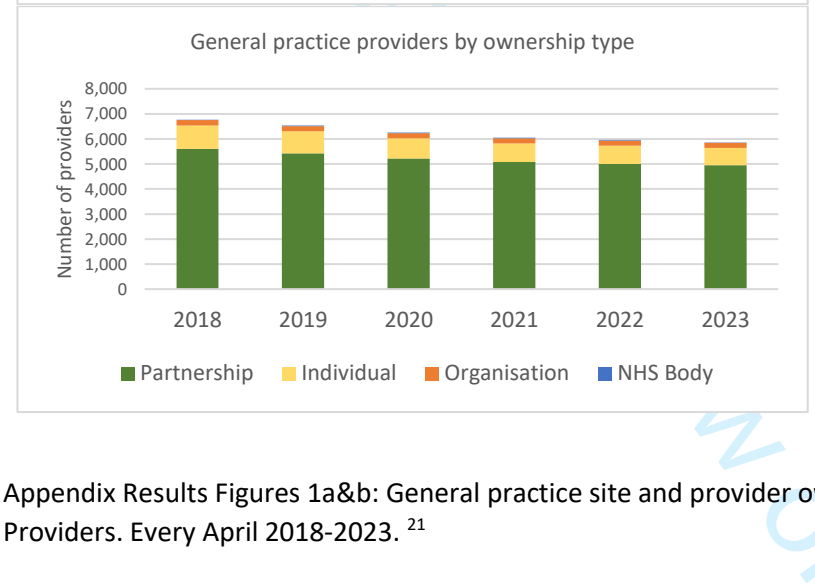
Year	Original total number of practices	Practices with ≤1000 patients removed	Qualified GP roles missing	Total remaining practices for Qualified GP analysis	Proportion of practices remaining for Qualified GP analysis	Trainee GP roles missing	Total remaining practices for Trainee GP analysis	Proportion of practices remaining for Trainee GP analysis	Nurse roles missing	Total remaining practices for Nurse analysis	Proportion of practices remaining for Nurse analysis	DPC roles missing	Total remaining practices for DPC analysis	Proportion of practices remaining for DPC analysis	Admin roles missing	Total remaining practices for Admin analysis	Percentage of practices remaining for Admin analysis	Overall Average
2015	7,623	29	430	7170	0.94	N/A	N/A	N/A	113	7481	0.98	136	7458	0.98	54	7540	0.99	**0.97**
2016	7,558	104	170	7304	0.97	N/A	N/A	N/A	136	7323	0.97	213	7244	0.96	39	7419	0.98	**0.97**
2017	7,354	122	96	7151	0.97	N/A	N/A	N/A	162	7074	0.96	336	6902	0.94	35	7198	0.98	**0.96**
2018	7,137	179	73	6899	0.97	0	6958	0.97	134	6839	0.96	277	6691	0.94	20	6942	0.97	**0.96**
2019	6,867	97	62	6715	0.98	0	6770	0.99	160	6620	0.96	312	6464	0.94	10	6763	0.98	**0.97**
2020	6,650	54	55	6547	0.98	0	6596	0.99	178	6423	0.97	354	6248	0.94	11	6588	0.99	**0.97**
2021	6,564	88	14	6464	0.98	0	6476	0.99	37	6440	0.98	57	6419	0.98	0	6476	0.99	**0.98**
2022	6,456	63	31	6364	0.99	0	6393	0.99	134	6263	0.97	166	6229	0.96	4	6391	0.99	**0.98**
Average					**0.97**			**0.99**			**0.97**			**0.95**			**0.98**	**0.97**

Appendix Methods Table 2: Number and proportion of practices that had missing workforce data and those that were excluded from workforce analysis of FTE/1000 patients as had ≤1000 registered patients. Every September 2015-2022.[22]

Supplementary Material – Results Appendices

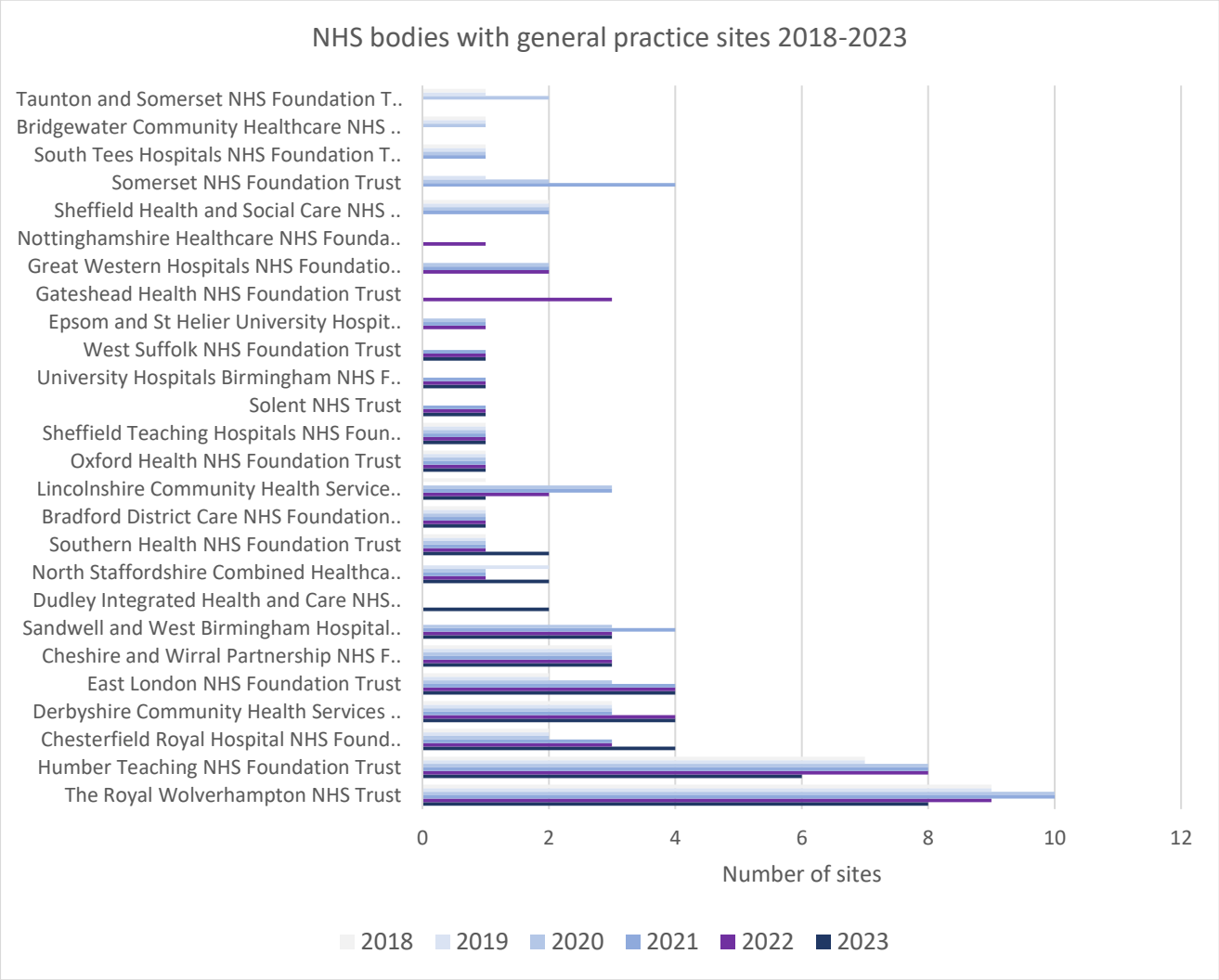
Appendix: Results Figures 1a&b





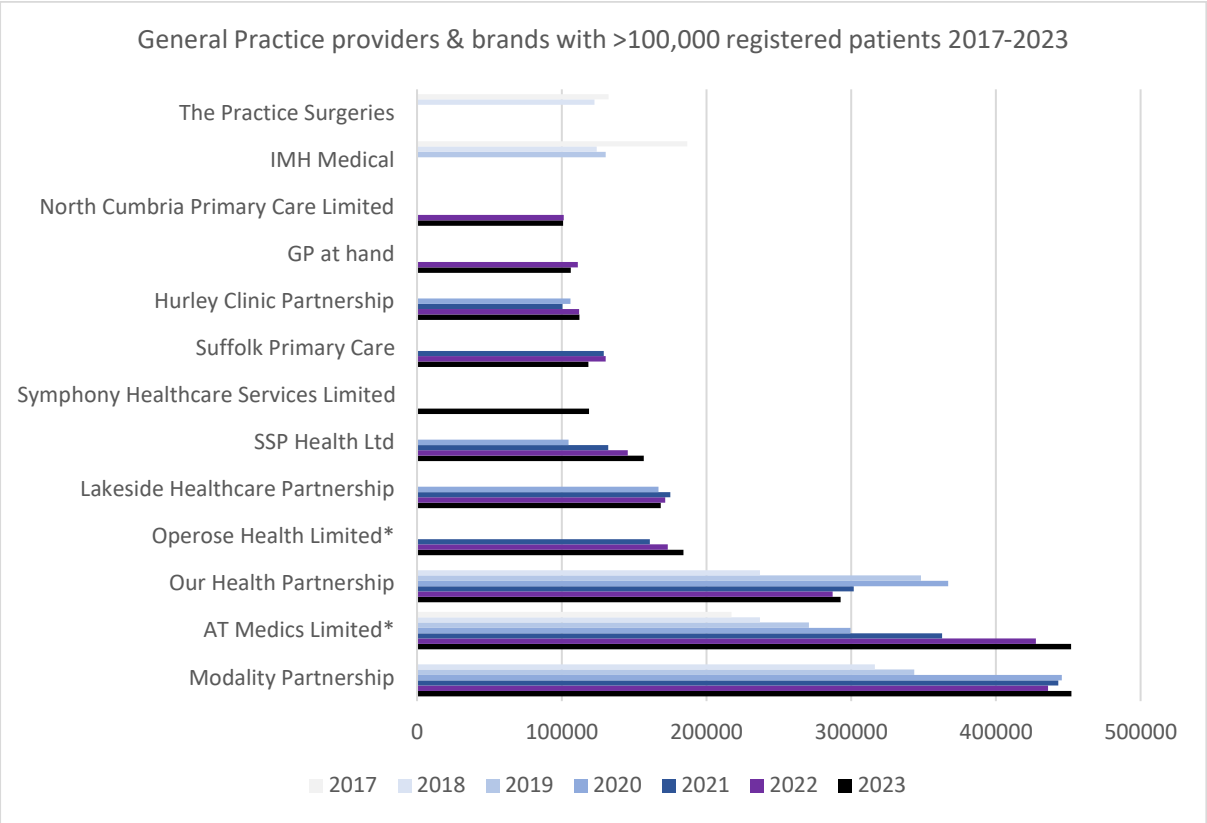
Appendix Results Figures 1a&b: General practice site and provider ownership by (a) Practice sites (b) Providers. Every April 2018-2023. [21]

Appendix: Results Figure 2



Appendix Results Figure 2: NHS bodies running general practice sites, with number of sites. Every April 2018-2023. [21]

Appendix: Results Figure 3



Appendix Results Figure 3: 'Mega-providers' - Providers and Brands with >100,000 registered patients across all practice sites. Every April 2017-2023. Note: Likely underestimate of total list size as 7% of associated practices' patient list size data did not merge with the CQC datasets[19, 21].

*Operose Health Limited and AT Medics Limited are part of the same organisation since 2021[29].

Appendix: Results Tables 1a&b

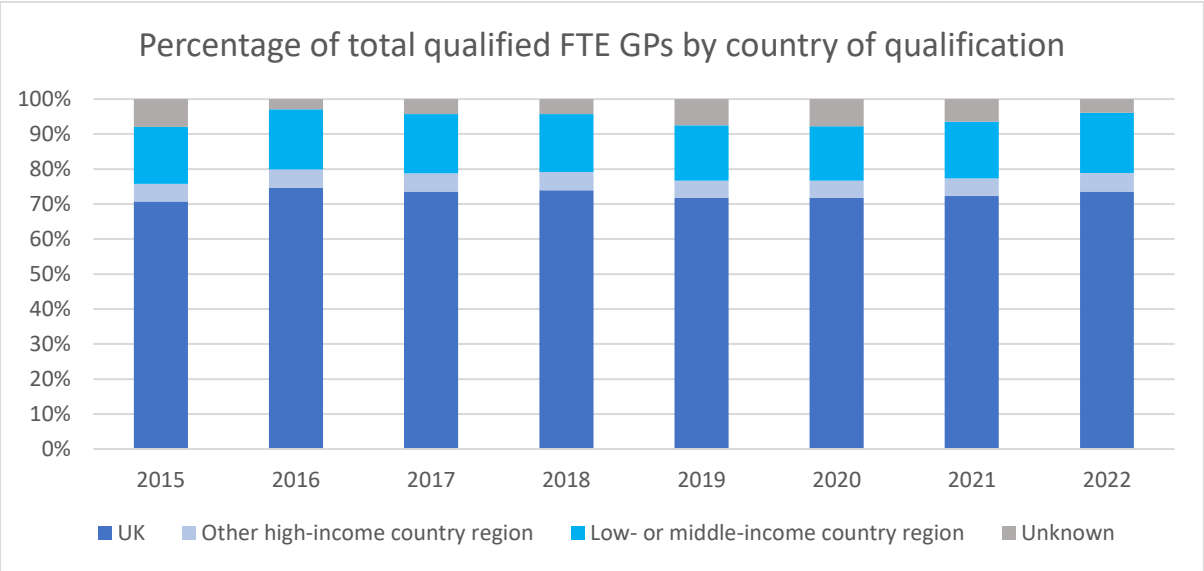
Year	GP Partner	GP Salaried	GP Locum	GP Retainer	GP Trainee	Nurse	Other DPC	Admin
2015	89%	67%	42%	44%	NA	65%	63%	68%
2016	90%	67%	42%	43%	NA	66%	64%	69%
2017	89%	67%	40%	41%	NA	67%	65%	69%
2018	88%	66%	39%	38%	96%	67%	66%	69%
2019	88%	65%	41%	38%	96%	68%	67%	70%
2020	87%	64%	41%	49%	97%	69%	68%	71%
2021	86%	64%	40%	40%	98%	69%	68%	71%
2022	86%	64%	41%	41%	97%	69%	71%	72%
Direction of change	↓	↓	↔	↔	↔	↑	↑	↑
Linear reg of total FTE / HC % by year P value	0.001*	0.000*	0.413	0.820	0.139	0.000*	0.000*	0.000*

Appendix Results Table 1a: Percentage of total full time equivalent out of total headcount for each general practice workforce role and associated P value for linear regression of FTE/HC% change between 2015-2022. *Change statistically significant as P<0.05. Every September 2015-2022. [22]

Year	GP Partner Female	GP Partner Male	GP Salaried Female	GP Salaried Male	GP Locum Female	GP Locum Male	GP Retainer Female	GP Retainer Male	GP Trainee Female	GP Trainee Male
2015	79%	96%	64%	75%	40%	44%	44%	46%	NA	NA
2016	80%	97%	64%	75%	40%	45%	43%	44%	NA	NA
2017	79%	96%	64%	75%	38%	43%	42%	37%	NA	NA
2018	79%	96%	63%	74%	36%	42%	38%	40%	93%	104%
2019	78%	95%	62%	72%	38%	44%	39%	37%	92%	103%
2020	78%	94%	61%	71%	39%	43%	39%	40%	93%	103%
2021	77%	93%	61%	70%	37%	43%	39%	42%	94%	103%
2022	78%	93%	62%	70%	39%	44%	39%	49%	93%	103%
Direction of change	↓	↓	↓	↓	↔	↔	↓	↔	↔	↔
Linear reg of total FTE / HC % by year P value	0.001*	0.002*	0.001*	0.000*	0.443	0.429	0.023*	0.815	0.141	0.087

Appendix Results Table 1b: Percentage of total full time equivalent out of total headcount by female and male gender for each GP role and associated P value for linear regression of FTE/HC% change between 2015-2022. *Change statistically significant as P<0.05. Every September 2015-2022. [22]

Appendix: Results Figure 4



Appendix Results Figure 4: Percentage of qualified total full time equivalent GPs by country of qualification region grouping. Every September 2015-2022. [22]

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title and abstract	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and time period within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract names sources of data Abstract defines national data that range between 2.5-10 years Indicated in abstract and explained in the methods
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	In background section		
Objectives	3	State specific objectives, including any prespecified hypotheses	In background section		
Methods					
Study Design	4	Present key elements of study design early in the paper	In methods section		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	In methods and supplementary material (methods appendices tables 1 & 2)		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	In methods – use of ODS codes and CQC registration location ID and provider ID ODS codes widely used in NHS. CQC the main registration and regulatory body for general practice Explained in methods and set out in supplementary material (methods appendices tables 1 & 2)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Explained in methods
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Explained in the methods		

Bias	9	Describe any efforts to address potential sources of bias	Addressed in the methods and limitations		
Study size	10	Explain how the study size was arrived at	Explained in the methods – national data sets, missing and excluded data reported in methods and supplementary material (methods appendices tables 1&2)		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Explained in the methods		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Explained in the methods		

Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Explained in the methods and supplementary material (methods appendices tables 1&2) Explained in the methods and supplementary material (methods appendices tables 1&2)
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Explained in the methods and supplementary material (methods appendices tables 1&2)
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Explained in the methods, results and supplementary material (methods appendices tables 1&2)	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Explained in the methods, results and supplementary material (methods appendices tables 1&2)
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders	Explained in the methods, results and supplementary material (methods appendices tables 1&2)		

		(b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	N/A		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Descriptive data without adjustment for confounders. Coefficient or IRR reported with 95%CI		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	10th and 90th centile reported where helpful to understand spread of data. P values reported for changes in FTE/HC over time.		

Discussion					
Key results	18	Summarise key results with reference to study objectives	At the start of the discussion		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Under limitations section	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Under methods and limitations section
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Covered in discussion and in limitations		
Generalisability	21	Discuss the generalisability (external validity) of the study results	National data used allows generalisability. However, need for further research to understand warranted and unwarranted variation highlighted		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	In acknowledgements section		
Accessibility of protocol, raw data, and		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as	In citations/ references

programming code				the study protocol, raw data or programming code.	

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

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The changing shape of English General Practice: A retrospective longitudinal study using national datasets examining organisational structure, workforce and recorded appointments

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All authors contributed to the planning, conduct and reporting of the study. LP undertook the analysis and drafting of the article. IP and DC provided technical expertise to enable the analysis of the data. IP, NM and DC provided feedback on various drafts of the article. LP is the guarantor of the study. LP attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. PPI input and feedback from NHS England (NHS Digital before February 2023), OHID and the CQC are outlined in the acknowledgements.

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Competing interests declaration

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/disclosure-of-interest/ and declare: LP is funded as a NIHR Doctoral Research Fellow (DRF-2017-10-088); no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Abstract

Objective

To describe the trends in the organisational structure, workforce and appointments recorded by role in English general practice over the past decade.

Design

Retrospective longitudinal study.

Setting

English General Practice.

Data sources & Participants

National administrative general practice datasets from NHS England, Office for Health Improvement and Disparities, and Care Quality Commission covering between 5 and 10 years between 2013 and 2023.

Results

Between 2013 and 2023, the number of general practices fell by 20% from 8,044 to 6,419; the average practice list size rose by 40% from 6,967 to 9,724 patients. The total population covered by providers with lists over 100,000 patients reached 2.3M in 2023 (0.5M in 2017). The proportion of practices under single-handed ownership fell from 13% to 11% between 2018 and 2023; there was little change in the proportion of practices owned by partnerships (average 80.3%), incorporated companies (6.9%) or NHS Trusts (0.7%).

Between 2015 and 2022, there was a 20% rise in the total full-time equivalent general practice workforce, including Primary Care Network staff, from 1.97 to 2.37/1000 patients because of an increase in multidisciplinary direct patient care roles and administrative roles. Nursing numbers remained stable and GP numbers fell. In September 2022, there were 0.45 qualified FTE GPs/1000 patients. By September 2022, GPs and other direct patient care roles each represented 19% of the full time equivalent/1000 patients workforce; administrative roles represented 51%. The workforce is predominantly female. Between 2018 and 2023, there was no clear upwards or downwards trend

in total appointments recorded/1000 patients with, on average, half of recorded appointments provided by GPs.

Conclusions

Since 2013, there was a shift in general practice towards larger practices and more multidisciplinary teams, alongside a reduction in the number of GPs/1000 patients. The impact of these changes on access, quality, and costs needs monitoring.

Strengths and Limitations of this study

- This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments reported by role over the past 5 to 10 years drawn from a number of sources that are not normally well integrated.
- It provides temporal trends of the general practice workforce and appointment activity relative to population size.
- There are limitations to the estimations of the Primary Care Network workforce in general practice and general practice appointment data are considered as 'experimental' by NHS England.
- Further work is needed to understand the relationship between growing organisational size, increasing multidisciplinary teams and falling GP numbers, and the impact of these changes on access, quality of care, and costs of services.
- Data on demand for general practice appointments and non-appointment related activity, merged NHS England and Care Quality Commission time-series datasets, alongside indices of deprivation with data on performance and income would enable research to understand the impact of trends.

Background

National Health Service (NHS) general practices have traditionally operated as publicly funded, general practitioner (GP)-owned, business partnerships. However, over the past decade, questions have started to be asked about whether the partnership model is still fit for purpose(1, 2). 'Large-scale' general practice organisations have emerged, such as GP federations and multisite providers, with some operating through limited companies(3-5). General practices that have become part of NHS Trusts have also generated interest among policymakers(6). In parallel, national policy in England has encouraged integration of health and care organisations. In 2019, all general practices were incentivised to form 'Primary Care Networks' (PCNs), resulting in around 1200 PCNs, typically covering populations of 30,000-50,000(7). In 2022, 42 Integrated Care Systems (ICSs) became statutory bodies to work with PCNs and other local health and care organisations to plan and deliver coordinated services(8).

The general practice workforce has also been moving away from the traditional model of GP partner(s) working with a practice nurse. There has been an expansion of employed ('salaried') GPs and the introduction of national programmes promoting the recruitment of pharmacists and other multidisciplinary 'Direct Patient Care' (DPC) roles into general practice(9, 10). This has been happening in the context of an ageing population with greater multimorbidity and levels of polypharmacy(11).

Despite a general awareness of these changes, it is hard to get an overall picture because information about different aspects of general practice is reported across multiple datasets. Consequently, news or organisational reports often provide limited statistical analysis of this information, and research studies often cover short time periods or have a single domain of focus(3, 12-22). By combining information from different national data sources, this paper provides an up-to-date analysis of trends in the organisational structure, workforce and appointments recorded by role in English general practice over the past decade. This is to enable providers to understand where they stand relative to national trends; researchers to identify and address relevant research questions; policymakers to understand the impact of their policies; and the public to be better informed regarding the changing shape of English general practice.

Methods

We used national general practice databases that are regularly published by NHS England (previously NHS Digital), the Office for Health Improvement and Disparities (OHID), and the Care Quality Commission (CQC)(23-28). The period covered by the datasets ranged from 5 to 10 years (Appendix: Table 1), reflecting the data available from different sources when we undertook the analyses. We used Organisational Data Service (ODS) codes to define a practice and used these to merge the various releases of datasets. NHS England, OHID and CQC were consulted where uncertainties arose about the data. Full methodological guidance on the datasets can be found on their websites (23-29). We report findings using RECORD guidance(30).

Population & practice metrics

The number of practices and their registered list sizes were identified using NHS England's 'Patients Registered at a GP Practice' datasets (23). The proportion of patients over 65 was obtained from OHID data (April 2023 data were taken from NHS England as OHID had not yet published theirs)(23, 24). Data from April 2013 to April 2023 were used to produce a time-series using figures released each April. All practices with the variables of interest these datasets were included (>99%).

Organisational structure

We used the CQC's archive of 'HSCA Active Locations' every April between 2017 and 2023 as the source of the practice site ('Location ID') and the provider ('Provider ID') that owned the practice, to identify providers with more than one practice site ('multisite providers')(25). The CQC's classification of ownership type, available from 2018, used the following four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). The identification of multisite providers was only possible from 2017 due to the way in which active practice locations had been archived by the CQC. The CQC also identified clusters of providers operated under an overarching 'Brand'. We labelled providers, or where it existed the overarching 'Brand', with a total list size exceeding 100,000 patients as 'mega-providers'. We merged CQC and list size datasets to calculate a mega-providers' list size. For an average of 7% of mega-providers' associated practices, a corresponding list size could not be matched, resulting in a likely underestimate of some of their total list sizes. Between 9 and 87 practice ODS codes were found to be used across two CQC practice 'locations' depending on the year, therefore, their merged list sizes were adjusted to avoid double-counting when calculating the 'mega-provider' list size.

Workforce

Workforce information was obtained from the revised NHS England 'General Practice Workforce' datasets every September between 2015 and 2022, reflecting the period during which data definitions were stable. General practice workforce categories cover GPs, nurses, other DPC roles (e.g. pharmacists, social prescribers, physician associates, paramedics)(31) and administrators.

We use the label 'qualified GPs' to mean GP partners, salaried GPs, GP locums and GP retainers (GPs re-entering the workforce after a period out-of-practice). We use the label 'GP trainees' to include GP trainees (ST1-4), and exclude Foundation Years (FY1-2) ad hoc doctors. Practice level GP trainee figures were only available for time-series analysis from 2018 due to changes in data collection methods(26, 32). Locum figures exclude ad hoc locums that only work briefly to cover short-term or unexpected absences.

We grouped GPs' country of qualification into three categories: UK, high-income country region, low- or middle-income country region. We use 'female', 'male' and 'other/unknown' to classify gender as per the original dataset. We group workforce roles by age (<35, 35-49, 50-64, 65+ years).

Individual staff data aggregated by NHS England at national level, excluding estimated values where no value was reported by the practice, were used to calculate total national headcount (HC) and full-time-equivalents (FTE) by age, gender and GPs' country of qualification. National FTE/HC proportions were calculated by role to examine trends in FTE working hours. For GPs, these were also broken down by male and female gender. Practice level data were used to calculate FTEs per 1000 patients values and to report on 10th to 90th percentiles. Per 1000 patients figures by gender and age were calculated by dividing each practice's workforce figures by its patient list size on the same date.

Practices with missing workforce data were automatically excluded from the denominator; this proportion varied by year and by role between 0.4% and 2.5%. Practices that had a list size of ≤1000 registered patients in September of the year of analysis were also excluded from FTE/1000 patients analyses, on the basis that they were likely to be atypical (e.g., closing or delivering care to a sub-segment of the population) and their workforce to population ratios would not be comparable. On average, 97% of practices were included in the practice level workforce per 1000 patient analyses (Appendix: Table 2).

As General Practice workforce figures exclude DPC and administrative roles contracted at PCN level who are likely to be working for practices, we estimated PCN FTE roles per 1000 patients by dividing the national FTE total of NHS England's 'PCN Workforce' figures, each September between 2020 and 2022, with the total number of patients registered in England in the corresponding month from NHS England's 'Patients Registered at a GP Practice'(23, 27). As not all PCNs submitted workforce figures

during this period, this will have resulted in an underestimate in PCN workforce figures per 1000 patients. Further details are described in the limitations.

Appointments

NHS England's 'Appointments in General Practice' data were based on reported total national figures (28). Appointments include face-to-face, telephone, video consultation/online appointments and home visits. Identifiable COVID vaccination related appointments are removed by NHS England(29). We converted appointments to appointments/week/1000 patients using the total number of registered patients across all practices in the same dataset. We report on the five years of data available between April 2018 and April 2023, with disaggregated nursing and DPC role appointments available from August 2021. While these are official statistics, NHS England still refers to them as 'experimental'(28, 29). Further details are described in the limitations.

Analysis

Analysis was based on statistically testing and describing the patterns across the variables outlined above. The number of practices in the datasets from each source were similar but not always in agreement due to variation in collection dates and methods.

Descriptive statistics are used to provide a summary of trends, with the mean and spread of the practice level values reported using 10th and 90th centiles. The absolute change per year coefficient or incidence rate-ratio (IRR) providing the relative change for the full time period, with 95% confidence intervals, are reported for Linear and Poisson regression analyses, respectively. STATA 17 and 18 was used for analysis and Excel for graphs.

Patient and Public Involvement statement

This paper is part of a wider research project examining the impact of inspections on the quality of general practice where there has been patient and public involvement in the design and undertaking of the study. Several drafts of this paper were reviewed by a patient with research expertise and who is a member of their general practice's 'Patient Participation Group'. Further details are in the acknowledgements.

Results

Organisational Structure

Population growth, practice numbers and list sizes

The total population registered with a general practice in England grew by 11% from 56,042,361 to 62,418,295 between April 2013 and April 2023 (640,816/yr [95%CI 604,260-677,372]), with a temporary slow-down in 2020/21 during the COVID pandemic (Figure 1a).

Alongside this population growth, the mean proportion of patients aged 65 and over increased from 16.3% to 17.9% (IRR 1.09 [95% CI 1.08-1.10]). The variation between practices across the time period saw a similar increase with 10th and 90th percentiles being 7.7% and 24.1% in April 2013 and 8.2% and 27.1% in April 2023.

Meanwhile, the total number of practices fell from 8,044 in April 2013 to 6,419 in April 2023, an average loss of 178 practices/yr [95%CI -193 to -163]. This represents a 20% reduction in the number of practices over ten years (Figure 1a)(23). In keeping, the total number of unique practice postcodes fell from 7,163 to 5,849, representing the loss of 18% unique locations over this period. In contrast, 16% of practices still shared a postcode in 2023, a slight reduction from 19% in 2013(23).

Between April 2013 and April 2023, the mean practice list size increased by 40% from 6,967 to 9,724 patients (291/yr [95%CI 279-303]). The spread of practice list size remained wide throughout this period with the 10th and 90th percentiles being 2,329 and 12,582 in April 2013, and 3,617 and 16,765 in April 2023 (Figure 1b)(23).

Figures 1a&b

The number of practices with lists exceeding 20,000 patients has risen noticeably; in 2013, these only represented 1% of practices (n=81) compared to 6% in 2023 (n=355) (IRR 5.5 [95%CI 4.3-7.0]). The largest practice list doubled from 52,386 to 106,308 patients. Some of these large practices operate over various practice sites, although this is not clear in the NHS England datasets as they operate under a single ODS code (33). Providers also exist that operate multiple practice sites under various ODS codes - 'multisite providers' - their true organisational list size is therefore larger than that captured under individual ODS codes (see below).

