NIHR | Collaboration for Leadership in Applied Health Research and Care Greater Manchester

Greater Manchester Workforce Project (Primary Care)

Work Package 1: Mapping of Primary care roles across Greater Manchester

Final Report

Working in collaboration with:

The 10 Clinical Commissioning Groups across Greater Manchester

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1.0 Executive Summary

- This report forms part of the Greater Manchester Primary Care Workforce Study being carried out by the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC) Greater Manchester (GM) in collaboration with the Greater Manchester Health and Social Care Partnership (GMHSCP). It presents findings from Work Package (WP) 1 of the study '*Mapping of primary care roles across Greater Manchester*' which aimed to conduct a baseline audit of the total staff employed in general practice in GM to enable a better understanding of current workforce capacity.
- The report examines the number of Full Time Equivalent (FTE) GP, nurses, Direct Patient Care (DPC) and administrative staff per 10,000 registered patients in Greater Manchester (GM).
- Findings are based on practices with complete *General and Personal Medical Services, England* data. Baseline assessments were made using the September 2018 extract of the data. Longitudinal assessments (performed to assess completion rates over time and data consistency) were made using extracts from September 2016 to September 2018.
- Whilst practice workforce returns for GPs (93.86%), nurses (94.92%), DPC (93.64%) and admin (93.43%) staff were high, approximately 21% of practices in GM had incomplete returns for at least one role. Complete returns varied across CCGs (highest in NHS Trafford CCG (87.50%) and lowest in NHS Oldham CCG (70.45%).
- Incomplete data was associated with practices with patients less satisfied with the overall experience of their practice but not associated with measures of deprivation and population need.
- In September 2018 there were 4.11 FTE GP, 2.34 FTE nurses, 1.22 FTE DPC and 11.23 FTE administrative staff per 10,000 registered patients in GM. These figures vary across and within CCGs:
    - NHS Stockport CCG had the largest volume of FTE GPs per 10,000 (4.79) and NHS Oldham CCG the lowest (3.64).
    - NHS Salford CCG had the largest volume of FTE nurses per 10,000 (2.92) and NHS Manchester CCG the lowest (1.82).
    - NHS Tameside and Glossop CCG had the largest volume of FTE DPC per 10,000 (1.84) and NHS Trafford CCG the lowest (0.67).
    - NHS Salford CCG had the largest volume of FTE admin per 10,000 (13.24) and NHS Manchester CCG the lowest (9.46).
- Differences in practice FTE GP were not associated with CCG-specific factors or practice or population differences, suggesting that variations here may

reflect local challenges in recruitment and retention. This may identify practices in relative greater need of support with recruitment and retention.

- Differences in FTE nurse, FTE DPC and FTE administrative staff were associated with measures of population need (age, deprivation) and also CCG-level factors. Future evaluations may wish to investigate why CCG differences are evident for these roles. Longitudinal assessment of practices with complete data in the September 2016 through to September 2018 data extracts suggests a decline in numbers of FTE GP and FTE administrative staff but little change in FTE nurse and FTE DPC staff numbers. This suggests an assessment of the impacts of expanding nurse or DPC staff in general practice in GM is not feasible at present.
- The longitudinal assessment was found to be unrepresentative across CCGs, practices with patients more satisfied with the overall experience of their practice, and population need. Given the increase in data completeness from June 2018, and the representative issues when comparing to previous data, any longitudinal analysis in the future should begin with the June 2018 extract.

2.0 Background and Context

The National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC) Greater Manchester (GM) is conducting a study (the *Greater Manchester Primary Care Workforce Study*) on the context and pressures related to the general practice workforce across GM, in collaboration with the Greater Manchester Health and Social Care Partnership (GMHSCP).

The *Greater Manchester Primary Care Workforce Study* aims to:

1) Assess the current landscape of the general practice workforce in GM (i.e. an audit of total number of staff employed in general practice in GM areas, by role – Work Package 1);
2) Examine factors affecting the supply and retention of GPs across GM areas GM (Work Package 2) and;
3) Analyse the implementation of new roles in general practice in each of these areas (in particular, the introduction of new 'non-medical' health professional roles – Work Package 3).

The study is designed to inform the GM Workforce Strategy and to provide analysis of the challenges (barriers) and opportunities (enablers) in each area to commissioners, providers and other relevant stakeholders. NIHR CLAHRC GM will produce a final report in autumn 2019 incorporating findings from Work Packages (WPs) 1-3.

This report presents findings from WP1 of the evaluation: *Mapping of primary care roles across Greater Manchester*. WP1 aimed to conduct a baseline audit of the total staff employed in general practice in GM by four staff groups: General Practitioners (GPs); nurses; staff employed in Direct Patient Care (DPC) roles; and administrative staff. This scoping work aimed to offer a better understanding of current workforce capacity and also to inform the study's subsequent WPs 2 and 3. The work builds on the evaluations of the general practice workforce by Health Education England by i) using more up to date data, ii) providing a more granular level of assessment (assessments of general practice in Greater Manchester across and within CCGs), and iii) given the data source has incomplete coverage, the report provides an assessment into how representative practices with complete data are of practices in Greater Manchester.

3.0 Data and Methodology

We used the *General and Personal Medical Services, England* data to answer the following questions:

1. What is the current general practice workforce in GM and does this vary across CCGs?
2. How has the general practice workforce in GM changed over time?
3. Is the available data representative of all practices across GM?

NIHR CLAHRC GM based this audit on the General and Personal Medical Services, England data submissions because the data contain information on all staff employed in general practice, is publicly available, covers both practices submitting either themselves or via HEE and is updated frequently. The September 2018 extract is the most recent accessible data and is the focus of this report.

This report presents a baseline mapping of the general practice workforce at September 2018. Staff roles covered include GPs (excluding retainers, registrars and locums – due to data limitations), nurses, staff in DPC roles and administrative staff. For a full description of the methodology, see Appendix 1.

The baseline picture is incomplete due to missing data in the General and Personal Medical Services, England data. Table 1 and Figure 1 summarise the extent of missing data in Greater Manchester based on the September 2018 extract.

In total, 78.60 percent of practices in GM had complete data for each staff role; this has improved from an approximate rate of 60% prior to June 2018. This increase at least partially reflects a change in how data are presented; prior to June 2018 it was not possible to distinguish between a submission of ‘zero’ headcount for a particular staff role and a lack of data for the role. Differentiating zeros from non-submission is likely to explain some proportion of the apparent increase in completeness.