Practice ownership, multisite providers and mega-providers

Ownership

CQC data on practice ownership were available between April 2018 and April 2023. During this period, the total number of practice sites registered with the CQC fell from 7,441 to 6,446 and their

respective providers fell from 6,769 to 5,863. Practice sites owned by 'Individual' GPs (i.e., single-handed ownership) fell in number from 975 to 724 (-51/yr [95%CI -62 to -40]), which corresponds to a statistically significant change in the proportion of practices they represent from 13% to 11% (IRR 0.86 [95%CI 0.77-0.94]). In contrast, there was no clear trend in the proportion of 'Partnerships', 'Organisations' and 'NHS bodies' which, respectively, on average, represented 80.3%, 6.9% and 0.7% of practice sites, and 83.6%, 3.3% and 0.3% of providers. The proportion of practice sites which 'Organisations' and 'NHS bodies' owned was over double the proportion of providers they represented as most are multisite providers (Appendix: Figures 1a&b). (25)

Twenty-six NHS bodies, most NHS Trusts, ran general practices between April 2018 and April 2023. Seventeen remained active in 2023. The number of practice sites run by each NHS body across these years ranged between one and ten (mean=2.5). In April 2023, the largest NHS body GP provider ran eight practice sites (Appendix: Figure 2)(25).

Multisite and Mega-providers

Between April 2017 and 2023, the proportion of multisite providers and their associated practices registered with the CQC remained stable, representing on average 4% of providers and 13% of practice sites(25). Examining providers and 'Brands' with >100,000 patients across all sites, i.e. 'mega-providers', there were three in 2017 compared with 11 in 2023. Their estimated total registered population increased from 0.5M to 2.3M. The number of practices under these mega-providers ranged between one and 42 (mean=27). The largest mega-provider registered with the CQC in April 2023 covered an estimated 452,097 patients (Appendix: Figure 3). However, examining organisational websites, two 'mega-providers' registered separately under the CQC merged in 2021 with an estimated total population of 635,979 over 56 practice in sites April 2023(34).

Workforce

General practice workforce

Figures on the general practice workforce were analysed from September 2015 to September 2022, during which time the number of practices in the practice level datasets changed from 7,623 to 6,456.

General practitioners

During this period, the total qualified GP headcount in England increased from 34,474 to 36,492. In contrast, the total FTE qualified GPs fell from 27,948 to 27,321. The average number of qualified GP FTEs/1000 fell from 0.53 to 0.45, representing a 15% fall (IRR 0.86 [95%CI 0.84-0.87]). Similarly, the 10th and 90th percentiles fell from 0.32 and 0.73 FTE/1000 in 2015 to 0.24 and 0.66 FTE/1000 in 2022. (Figure 2a).

Figures 2a-d

The fall in qualified FTE GPs/1000 was associated with a 26% drop in GP partners from 0.39 to 0.29 FTEs/1000 (IRR 0.70 [95%CI 0.69-0.72]). In contrast, there was a 25% rise in the average number of salaried GPs from 0.12 (p10-p90, 0-0.30) to 0.15 (p10-p90, 0-0.32) FTEs/1000 (IRR 1.31 [95%CI 1.27-1.35]). The proportion of FTE salaried GPs out of all qualified FTE GPs increased from 23% to 36%; as a HC proportion, it increased from 28% (n=9817) to 42% (n=15,297). In 2015, 61% of practices reported having salaried GPs; in 2022 this had increased to 74%.

There was no clear trend in the use of regular GP locums. The proportion of practices reporting regular locum use averaged around 17% since 2015, with annual mean regular locum figures around 0.019 (p10-p90, 0-0.064) FTEs/1000. The number of GP retainers, although rising from a HC of 165 to 613, remained very small, representing 0.001 in 2015 and 0.004 FTEs/1000 in 2022 (IRR 3.12 [95%CI 2.4-4.1]). Between 2015 and 2022, the proportion of qualified GPs who had qualified in the UK remained around 73% (Appendix: Figure 4). The mean number of GP trainees increased from 0.06 (p10-p90, 0-0.21) to 0.12 (p10-p90, 0-0.34) FTEs/1000 between 2018 and 2022 (IRR 1.75 [95%CI 1.68-1.81]). The proportion of practices reporting a GP trainee (ST1-4) increased from 35% to 50% during the same period.

As a proportion of all qualified GPs, between 2015 and 2022, the female:male HC ratio shifted from 52:48 to 57:43, and the FTE ratio shifted from 46:54 to 52:48 (Figure 3a). The loss of qualified FTE GPs/1000 was steeper, at 23%, among male GPs from 0.30 to 0.23 FTEs/1000 (IRR 0.76 [95%CI 0.75-0.78]), compared with female GPs, at 4%, from 0.23 to 0.22 FTEs/1000 (IRR 0.97[95%CI 0.95-0.99]). The age distribution of qualified GPs has remained relatively stable since 2015, with 35-49-year-olds representing on average 49% of the total (Appendix: Figure 5a).

Figures 3a-d

The percentage of total FTEs out of total HC fell for GP partners (89%-86%) and salaried GPs (67%-64%). The FTE/HC percentage for GP locums, retainers and trainees (since 2018) did not change significantly. Across all GP roles, females were more likely to report working fewer FTE hours than male GPs (Appendix: Tables 3a&b).

Nurses and other Direct Patient Care roles

The mean number of FTE nurses remained relatively stable between 2015 and 2022 at around 0.26 FTEs/1000 (IRR 1.05 [95%CI 1.03-1.08]), with, on average, 97% of practices reporting employing a

nurse. Across practices, there was typically a four-fold variation in nurses between the 10th and 90th percentile of practices, with values of 0.10 and 0.44 FTEs/1000 in 2022 (Figure 2b).

In comparison, the mean number of other DPC roles employed by practices grew from 0.15 (p10-p90, 0-0.34) to 0.25 (p10-p90, 0-0.53) FTEs/1000. This corresponds to an increase of 67% (IRR 1.67 [95%CI 1.63-1.71]) (Figure 2c). The proportion of practices that reported employing any DPC roles increased from 72% to 89% between 2015 and 2022.

The vast majority of staff in nursing (>96% annually) and DPC roles (>87% annually) were women (Figures 3b&c). The nursing workforce was older than those in DPC roles (Appendix: Figures 5b&c). The FTE/HC increased for nurses (65%-69%) and DPC roles employed at practice level (63%-71%) (Appendix: Table 3a).

Administrative roles

Administrative roles increased by 14% from a mean of 1.05 (p10-p90, 0.17-1.56) to 1.19 (p10-p90, 0.73-1.67) FTEs/1000 between 2015 and 2022 (IRR 1.16 [95%CI 1.14-1.17]) (Figure 2d). Within administrative roles, the mean number of managers remained around 0.19 (p10-p90, 0.06-0.34) FTEs/1000 (IRR 1.03 [95%CI 1.00-1.06]).

The vast majority of the administrative workforce were women (>93% annually; Figure 3d), and the 50-64 age group made up the majority of the FTE administrative workforce, never falling below 43% annually (Appendix: Figure 5d). The FTE/HC increased from 68% to 72% (Appendix: Table 3a).

Combined general practice and PCN workforce

Using 'Primary Care Network Workforce' data, we estimated that since the inception of PCNs in 2019, there had been at least a further 0.21 DPC and 0.02 administrative FTE roles/1000 contracted via PCNs by September 2022(27) (Figure 4).

Figure 4

The combined general practice and PCN workforce increased from 1.97 to 2.37 FTEs/1000 patients between 2015 and 2022 (0.047/yr [95%CI 0.024-0.069]). A 20% rise, or in other words, from one member of staff per 508 patients to one per 422. These combined figures suggest that FTEs/1000 DPC roles in 2022 represented around 19% of the general practice workforce, the same proportion as qualified FTE GPs. Nurses represented 11% and administrative roles 51%, the largest proportion.

Appointments

The number of practices reporting appointments in the total monthly 'Appointments in General Practice' dataset was 6,385 in April 2018 and 6,361 in April 2023, respectively covering 89.9% and

99.9% of all registered patients in England(28, 29). We estimated that during this period there were between 63 and 119(mean=98) appointments/week/1000 patients reported. Peaks were seen between September and November each year, and appointments dipped between April and August 2020. There was no clear overall upwards or downwards trend in total appointments/week/1000 patients during the five-year time series.

GP appointments ranged from 35 to 57(mean=49)/week/1000, with no clear trend over time - despite the fall in qualified GP FTEs/1000. Where reported, nurse appointments ranged between 18 and 28(mean=22)/week/1000. DPC role appointments ranged between 17 and 26(mean=21)/week/1000. DPC role appointments showed an upwards trend from when first reported in August 2021 (0.24 more appointments/week/1000 [95%CI 0.10-0.39]). Between 3% and 11%(mean=5%) of appointments had data quality issues or the staff roles delivering appointments were unknown (Figure 5). Limitations regarding appointment data are discussed further below.

Figure 5

Discussion

Our analysis shows how in the last decade, within the context of a growing and ageing population, there has been a shift in English general practice towards fewer but larger organisations and more multidisciplinary teams with fewer FTE GPs per 1000 patients.

The move towards larger scale organisations has been encouraged by Government policy and professional bodies to generate economies of scale as a result of shared back-office functions, joint service delivery and standardised processes(3, 5, 35). However, the evidence regarding whether larger organisations deliver better quality care or are more cost-effective is mixed(4, 36-41). The diversification of the general practice workforce has also been driven by national policy and proposed as a solution to GP shortages(14, 42, 43). However, concerns have been raised by GPs, researchers and the media about the burden of the additional training needs of a broader multi-disciplinary team, the effect on relational continuity of care, its cost-effectiveness, equity in distribution of roles and the safety of using such roles without sufficient GP oversight(14, 44-52).

While it was not possible to determine whether practices which closed did so with list dispersion or merged with another local practice, analysis shows a reduction of 18% in unique practice postcodes in the past decade. This is likely to affect equity of access due to the increasing distance to the practice for patients for whom travel is difficult. This has also been shown to have a negative effect on income and patient satisfaction in remaining local practices that absorb the population as they may struggle to meet patient needs (41, 53, 54). In contrast, 16% of practices still share a postcode.

While this may enhance patient choice, it may also result in inefficiencies where practices operate in parallel.

Operating a practice as a partnership continues to be the dominant model of ownership. While absolute numbers of practices under single-handed ownership are falling at a faster rate than other forms of general practice ownership, they still represent 11% of practices. Despite Government and research interest in practices run by incorporated organisations and NHS bodies, these own a minority of practices (5, 6). Notably, over one-third of NHS Trusts that have run practices over the past five years no longer do so. This may suggest that Trusts' involvement was intended to be transitional or they faced challenges in their ability to provide general practice which affected their wish to continue.

To date practices, unlike hospitals, have been allowed to close when they were no longer financially viable or made to close where there were regulatory concerns(54, 55). However, with increasing organisational size, including 13% of practices being part of a multisite provider, and the expansion of 'mega-providers', covering an estimated 2.3M people in April 2023, mitigating the risks of general practice providers becoming 'too big to fail' merits regulatory consideration.

GP figures reported elsewhere often include trainees, are calculated by headcount, or as full-time equivalents but without adjusting for population size, and, therefore, do not accurately reflect the active qualified workforce(19, 21, 26). Our analysis demonstrates a 15% reduction in FTE qualified GPs/1000 since 2015, with 0.451522 FTE qualified GPs/1000 in September 2022 - in other words one FTE GP per 2215 patients. This figure is close to recent ONS calculations, but well below the figure reported by the OECD for the UK (0.81/1000 patients – calculated by headcount and including trainees) which, if revised using our definition of qualified GPs, would place England in the quartile of OECD countries with the lowest number of GPs per population(21, 56). While GP trainee figures are rising, there is no guarantee that, once qualified, these doctors will work full-time, or remain in general practice(57).

There is a stable reliance on doctors who qualified outside the UK, representing around a quarter of GPs - mostly from low- or middle-income country regions. Their contribution, in particular to underserved populations, is well documented, but the challenges of doing so often under-recognised and undervalued(58-61). Ongoing NHS reliance on doctors from overseas raises questions around ethical international recruitment(62).

The majority of the workforce is made up of administrative roles, yet they receive little attention(63, 64). As practices become larger and more complex, and because of the importance of these roles for public facing and back-office functions, greater research and policy focus on the administration and

management of general practice is an increasingly urgent priority. The majority of the workforce is female. This has implications to ensure parity of opportunities, income and working conditions with male counterparts(65). It has further implications for workforce planning as analysis of GP FTE/HC suggests that female GPs are likely to work fewer FTE hours than males (Appendix: Table 3b).

Although other DPC roles and qualified GPs both represented around a fifth of the combined FTE general practice and PCN workforce at the end of the workforce time series in September 2022, appointment/1000 patients data suggested that GPs still provided around half of appointments, whereas DPC roles provided around a fifth. Contributory factors to this discrepancy could include issues with the data collection process, that DPC role appointments are longer and/or more of their time is spent on non-patient facing activity or at PCN level, and, therefore, is not captured in general practice appointments(27). Appointment data indicate annual peaks of activity around financially incentivised 'flu vaccination season and a trough following the first COVID lockdown. The provision of an estimated average of 98 appointments/week/1000 between 2018 and 2023 equates to 5.1 appointments/year/patient. This figure, although similar to values reported in 2014 and in 2022, is below 2019 estimates and should be interpreted with caution(12, 66, 67). Our analysis, while it shows a rise in DPC appointments/1000, does not suggest rising total or GP appointments numbers relative to the population. This is in contrast to figures recently reported elsewhere that do not take into account population growth, include COVID vaccination activity, cover shorter time periods and/or use smaller datasets (18, 20, 68, 69).

Trends point to a changing role for the GP partner from a self-managing owner of a small business to holding responsibility for the governance of a much larger organisation and its associated multidisciplinary team. This is happening against a background of falling numbers of GPs, where both partners and salaried GPs are reducing their FTE hours. This indicates the need to prioritise the retention of the existing GP workforce. Falling patient satisfaction and reduced continuity of care, captured in the annual national general practice patient survey, is a warning that this period of transition is proving challenging to patients, particularly within the context of a growing and ageing population, alongside post-COVID pandemic and secondary care pressures(70-72).

Limitations

NHS England's total registered population in general practice was 7% (over 4.4 million people) higher than Office for National Statistics' (ONS) 2021 mid-year estimates(23, 73). NHS England is aware of this discrepancy, that appears to be increasing over time, and attributes a range of factors to this, including delayed de-registrations and duplicate records(74). This has implications when reporting

values relative to population size, particularly where patient turnover and, therefore, discrepancies between NHS England and ONS population figures may be greater.

We confirmed with NHS England that general practice and PCN workforce datasets did not double count roles. However, not all PCNs contributed to national PCN workforce figures, with 50.3% responding in September 2020 and 87.5% by September 2022(75). Also a small proportion (<1%) of practices are not part of a PCN(7). Therefore, using national registered patient numbers will have underestimated the PCN workforce/1000 patients, particularly for the initial years.

The requirement for practices to capture appointment data in a standardised format was only introduced in March 2021 and NHS England's appointment data are still deemed 'experimental' due to variation in working methods and recording between practices (29, 76). COVID resulted in atypical appointment provision during 2020/21 when many practices limited face-to-face access and demand fell as many patients avoided healthcare settings. From August 2021 the recording of the role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID of the person delivering the appointment. Our estimated number of appointments per week, using monthly figures, do not account for the exact number of working days each month. These factors affect the interpretability of the appointment trends. Appointment data also do not capture other activities, including managing correspondence, prescriptions, reviewing test results, staff supervision, management and quality improvement work. In addition, digital encounters such as online consultations delivered through separate messaging software may not be captured, unless recorded as an appointment. Workforce FTE figures are unlikely to be capturing over time, which is common in general practice(66, 77-79).

Strengths and opportunities for future research and policy

This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments recorded by role over the past decade. It provides a comprehensive overview of the temporal trends in general practice workforce and reported appointments relative to population size.

While the data used in this paper is openly available and interactive data dashboards are emerging(16, 18, 20-22, 80), making access more user-friendly would improve the ability of this data to inform policy and practice. In particular, NHS England ODS codes should better align with CQC location and provider data. Datasets could also be merged at practice level to include indices of deprivation and other practice level performance data such as QOF scores and GP patient satisfaction survey responses alongside income. The capture of data such as demand for

appointments and workforce time spent on non-appointment related activities would also enhance understanding of how general practice is functioning.

Our analysis offers a benchmark for providers and commissioners, as well as for international comparisons. However, further research to understand what represents warranted versus unwarranted variation is important as the provision of care should vary subject to the needs of local populations. The relationship between the trends reported here and access, quality of care, or costs was beyond the scope of this paper. Work by others in these areas is already underway, in particular, examining inequities in workforce distribution(13, 21, 50, 51, 53, 67, 81-83). However, opportunities exist for further research in this area to understand the wider impact of the changing shape of English general practice.

Conclusions

Over the past decade, the organisational structure and workforce of general practice in England has clearly shifted towards larger practices with extended multidisciplinary teams. The implications of these changes, alongside the fall in the number of practices and FTE qualified GPs, needs careful monitoring to assess their impact on access, quality of care, and costs.

Data Availability

All the data used is publicly available via NHS England (previously NHS Digital) and the Care Quality Commission.

Ethical approval

All data used is publicly available. No ethical approval was required for this study

Transparency Statement

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Competing interests

The authors declare no competing interests

Author Contribution Statement

All authors contributed to the planning, conduct and reporting of the study. LP undertook the analysis and drafting of the article. IP and DC provided technical expertise to enable the analysis of the data. IP, NM and DC provided feedback on various drafts of the article. LP is the guarantor of the study. LP attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Patient and Public Involvement, and feedback from NHS England (NHS Digital before February 2023), OHID and the CQC are outlined in the acknowledgements.

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Figure Legend

Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. (23)

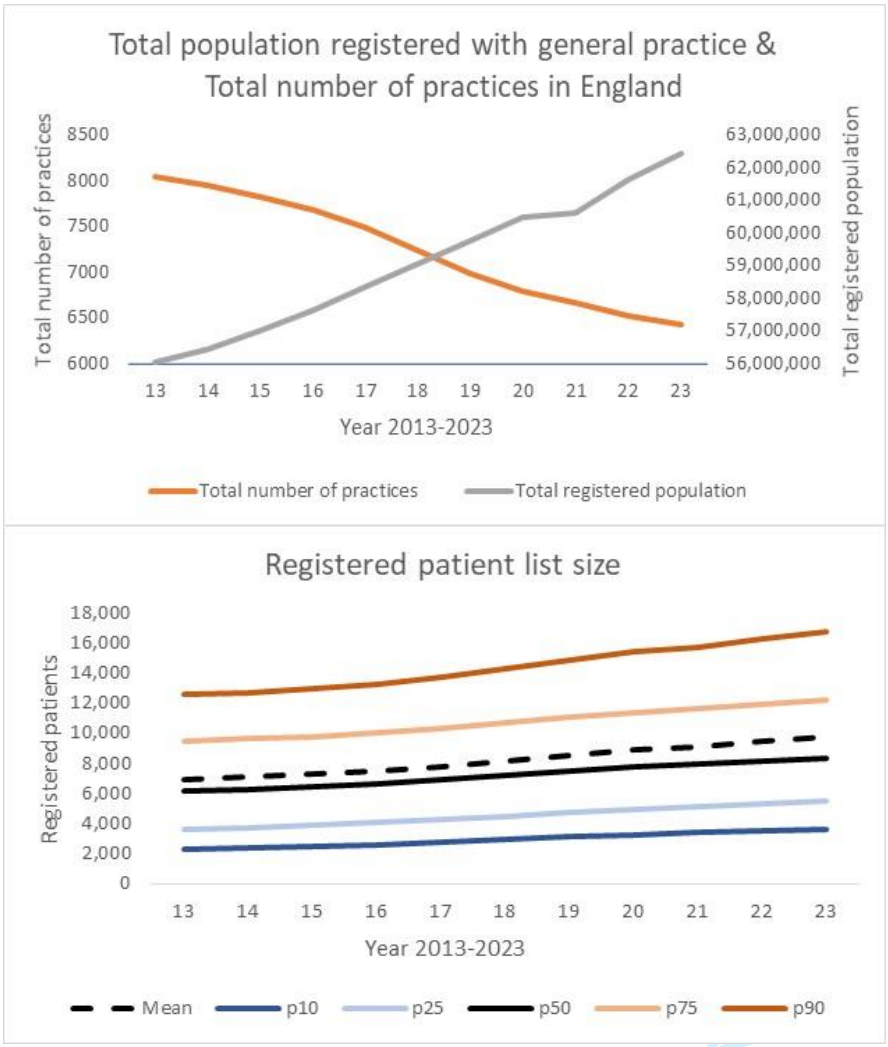
Figures 2a-d: Full time equivalent (FTE) per 1000 patients general practice workforce roles in England: mean, p10, p50 and p90 (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care (DPC) roles; (d) Administrative roles. Note: Different scale on Y-axis for administrative roles. Every September 2015-2022. (26)

Figures 3a-d: Total full time (FTE) equivalent general practice workforce roles by gender in England: (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care (DPC) roles; (d) Administrative roles. Every September 2015-2022. (26)

Figure 4: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce per 1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. (26, 27)

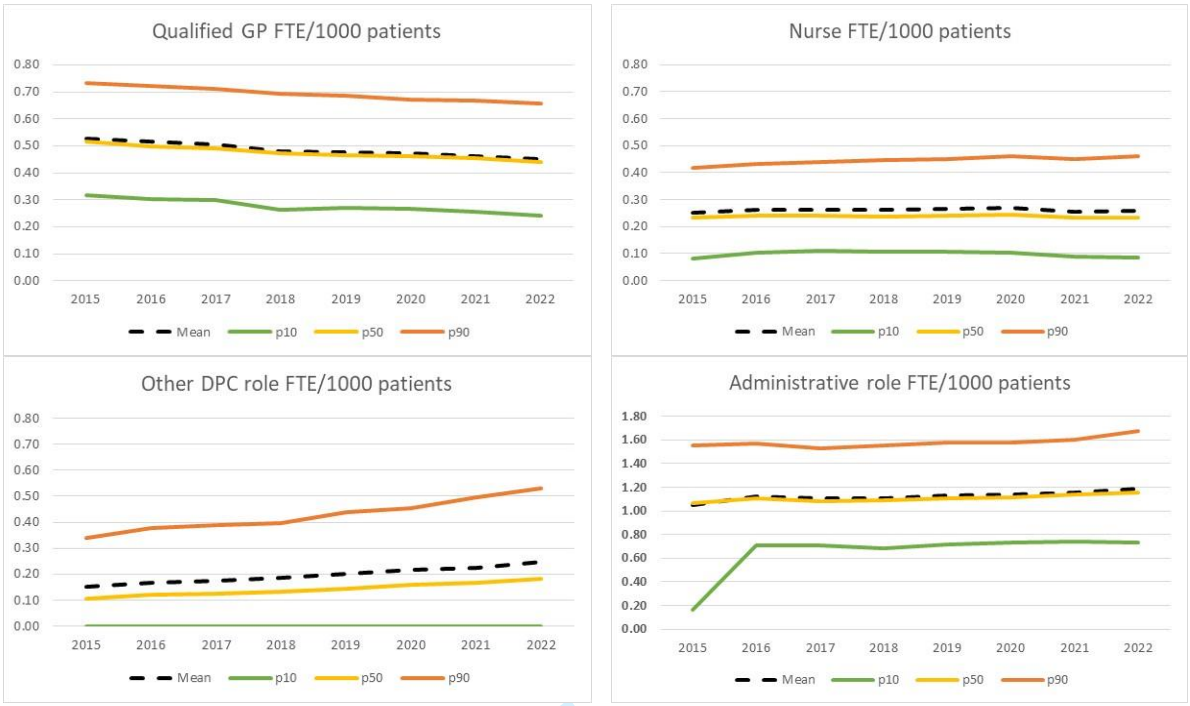
Figure 5: Average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. (28)

Figures 1a&b



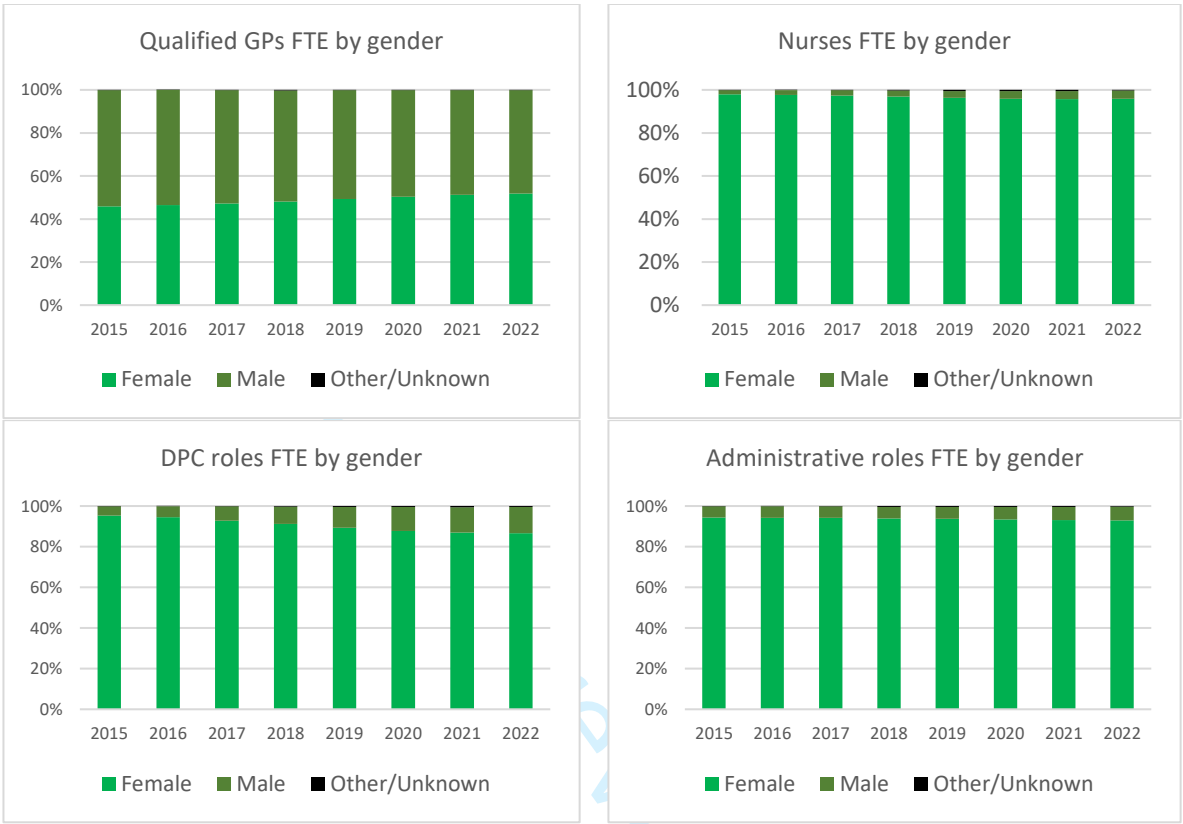
Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. [23]

Figures 2a-d



Figures 2a-d: Full time equivalent (FTE) per 1000 patients general practice workforce roles in England: mean, p10, p50 and p90 (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care (DPC) roles; (d) Administrative roles. Note: Different scale on Y-axis for administrative roles. Every September 2015-2022. [26]

Figures 3a-d



Figures 3a-d: Total full time (FTE) equivalent general practice workforce roles by gender in England: (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care (DPC) roles; (d) Administrative roles. Every September 2015-2022. [26]

Figure 4

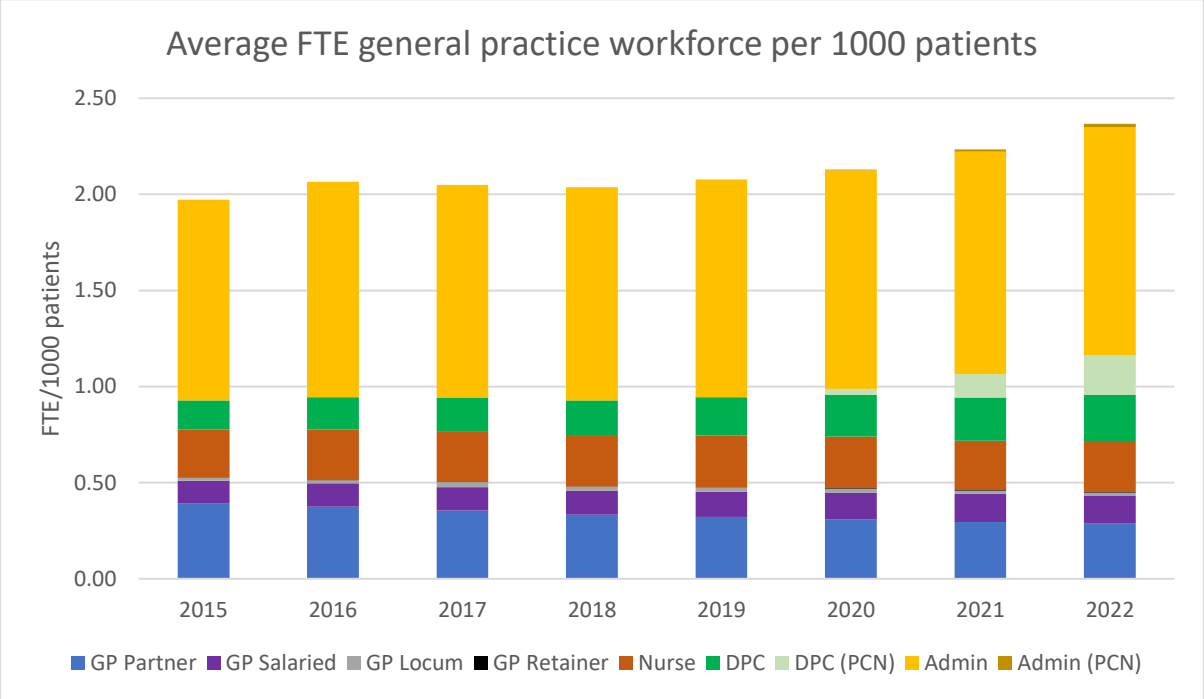


Figure 4: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce/1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. [26, 27]

Figure 5

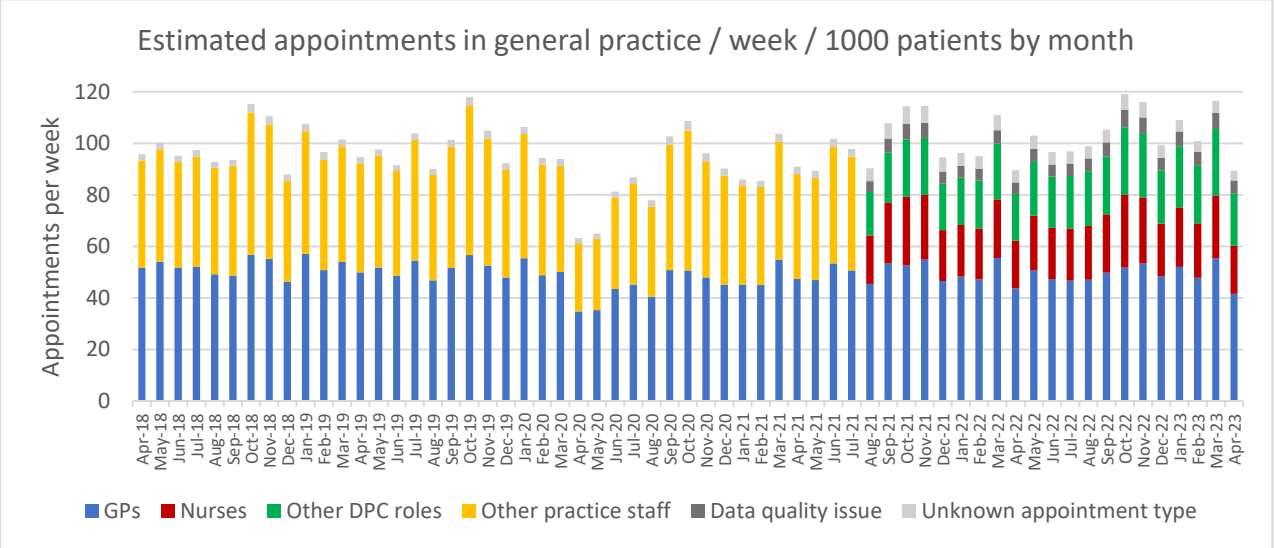


Figure 5: Estimated average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. [28]

The changing shape of English General Practice: A retrospective longitudinal study using national datasets examining organisational structure, workforce and recorded appointments

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Appendices

Appendix: Table 1 (Methods)

Time trend variables	Source (practice / national level)	Time trend period (total time period and frequency of data used)	Percentage range (mean) of observations reported after removal of missing data and exclusions
Organisational Structure			
Total registered population; Total number of practices; Practice list size; Practice postcode	NHS Digital -Patients Registered at a GP Practice [23] **(Practice)**	Apr 2013-Apr 2023 **(10 yrs, annual)** Postcode Jul 2013-Apr 2023 **(9.75 yrs, annual)**	Registered patients 92%-100% (99.9%) Postcode 99%-100% (99.99%)
Proportion of registered patients >65 years old	OHID -'Fingertips Public Health Data'(2013-2022) [24] & NHS Digital-Patients Registered at a GP Practice (2023) [23] **(Practice)**	Apr 2013-Apr 2023 **(10 yrs, annual)**	98%
Ownership of practice and provider	CQC - Archive of 'HSCA Active Locations with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2018-Apr 2023 **(5 yrs, annual)**	100%
Multisite providers	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2017-Apr 2023 **(6 yrs, annual)**	100%
Mega-provider list size	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice'. [25] CQC's 'Location ID' mapped to ODS code using CQC's 'GP Practice Locations for providers registered or previously registered under the Health and Social Care Act' dated 28.7.23. ODS code merged with NHS Digital Patients Registered at a GP Practice [23] **(Practice)**	Apr 2017-Apr 2023 **(6 yrs, annual)**	Mega-providers' associated practices' registered patient list sizes 90%-96% (93%)
Workforce & Appointments			
General Practice Workforce at practice level (FTE/1000 patients)	NHS Digital – General Practice Workforce [26] ('Practice-Level CSV) Data included practice list size for the corresponding month to calculate FTE/1000 patient figures.	Sep 2015-Sep 2022 **(7 yrs, annual)** Trainee GPs	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%)

	Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. **(Practice)**	Sep 2018-Sep 2022 **(4 yrs, annual)**	GP trainees: 100% Nat: September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
General Practice Workforce at national level (total HC; total FTE; total FTE by age, sex and qualified GP by country of qualification)	NHS Digital – General Practice Workforce [26] ('Individual-Level CSV) Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. Where no data was submitted by a practice for a staff group (i.e. GP, nurses, DPC, Admin), 'Estimated' figures provided by NHS Digital are excluded. **(National)**	Sep 2015-Sep 2022 **(7 yrs, annual)**	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%) GP trainees: 100% Nat: September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
Primary Care Network (PCN) Workforce mean FTE per 1000 patients	NHS Digital – Primary Care Network Workforce [27] with mean FTE / 1000 patients calculated by dividing national FTE totals with the total number of registered patients in England in the corresponding month from NHS Digital -Patients Registered at a GP Practice [23] (This will have resulted in an underestimate as not all PCNs submitted data) **(National)**	Sep 2020- Sep 2022 **(2.5 yrs, annual, combined with General Practice Workforce data to provide 7 yrs of data)**	Percentage of PCNs that submitted data September 2020: 50.3% September 2021: 78.4% September 2022: 87.5%
Appointments by role per week per 1000 patients	NHS Digital- Appointment in General Practice [28] (used most recent data from May '23, Jan '21 & Oct '18 'GP enhanced appointment' excel publications) with appointments per week per 1000 patients calculated using 'Registered patients at included practices' figures from the same dataset. Monthly figures were multiplied by 12 and divided by 52.1429 to estimate weekly values (NB: Cross-check by NHS England using the exact days in the month to calculate weekly values did not make a significant change to values and trends). **(National)**	Apr 2018- Apr 2023 **(5 yrs, monthly)** In August 2021 recording of role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID (Spine Directory Service 'SDS') of the person delivering the appointment.	Practice coverage: 88.5%-98.9% Total patients in included practices coverage: 89.9%-99.9%

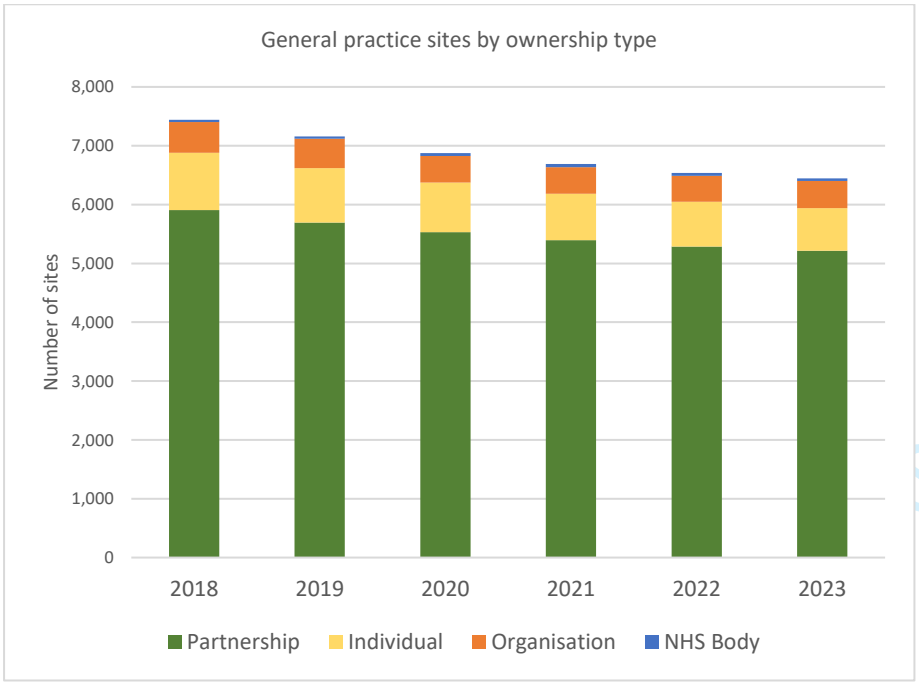
Appendix Table 1: Organisational structure, workforce and reported appointment variables: source, level of data, frequency used, time period used, percentage of original data reported after removal of missing observations and exclusions [23-28]. NB: NHS Digital became NHS England in February 2023.

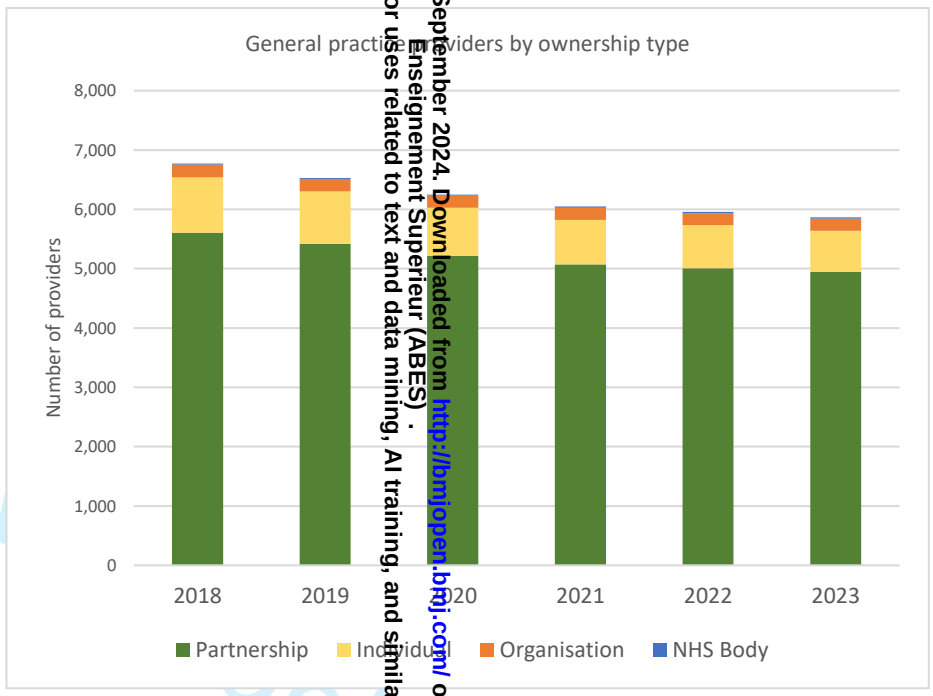
Appendix: Table 2 (Methods)

Year	Original total number of practices	Practices with ≤1000 patients removed	Qualified GP roles missing	Total remaining practices for Qualified GP analysis	Proportion of practices remaining for Qualified GP analysis	Trainee GP roles missing	Total remaining practices for Trainee GP analysis	Proportion of practices remaining for Trainee GP analysis	Nurse roles missing	Total remaining practices for Nurse analysis	Proportion of practices remaining for Nurse analysis	DPC roles missing	Total remaining practices for DPC analysis	Proportion of practices remaining for DPC analysis	Admin roles missing	Total remaining practices for Admin analysis	Percentage of practices remaining for Admin analysis	Overall Average
2015	7,623	29	430	7170	0.94	N/A	N/A	N/A	113	7481	0.98	136	7458	0.98	54	7540	0.99	**0.97**
2016	7,558	104	170	7304	0.97	N/A	N/A	N/A	136	7323	0.97	213	7244	0.96	39	7419	0.98	**0.97**
2017	7,354	122	96	7151	0.97	N/A	N/A	N/A	162	7074	0.96	336	7002	0.94	35	7198	0.98	**0.96**
2018	7,137	179	73	6899	0.97	0	6958	0.97	134	6839	0.96	277	6891	0.94	20	6942	0.97	**0.96**
2019	6,867	97	62	6715	0.98	0	6770	0.99	160	6620	0.96	312	6464	0.94	10	6763	0.98	**0.97**
2020	6,650	54	55	6547	0.98	0	6596	0.99	178	6423	0.97	354	6248	0.94	11	6588	0.99	**0.97**
2021	6,564	88	14	6464	0.98	0	6476	0.99	37	6440	0.98	57	6419	0.98	0	6476	0.99	**0.98**
2022	6,456	63	31	6364	0.99	0	6393	0.99	134	6263	0.97	166	6229	0.96	4	6391	0.99	**0.98**
Average					**0.97**			**0.99**			**0.97**			**0.95**			**0.98**	**0.97**

Appendix Table 2: Number and proportion of practices that had missing workforce data and those that were excluded from workforce analysis of FTE/1000 patients as had ≤1000 registered patients. Every September 2015-2022. (Source: NHS England)[26]

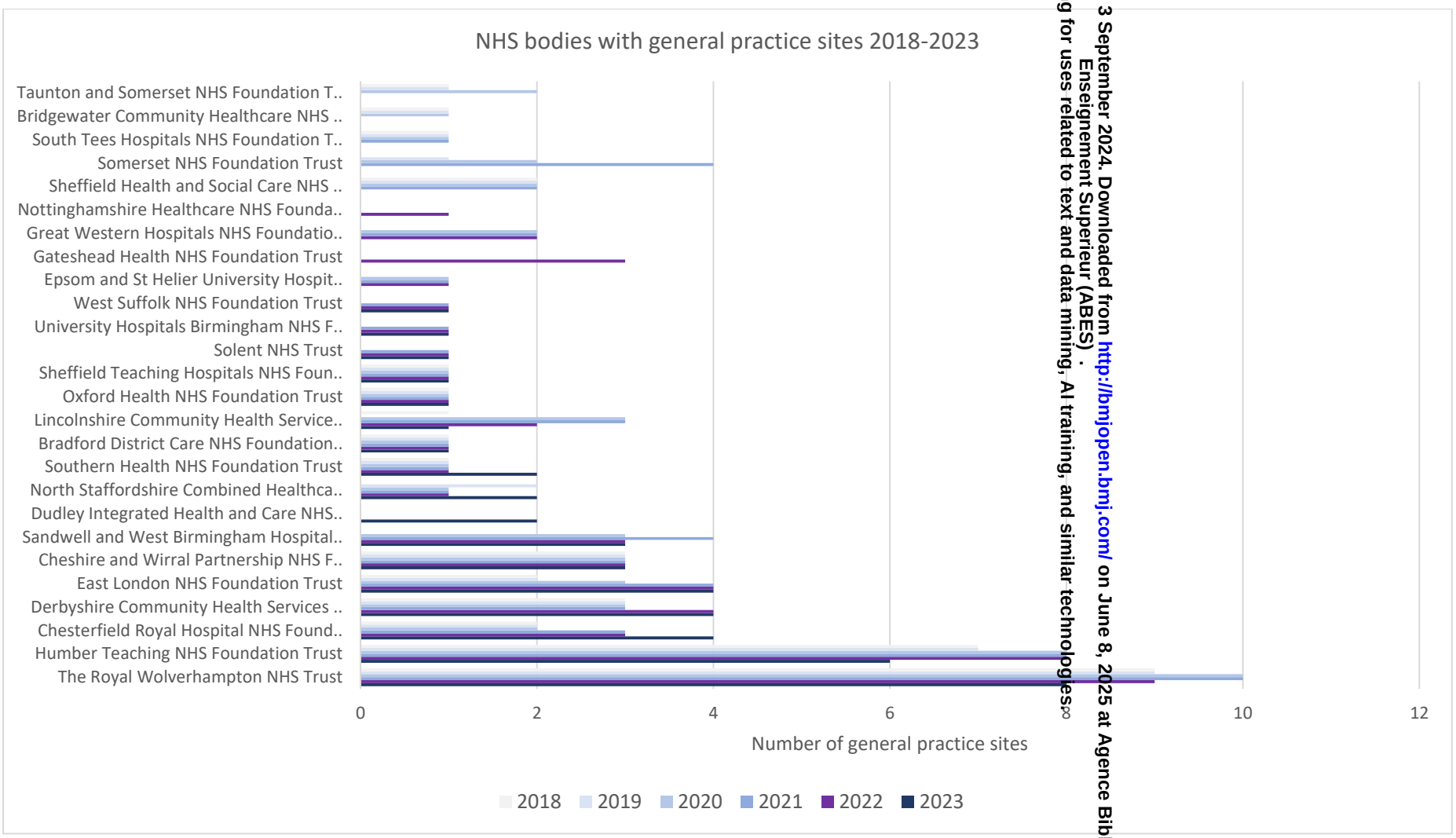
Appendix: Figures 1a&b (Results)





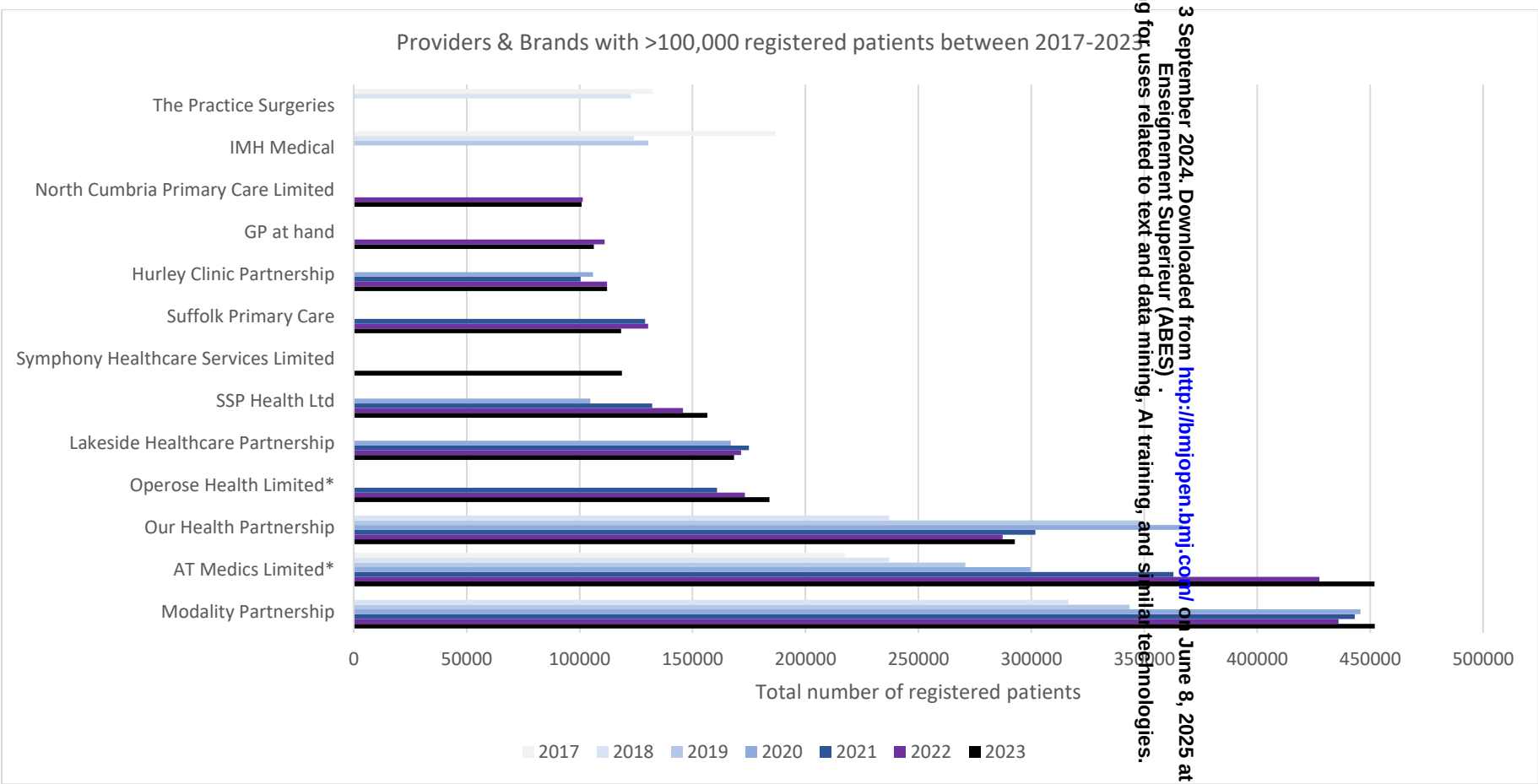
Appendix Figures 1a&b: General practice 'site' and 'provider' ownership by (a) Practice sites (b) Providers. Every April 2018-2023. (Source: CQC) [25]. NB: The Care Quality Commission (CQC) classifies ownership type in four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). Providers may have more than one site.

Appendix: Figure 2 (Results)



Appendix Figure 2: NHS bodies running general practice sites, with number of sites. Every April 2018-2023. (Source: CQC) [25]

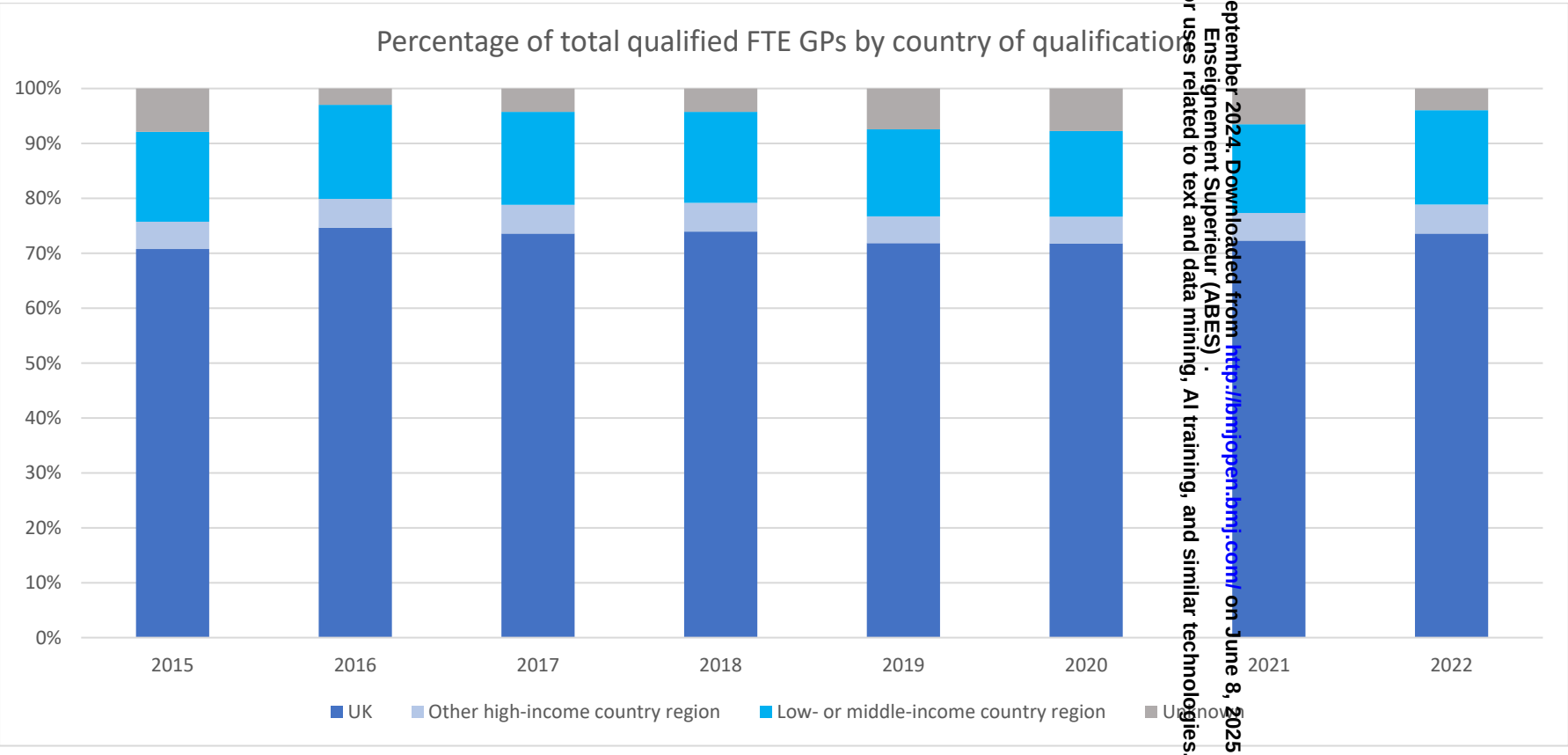
Appendix: Figure 3 (Results)



Appendix Figure 3: 'Mega-providers' - Providers and Brands with >100,000 registered patients across all practice sites Every April 2017-2023. NB: Likely underestimate of total list size as 7% of NHS England's associated practices' patient list size data did not merge with the CQC datasets. (Sources: NHS England & CQC) [23, 25].

*Operose Health Limited and AT Medics Limited became part of the same organisation in 2021[34].

Appendix: Figure 4 (Results)



Appendix Figure 4: Percentage of qualified total full time equivalent (FTE) GPs in England by country of qualification region grouping. Every September 2015-2022. (Source: NHS England) [26]

Appendix: Tables 3a&b (Results)

Table 3a

Year	GP Partner	GP Salaried	GP Locum	GP Retainer	GP Trainee	Nurse	Other DPC	Admin
2015	89%	67%	42%	44%	NA	65%	63%	68%
2016	90%	67%	42%	43%	NA	66%	64%	69%
2017	89%	67%	40%	41%	NA	67%	65%	69%
2018	88%	66%	39%	38%	96%	67%	66%	69%
2019	88%	65%	41%	38%	96%	68%	67%	70%
2020	87%	64%	41%	49%	97%	69%	68%	71%
2021	86%	64%	40%	40%	98%	69%	68%	71%
2022	86%	64%	41%	41%	97%	69%	71%	72%
Direction of change	↓	↓	↔	↔	↔	↑	↑	↑
Linear reg of total FTE / HC % by year P value	0.001*	0.000*	0.413	0.820	0.139	0.000*	0.000*	0.000*

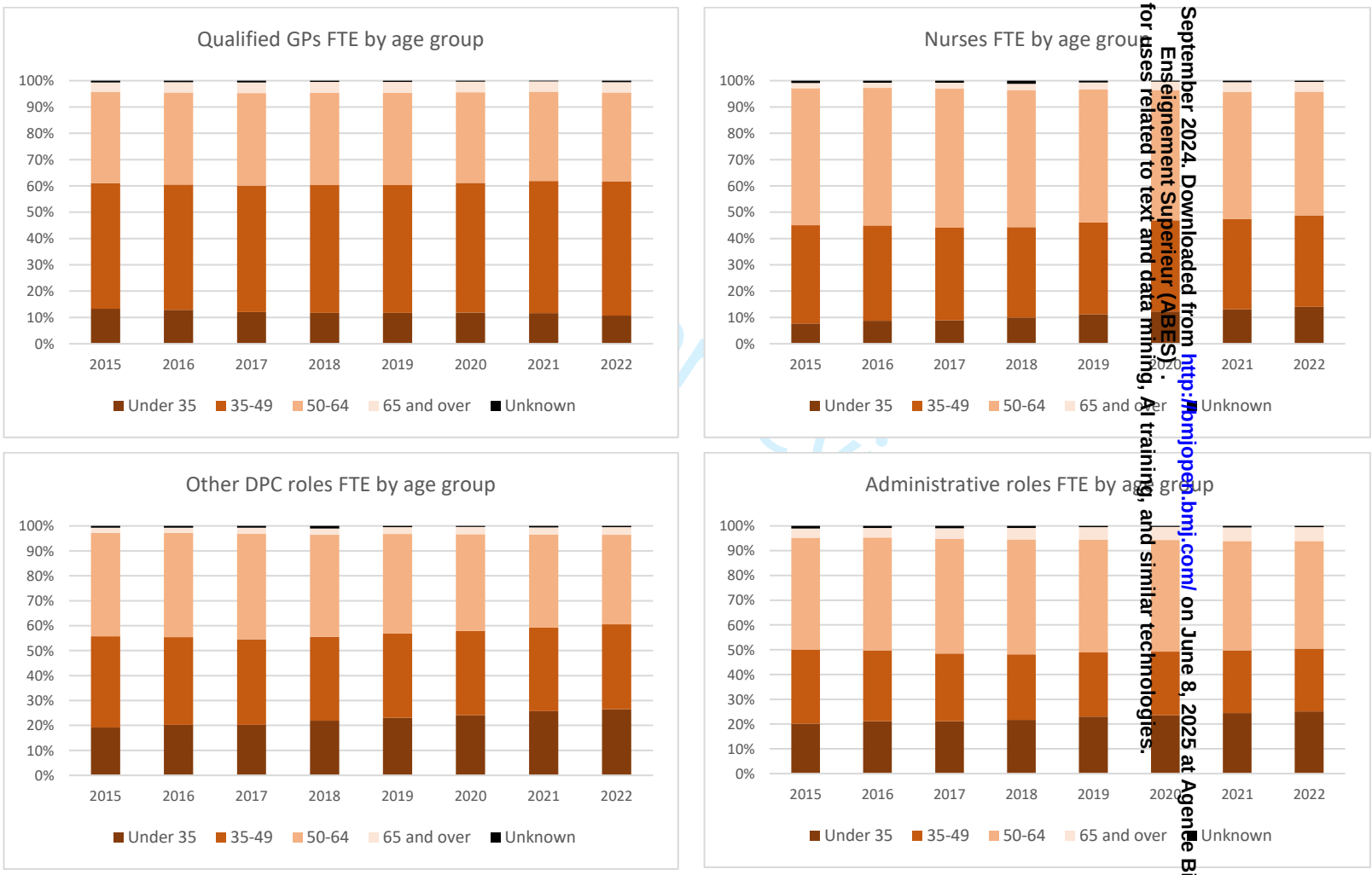
Appendix Table 3a: Total full time equivalent (FTE) out of total headcount (HC) percentage for each general practice workforce role and associated P value for linear regression of FTE/HC%. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England) [26]

Table 3b

Year	GP Partner Female	GP Partner Male	Salaried GP Female	Salaried GP Male	Locum GP Female	Locum GP Male	Retainer GP Female	Retainer GP Male	Trainee GP Female	Trainee GP Male
2015	0.79	0.96	0.64	0.75	0.40	0.44	0.44	0.46	NA	NA
2016	0.80	0.97	0.64	0.75	0.40	0.45	0.43	0.44	NA	NA
2017	0.79	0.96	0.64	0.75	0.38	0.43	0.42	0.37	NA	NA
2018	0.79	0.96	0.63	0.74	0.36	0.42	0.38	0.40	0.93	1.04
2019	0.78	0.95	0.62	0.72	0.38	0.44	0.39	0.37	0.92	1.03
2020	0.78	0.94	0.61	0.71	0.39	0.43	0.39	0.40	0.93	1.03
2021	0.77	0.93	0.61	0.70	0.37	0.43	0.39	0.42	0.94	1.03
2022	0.78	0.93	0.62	0.70	0.39	0.44	0.39	0.49	0.93	1.03
Direction of change	↓	↓	↓	↓	↔	↔	↓	↔	↔	↔
Linear reg of total FTE / HC % by year P value	0.001*	0.002*	0.001*	0.000*	0.443	0.429	0.023*	0.815	0.441	0.087

Appendix Table 3b: Total full time equivalent (FTE) out of total headcount (HC) proportion by gender for each GP role and associated P value for linear regression of FTE/HC. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England)

Appendix: Figures 5a-d (Results)



Appendix Figures 5a-d: Total full time equivalent (FTE) general practice workforce roles by age group: (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care roles; (d) Administrative roles. Every September 2015-2022. (Source: NHS England) [26]

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title and abstract	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and time period within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract names sources of data Abstract defines national data that range between 5-10 years Indicated in abstract and explained in the methods
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	In background section		
Objectives	3	State specific objectives, including any prespecified hypotheses	In background section		
Methods					
Study Design	4	Present key elements of study design early in the paper	In methods section		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	In methods and supplementary material (methods appendices tables 1 & 2)		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	In methods – use of ODS codes and CQC registration location ID and provider ID ODS codes widely used in NHS. CQC the main registration and regulatory body for general practice Explained in methods and set out in supplementary material (methods appendices tables 1 & 2)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Explained in methods
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Explained in the methods		

Bias	9	Describe any efforts to address potential sources of bias	Addressed in the methods and limitations		
Study size	10	Explain how the study size was arrived at	Explained in the methods – national data sets, missing and excluded data reported in methods and supplementary material (methods appendices tables 1&2)		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Explained in the methods		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Explained in the methods		

Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Explained in the methods and supplementary material (methods appendices tables 1&2) Explained in the methods and supplementary material (methods appendices tables 1&2)
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Explained in the methods and supplementary material (methods appendices tables 1&2)
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Explained in the methods, results and supplementary material (methods appendices tables 1&2)	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Explained in the methods, results and supplementary material (methods appendices tables 1&2)
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders	Explained in the methods, results and supplementary material (methods appendices tables 1&2)		

		(b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	N/A		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Descriptive data without adjustment for confounders. Coefficient or IRR reported with 95%CI		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	10th and 90th centile reported where helpful to understand spread of data. P values reported for changes in FTE/HC over time.		

Discussion					
Key results	18	Summarise key results with reference to study objectives	At the start of the discussion		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Under limitations section	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Under methods and limitations section
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Covered in discussion and in limitations		
Generalisability	21	Discuss the generalisability (external validity) of the study results	National data used allows generalisability. However, need for further research to understand warranted and unwarranted variation highlighted		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	In acknowledgements section		
Accessibility of protocol, raw data, and		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as	In citations/ references

programming code				the study protocol, raw data or programming code.	

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

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The changing shape of English General Practice: A retrospective longitudinal study using national datasets describing trends in organisational structure, workforce and recorded appointments

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Abstract

Objective

To describe trends in the organisational structure, workforce and appointments in English general practice.

Design

Retrospective longitudinal study.

Setting

English General Practice.

Data sources & Participants

NHS England, Office for Health Improvement and Disparities, and Care Quality Commission national datasets covering between 5 and 10 years between 2013 and 2023.

Results

Between 2013 and 2023, the number of general practices fell by 20% from 8,044 to 6,419; the average practice list size rose by 40% from 6,967 to 9,724 patients. The total population covered by providers with lists over 100,000 patients reached 2.3 million in 2023 (0.5 million in 2017). The proportion of practices under individual ownership fell from 13% to 11% between 2018 and 2023; there was little change in the proportion owned by partnerships, incorporated companies or NHS Trusts, which respectively averaged around 80.3%, 6.9% and 0.7%.

Between 2015 and 2022, there was a 20% rise in the total full-time equivalent general practice workforce, including Primary Care Network staff, from 1.97 to 2.37/1000 patients because of an increase in multidisciplinary direct patient care and administrative roles. Nursing numbers remained stable and qualified GP numbers fell by 15%. In September 2022, there were 0.45 qualified FTE GPs/1000 patients; GPs and other direct patient care roles each represented 19% of the full time equivalent/1000 patients workforce; administrative roles represented 51%. The general practice workforce is predominantly female. A quarter of GPs qualified overseas. Between 2018 and 2023, there was no clear upwards or downwards trend in total appointments/1000 patients with, on average, half provided by GPs.

Conclusions

Since 2013, there has been a shift in general practice towards larger practices with more multidisciplinary teams, alongside a reduction in the number of GPs/1000 patients. We recommend that the impact of these changes on access, quality, and costs are monitored.

Strengths and Limitations of this study

- This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments reported by role over the past 5 to 10 years drawn from a number of sources that are not normally well integrated.
- It provides temporal trends of the general practice workforce and appointment activity relative to population size.
- There are limitations to the estimations of the Primary Care Network workforce in general practice and general practice appointment data are considered as 'experimental' by NHS England.

- Further work is needed to understand the relationship between growing organisational size, increasing multidisciplinary teams and falling GP numbers, and the impact of these changes on access, quality of care, and costs of services.
- Data on demand for general practice appointments and non-appointment related activity, merged NHS England and Care Quality Commission time-series datasets, alongside indices of deprivation with data on performance and income would enable further research to understand the impact of trends.

Background

National Health Service (NHS) general practices have traditionally operated as publicly funded, but independently-contracted partnerships, mainly with general practitioners (GPs) as the partners. However, over the past decade, questions have started to be asked about whether the partnership model is still fit for purpose(1, 2). 'Large-scale' general practice organisations have emerged, such as GP federations and multisite providers, with some operating through limited companies(3-5). General practices that have become part of NHS Trusts have also generated interest among policymakers(6). In parallel, national policy in England has encouraged integration of health and care organisations. In 2019, all general practices were incentivised to form 'Primary Care Networks' (PCNs), resulting in around 1200 PCNs in England, typically covering populations of 30,000-50,000(7). In 2022, 42 Integrated Care Systems (ICSs) became statutory bodies to work with PCNs and other local health and care organisations to plan and deliver coordinated services(8).

The general practice workforce has also been moving away from the traditional model of GP partner(s) working with a practice nurse. There has been an expansion of employed ('salaried') GPs and the introduction of national programmes promoting the recruitment of pharmacists and other multidisciplinary 'Direct Patient Care' (DPC) roles into general practice, notably through the 'Additional Roles Reimbursement Scheme' which from 2019 provided financial incentives via PCNs to employ additional DPC roles (9, 10). This has been happening in the context of an ageing and growing population with greater multimorbidity and levels of polypharmacy(11).

Despite a general awareness of these changes, it is hard to get an overall picture because information about different aspects of general practice is reported across multiple datasets. Consequently, news or organisational reports often provide limited statistical analysis of this information, and research studies often cover short time periods or have a single domain of focus(3, 12-22). Therefore, by combining information from different national data sources, we aim to describe the trends in the organisational structure, workforce and appointments recorded by role in English general practice over the past decade, and consider the implication of these trends.

Methods

We used national general practice databases that are regularly published by NHS England (previously NHS Digital), the Office for Health Improvement and Disparities (OHID), and the Care Quality Commission (CQC)(23-28). The period covered by the datasets ranged from 5 to 10 years (Appendix: Table 1), reflecting the data available from different sources when we undertook the analyses. We

used Organisational Data Service (ODS) codes to define a practice and used these to merge the various releases of datasets. NHS England, OHID and CQC were consulted where uncertainties arose about the data. Full methodological guidance on the datasets can be found on their websites (23-29). We report findings using RECORD guidance(30).

Population & practice metrics

The number of practices and their registered list sizes were identified using NHS England's 'Patients Registered at a GP Practice' datasets (23). The proportion of patients over 65 was obtained from OHID data (April 2023 data were taken from NHS England as OHID had not yet published theirs)(23, 24). Data from April 2013 to April 2023 were used to produce a time-series using figures released each April. All practices with the variables of interest in these datasets were included (>99%).

Organisational structure

We used the CQC's archive of 'HSCA Active Locations' every April between 2017 and 2023 as the source of the practice site ('Location ID') and the provider ('Provider ID') that owned the practice, to identify providers with more than one practice site ('multisite providers')(25). The CQC's classification of ownership type, available from 2018, used the following four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). The identification of multisite providers was only possible from 2017 due to the way in which active practice locations had been archived by the CQC. The CQC also identified clusters of providers operated under an overarching 'Brand'. We labelled providers, or the overarching 'Brand' where it existed, with a total list size exceeding 100,000 patients as 'mega-providers'. We merged CQC and list size datasets to calculate a mega-providers' list size. For an average of 7% of mega-providers' associated practices, a corresponding list size could not be matched, resulting in a probable underestimate of some of their total list sizes. Between 9 and 87 practice ODS codes were found to be used across two CQC practice 'locations', depending on the year; therefore, their merged list sizes were adjusted to avoid double-counting when calculating the 'mega-provider' list size.

Workforce

Workforce information was obtained from the revised NHS England 'General Practice Workforce' datasets every September between 2015 and 2022, reflecting the period during which data definitions were stable. General practice workforce categories cover GPs, nurses, other DPC roles (e.g. pharmacists, social prescribers, physician associates, paramedics)(31) and administrators.

We use the label 'qualified GPs' to mean GP partners, salaried GPs, GP locums and GP retainers (GPs re-entering the workforce after a period out-of-practice). We use the label 'GP trainees' to include GP trainees (ST1-4), but to exclude Foundation Years (FY1-2) doctors. Practice level GP trainee figures were only available for time-series analysis from 2018 due to changes in data collection methods(26, 32). Locum figures exclude ad hoc locums that only work briefly to cover short-term or unexpected absences.

We grouped GPs' country of qualification into three categories: UK, high-income country region, low- or middle-income country region. We use 'female', 'male' and 'other/unknown' to classify gender as per the original dataset. We group workforce roles by age (<35, 35-49, 50-64, 65+ years).

Individual staff data aggregated by NHS England at national level, excluding estimated values where no value was reported by the practice, were used to calculate total national headcount (HC) and full-time-equivalents (FTE) by age, gender and GPs' country of qualification. National FTE/HC proportions were calculated by role to examine trends in FTE working hours. For GPs, these were also broken down by male and female gender. Practice level data were used to calculate FTEs per 1000 patients values and to report on the 10th to 90th percentiles. Per 1000 patients figures by gender and age were calculated by dividing each practice's workforce figures by its patient list size on the same date and then multiplying by 1000.

Practices with missing workforce data were automatically excluded from the denominator; this proportion varied by year and by role between 0.4% and 2.5%. Practices that had a list size of ≤1000 registered patients in September of the year of analysis were also excluded from FTE/1000 patients analyses, on the basis that they were likely to be atypical (e.g., closing or delivering care to a sub-segment of the population) and their workforce to population ratios would not be comparable. On average, 97% of practices were included in the practice level workforce per 1000 patient analyses (Appendix: Table 2).

As General Practice workforce figures exclude DPC and administrative roles contracted at PCN level who are likely to be working for practices, we estimated PCN FTE roles per 1000 patients by dividing the national FTE total of NHS England's 'PCN Workforce' figures (and then multiplying by 1000), each September between 2020 and 2022, with the total number of patients registered in England in the corresponding month from NHS England's 'Patients Registered at a GP Practice'(23, 27). As not all PCNs submitted workforce figures during this period, this will have resulted in an underestimate in PCN workforce figures per 1000 patients. Further details are described in the limitations.

Appointments

NHS England's 'Appointments in General Practice' data were based on reported total national figures (28). Appointments include face-to-face, telephone, video consultation/online appointments and home visits. Identifiable COVID vaccination related appointments are removed by NHS England(29). We converted appointments to appointments/week/1000 patients using the total number of registered patients across all practices in the same dataset. We report on the five years of data available between April 2018 and April 2023, with disaggregated nursing and DPC role appointments available from August 2021. While these are official statistics, NHS England still refers to them as 'experimental'(28, 29). Further details are described in the limitations.

Analysis

Analysis was based on statistically testing and describing the patterns across the variables outlined above. The number of practices in the datasets from each source were similar but not always in agreement due to variation in collection dates and methods.

Descriptive statistics are used to provide a summary of trends, with the mean and spread of the practice level values reported using 10th and 90th centiles. The absolute change per year coefficient or incidence rate-ratio (IRR) providing the relative change for the full time period, with 95% confidence intervals, are reported for Linear and Poisson regression analyses, respectively. STATA 17 and 18 was used for analysis and Excel for graphs.

Patient and Public Involvement statement

This paper is part of a wider research project examining the impact of inspections on the quality of general practice where there has been patient and public involvement in the design and undertaking of the study. Several drafts of this paper were reviewed by a patient with research expertise and who is a member of their general practice's 'Patient Participation Group'. Further details are in the acknowledgements.

Results

Organisational Structure

Population growth, practice numbers and list sizes

The total population registered with a general practice in England grew by 11% from 56,042,361 to 62,418,295 between April 2013 and April 2023 (640,816/year [95%CI 604,260-677,372]), with a temporary slow-down in 2020/21 during the COVID pandemic (Figure 1a).

Alongside this population growth, the mean proportion of patients aged 65 and over increased from 16.3% to 17.9% (IRR 1.09 [95% CI 1.08-1.10]). The variation between practices across the time period saw a similar increase with 10th and 90th percentiles being 7.7% and 24.1% in April 2013 and 8.2% and 27.1% in April 2023.

Meanwhile, the total number of practices fell from 8,044 in April 2013 to 6,419 in April 2023, an average loss of 178 practices/year [95%CI -193 to -163]. This represents a 20% reduction in the number of practices over ten years (Figure 1a)(23). This is consistent with the total number of unique practice postcodes falling from 7,163 to 5,849, representing the loss of 18% unique locations by registered ODS code over this period. In contrast, 16% of practices still shared a postcode in 2023, a slight reduction from 19% in 2013(23).

Between April 2013 and April 2023, the mean practice list size increased by 40% from 6,967 to 9,724 patients (291/yr [95%CI 279-303]). The spread of practice list size remained wide throughout this period with the 10th and 90th percentiles being 2,329 and 12,582 in April 2013, and 3,617 and 16,765 in April 2023 (Figure 1b)(23).

Figures 1a&b

The number of practices with lists exceeding 20,000 patients has risen noticeably; in 2013, these only represented 1% of practices (n=81) compared to 6% in 2023 (n=355) (IRR 5.5 [95%CI 4.3-7.0]). The largest practice list doubled from 52,386 to 106,308 patients. Some of these large practices operate over various practice sites, although this is not clear in the NHS England datasets as they operate under a single ODS code (33). Providers also exist that operate multiple practice sites under various ODS codes - 'multisite providers' - their true organisational list size is therefore larger than that captured under individual ODS codes (see below).

Practice ownership, multisite providers and mega-providers

Ownership

CQC data on practice ownership were available between April 2018 and April 2023. During this period, the total number of practice sites registered with the CQC fell from 7,441 to 6,446 and their respective providers fell from 6,769 to 5,863. Practice sites owned by 'Individual' GPs (i.e., single-handed ownership) fell in number from 975 to 724 (-51/year [95%CI -62 to -40]), which corresponds to a statistically significant change in the proportion of practices they represent from 13% to 11% (IRR 0.86 [95%CI 0.77-0.94]). In contrast, there was no clear trend in the proportion of 'Partnerships', 'Organisations' and 'NHS bodies' which, respectively, on average, represented 80.3%, 6.9% and 0.7% of practice sites, and 83.6%, 3.3% and 0.3% of providers. The proportion of practice sites which

'Organisations' and 'NHS bodies' owned was over double the proportion of providers they represented as most are multisite providers (Appendix: Figures 1a&b). (25)

Twenty-six NHS bodies, mostly NHS Trusts, ran general practices between April 2018 and April 2023. Seventeen remained active in 2023. The number of practice sites run by each NHS body across these years ranged between one and ten (mean=2.5). In April 2023, the largest NHS body GP provider ran eight practice sites (Appendix: Figure 2)(25).

Multisite and Mega-providers

Between April 2017 and 2023, the proportion of multisite providers and their associated practices registered with the CQC remained stable, representing on average 4% of providers and 13% of practice sites(25). Examining providers and 'Brands' with >100,000 patients across all sites, i.e. 'mega-providers', there were three in 2017 compared with 11 in 2023. Their estimated total registered population increased from 0.5 million to 2.3 million. The number of practices under these mega-providers ranged between one and 42 (mean=27). The largest mega-provider registered with the CQC in April 2023 covered an estimated 452,097 patients (Appendix: Figure 3). However, examining organisational websites, two 'mega-providers' registered separately under the CQC merged in 2021 with an estimated total population of 635,979 over 56 practice in sites April 2023(34).

Workforce

General practice workforce

Figures on the general practice workforce from September 2015 to September 2022 were analysed, during which time the number of practices in the practice level datasets declined from 7,623 to 6,456.

General practitioners

Between September 2015 and September 2022, the total qualified GP headcount in England increased from 34,474 to 36,492. In contrast, the total FTE qualified GPs fell from 27,948 to 27,321. The average number of qualified GP FTEs/1000 fell from 0.53 to 0.45, representing a 15% fall (IRR 0.86 [95%CI 0.84-0.87]). Similarly, the 10th and 90th percentiles fell from 0.32 and 0.73 FTE/1000 in 2015 to 0.24 and 0.66 FTE/1000 in 2022. (Figure 2a(i)).

Figures 2a-d

The fall in qualified FTE GPs/1000 mirrored a 26% drop in GP partners from 0.39 to 0.29 FTEs/1000 (IRR 0.70 [95%CI 0.69-0.72]). In contrast, there was a 25% rise in the average number of salaried GPs from 0.12 (p10-p90, 0-0.30) to 0.15 (p10-p90, 0-0.32) FTEs/1000 (IRR 1.31 [95%CI 1.27-1.35]). The

proportion of FTE salaried GPs out of all qualified FTE GPs increased from 23% to 36%; as a HC proportion, it increased from 28% (n=9817) to 42% (n=15,297). In 2015, 61% of practices reported employing salaried GPs; in 2022 this had increased to 74%.

The use of regular GP locums showed no clear trend. The proportion of practices reporting regular locum use averaged has around 17% since 2015, with annual mean FTE regular locums/1000 around 0.019 (p10-p90, 0-0.064). The number of GP retainers, although rising from a HC of 165 to 613, remained very small, representing 0.001 in 2015 and 0.004 FTEs/1000 in 2022 (IRR 3.12 [95%CI 2.4-4.1]). Between 2015 and 2022, the proportion of qualified GPs who had qualified in the UK remained around 73% (Appendix: Figure 4). The mean number of GP trainees increased from 0.06 (p10-p90, 0-0.21) to 0.12 (p10-p90, 0-0.34) FTEs/1000 between 2018 and 2022 (IRR 1.75 [95%CI 1.68-1.81]). The proportion of practices reporting a GP trainee (ST1-4) increased from 35% to 50% during the same period.

As a proportion of all qualified GPs, between 2015 and 2022, the female:male HC ratio shifted from 52:48 to 57:43, and the FTE ratio shifted from 46:54 to 52:48 (Figure 2a(ii)). The loss of qualified FTE GPs/1000 was steeper, at 23%, among male GPs from 0.30 to 0.23 FTEs/1000 (IRR 0.76 [95%CI 0.75-0.78]), compared with female GPs, at 4%, from 0.23 to 0.22 FTEs/1000 (IRR 0.97[95%CI 0.95-0.99]). The age distribution of qualified GPs has remained relatively stable since 2015, with 35-49-year-olds representing on average 49% of the total (Appendix: Figure 5a).

The percentage of total FTEs out of total HC fell for GP partners (89%-86%) and salaried GPs (67%-64%). The FTE/HC percentage for GP locums, retainers and trainees (since 2018) did not change significantly. Across all GP roles, females were more likely to report working fewer FTE hours than male GPs (Appendix: Tables 3a&b).

Nurses and other Direct Patient Care roles

The mean number of FTE nurses remained relatively stable between 2015 and 2022 at around 0.26 FTEs/1000 (IRR 1.05 [95%CI 1.03-1.08]), with, on average, 97% of practices reporting employing a nurse. Across practices, there was typically a four-fold variation in nurses between the 10th and 90th percentile of practices, with values of 0.10 and 0.44 FTEs/1000 in 2022 (Figure 2b(i)).

In comparison, the mean number of other DPC roles employed by practices grew from 0.15 (p10-p90, 0-0.34) to 0.25 (p10-p90, 0-0.53) FTEs/1000. This corresponds to an increase of 67% (IRR 1.67 [95%CI 1.63-1.71]) (Figure 2c(i)). The proportion of practices that reported employing any DPC roles increased from 72% to 89% between 2015 and 2022.

The vast majority of staff in nursing (>96% annually) and DPC roles (>87% annually) were women (Figures 2b(ii) & c(ii)). The nursing workforce was older than those in DPC roles (Appendix: Figures 5b&c). The FTE/HC increased for nurses (65%-69%) and DPC roles employed at practice level (63%-71%) (Appendix: Table 3a).

Administrative roles

Administrative roles increased by 14% from a mean of 1.05 (p10-p90, 0.17-1.56) to 1.19 (p10-p90, 0.73-1.67) FTEs/1000 between 2015 and 2022 (IRR 1.16 [95%CI 1.14-1.17]) (Figure 2d(i)). Within administrative roles, the mean number of managers remained around 0.19 (p10-p90, 0.06-0.34) FTEs/1000 (IRR 1.03 [95%CI 1.00-1.06]).

The vast majority of the administrative workforce were women (>93% annually; Figure 2d(ii)), and the 50-64 age group made up the majority of the FTE administrative workforce, never falling below 43% annually (Appendix: Figure 5d). The FTE/HC increased from 68% to 72% (Appendix: Table 3a).

Combined general practice and PCN workforce

Using 'Primary Care Network Workforce' data, we estimated that since the inception of PCNs in 2019, there had been at least a further 0.21 DPC and 0.02 administrative FTE roles/1000 contracted via PCNs by September 2022(27) (Figure 3).

Figure 3

The combined general practice and PCN workforce increased from 1.97 to 2.37 FTEs/1000 patients between 2015 and 2022 (0.047/year [95%CI 0.024-0.069]). This represents a 20% rise, or in other words, an increase from one member of staff per 508 patients to one per 422 patients. These combined figures suggest that FTEs/1000 DPC roles in 2022 represented around 19% of the general practice workforce, the same proportion as qualified FTE GPs. Nurses represented 11% and administrative roles 51%, the largest proportion.

Appointments

The number of practices reporting appointments in the total monthly 'Appointments in General Practice' dataset was 6,385 in April 2018 and 6,361 in April 2023, respectively covering 89.9% and 99.9% of all registered patients in England(28, 29). We estimated that during this period there were between 63 and 119(mean=98) appointments/week/1000 patients reported. Peaks were seen between September and November each year, and appointments dipped between April and August 2020. There was no clear overall upwards or downwards trend in total appointments/week/1000 patients during the five-year time series.

GP appointments ranged from 35 to 57(mean=49)/week/1000, with no clear trend over time - despite the fall in qualified GP FTEs/1000. Where reported, nurse appointments ranged between 18 and 28(mean=22)/week/1000. DPC role appointments ranged between 17 and 26(mean=21)/week/1000. DPC role appointments showed an upwards trend from when first reported in August 2021 (0.24 more appointments/week/1000 [95%CI 0.10-0.39]). Between 3% and 11%(mean=5%) of appointments had data quality issues or the staff roles delivering appointments were unknown (Figure 4). Limitations regarding appointment data are discussed further below.

Figure 4

Discussion

Trends in the organisational structure, workforce and appointments in English general practice show that in the last decade, within the context of a growing and ageing population, there has been a shift towards fewer but larger organisations and more multidisciplinary teams with fewer qualified FTE GPs per 1000 patients. Despite this GPs continue to provide around half of appointments with no clear upwards or downwards trend in the number of appointments per 1000 patients since April 2018. Operating a practice as a partnership continues to be the dominant model of ownership. The workforce is predominantly female and there is a stable reliance on doctors who qualified outside the UK. Administrative roles make-up over half of the FTE workforce.

The move towards larger scale organisations has been encouraged by Government policy and professional bodies to generate economies of scale as a result of shared back-office functions, joint service delivery and standardised processes(3, 5, 35). However, the evidence regarding whether larger organisations deliver better quality primary care or are more cost-effective is mixed(4, 36-41). The diversification of the general practice workforce has also been driven by national policy and proposed as a solution to GP shortages(14, 42, 43). While broadening the multi-disciplinary team can provide additional expertise, concerns have been raised by GPs, researchers and the media about the burden of their additional training needs, the effect on relational continuity of care, its cost-effectiveness, equity in distribution of roles and the safety of using such roles without sufficient GP oversight(14, 44-52).

Our analysis shows a reduction of 18% in unique practice postcodes in the past decade. It was not possible to determine whether practices which closed did so with list dispersion or merged with another local practice, and therefore it was not possible to determine whether the loss of a unique postcode was due to the physical closure of a site or it becoming a 'branch' of another practice registered under an existing ODS code and postcode. Where there was a physical closure, this is likely to have affected equity of access due to the increasing distance to the practice for patients for

whom travel is difficult. Practice closures have also been shown to have a negative effect on income and patient satisfaction in remaining local practices that absorb the population as they may struggle to meet patient needs (41, 53, 54). In contrast, 16% of practices still share a postcode. While this may enhance patient choice, it may also result in inefficiencies where practices operate in parallel.

While absolute numbers of practices under individual ownership are falling at a faster rate than other forms of general practice ownership, they still represent 11% of practices. Despite Government and research interest in practices run by incorporated organisations and NHS bodies, these own a minority of practices (5, 6). Notably, over one-third of NHS Trusts that have run practices over the past five years no longer do so. This may suggest that Trusts' involvement was intended to be transitional or they faced challenges to their capability to provide general practice which affected their wish to continue.

To date practices, unlike hospitals, have been allowed to close when they were no longer financially viable or made to close where there were regulatory concerns(54, 55). However, with increasing organisational size, including 13% of practices being part of a multisite provider and the expansion of 'mega-providers', mitigating the risks of general practice providers becoming 'too big to fail' merits regulatory consideration.

GP figures reported elsewhere often include trainees, are calculated by headcount, or as full-time equivalents but without adjusting for population size, and, therefore, do not accurately reflect the active qualified workforce(19, 21, 26). Our analysis demonstrates a 15% reduction in FTE qualified GPs/1000 since 2015, with 0.451522 FTE qualified GPs/1000 in September 2022 - in other words one FTE GP per 2215 patients. This figure is close to recent ONS calculations, but well below the figure reported by the OECD for the UK (0.81/1000 patients – calculated by headcount and including trainees) which, if revised using our definition of qualified GPs, would place England in the quartile of OECD countries with the lowest number of GPs per population(21, 56). While GP trainee figures are rising, this will result in a less experienced workforce if qualified GPs continue to leave. There is also no guarantee that, once qualified, GP trainees will work full-time in general practice (workforce data suggests the majority of trainees work full-time in general practice while qualified GPs do not), or remain in general practice(57).

Doctors who qualified overseas represent around a quarter of GPs - mostly from low- or middle-income country regions. Their contribution, in particular to underserved populations, is well documented, but the challenges of doing so often under-recognised and undervalued(58-61). Ongoing NHS reliance on doctors from overseas raises questions around ethical international recruitment(62).

Administrative roles in general practice receive little research and policy attention(63, 64). As practices become larger and more complex, and because of the importance of these roles for public facing and back-office functions, greater research and policy focus on the administration and management of general practice is an increasingly urgent priority.

The majority of the workforce is female. This has implications to ensure parity of opportunities, income and working conditions with male counterparts(65). It has further implications for workforce planning as analysis of GP FTE/HC suggests that female GPs are likely to work fewer FTE hours than males (Appendix: Table 3b).

Although other DPC roles and qualified GPs both represented around a fifth of the combined FTE general practice and PCN workforce at the end of the workforce time series in September 2022, appointment/1000 patients data suggested that GPs still provided around half of appointments, whereas DPC roles provided around a fifth. Contributory factors to this discrepancy could include issues with the data collection process, that DPC role appointments are longer and/or more of their time is spent on non-patient facing activity or at PCN level, and, therefore, is not captured in general practice appointments(27). Appointment data indicate annual peaks of activity around financially incentivised 'flu vaccination season and a trough following the first COVID lockdown. The provision of an estimated average of 98 appointments/week/1000 between 2018 and 2023 equates to 5.1 appointments/year/patient. This figure, although similar to values reported in 2014 and in 2022, is below 2019 estimates and should be interpreted with caution(12, 66, 67). Our analysis does not suggest a trend of rising or falling total or GP appointments numbers relative to the population since April 2018. This is in contrast to figures recently reported elsewhere that do not take into account population growth, include COVID vaccination activity, cover shorter time periods and/or use smaller datasets (18, 20, 68, 69). Falling GP numbers delivering the same number of appointments/1000 seems unsustainable, therefore there is likely to be a tipping point in the near future where the majority of appointments in English general practice are no longer delivered by GPs. Maintaining relational continuity of care will be harder to achieve if patients need to see different clinicians for different problems, this is likely to have implications for quality of care(70, 71).

Trends point to a changing role for the GP partner from a self-managing owner of a small business to holding responsibility for the governance of a much larger organisation and its associated multidisciplinary team. This is happening against a background of falling numbers of GPs, where both partners and salaried GPs are reducing their FTE hours. This indicates the need to prioritise the retention of the existing GP workforce, as well as prepare GPs for a different model of practice. Falling patient satisfaction and reduced continuity of care, captured in the annual national general practice patient survey, is a warning that this period of transition is proving challenging to patients,

particularly within the context of a growing and ageing population, alongside post-COVID pandemic and secondary care pressures(72-75).

Limitations

NHS England's total registered population in general practice was 7% (over 4.4 million people) higher than Office for National Statistics' (ONS) 2021 mid-year estimates(23, 76). NHS England is aware of this discrepancy, that appears to be increasing over time, and attributes a range of factors to this, including delayed de-registrations and duplicate records(77). This has implications when reporting values relative to population size, particularly where patient turnover and, therefore, discrepancies between NHS England and ONS population figures may be greater.

We confirmed with NHS England that general practice and PCN workforce datasets did not double count roles. However, not all PCNs contributed to national PCN workforce figures, with 50.3% responding in September 2020 and 87.5% by September 2022(78). Also a small proportion (<1%) of practices are not part of a PCN(7). Therefore, using national registered patient numbers will have underestimated the PCN workforce/1000 patients, particularly for the initial years.

The requirement for practices to capture appointment data in a standardised format was only introduced in March 2021 and NHS England's appointment data are still deemed 'experimental' due to variation in working methods and recording between practices (29, 79). COVID resulted in atypical appointment provision during 2020/21 when many practices limited face-to-face access and demand fell as many patients avoided healthcare settings. From August 2021 the recording of the role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID of the person delivering the appointment. Our estimated number of appointments per week, using monthly figures, do not account for the exact number of working days each month. These factors affect the interpretability of the appointment trends. Appointment data also do not capture other general practice work, including managing correspondence, prescriptions, reviewing test results, staff supervision, management and quality improvement work. In addition, digital encounters such as online consultations delivered through separate messaging software may not be captured, unless recorded as an appointment. Workforce FTE figures are unlikely to be capturing overtime, which is common in general practice(66, 80-82).

Strengths and opportunities for future research and policy

This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments recorded by role over the past decade. It provides a comprehensive overview of the temporal trends in general practice workforce and reported appointments relative to population size.

While the data used in this paper is openly available and interactive data dashboards are emerging(16, 18, 20-22, 83), making access more user-friendly would facilitate the use of this data to inform policy and practice. In particular, NHS England ODS codes should better align with CQC location and provider data and it should be easier to identify practices that have multiple sites but are operating under a single ODS code and/or CQC 'Location ID'. Datasets could also be merged at practice level to include indices of deprivation and other practice level performance data such as QOF scores and GP patient satisfaction survey responses alongside income. The capture of data such as demand for appointments and workforce time spent on non-appointment related activities would also enhance understanding of how general practices are functioning.

Our analysis offers a benchmark for providers and commissioners, as well as for international comparisons. However, further research to understand what represents warranted versus unwarranted variation is important as the provision of care should vary subject to the needs of local populations. The relationship between the trends reported here and access, quality of care, or costs was beyond the scope of this paper. Work by others in these areas is already underway, in particular, examining inequities in workforce distribution(13, 21, 50, 51, 53, 67, 84-86). However, opportunities exist for further research in this area to understand the wider impact of the changing shape of English general practice.

Conclusions

Over the past decade, the organisational structure and workforce of general practice in England has clearly shifted towards larger practices with extended multidisciplinary teams. We recommend that these changes, alongside the fall in the number of practices and FTE qualified GPs, are carefully monitoring to assess their impact on access, quality of care, and costs.

Data Availability

All the data used is publicly available via NHS England (previously NHS Digital) and the Care Quality Commission.

Ethical approval

All data used is publicly available. No ethical approval was required for this study

Transparency Statement

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Competing interests

The authors declare no competing interests

Author Contribution Statement

All authors contributed to the planning, conduct and reporting of the study. LP undertook the analysis and drafting of the article. IP and DC provided technical expertise to enable the analysis of the data. IP, NM and DC provided feedback on various drafts of the article. LP is the guarantor of the study. LP attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Patient and Public Involvement, and feedback from NHS England (NHS Digital before February 2023), OHID and the CQC are outlined in the acknowledgements.

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Figure Legend

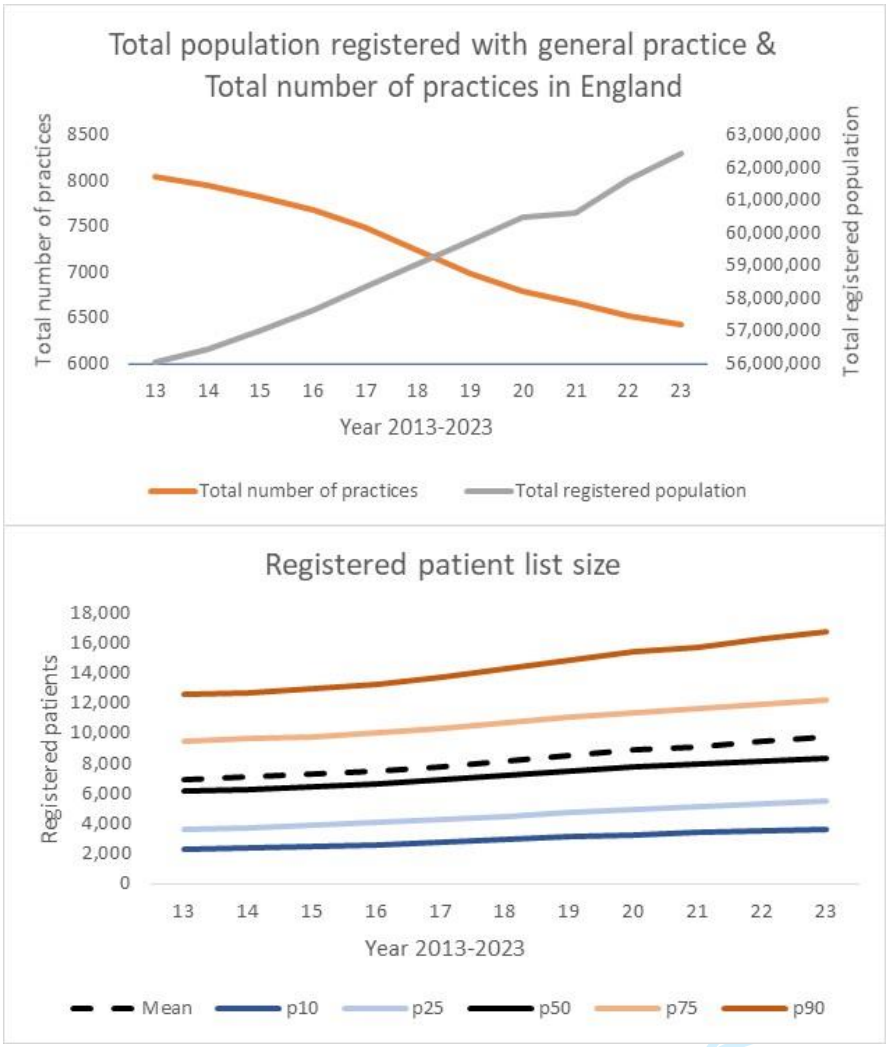
Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. (23)

Figures 2a-d: (i) Full time equivalent (FTE) per 1000 patients general practice workforce roles in England mean, p10, p50 and p90 (note different scale on Y-axis for administrative roles); (ii) Percentage of full time equivalent (FTE) general practice workforce roles by gender in England. Every September 2015-2022. (26)

Figure 3: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce per 1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. (26, 27)

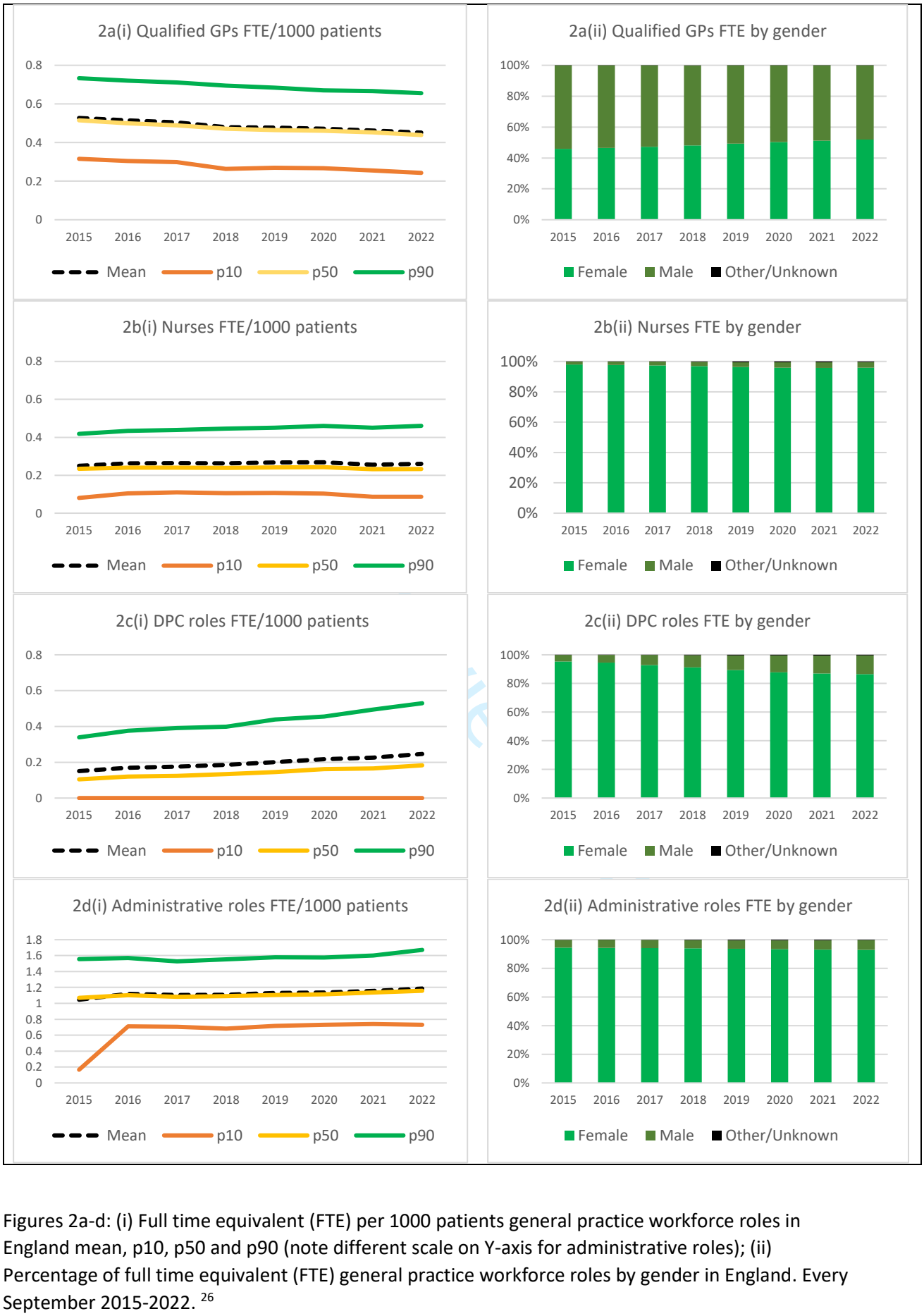
Figure 4: Average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. (28)

Figures 1a&b



Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. [23]

Figures 2a-d



Figures 2a-d: (i) Full time equivalent (FTE) per 1000 patients general practice workforce roles in England mean, p10, p50 and p90 (note different scale on Y-axis for administrative roles); (ii) Percentage of full time equivalent (FTE) general practice workforce roles by gender in England. Every September 2015-2022. [26]

Figure 3

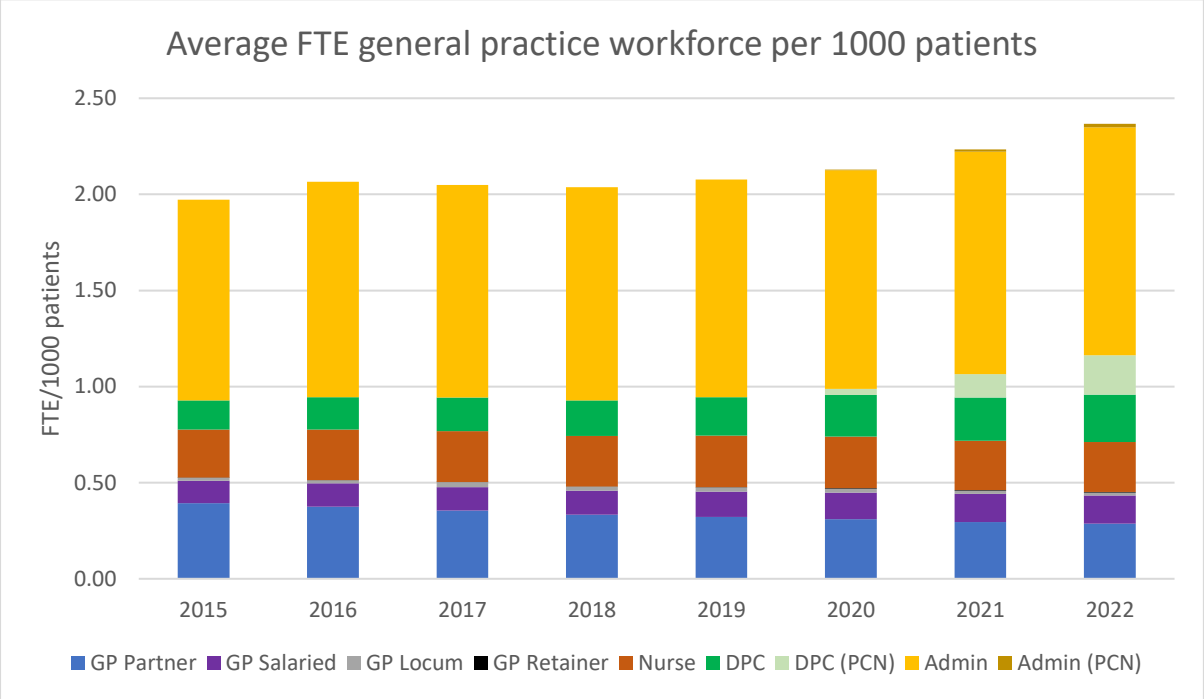


Figure 3: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce/1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. [26, 27]

Figure 4

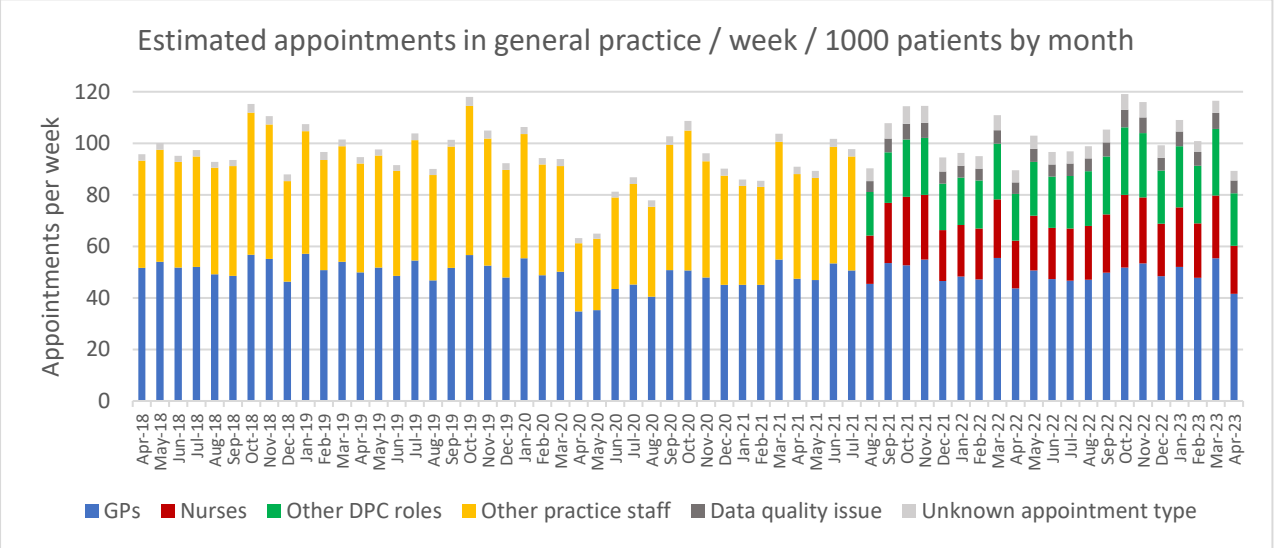


Figure 4: Estimated average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. [28]

The changing shape of English General Practice: A retrospective longitudinal study using national datasets describing trends in organisational structure, workforce and recorded appointments

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Appendices

Appendix: Table 1 (Methods)

Time trend variables	Source (practice / national level)	Time trend period (total time period and frequency of data used)	Percentage range (mean) of observations reported after removal of missing data and exclusions
Organisational Structure			
Total registered population; Total number of practices; Practice list size; Practice postcode	NHS Digital -Patients Registered at a GP Practice [23] **(Practice)**	Apr 2013-Apr 2023 **(10 years, annual)** Postcode Jul 2013-Apr 2023 **(9.75 years, annual)**	Registered patients 99.2%-100% (99.9%) Postcode 99.9%-100% (99.99%)
Proportion of registered patients >65 years old	OHID -'Fingertips Public Health Data'(2013-2022) [24] & NHS Digital-Patients Registered at a GP Practice (2023) [23] **(Practice)**	Apr 2013-Apr 2023 **(10 years, annual)**	100%
Ownership of practice and provider	CQC - Archive of 'HSCA Active Locations with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2018-Apr 2023 **(5 years, annual)**	100%
Multisite providers	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2017-Apr 2023 **(6 years, annual)**	100%
Mega-provider list size	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice'. [25] CQC's 'Location ID' mapped to ODS code using CQC's 'GP Practice Locations for providers registered or previously registered under the Health and Social Care Act' dated 28.7.23. ODS code merged with NHS Digital Patients Registered at a GP Practice [23] **(Practice)**	Apr 2017-Apr 2023 **(6 years, annual)**	Mega-providers' associated practices' registered patient list sizes 90%-96% (93%)
Workforce & Appointments			
General Practice Workforce at practice level (FTE/1000 patients)	NHS Digital – General Practice Workforce [26] ('Practice-Level CSV) Data included practice list size for the corresponding month to calculate FTE/1000 patient figures.	Sep 2015-Sep 2022 **(7 years, annual)** Trainee GPs	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%)

	Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. **(Practice)**	Sep 2018-Sep 2022 **(4 years, annual)**	GP trainees: 100% Nat September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
General Practice Workforce at national level (total HC; total FTE; total FTE by age, sex and qualified GP by country of qualification)	NHS Digital – General Practice Workforce [26] ('Individual-Level CSV) Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. Where no data was submitted by a practice for a staff group (i.e. GP, nurses, DPC, Admin), 'Estimated' figures provided by NHS Digital are excluded. **(National)**	Sep 2015-Sep 2022 **(7 years, annual)**	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%) GP trainees: 100% Nat September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
Primary Care Network (PCN) Workforce mean FTE per 1000 patients	NHS Digital – Primary Care Network Workforce [27] with mean FTE / 1000 patients calculated by dividing national FTE totals with the total number of registered patients in England in the corresponding month from NHS Digital -Patients Registered at a GP Practice [23] (This will have resulted in an underestimate as not all PCNs submitted data) **(National)**	Sep 2020- Sep 2022 **(2.5 years, annual, combined with General Practice Workforce data to provide 7 years of data)**	Percentage of PCNs that submitted data September 2020: 50.3% September 2021: 78.4% September 2022: 87.5%
Appointments by role per week per 1000 patients	NHS Digital- Appointment in General Practice [28] (used most recent data from May '23, Jan '21 & Oct '18 'GP enhanced appointment' excel publications) with appointments per week per 1000 patients calculated using 'Registered patients at included practices' figures from the same dataset. Monthly figures were multiplied by 12 and divided by 52.1429 to estimate weekly values (NB: Cross-check by NHS England using the exact days in the month to calculate weekly values did not make a significant change to values and trends). **(National)**	Apr 2018- Apr 2023 **(5 years, monthly)** In August 2021 recording of role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID (Spine Directory Service 'SDS') of the person delivering the appointment.	Practice coverage: 88.5%-98.9% Total patients in included practices coverage: 89.9%-99.9%

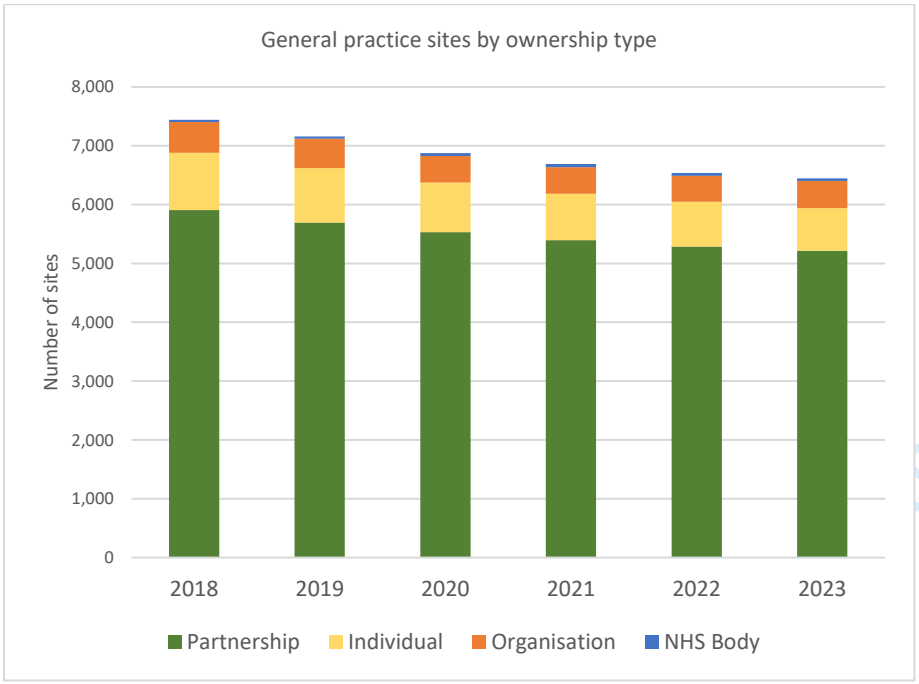
Appendix Table 1: Organisational structure, workforce and reported appointment variables: source, level of data, frequency used, time period used, percentage of original data reported after removal of missing observations and exclusions [23-28]. NB: NHS Digital became NHS England in February 2023.

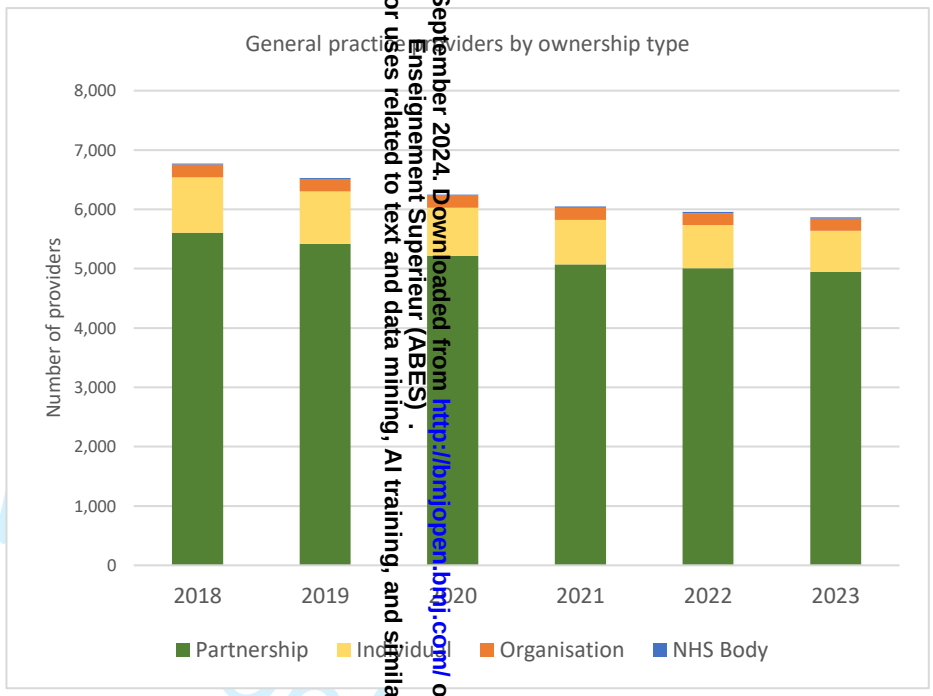
Appendix: Table 2 (Methods)

Year	Original total number of practices	Practices with ≤1000 patients removed	Qualified GP roles missing	Total remaining practices for Qualified GP analysis	Proportion of practices remaining for Qualified GP analysis	Trainee GP roles missing	Total remaining practices for Trainee GP analysis	Proportion of practices remaining for Trainee GP analysis	Nurse roles missing	Total remaining practices for Nurse analysis	Proportion of practices remaining for Nurse analysis	DPC roles missing	Total remaining practices for DPC analysis	Proportion of practices remaining for DPC analysis	Admin roles missing	Total remaining practices for Admin analysis	Percentage of practices remaining for Admin analysis	Overall Average
2015	7,623	29	430	7170	0.94	N/A	N/A	N/A	113	7481	0.98	136	7458	0.98	54	7540	0.99	**0.97**
2016	7,558	104	170	7304	0.97	N/A	N/A	N/A	136	7323	0.97	213	7244	0.96	39	7419	0.98	**0.97**
2017	7,354	122	96	7151	0.97	N/A	N/A	N/A	162	7074	0.96	336	7002	0.94	35	7198	0.98	**0.96**
2018	7,137	179	73	6899	0.97	0	6958	0.97	134	6839	0.96	277	6891	0.94	20	6942	0.97	**0.96**
2019	6,867	97	62	6715	0.98	0	6770	0.99	160	6620	0.96	312	6464	0.94	10	6763	0.98	**0.97**
2020	6,650	54	55	6547	0.98	0	6596	0.99	178	6423	0.97	354	6248	0.94	11	6588	0.99	**0.97**
2021	6,564	88	14	6464	0.98	0	6476	0.99	37	6440	0.98	57	6419	0.98	0	6476	0.99	**0.98**
2022	6,456	63	31	6364	0.99	0	6393	0.99	134	6263	0.97	166	6229	0.96	4	6391	0.99	**0.98**
Average					**0.97**			**0.99**			**0.97**			**0.95**			**0.98**	**0.97**

Appendix Table 2: Number and proportion of practices that had missing workforce data and those that were excluded from workforce analysis of FTE/1000 patients as had ≤1000 registered patients. Every September 2015-2022. (Source: NHS England)[26]

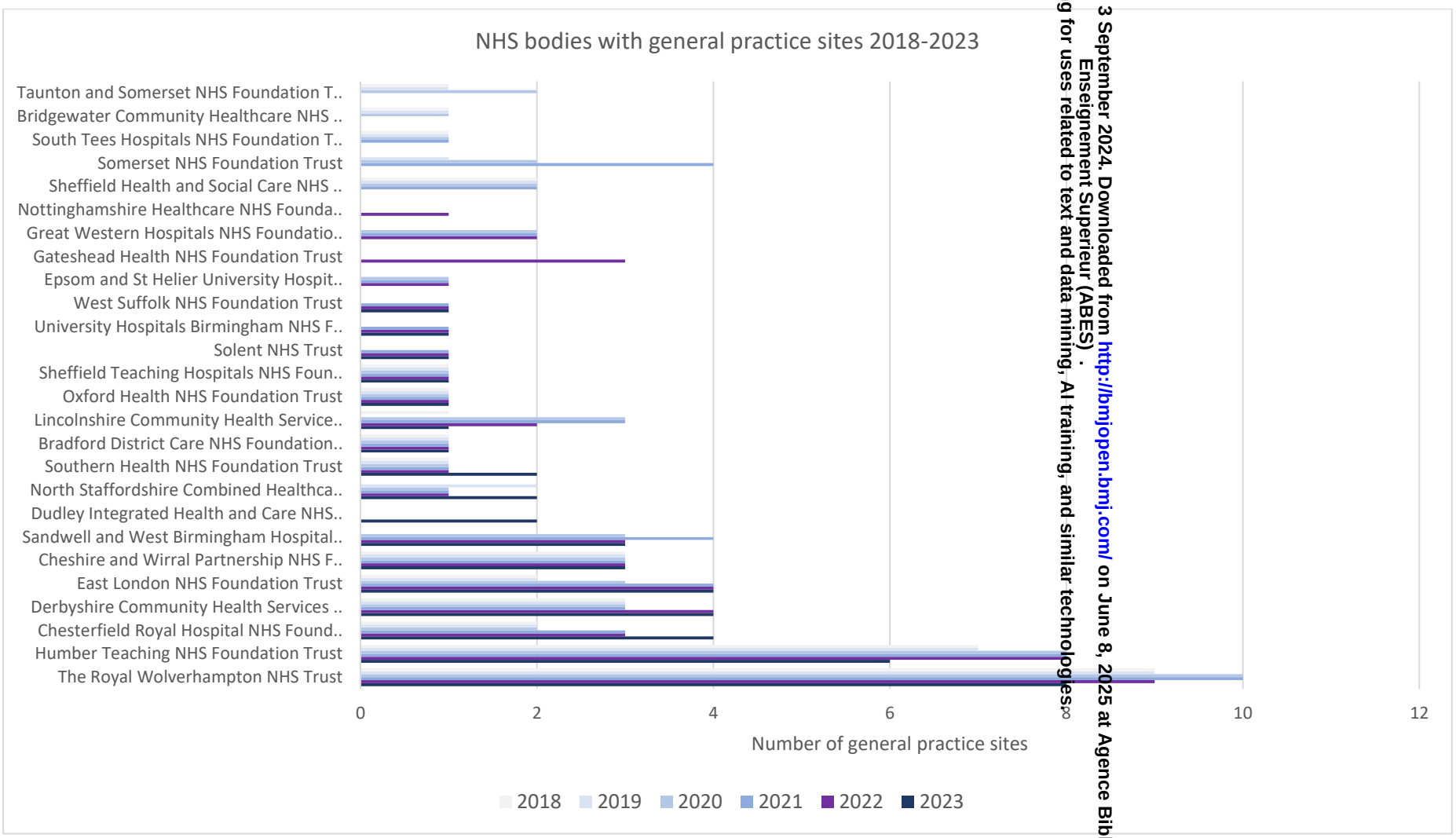
Appendix: Figures 1a&b (Results)





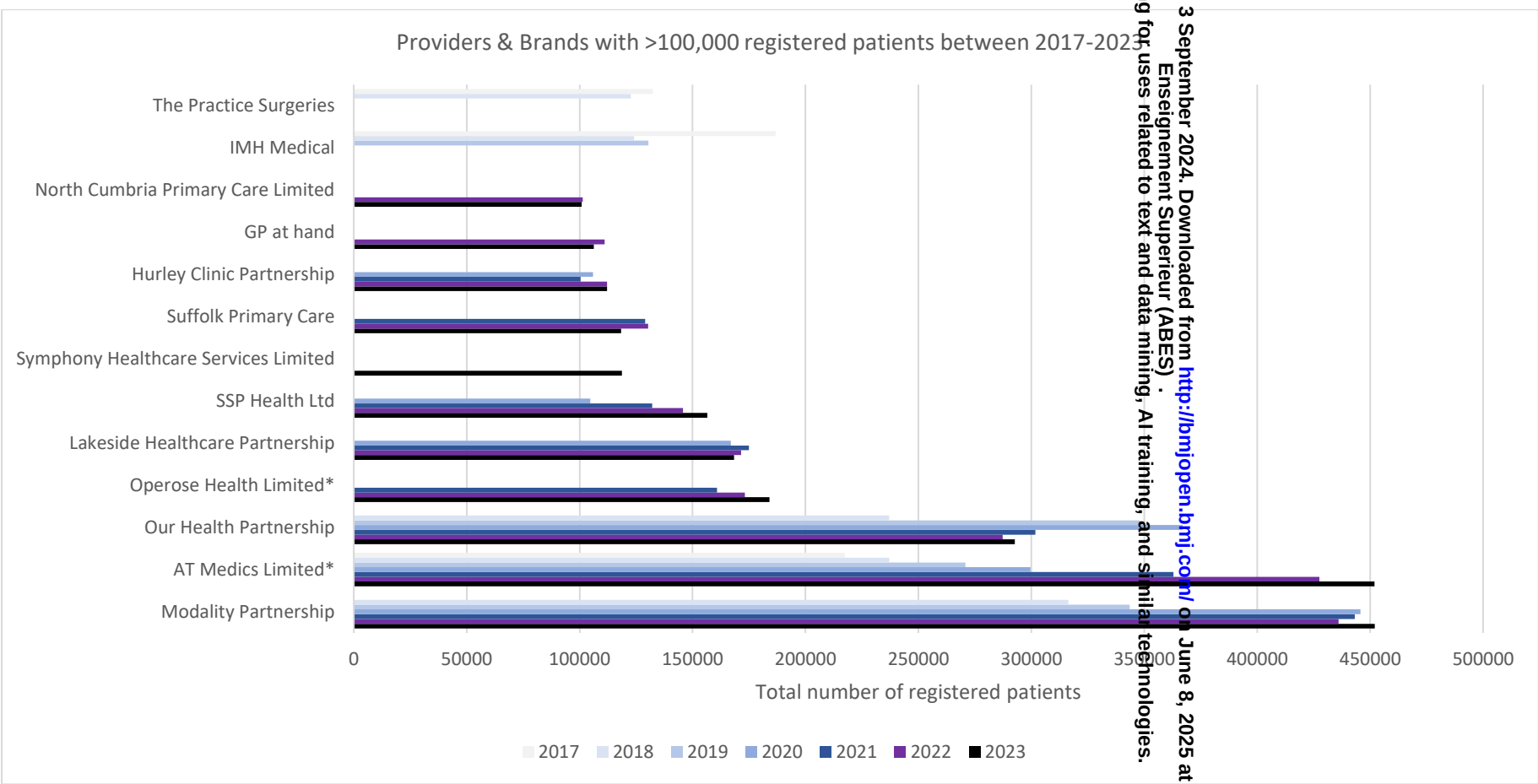
Appendix Figures 1a&b: General practice 'site' and 'provider' ownership by (a) Practice sites (b) Providers. Every April 2018-2023. (Source: CQC) [25]. NB: The Care Quality Commission (CQC) classifies ownership type in four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). Providers may have more than one site.

Appendix: Figure 2 (Results)



Appendix Figure 2: NHS bodies running general practice sites, with number of sites. Every April 2018-2023. (Source: CQC) [25]

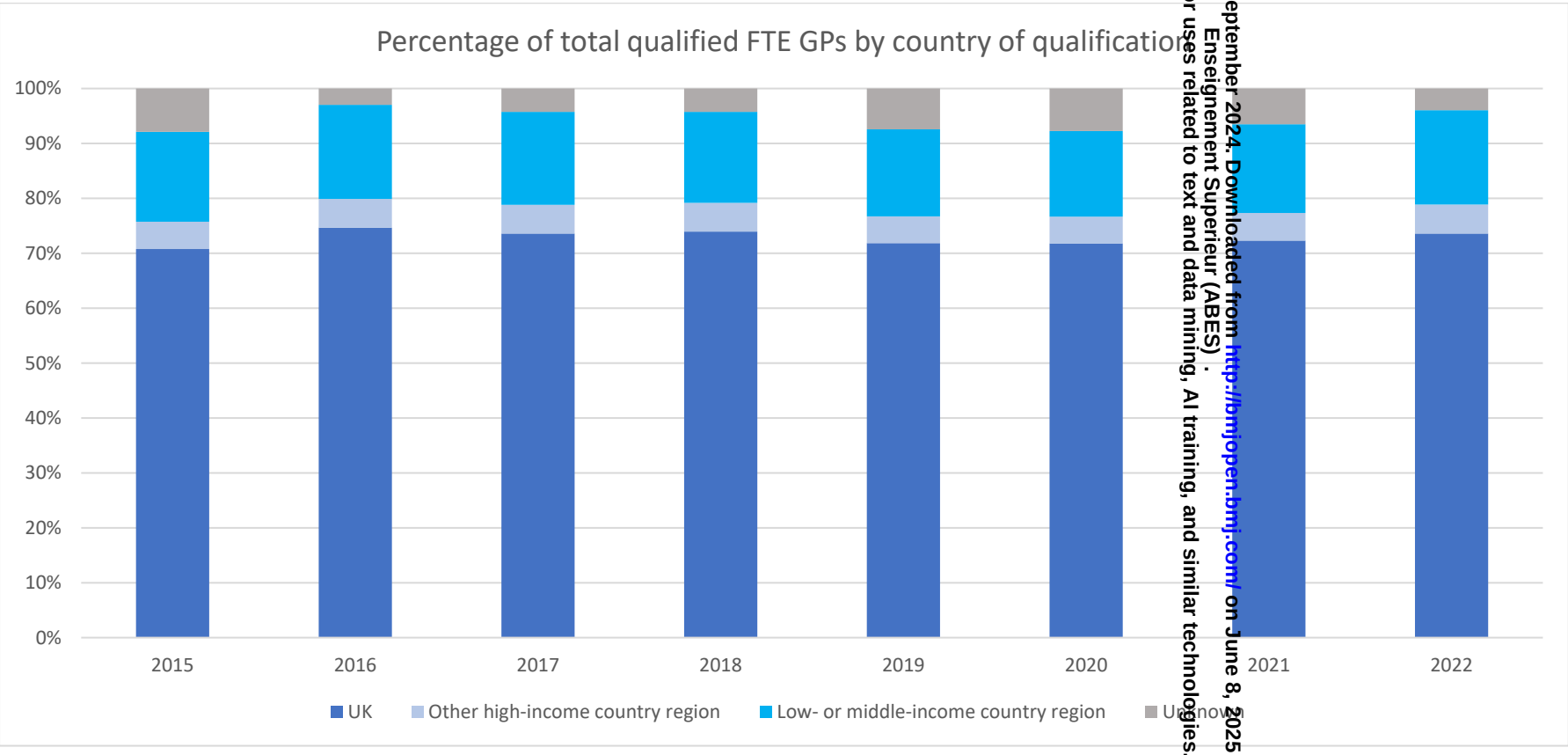
Appendix: Figure 3 (Results)



Appendix Figure 3: 'Mega-providers' - Providers and Brands with >100,000 registered patients across all practice sites Every April 2017-2023. NB: Likely underestimate of total list size as 7% of NHS England's associated practices' patient list size data did not merge with the CQC datasets. (Sources: NHS England & CQC) [23, 25].

*Operose Health Limited and AT Medics Limited became part of the same organisation in 2021[34].

Appendix: Figure 4 (Results)



Appendix Figure 4: Percentage of qualified total full time equivalent (FTE) GPs in England by country of qualification region grouping. Every September 2015-2022. (Source: NHS England) [26]

Appendix: Tables 3a&b (Results)

Table 3a

Year	GP Partner	GP Salaried	GP Locum	GP Retainer	GP Trainee	Nurse	Other DPC	Admin
2015	89%	67%	42%	44%	NA	65%	63%	68%
2016	90%	67%	42%	43%	NA	66%	64%	69%
2017	89%	67%	40%	41%	NA	67%	65%	69%
2018	88%	66%	39%	38%	96%	67%	66%	69%
2019	88%	65%	41%	38%	96%	68%	67%	70%
2020	87%	64%	41%	49%	97%	69%	68%	71%
2021	86%	64%	40%	40%	98%	69%	68%	71%
2022	86%	64%	41%	41%	97%	69%	71%	72%
Direction of change	↓	↓	↔	↔	↔	↑	↑	↑
Linear reg of total FTE / HC % by year P value	0.001*	0.000*	0.413	0.820	0.139	0.000*	0.000*	0.000*

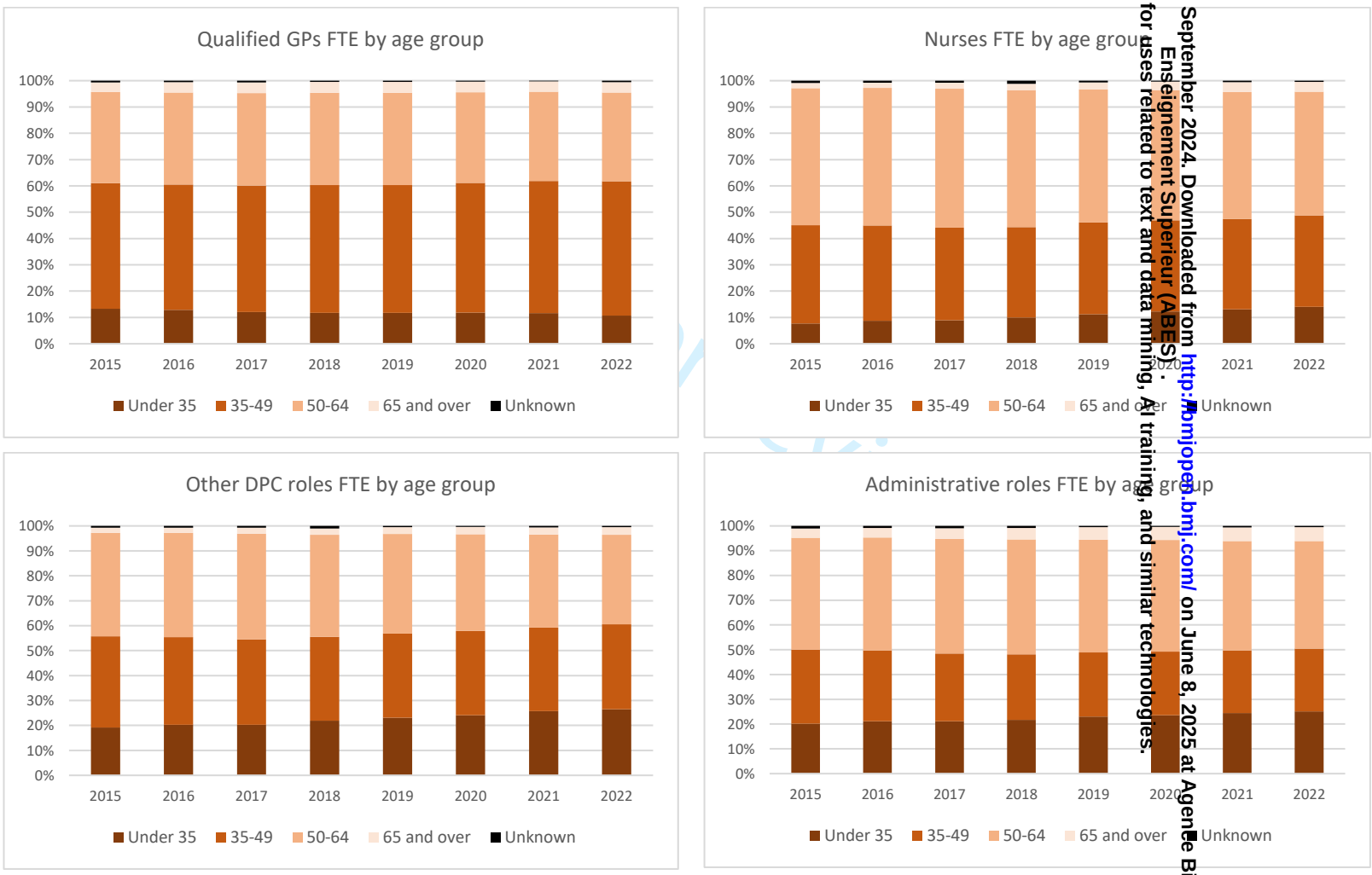
Appendix Table 3a: Total full time equivalent (FTE) out of total headcount (HC) percentage for each general practice workforce role and associated P value for linear regression of FTE/HC%. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England) [26]

Table 3b

Year	GP Partner Female	GP Partner Male	Salaried GP Female	Salaried GP Male	Locum GP Female	Locum GP Male	Retainer GP Female	Retainer GP Male	Trainee GP Female	Trainee GP Male
2015	0.79	0.96	0.64	0.75	0.40	0.44	0.44	0.46	NA	NA
2016	0.80	0.97	0.64	0.75	0.40	0.45	0.43	0.44	NA	NA
2017	0.79	0.96	0.64	0.75	0.38	0.43	0.42	0.37	NA	NA
2018	0.79	0.96	0.63	0.74	0.36	0.42	0.38	0.40	0.93	1.04
2019	0.78	0.95	0.62	0.72	0.38	0.44	0.39	0.37	0.92	1.03
2020	0.78	0.94	0.61	0.71	0.39	0.43	0.39	0.40	0.93	1.03
2021	0.77	0.93	0.61	0.70	0.37	0.43	0.39	0.42	0.94	1.03
2022	0.78	0.93	0.62	0.70	0.39	0.44	0.39	0.49	0.93	1.03
Direction of change	↓	↓	↓	↓	↔	↔	↓	↔	↔	↔
Linear reg of total FTE / HC % by year P value	0.001*	0.002*	0.001*	0.000*	0.443	0.429	0.023*	0.815	0.441	0.087

Appendix Table 3b: Total full time equivalent (FTE) out of total headcount (HC) proportion by gender for each GP role and associated P value for linear regression of FTE/HC. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England)

Appendix: Figures 5a-d (Results)



Appendix Figures 5a-d: Total full time equivalent (FTE) general practice workforce roles by age group: (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care roles; (d) Administrative roles. Every September 2015-2022. (Source: NHS England) [26]

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title and abstract	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and time period within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract names sources of data (page 1) Abstract defines national data that range between 5-10 years (page 1) Indicated in abstract and explained in the methods (pg 1 & pg 5)
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	In background section (page 4)		
Objectives	3	State specific objectives, including any prespecified hypotheses	In background section (page 4)		
Methods					
Study Design	4	Present key elements of study design early in the paper	In methods section (page 4)		
Setting	5	Describe the setting, locations, and relevant dates, including	In methods and supplementary material (methods		

		periods of recruitment, exposure, follow-up, and data collection	page 4-7, and appendices tables 1 & 2)		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	In methods – use of ODS codes and CQC registration location ID and provider ID (pages 4&5) ODS codes widely used in NHS. CQC the main registration and regulatory body for general practice Explained in methods and set out in supplementary material (appendices tables 1 & 2)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Explained in methods (pg 4-7)
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	Explained in the methods (pages 4-7)		

		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	Addressed in the methods (pages 4-7) and limitations (page 14)		
Study size	10	Explain how the study size was arrived at	Explained in the methods – national data sets, missing and excluded data reported in methods and supplementary material (methods pages 4-7, appendices tables 1&2)		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Explained in the methods (pages 4-7)		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed	Explained in the methods (pages 4-7)		

		Cross-sectional study - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2) Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2)
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2)
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage.	Explained in the methods, results and supplementary material (methods, paged 4-7, appendices tables 1&2)	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Explained in the methods, results and supplementary material (methods paged 4-7, appendices tables 1&2)

		(c) Consider use of a flow diagram			
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Explained in the methods, results and supplementary material (methods paged 4-7, appendices tables 1&2)		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	N/A		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Descriptive data without adjustment for confounders. Coefficient or IRR reported with 95%CI		

Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	10th and 90th centile reported where helpful to understand spread of data. P values reported for changes in FTE/HC over time.		
Discussion					
Key results	18	Summarise key results with reference to study objectives	At the start of the discussion (page 12)		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Under limitations section (pages 14-15)	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Under methods (paged 4-7) and limitations section (paged 14-15)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Covered in discussion (paged 12-14) and in limitations (pages 14-15)		
Generalisability	21	Discuss the generalisability (external validity) of the study results	National data used allows generalisability. However, need for further research to understand warranted and unwarranted variation highlighted in discussion (pages15-16)		

Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	In acknowledgements section (paged 16 and 17)		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	In citations/ references 23-28 (page 18)

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

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The changing shape of English General Practice: A retrospective longitudinal study using national datasets describing trends in organisational structure, workforce and recorded appointments

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The changing shape of English General Practice: A retrospective longitudinal study using national datasets describing trends in organisational structure, workforce and recorded appointments

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Abstract

Objective

To describe trends in the organisational structure, workforce and appointments in English general practice.

Design

Retrospective longitudinal study.

Setting

English General Practice.

Data sources & Participants

NHS England, Office for Health Improvement and Disparities, and Care Quality Commission national datasets covering between 5 and 10 years between 2013 and 2023.

Results

Between 2013 and 2023, the number of general practices fell by 20% from 8,044 to 6,419; the average practice list size rose by 40% from 6,967 to 9,724 patients. The total population covered by providers with lists over 100,000 patients reached 2.3 million in 2023 (0.5 million in 2017). The proportion of practices under individual ownership fell from 13% to 11% between 2018 and 2023; there was little change in the proportion owned by partnerships, incorporated companies or NHS Trusts, which respectively averaged around 80.3%, 6.9% and 0.7%.

Between 2015 and 2022, there was a 20% rise in the total full-time equivalent general practice workforce, including Primary Care Network staff, from 1.97 to 2.37/1000 patients because of an increase in multidisciplinary direct patient care and administrative roles. Nursing numbers remained stable and qualified GP numbers fell by 15%. In September 2022, there were 0.45 qualified FTE GPs/1000 patients; GPs and other direct patient care roles each represented 19% of the full time equivalent/1000 patients workforce; administrative roles represented 51%. The general practice workforce is predominantly female. A quarter of GPs qualified overseas. Between 2018 and 2023, there was no clear upwards or downwards trend in total appointments/1000 patients with, on average, half provided by GPs.

Conclusions

Since 2013, there has been a shift in general practice towards larger practices with more multidisciplinary teams, alongside a reduction in the number of GPs/1000 patients. We recommend that the impact of these changes on access, quality, and costs are monitored.

Strengths and Limitations of this study

- This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments reported by role over the past 5 to 10 years drawn from a number of sources that are not normally well integrated.
- It provides temporal trends of the general practice workforce and appointment activity relative to population size.
- There are limitations to the estimations of the Primary Care Network workforce in general practice and general practice appointment data are considered as 'experimental' by NHS England.

- Further work is needed to understand the relationship between growing organisational size, increasing multidisciplinary teams and falling GP numbers, and the impact of these changes on access, quality of care, and costs of services.
- Data on demand for general practice appointments and non-appointment related activity, merged NHS England and Care Quality Commission time-series datasets, alongside indices of deprivation with data on performance and income would enable further research to understand the impact of trends.

Background

National Health Service (NHS) general practices have traditionally operated as publicly funded, but independently-contracted partnerships, mainly with general practitioners (GPs) as the partners. However, over the past decade, questions have started to be asked about whether the partnership model is still fit for purpose(1, 2). 'Large-scale' general practice organisations have emerged, such as GP federations and multisite providers, with some operating through limited companies(3-5). General practices that have become part of NHS Trusts have also generated interest among policymakers(6). In parallel, national policy in England has encouraged integration of health and care organisations. In 2019, all general practices were incentivised to form 'Primary Care Networks' (PCNs), resulting in around 1200 PCNs in England, typically covering populations of 30,000-50,000(7). In 2022, 42 Integrated Care Systems (ICSs) became statutory bodies to work with PCNs and other local health and care organisations to plan and deliver coordinated services(8).

The general practice workforce has also been moving away from the traditional model of GP partner(s) working with a practice nurse. There has been an expansion of employed ('salaried') GPs and the introduction of national programmes promoting the recruitment of pharmacists and other multidisciplinary 'Direct Patient Care' (DPC) roles into general practice, notably through the 'Additional Roles Reimbursement Scheme' which from 2019 provided financial incentives via PCNs to employ additional DPC roles (9, 10). This has been happening in the context of an ageing and growing population with greater multimorbidity and levels of polypharmacy(11).

Despite a general awareness of these changes, it is hard to get an overall picture because information about different aspects of general practice is reported across multiple datasets. Consequently, news or organisational reports often provide limited statistical analysis of this information, and research studies often cover short time periods or have a single domain of focus(3, 12-22). Therefore, by combining information from different national data sources, we aim to describe the trends in the organisational structure, workforce and appointments recorded by role in English general practice over the past decade, and consider the implication of these trends.

Methods

We used national general practice databases that are regularly published by NHS England (previously NHS Digital), the Office for Health Improvement and Disparities (OHID), and the Care Quality Commission (CQC)(23-28). The period covered by the datasets ranged from 5 to 10 years (Appendix: Table 1), reflecting the data available from different sources when we undertook the analyses. We

used Organisational Data Service (ODS) codes to define a practice and used these to merge the various releases of datasets. NHS England, OHID and CQC were consulted where uncertainties arose about the data. Full methodological guidance on the datasets can be found on their websites (23-29). We report findings using RECORD guidance(30).

Population & practice metrics

The number of practices and their registered list sizes were identified using NHS England's 'Patients Registered at a GP Practice' datasets (23). The proportion of patients over 65 was obtained from OHID data (April 2023 data were taken from NHS England as OHID had not yet published theirs)(23, 24). Data from April 2013 to April 2023 were used to produce a time-series using figures released each April. All practices with the variables of interest in these datasets were included (>99%).

Organisational structure

We used the CQC's archive of 'HSCA Active Locations' every April between 2017 and 2023 as the source of the practice site ('Location ID') and the provider ('Provider ID') that owned the practice, to identify providers with more than one practice site ('multisite providers')(25). The CQC's classification of ownership type, available from 2018, used the following four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). The identification of multisite providers was only possible from 2017 due to the way in which active practice locations had been archived by the CQC. The CQC also identified clusters of providers operated under an overarching 'Brand'. We labelled providers, or the overarching 'Brand' where it existed, with a total list size exceeding 100,000 patients as 'mega-providers'. We merged CQC and list size datasets to calculate a mega-providers' list size. For an average of 7% of mega-providers' associated practices, a corresponding list size could not be matched, resulting in a probable underestimate of some of their total list sizes. Between 9 and 87 practice ODS codes were found to be used across two CQC practice 'locations', depending on the year; therefore, their merged list sizes were adjusted to avoid double-counting when calculating the 'mega-provider' list size.

Workforce

Workforce information was obtained from the revised NHS England 'General Practice Workforce' datasets every September between 2015 and 2022, reflecting the period during which data definitions were stable. General practice workforce categories cover GPs, nurses, other DPC roles (e.g. pharmacists, social prescribers, physician associates, paramedics)(31) and administrators.

We use the label 'qualified GPs' to mean GP partners, salaried GPs, GP locums and GP retainers (GPs re-entering the workforce after a period out-of-practice). We use the label 'GP trainees' to include GP trainees (ST1-4), but to exclude Foundation Years (FY1-2) doctors. Practice level GP trainee figures were only available for time-series analysis from 2018 due to changes in data collection methods(26, 32). Locum figures exclude ad hoc locums that only work briefly to cover short-term or unexpected absences.

We grouped GPs' country of qualification into three categories: UK, high-income country region, low- or middle-income country region. We use 'female', 'male' and 'other/unknown' to classify gender as per the original dataset. We group workforce roles by age (<35, 35-49, 50-64, 65+ years).

Individual staff data aggregated by NHS England at national level, excluding estimated values where no value was reported by the practice, were used to calculate total national headcount (HC) and full-time-equivalents (FTE) by age, gender and GPs' country of qualification. National FTE/HC proportions were calculated by role to examine trends in FTE working hours. For GPs, these were also broken down by male and female gender. Practice level data were used to calculate FTEs per 1000 patients values and to report on the 10th to 90th percentiles. Per 1000 patients figures by gender and age were calculated by dividing each practice's workforce figures by its patient list size on the same date and then multiplying by 1000.

Practices with missing workforce data were automatically excluded from the denominator; this proportion varied by year and by role between 0.4% and 2.5%. Practices that had a list size of ≤1000 registered patients in September of the year of analysis were also excluded from FTE/1000 patients analyses, on the basis that they were likely to be atypical (e.g., closing or delivering care to a sub-segment of the population) and their workforce to population ratios would not be comparable. On average, 97% of practices were included in the practice level workforce per 1000 patient analyses (Appendix: Table 2).

As General Practice workforce figures exclude DPC and administrative roles contracted at PCN level who are likely to be working for practices, we estimated PCN FTE roles per 1000 patients by dividing the national FTE total of NHS England's 'PCN Workforce' figures (and then multiplying by 1000), each September between 2020 and 2022, with the total number of patients registered in England in the corresponding month from NHS England's 'Patients Registered at a GP Practice'(23, 27). As not all PCNs submitted workforce figures during this period, this will have resulted in an underestimate in PCN workforce figures per 1000 patients. Further details are described in the limitations.

Appointments

NHS England's 'Appointments in General Practice' data were based on reported total national figures (28). Appointments include face-to-face, telephone, video consultation/online appointments and home visits. Identifiable COVID vaccination related appointments are removed by NHS England(29). We converted appointments to appointments/week/1000 patients using the total number of registered patients across all practices in the same dataset. We report on the five years of data available between April 2018 and April 2023, with disaggregated nursing and DPC role appointments available from August 2021. While these are official statistics, NHS England still refers to them as 'experimental'(28, 29). Further details are described in the limitations.

Analysis

Analysis was based on statistically testing and describing the patterns across the variables outlined above. The number of practices in the datasets from each source were similar but not always in agreement due to variation in collection dates and methods.

Descriptive statistics are used to provide a summary of trends, with the mean and spread of the practice level values reported using 10th and 90th centiles. The absolute change per year coefficient or incidence rate-ratio (IRR) providing the relative change for the full time period, with 95% confidence intervals, are reported for Linear and Poisson regression analyses, respectively. STATA 17 and 18 was used for analysis and Excel for graphs.

Patient and Public Involvement statement

This paper is part of a wider research project examining the impact of inspections on the quality of general practice where there has been patient and public involvement in the design and undertaking of the study. Several drafts of this paper were reviewed by a patient with research expertise and who is a member of their general practice's 'Patient Participation Group'. Further details are in the acknowledgements.

Results

Organisational Structure

Population growth, practice numbers and list sizes

The total population registered with a general practice in England grew by 11% from 56,042,361 to 62,418,295 between April 2013 and April 2023 (640,816/year [95%CI 604,260-677,372]), with a temporary slow-down in 2020/21 during the COVID pandemic (Figure 1a).

Alongside this population growth, the mean proportion of patients aged 65 and over increased from 16.3% to 17.9% (IRR 1.09 [95% CI 1.08-1.10]). The variation between practices across the time period saw a similar increase with 10th and 90th percentiles being 7.7% and 24.1% in April 2013 and 8.2% and 27.1% in April 2023.

Meanwhile, the total number of practices fell from 8,044 in April 2013 to 6,419 in April 2023, an average loss of 178 practices/year [95%CI -193 to -163]. This represents a 20% reduction in the number of practices over ten years (Figure 1a)(23). This is consistent with the total number of unique practice postcodes falling from 7,163 to 5,849, representing the loss of 18% unique locations by registered ODS code over this period. In contrast, 16% of practices still shared a postcode in 2023, a slight reduction from 19% in 2013(23).

Between April 2013 and April 2023, the mean practice list size increased by 40% from 6,967 to 9,724 patients (291/yr [95%CI 279-303]). The spread of practice list size remained wide throughout this period with the 10th and 90th percentiles being 2,329 and 12,582 in April 2013, and 3,617 and 16,765 in April 2023 (Figure 1b)(23).

Figures 1a&b

The number of practices with lists exceeding 20,000 patients has risen noticeably; in 2013, these only represented 1% of practices (n=81) compared to 6% in 2023 (n=355) (IRR 5.5 [95%CI 4.3-7.0]). The largest practice list doubled from 52,386 to 106,308 patients. Some of these large practices operate over various practice sites, although this is not clear in the NHS England datasets as they operate under a single ODS code (33). Providers also exist that operate multiple practice sites under various ODS codes - 'multisite providers' - their true organisational list size is therefore larger than that captured under individual ODS codes (see below).

Practice ownership, multisite providers and mega-providers

Ownership

CQC data on practice ownership were available between April 2018 and April 2023. During this period, the total number of practice sites registered with the CQC fell from 7,441 to 6,446 and their respective providers fell from 6,769 to 5,863. Practice sites owned by 'Individual' GPs (i.e., single-handed ownership) fell in number from 975 to 724 (-51/year [95%CI -62 to -40]), which corresponds to a statistically significant change in the proportion of practices they represent from 13% to 11% (IRR 0.86 [95%CI 0.77-0.94]). In contrast, there was no clear trend in the proportion of 'Partnerships', 'Organisations' and 'NHS bodies' which, respectively, on average, represented 80.3%, 6.9% and 0.7% of practice sites, and 83.6%, 3.3% and 0.3% of providers. The proportion of practice sites which

'Organisations' and 'NHS bodies' owned was over double the proportion of providers they represented as most are multisite providers (Appendix: Figures 1a&b). (25)

Twenty-six NHS bodies, mostly NHS Trusts, ran general practices between April 2018 and April 2023. Seventeen remained active in 2023. The number of practice sites run by each NHS body across these years ranged between one and ten (mean=2.5). In April 2023, the largest NHS body GP provider ran eight practice sites (Appendix: Figure 2)(25).

Multisite and Mega-providers

Between April 2017 and 2023, the proportion of multisite providers and their associated practices registered with the CQC remained stable, representing on average 4% of providers and 13% of practice sites(25). Examining providers and 'Brands' with >100,000 patients across all sites, i.e. 'mega-providers', there were three in 2017 compared with 11 in 2023. Their estimated total registered population increased from 0.5 million to 2.3 million. The number of practices under these mega-providers ranged between one and 42 (mean=27). The largest mega-provider registered with the CQC in April 2023 covered an estimated 452,097 patients (Appendix: Figure 3). However, examining organisational websites, two 'mega-providers' registered separately under the CQC merged in 2021 with an estimated total population of 635,979 over 56 practice in sites April 2023(34).

Workforce

General practice workforce

Figures on the general practice workforce from September 2015 to September 2022 were analysed, during which time the number of practices in the practice level datasets declined from 7,623 to 6,456.

General practitioners

Between September 2015 and September 2022, the total qualified GP headcount in England increased from 34,474 to 36,492. In contrast, the total FTE qualified GPs fell from 27,948 to 27,321. The average number of qualified GP FTEs/1000 fell from 0.53 to 0.45, representing a 15% fall (IRR 0.86 [95%CI 0.84-0.87]). Similarly, the 10th and 90th percentiles fell from 0.32 and 0.73 FTE/1000 in 2015 to 0.24 and 0.66 FTE/1000 in 2022. (Figure 2a(i)).

Figures 2a-d

The fall in qualified FTE GPs/1000 mirrored a 26% drop in GP partners from 0.39 to 0.29 FTEs/1000 (IRR 0.70 [95%CI 0.69-0.72]). In contrast, there was a 25% rise in the average number of salaried GPs from 0.12 (p10-p90, 0-0.30) to 0.15 (p10-p90, 0-0.32) FTEs/1000 (IRR 1.31 [95%CI 1.27-1.35]). The

proportion of FTE salaried GPs out of all qualified FTE GPs increased from 23% to 36%; as a HC proportion, it increased from 28% (n=9817) to 42% (n=15,297). In 2015, 61% of practices reported employing salaried GPs; in 2022 this had increased to 74%.

The use of regular GP locums showed no clear trend. The proportion of practices reporting regular locum use averaged has around 17% since 2015, with annual mean FTE regular locums/1000 around 0.019 (p10-p90, 0-0.064). The number of GP retainers, although rising from a HC of 165 to 613, remained very small, representing 0.001 in 2015 and 0.004 FTEs/1000 in 2022 (IRR 3.12 [95%CI 2.4-4.1]). Between 2015 and 2022, the proportion of qualified GPs who had qualified in the UK remained around 73% (Appendix: Figure 4). The mean number of GP trainees notably increased from 0.06 (p10-p90, 0-0.21) to 0.12 (p10-p90, 0-0.34) FTEs/1000 between 2018 and 2022 (IRR 1.75 [95%CI 1.68-1.81]). The proportion of practices reporting a GP trainee (ST1-4) increased from 35% to 50% during the same period.

As a proportion of all qualified GPs, between 2015 and 2022, the female:male HC ratio shifted from 52:48 to 57:43, and the FTE ratio shifted from 46:54 to 52:48 (Figure 2a(ii)). The loss of qualified FTE GPs/1000 was steeper, at 23%, among male GPs from 0.30 to 0.23 FTEs/1000 (IRR 0.76 [95%CI 0.75-0.78]), compared with female GPs, at 4%, from 0.23 to 0.22 FTEs/1000 (IRR 0.97[95%CI 0.95-0.99]). The age distribution of qualified GPs has remained relatively stable since 2015, with 35-49-year-olds representing on average 49% of the total (Appendix: Figure 5a).

The percentage of total FTEs out of total HC fell for GP partners (89%-86%) and salaried GPs (67%-64%). The FTE/HC percentage for GP locums, retainers and trainees (since 2018) did not change significantly. Across all GP roles, females were more likely to report working fewer FTE hours than male GPs (Appendix: Tables 3a&b).

Nurses and other Direct Patient Care roles

The mean number of FTE nurses remained relatively stable between 2015 and 2022 at around 0.26 FTEs/1000 (IRR 1.05 [95%CI 1.03-1.08]), with, on average, 97% of practices reporting employing a nurse. Across practices, there was typically a four-fold variation in nurses between the 10th and 90th percentile of practices, with values of 0.10 and 0.44 FTEs/1000 in 2022 (Figure 2b(i)).

In comparison, the mean number of other DPC roles employed by practices grew from 0.15 (p10-p90, 0-0.34) to 0.25 (p10-p90, 0-0.53) FTEs/1000. This corresponds to an increase of 67% (IRR 1.67 [95%CI 1.63-1.71]) (Figure 2c(i)). The proportion of practices that reported employing any DPC roles increased from 72% to 89% between 2015 and 2022.

The vast majority of staff in nursing (>96% annually) and DPC roles (>87% annually) were women (Figures 2b(ii) & c(ii)). The nursing workforce was older than those in DPC roles (Appendix: Figures 5b&c). The FTE/HC increased for nurses (65%-69%) and DPC roles employed at practice level (63%-71%) (Appendix: Table 3a).

Administrative roles

Administrative roles increased by 14% from a mean of 1.05 (p10-p90, 0.17-1.56) to 1.19 (p10-p90, 0.73-1.67) FTEs/1000 between 2015 and 2022 (IRR 1.16 [95%CI 1.14-1.17]) (Figure 2d(i)). Within administrative roles, the mean number of managers remained around 0.19 (p10-p90, 0.06-0.34) FTEs/1000 (IRR 1.03 [95%CI 1.00-1.06]).

The vast majority of the administrative workforce were women (>93% annually; Figure 2d(ii)), and the 50-64 age group made up the majority of the FTE administrative workforce, never falling below 43% annually (Appendix: Figure 5d). The FTE/HC increased from 68% to 72% (Appendix: Table 3a).

Combined general practice and PCN workforce

Using 'Primary Care Network Workforce' data, we estimated that since the inception of PCNs in 2019, there had been at least a further 0.21 DPC and 0.02 administrative FTE roles/1000 contracted via PCNs by September 2022(27) (Figure 3).

Figure 3

The combined general practice and PCN workforce increased from 1.97 to 2.37 FTEs/1000 patients between 2015 and 2022 (0.047/year [95%CI 0.024-0.069]). This represents a 20% rise, or in other words, an increase from one member of staff per 508 patients to one per 422 patients. These combined figures suggest that FTEs/1000 DPC roles in 2022 represented around 19% of the general practice workforce, the same proportion as qualified FTE GPs. Nurses represented 11% and administrative roles 51%, the largest proportion.

Appointments

The number of practices reporting appointments in the total monthly 'Appointments in General Practice' dataset was 6,385 in April 2018 and 6,361 in April 2023, respectively covering 89.9% and 99.9% of all registered patients in England(28, 29). Using national level data, we estimated that during this period there were between 63 and 119(mean=98) appointments/week/1000 patients reported. Peaks were seen between September and November each year, and appointments dipped between April and August 2020. There was no clear overall upwards or downwards trend in total appointments/week/1000 patients during the five-year time series.

GP appointments ranged from 35 to 57(mean=49)/week/1000, with no clear trend over time - despite the fall in qualified GP FTEs/1000. Where reported, nurse appointments ranged between 18 and 28(mean=22)/week/1000. DPC role appointments ranged between 17 and 26(mean=21)/week/1000. DPC role appointments showed an upwards trend from when first reported in August 2021 (0.24 more appointments/week/1000 [95%CI 0.10-0.39]). Between 3% and 11%(mean=5%) of appointments had data quality issues or the staff roles delivering appointments were unknown (Figure 4). Limitations regarding appointment data are discussed further below.

Figure 4

Discussion

Trends in the organisational structure, workforce and appointments in English general practice show that in the last decade, within the context of a growing and ageing population, there has been a shift towards fewer but larger organisations and more multidisciplinary teams with fewer qualified FTE GPs per 1000 patients. Both qualified GPs and DPC roles, including the PCN workforce, now represent 19% of the FTE workforce in general practice. Despite this GPs continue to provide around half of appointments with no clear upwards or downwards trend in the number of appointments per 1000 patients since April 2018. Operating a practice as a partnership continues to be the dominant model of ownership. The workforce is predominantly female and there is a stable reliance on doctors who qualified outside the UK. Administrative roles make-up over half of the FTE workforce.

The move towards larger scale organisations has been encouraged by Government policy and professional bodies to improve quality and generate economies of scale as a result of shared back-office functions, joint service delivery and standardised processes(3, 5, 35). However, the evidence regarding whether larger organisations deliver better quality primary care or are more cost-effective is mixed(4, 36-41). The diversification of the general practice workforce has also been driven by national policy and proposed as a solution to GP shortages(14, 42, 43). While broadening the multi-disciplinary team can provide additional expertise, concerns have been raised by GPs, researchers and the media about the burden of their additional training needs, the effect on relational continuity of care, its cost-effectiveness, equity in distribution of roles and the safety of using such roles without sufficient GP oversight(14, 44-52).

Our analysis shows a reduction of 18% in unique practice postcodes in the past decade. It was not possible to determine whether practices which closed did so with list dispersion or merged with another local practice, and therefore it was not possible to determine whether the loss of a unique postcode was due to the physical closure of a site or it becoming a 'branch' of another practice registered under an existing ODS code and postcode. Where there was a physical closure, this is

likely to have affected equity of access due to the increasing distance to the practice for patients for whom travel is difficult. Practice closures have also been shown to have a negative effect on income and patient satisfaction in remaining local practices that absorb the population as they may struggle to meet patient needs (41, 53, 54). In contrast, 16% of practices still share a postcode. While this may enhance patient choice, it may also result in inefficiencies where practices operate in parallel.

While absolute numbers of practices under individual ownership are falling at a faster rate than other forms of general practice ownership, they still represent 11% of practices. Despite Government and research interest in practices run by incorporated organisations and NHS bodies, these own a minority of practices (5, 6). Notably, over one-third of NHS Trusts that have run practices over the past five years no longer do so. This may suggest that Trusts' involvement was intended to be transitional or they faced challenges to their ability to provide general practice which affected their wish to continue (6).

To date practices, unlike hospitals, have been allowed to close when they were no longer financially viable or made to close where there were regulatory concerns(54, 55). However, with increasing organisational size, including at least 13% of practices being part of a multisite provider based on their CQC registration and the expansion of 'mega-providers', mitigating the risks of general practice providers becoming 'too big to fail' merits regulatory consideration.

GP figures reported elsewhere often include trainees, are calculated by headcount, or as full-time equivalents but without adjusting for population size, and, therefore, do not accurately reflect the active qualified workforce(19, 21, 26). Our analysis demonstrates a 15% reduction in FTE qualified GPs/1000 since 2015, with 0.451522 FTE qualified GPs/1000 in September 2022 - in other words one FTE GP per 2215 patients. This figure is close to recent ONS calculations, but well below the figure reported by the OECD for the UK (0.81/1000 patients – calculated by headcount and including trainees) which, if revised using our definition of qualified GPs, would place England in the quartile of OECD countries with the lowest number of GPs per population(21, 56). While GP trainee figures are rising, this will result in a less experienced workforce if qualified GPs continue to leave. There is also no guarantee that, once qualified, GP trainees will work full-time in general practice (workforce data suggests the majority of trainees work full-time in general practice while qualified GPs do not), or remain in general practice(57). This highlights the need to address factors which lead to GPs reducing or leaving clinical practice (58-61).

Doctors who qualified overseas represent around a quarter of GPs - mostly from low- or middle-income country regions. Their contribution, in particular to underserved populations, is well documented, but the challenges of doing so often under-recognised and undervalued(62-65).

Ongoing NHS reliance on doctors from overseas raises questions around ethical international recruitment(66).

Administrative roles in general practice receive little research and policy attention(67, 68). As practices become larger and more complex, and because of the importance of these roles for public facing and back-office functions, greater research and policy focus on the administration and management of general practice is an increasingly urgent priority.

The majority of the workforce is female. GP FTE/HC figures indicate that female GPs, on average, report working fewer FTE hours in general practice than males (Appendix: Table 3b). Understanding the reasons for this, its implications for workforce planning and what policies would support the retention of this workforce is critical (61). It has implications to ensure parity of opportunities, income and working conditions with male counterparts(69).

Although other DPC roles and qualified GPs both represented around a fifth of the combined FTE general practice and PCN workforce at the end of the workforce time series in September 2022, appointment/1000 patients data suggested that GPs still provided around half of appointments, whereas DPC roles provided around a fifth. Contributory factors to this discrepancy could include issues with the data collection process, that DPC role appointments are longer and/or more of their time is spent on non-patient facing activity or at PCN level, and, therefore, is not captured in general practice appointments(27). Appointment data indicate annual peaks of activity around financially incentivised 'flu vaccination season and a trough following the first COVID lockdown. The provision of an estimated average of 98 appointments/week/1000 between 2018 and 2023 equates to 5.1 appointments/year/patient. This figure, although similar to values reported in 2014 and in 2022, is below 2019 estimates and should be interpreted with caution(12, 70, 71). Our analysis does not suggest a trend of rising or falling total or GP appointments numbers relative to the population since April 2018. This is in contrast to figures recently reported elsewhere that do not take into account population growth, include COVID vaccination activity, cover shorter time periods and/or use smaller datasets (18, 20, 72, 73). Falling GP numbers delivering the same number of appointments/1000 seems unsustainable, therefore there is likely to be a tipping point in the near future where the majority of appointments in English general practice are no longer delivered by GPs. Maintaining relational continuity of care will be harder to achieve if there is a shortage of GP appointments and if patients need to see different clinicians for different problems, this is likely to have implications for quality of care(74-76).

Trends point to a changing role for the GP partner from a self-managing owner of a small business to holding responsibility for the governance of a much larger organisation and its associated

multidisciplinary team. This is happening against a background of falling numbers of GPs, where both partners and salaried GPs are reducing their FTE hours. This indicates the need to prioritise the retention of the existing GP workforce, as well as prepare GPs for a different model of practice. Reduced continuity of care, captured in the annual national general practice patient survey and lowest ever levels of public satisfaction with general practice, are a warning that this period of transition is proving challenging to patients, particularly within the context of a growing and ageing population, alongside post-COVID pandemic and secondary care pressures(76-81).

Limitations

NHS England's total registered population in general practice was 7% (over 4.4 million people) higher than Office for National Statistics' (ONS) 2021 mid-year estimates(23, 82). NHS England is aware of this discrepancy, that appears to be increasing over time, and attributes a range of factors to this, including delayed de-registrations and duplicate records(83). This has implications when reporting values relative to population size, particularly where patient turnover and, therefore, discrepancies between NHS England and ONS population figures may be greater.

We confirmed with NHS England that general practice and PCN workforce datasets did not double count roles. However, not all PCNs contributed to national PCN workforce figures, with 50.3% responding in September 2020 and 87.5% by September 2022(84). Also a small proportion (<1%) of practices are not part of a PCN(7). Therefore, using national registered patient numbers will have underestimated the PCN workforce/1000 patients, particularly for the initial years.

The requirement for practices to capture appointment data in a standardised format was only introduced in March 2021 and NHS England's appointment data are still deemed 'experimental' due to variation in working methods and recording between practices (29, 85). COVID resulted in atypical appointment provision during 2020/21 when many practices limited face-to-face access and demand fell as many patients avoided healthcare settings. From August 2021 the recording of the role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID of the person delivering the appointment. Our estimated number of appointments per week, using monthly figures, do not account for the exact number of working days each month. These factors affect the interpretability of the appointment trends. Appointment data also do not capture other general practice work, including managing correspondence, prescriptions, reviewing test results, staff supervision, management and quality improvement work. In addition, digital encounters such as online consultations delivered through separate messaging software may not be captured, unless recorded as an appointment. Workforce

FTE figures are unlikely to be capturing overtime, which is common in general practice(58, 70, 86, 87).

Strengths and opportunities for future research and policy

This study provides an up-to-date analysis of national trends in English general practice's organisational structure, workforce and appointments recorded by role over the past decade. It provides a comprehensive overview of the temporal trends in general practice workforce and reported appointments relative to population size.

While the data used in this paper is openly available and interactive data dashboards are emerging(16, 18, 20-22, 88), making access more user-friendly would facilitate the use of this data to inform policy and practice. In particular, NHS England ODS codes should better align with CQC location and provider data and it should be easier to identify practices that have multiple sites but are operating under a single ODS code and/or CQC 'Location ID'. Datasets could also be merged at practice level to include indices of deprivation and other practice level performance data such as QOF scores and GP patient satisfaction survey responses alongside income. The capture of data such as demand for appointments and workforce time spent on non-appointment related activities would also enhance understanding of how general practices are functioning.

Our analysis offers a benchmark for providers and commissioners, as well as for international comparisons. However, further research to understand what represents warranted versus unwarranted variation is important as the provision of care should vary subject to the needs of local populations. The relationship between the trends reported here and access, quality of care, or costs was beyond the scope of this paper. Work by others in these areas is already underway, in particular, examining inequities in workforce distribution(13, 14, 21, 50, 51, 53, 71, 89-91). However, opportunities exist for further research in this area to understand the wider impact of the changing shape of English general practice.

Conclusions

Over the past decade, the organisational structure and workforce of general practice in England has clearly shifted towards larger practices with extended multidisciplinary teams. We recommend that these changes, alongside the fall in the number of practices and FTE qualified GPs, are carefully monitoring to assess their impact on access, quality of care, and costs.

Data Availability

All the data used is publicly available via NHS England (previously NHS Digital) and the Care Quality Commission.

Ethical approval

All data used is publicly available. No ethical approval was required for this study

Transparency Statement

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Competing interests

The authors declare no competing interests

Author Contribution Statement

All authors contributed to the planning, conduct and reporting of the study. LP undertook the analysis and drafting of the article. IP and DC provided technical expertise to enable the analysis of the data. IP, NM and DC provided feedback on various drafts of the article. LP is the guarantor of the study. LP attests that all listed authors meet authorship criteria and that no others meeting the

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Figure Legend

Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. (23)

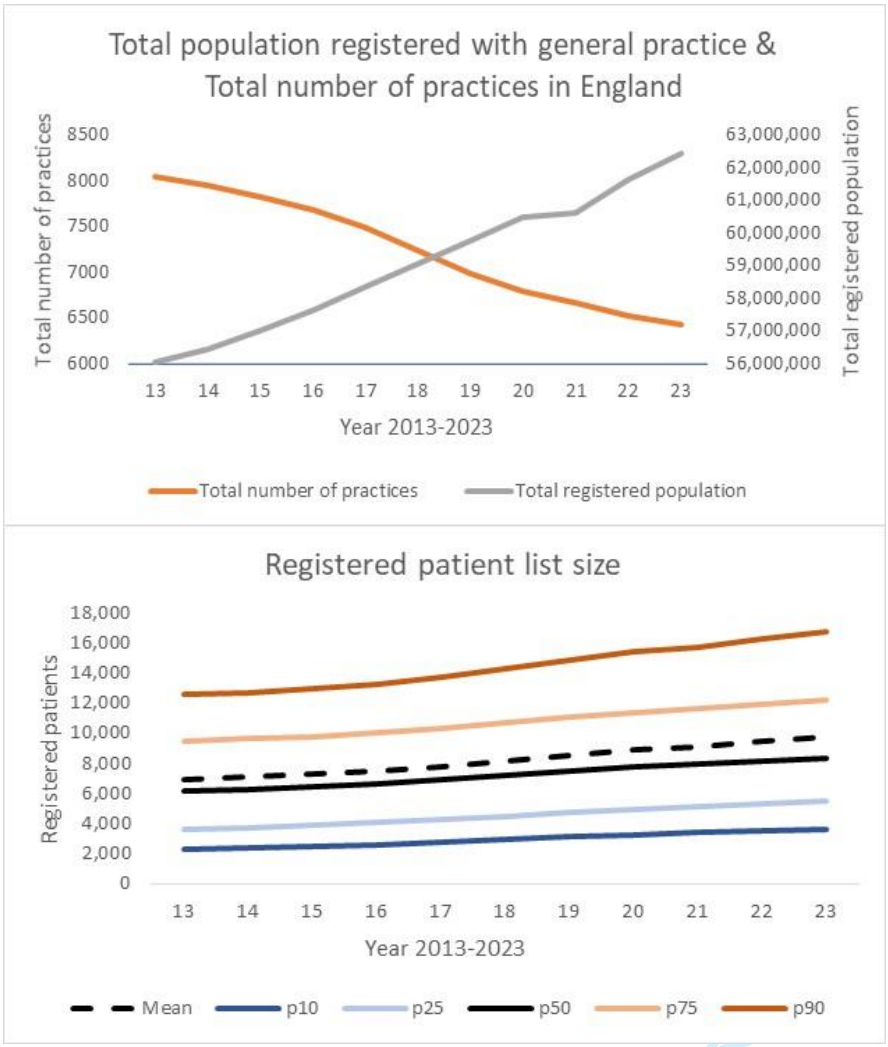
Figures 2a-d: (i) Full time equivalent (FTE) per 1000 patients general practice workforce roles in England mean, p10, p50 and p90 (note different scale on Y-axis for administrative roles); (ii)

Percentage of full time equivalent (FTE) general practice workforce roles by gender in England. Every September 2015-2022. (26)

Figure 3: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce per 1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. (26, 27)

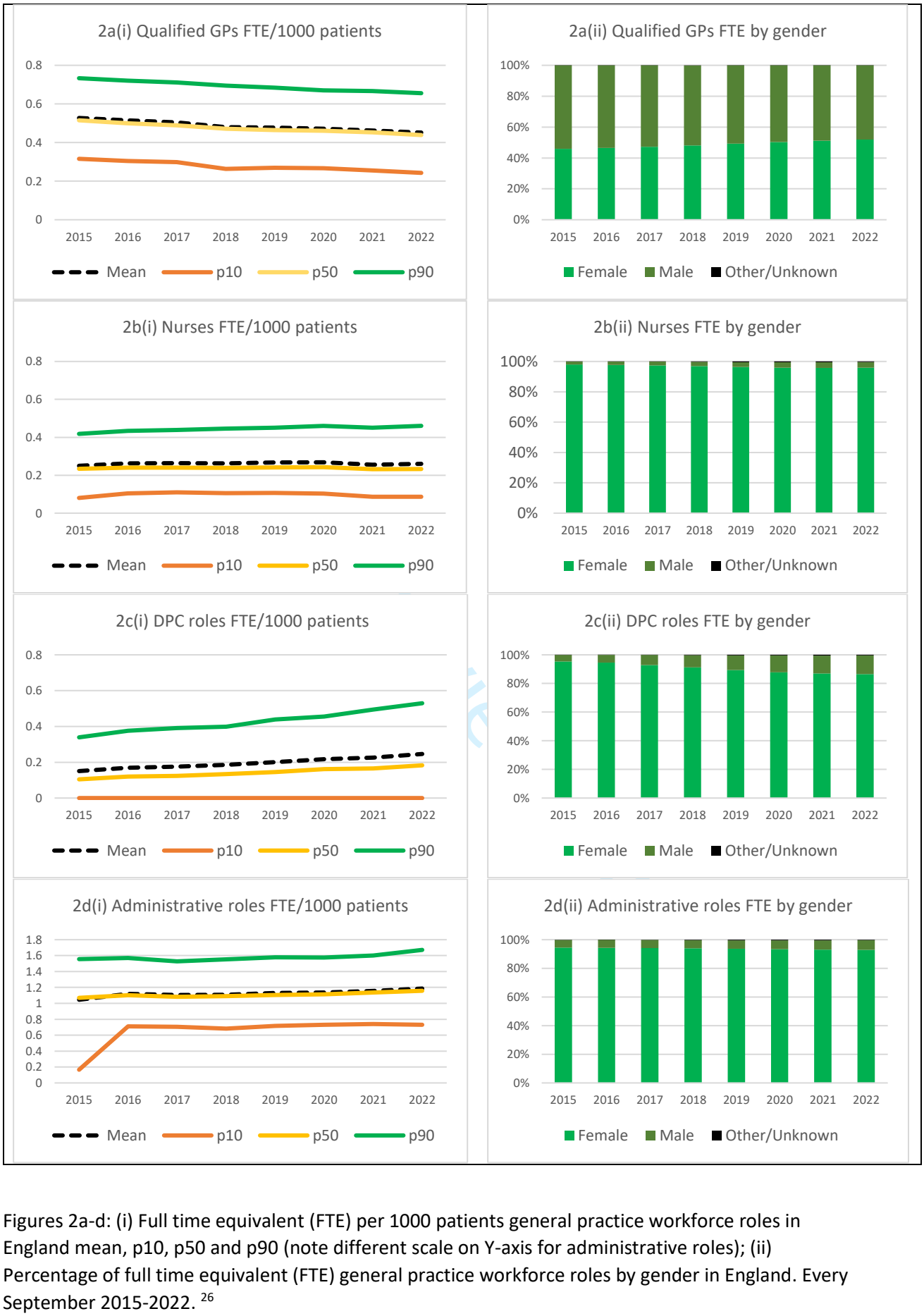
Figure 4: Average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. (28)

Figures 1a&b



Figures 1a&b: (a) Total number of general practices in England and total population registered with general practice; (b) Practice list size by registered patients. Every April 2013-2023. [23]

Figures 2a-d



Figures 2a-d: (i) Full time equivalent (FTE) per 1000 patients general practice workforce roles in England mean, p10, p50 and p90 (note different scale on Y-axis for administrative roles); (ii) Percentage of full time equivalent (FTE) general practice workforce roles by gender in England. Every September 2015-2022. [26]

Figure 3

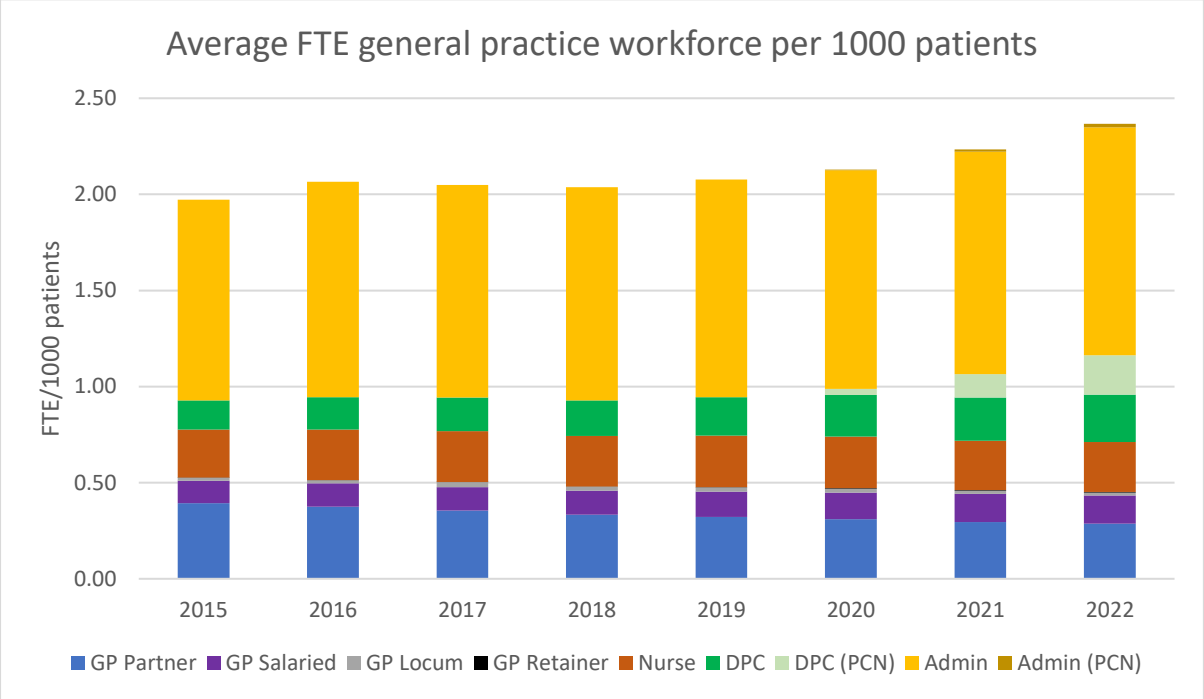


Figure 3: Average full time equivalent (FTE) general practice (excluding GP trainees) workforce/1000 patients, including Primary Care Networks' (PCN) other Direct Patient Care (DPC) roles and administrative roles in England. Every September 2015-2022. [26, 27]

Figure 4

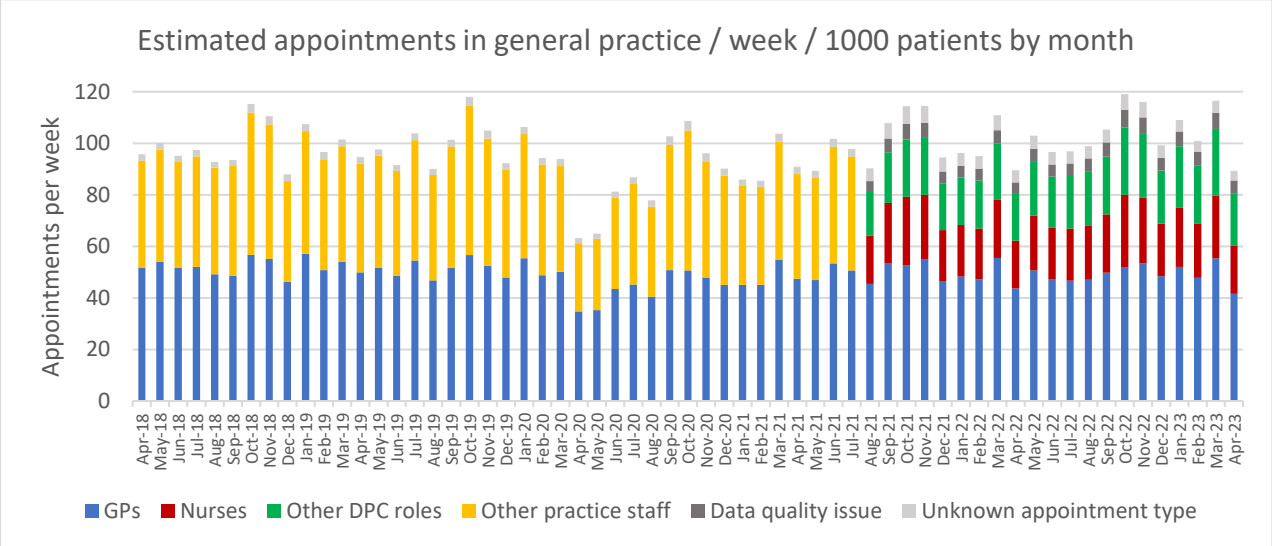


Figure 4: Estimated average number of appointments by role per week per 1000 patients in England. Presented by month between April 2018 and April 2023. [28]

The changing shape of English General Practice: A retrospective longitudinal study using national datasets describing trends in organisational structure, workforce and recorded appointments

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Appendices

Appendix: Table 1 (Methods)

Time trend variables	Source (practice / national level)	Time trend period (total time period and frequency of data used)	Percentage range (mean) of observations reported after removal of missing data and exclusions
Organisational Structure			
Total registered population; Total number of practices; Practice list size; Practice postcode	NHS Digital -Patients Registered at a GP Practice [23] **(Practice)**	Apr 2013-Apr 2023 **(10 years, annual)** Postcode Jul 2013-Apr 2023 **(9.75 years, annual)**	Registered patients 99.2%-100% (99.9%) Postcode 99.9%-100% (99.99%)
Proportion of registered patients >65 years old	OHID -'Fingertips Public Health Data'(2013-2022) [24] & NHS Digital-Patients Registered at a GP Practice (2023) [23] **(Practice)**	Apr 2013-Apr 2023 **(10 years, annual)**	100%
Ownership of practice and provider	CQC - Archive of 'HSCA Active Locations with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2018-Apr 2023 **(5 years, annual)**	100%
Multisite providers	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice' [25] **(Practice)**	Apr 2017-Apr 2023 **(6 years, annual)**	100%
Mega-provider list size	CQC - Archive of 'HSCA Active Locations' with 'Primary Inspection Location' filtered to 'GP practice'. [25] CQC's 'Location ID' mapped to ODS code using CQC's 'GP Practice Locations for providers registered or previously registered under the Health and Social Care Act' dated 28.7.23. ODS code merged with NHS Digital Patients Registered at a GP Practice [23] **(Practice)**	Apr 2017-Apr 2023 **(6 years, annual)**	Mega-providers' associated practices' registered patient list sizes 90%-96% (93%)
Workforce & Appointments			
General Practice Workforce at practice level (FTE/1000 patients)	NHS Digital – General Practice Workforce [26] ('Practice-Level CSV) Data included practice list size for the corresponding month to calculate FTE/1000 patient figures.	Sep 2015-Sep 2022 **(7 years, annual)** Trainee GPs	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%)

	Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. **(Practice)**	Sep 2018-Sep 2022 **(4 years, annual)**	GP trainees: 100% Nov September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
General Practice Workforce at national level (total HC; total FTE; total FTE by age, sex and qualified GP by country of qualification)	NHS Digital – General Practice Workforce [26] ('Individual-Level CSV) Where data about a member of staff was submitted by a practice, but FTE figures were not, 'Estimated FTE' figures provided by NHS Digital are included. Where no data was submitted by a practice for a staff group (i.e. GP, nurses, DPC, Admin), 'Estimated' figures provided by NHS Digital are excluded. **(National)**	Sep 2015-Sep 2022 **(7 years, annual)**	GPs: 94%-99% (97%) Nurses: 96%-98% (97%) Other DPC roles: 94%-98% (95%) Administrative roles: 97%-99% (98%) GP trainees: 100% Nov September 2015 88.1% of practices submitted data, by July 2022 99.6% of practices submitted data.
Primary Care Network (PCN) Workforce mean FTE per 1000 patients	NHS Digital – Primary Care Network Workforce [27] with mean FTE / 1000 patients calculated by dividing national FTE totals with the total number of registered patients in England in the corresponding month from NHS Digital -Patients Registered at a GP Practice [23] (This will have resulted in an underestimate as not all PCNs submitted data) **(National)**	Sep 2020- Sep 2022 **(2.5 years, annual, combined with General Practice Workforce data to provide 7 years of data)**	Percentage of PCNs that submitted data September 2020: 50.3% September 2021: 78.4% September 2022: 87.5%
Appointments by role per week per 1000 patients	NHS Digital- Appointment in General Practice [28] (used most recent data from May '23, Jan '21 & Oct '18 'GP enhanced appointment' excel publications) with appointments per week per 1000 patients calculated using 'Registered patients at included practices' figures from the same dataset. Monthly figures were multiplied by 12 and divided by 52.1429 to estimate weekly values (NB: Cross-check by NHS England using the exact days in the month to calculate weekly values did not make a significant change to values and trends). **(National)**	Apr 2018- Apr 2023 **(5 years, monthly)** In August 2021 recording of role type delivering an appointment changed from that set by practice staff when creating the appointment to that captured through the smart card ID (Spine Directory Service 'SDS') of the person delivering the appointment.	Practice coverage: 88.5%-98.9% Total patients in included practices coverage: 89.9%-99.9%

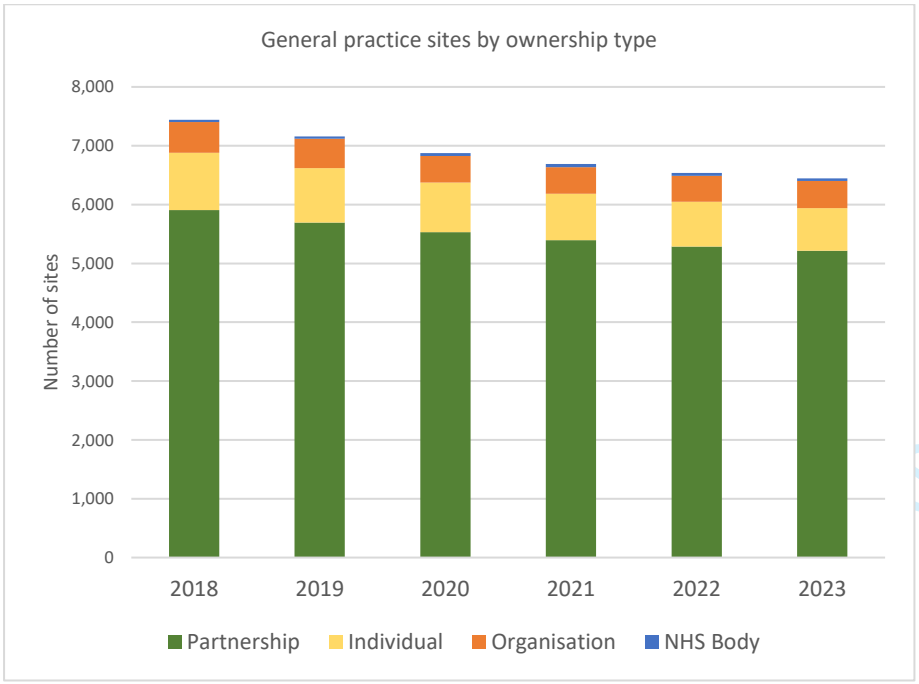
Appendix Table 1: Organisational structure, workforce and reported appointment variables: source, level of data, frequency used, time period used, percentage of original data reported after removal of missing observations and exclusions [23-28]. NB: NHS Digital became NHS England in February 2023.

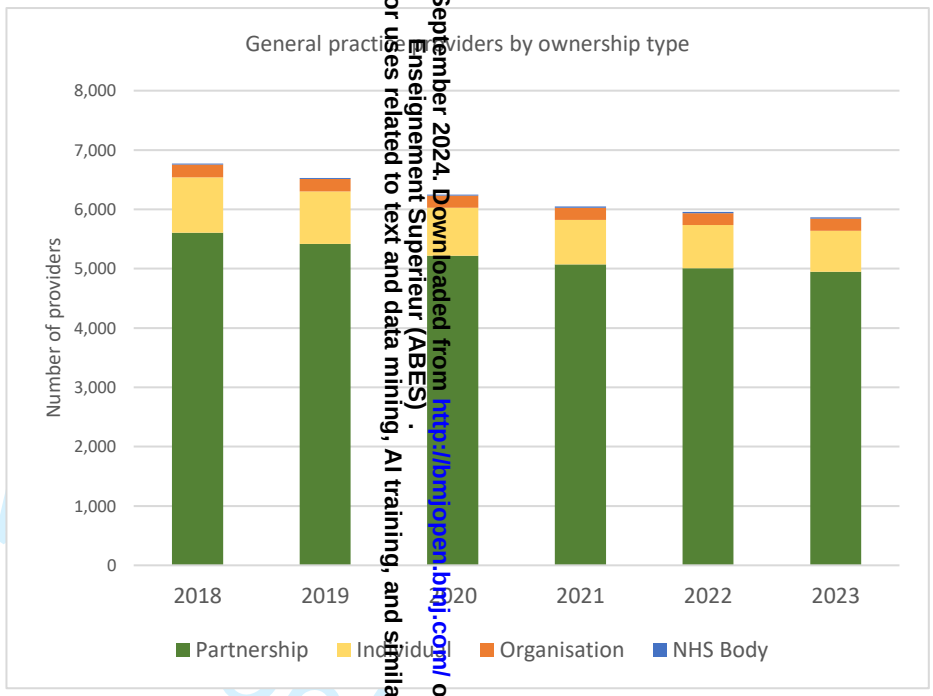
Appendix: Table 2 (Methods)

Year	Original total number of practices	Practices with ≤1000 patients removed	Qualified GP roles missing	Total remaining practices for Qualified GP analysis	Proportion of practices remaining for Qualified GP analysis	Trainee GP roles missing	Total remaining practices for Trainee GP analysis	Proportion of practices remaining for Trainee GP analysis	Nurse roles missing	Total remaining practices for Nurse analysis	Proportion of practices remaining for Nurse analysis	DPC roles missing	Total remaining practices for DPC analysis	Proportion of practices remaining for DPC analysis	Admin roles missing	Total remaining practices for Admin analysis	Percentage of practices remaining for Admin analysis	Overall Average
2015	7,623	29	430	7170	0.94	N/A	N/A	N/A	113	7481	0.98	136	7458	0.98	54	7540	0.99	**0.97**
2016	7,558	104	170	7304	0.97	N/A	N/A	N/A	136	7323	0.97	213	7244	0.96	39	7419	0.98	**0.97**
2017	7,354	122	96	7151	0.97	N/A	N/A	N/A	162	7074	0.96	336	7002	0.94	35	7198	0.98	**0.96**
2018	7,137	179	73	6899	0.97	0	6958	0.97	134	6839	0.96	277	6991	0.94	20	6942	0.97	**0.96**
2019	6,867	97	62	6715	0.98	0	6770	0.99	160	6620	0.96	312	6464	0.94	10	6763	0.98	**0.97**
2020	6,650	54	55	6547	0.98	0	6596	0.99	178	6423	0.97	354	6248	0.94	11	6588	0.99	**0.97**
2021	6,564	88	14	6464	0.98	0	6476	0.99	37	6440	0.98	57	6419	0.98	0	6476	0.99	**0.98**
2022	6,456	63	31	6364	0.99	0	6393	0.99	134	6263	0.97	166	6229	0.96	4	6391	0.99	**0.98**
Average					**0.97**			**0.99**			**0.97**			**0.95**			**0.98**	**0.97**

Appendix Table 2: Number and proportion of practices that had missing workforce data and those that were excluded from workforce analysis of FTE/1000 patients as had ≤1000 registered patients. Every September 2015-2022. (Source: NHS England)[26]

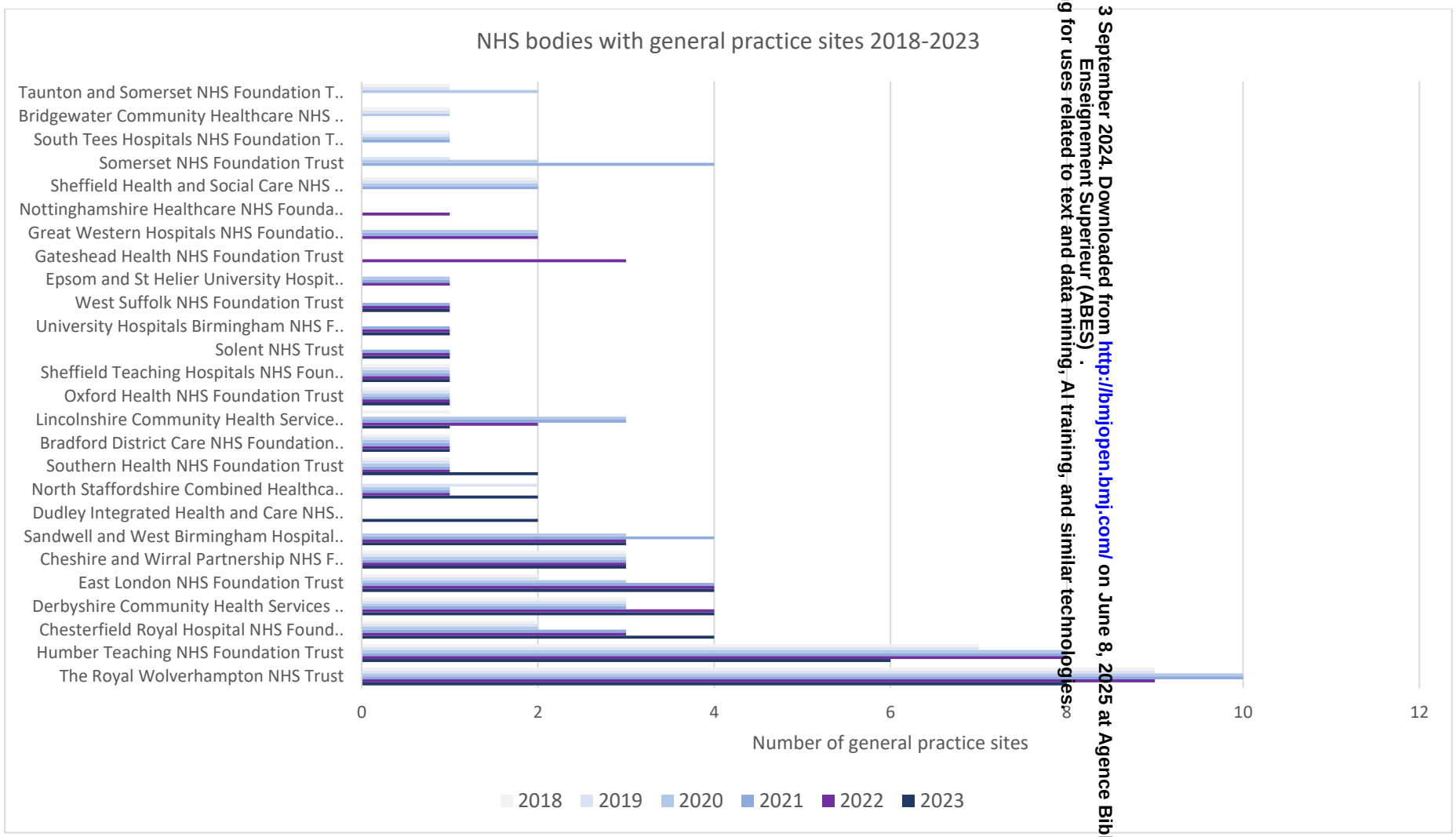
Appendix: Figures 1a&b (Results)





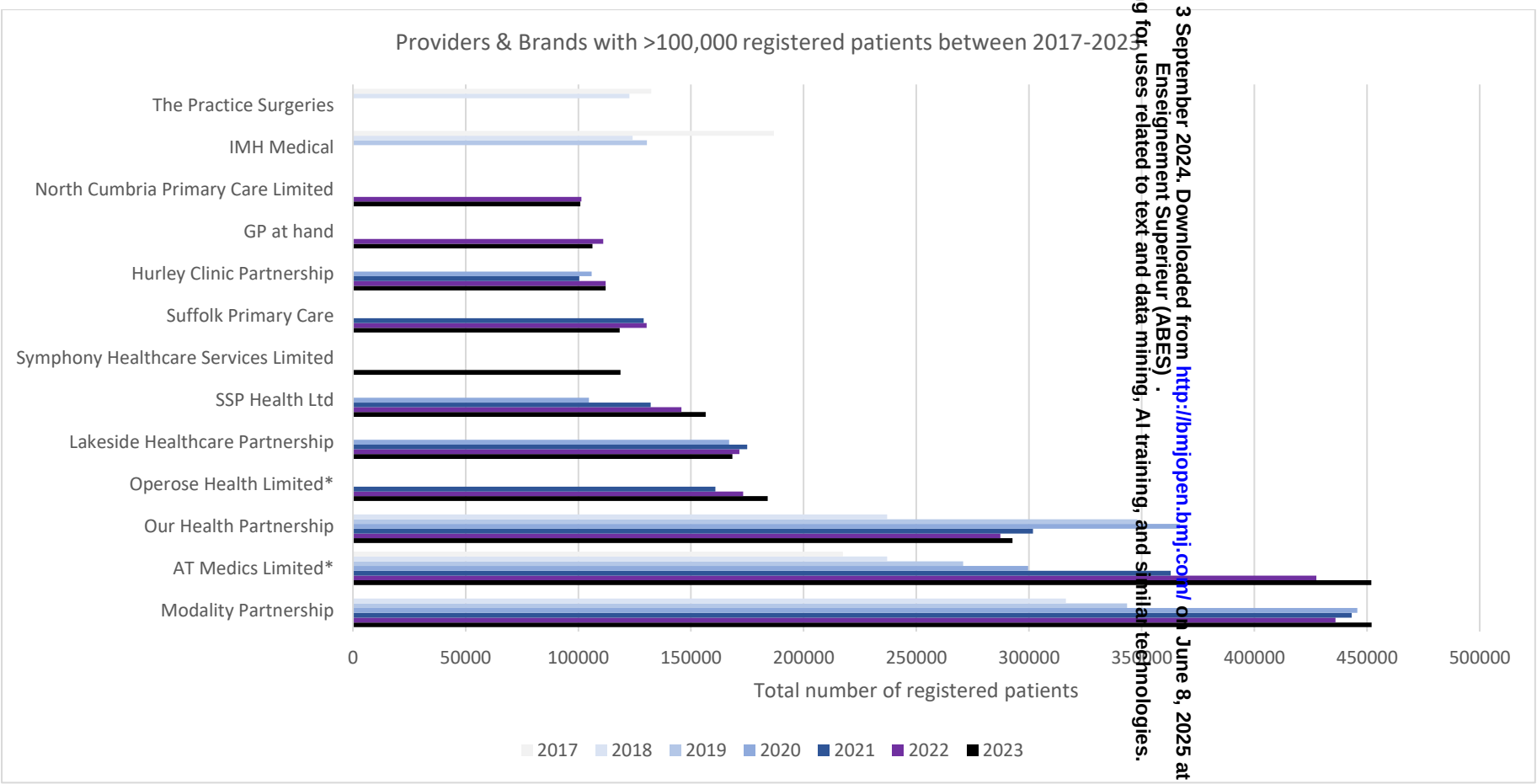
Appendix Figures 1a&b: General practice 'site' and 'provider' ownership by (a) Practice sites (b) Providers. Every April 2018-2023. (Source: CQC) [25]. NB: The Care Quality Commission (CQC) classifies ownership type in four categories: 'Partnership', 'Individual' (i.e. single-handed ownership), 'Organisation' (i.e. incorporated limited or community interest company), or 'NHS body' (i.e. NHS Trust). Providers may have more than one site.

Appendix: Figure 2 (Results)



Appendix Figure 2: NHS bodies running general practice sites, with number of sites. Every April 2018-2023. (Source: CQC) [25]

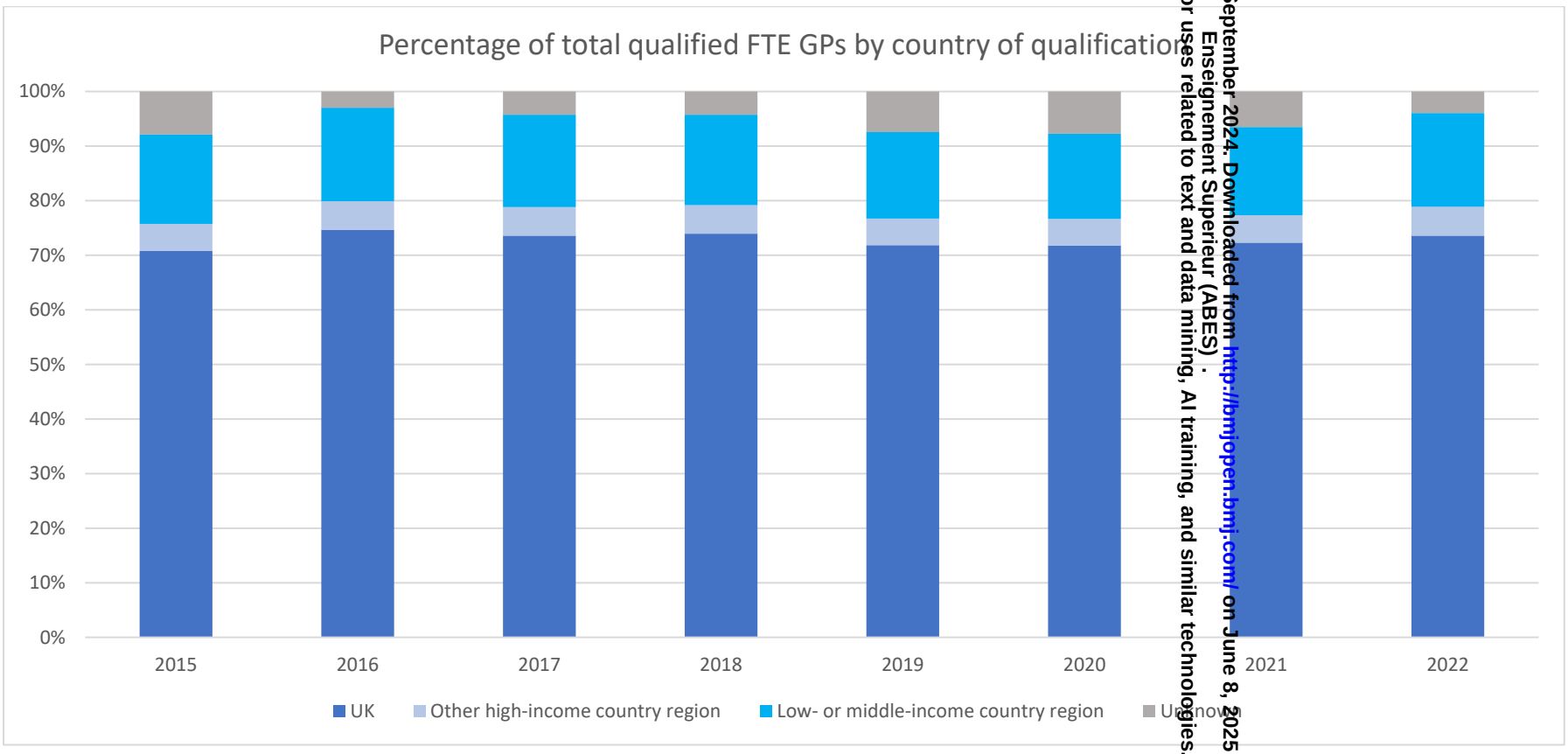
Appendix: Figure 3 (Results)



Appendix Figure 3: 'Mega-providers' - Providers and Brands with >100,000 registered patients across all practice sites Every April 2017-2023. NB: Likely underestimate of total list size as 7% of NHS England's associated practices' patient list size data did not merge with the CQC datasets. (Sources: NHS England & CQC) [23, 25].

*Operose Health Limited and AT Medics Limited became part of the same organisation in 2021[34].

Appendix: Figure 4 (Results)



Appendix Figure 4: Percentage of qualified total full time equivalent (FTE) GPs in England by country of qualification region grouping. Every September 2015-2022. (Source: NHS England) [26]

Appendix: Tables 3a&b (Results)

Table 3a

Year	GP Partner	GP Salaried	GP Locum	GP Retainer	GP Trainee	Nurse	Other DPC	Admin
2015	89%	67%	42%	44%	NA	65%	63%	68%
2016	90%	67%	42%	43%	NA	66%	64%	69%
2017	89%	67%	40%	41%	NA	67%	65%	69%
2018	88%	66%	39%	38%	96%	67%	66%	69%
2019	88%	65%	41%	38%	96%	68%	67%	70%
2020	87%	64%	41%	49%	97%	69%	68%	71%
2021	86%	64%	40%	40%	98%	69%	68%	71%
2022	86%	64%	41%	41%	97%	69%	71%	72%
Direction of change	↓	↓	↔	↔	↔	↑	↑	↑
Linear reg of total FTE / HC % by year P value	0.001*	0.000*	0.413	0.820	0.139	0.000*	0.000*	0.000*

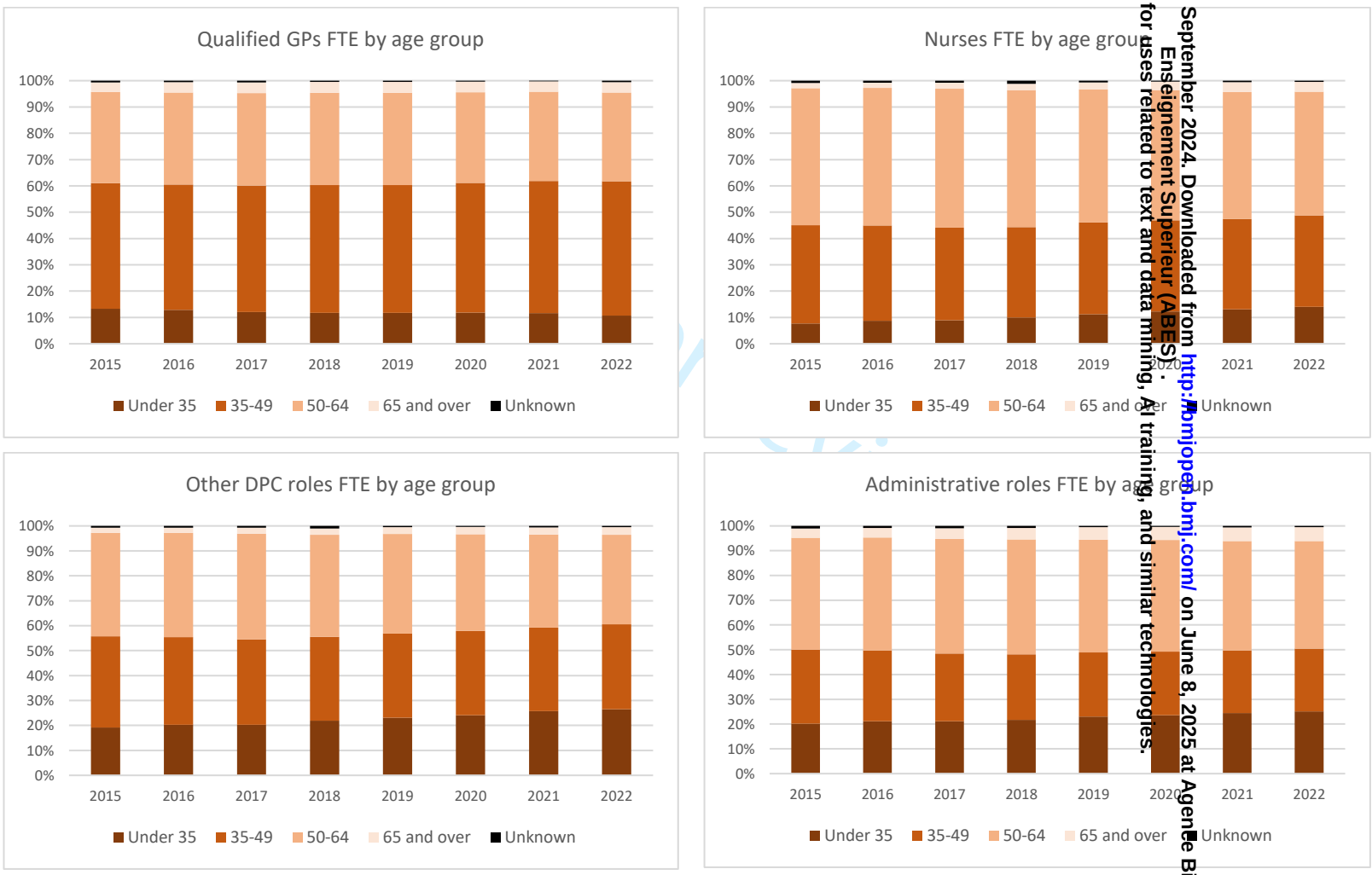
Appendix Table 3a: Total full time equivalent (FTE) out of total headcount (HC) percentage for each general practice workforce role and associated P value for linear regression of FTE/HC%. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England) [26]

Table 3b

Year	GP Partner Female	GP Partner Male	Salaried GP Female	Salaried GP Male	Locum GP Female	Locum GP Male	Retainer GP Female	Retainer GP Male	Trainee GP Female	Trainee GP Male
2015	0.79	0.96	0.64	0.75	0.40	0.44	0.44	0.46	NA	NA
2016	0.80	0.97	0.64	0.75	0.40	0.45	0.43	0.44	NA	NA
2017	0.79	0.96	0.64	0.75	0.38	0.43	0.42	0.37	NA	NA
2018	0.79	0.96	0.63	0.74	0.36	0.42	0.38	0.40	0.93	1.04
2019	0.78	0.95	0.62	0.72	0.38	0.44	0.39	0.37	0.92	1.03
2020	0.78	0.94	0.61	0.71	0.39	0.43	0.39	0.40	0.93	1.03
2021	0.77	0.93	0.61	0.70	0.37	0.43	0.39	0.42	0.94	1.03
2022	0.78	0.93	0.62	0.70	0.39	0.44	0.39	0.49	0.93	1.03
Direction of change	↓	↓	↓	↓	↔	↔	↓	↔	↔	↔
Linear reg of total FTE / HC % by year P value	0.001*	0.002*	0.001*	0.000*	0.443	0.429	0.023*	0.815	0.441	0.087

Appendix Table 3b: Total full time equivalent (FTE) out of total headcount (HC) proportion by gender for each GP role and associated P value for linear regression of FTE/HC. *Change statistically significant as P<0.05. Every September 2015-2022. (Source: NHS England)

Appendix: Figures 5a-d (Results)



Appendix Figures 5a-d: Total full time equivalent (FTE) general practice workforce roles by age group: (a) Qualified GPs; (b) Nurses; (c) Other Direct Patient Care roles; (d) Administrative roles. Every September 2015-2022. (Source: NHS England) [26]

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title and abstract	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and time period within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract names sources of data (page 1) Abstract defines national data that range between 5-10 years (page 1) Indicated in abstract and explained in the methods (pg 1 & pg 5)
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	In background section (page 4)		
Objectives	3	State specific objectives, including any prespecified hypotheses	In background section (page 4)		
Methods					
Study Design	4	Present key elements of study design early in the paper	In methods section (page 4)		
Setting	5	Describe the setting, locations, and relevant dates, including	In methods and supplementary material (methods		

		periods of recruitment, exposure, follow-up, and data collection	page 4-7, and appendices tables 1 & 2)		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	In methods – use of ODS codes and CQC registration location ID and provider ID (pages 4&5) ODS codes widely used in NHS. CQC the main registration and regulatory body for general practice Explained in methods and set out in supplementary material (appendices tables 1 & 2)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Explained in methods (pg 4-7)
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	Explained in the methods (pages 4-7)		

		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	Addressed in the methods (pages 4-7) and limitations (page 14)		
Study size	10	Explain how the study size was arrived at	Explained in the methods – national data sets, missing and excluded data reported in methods and supplementary material (methods pages 4-7, appendices tables 1&2)		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Explained in the methods (pages 4-7)		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed	Explained in the methods (pages 4-7)		

		Cross-sectional study - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2) Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2)
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Explained in the methods and supplementary material (methods paged 4-7, appendices tables 1&2)
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage.	Explained in the methods, results and supplementary material (methods, paged 4-7, appendices tables 1&2)	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Explained in the methods, results and supplementary material (methods paged 4-7, appendices tables 1&2)

		(c) Consider use of a flow diagram			
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Explained in the methods, results and supplementary material (methods paged 4-7, appendices tables 1&2)		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	N/A		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Descriptive data without adjustment for confounders. Coefficient or IRR reported with 95%CI		

Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	10th and 90th centile reported where helpful to understand spread of data. P values reported for changes in FTE/HC over time.		
Discussion					
Key results	18	Summarise key results with reference to study objectives	At the start of the discussion (page 12)		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Under limitations section (pages 14-15)	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Under methods (paged 4-7) and limitations section (paged 14-15)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Covered in discussion (paged 12-14) and in limitations (pages 14-15)		
Generalisability	21	Discuss the generalisability (external validity) of the study results	National data used allows generalisability. However, need for further research to understand warranted and unwarranted variation highlighted in discussion (pages15-16)		

Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	In acknowledgements section (paged 16 and 17)		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	In citations/ references 23-28 (page 18)

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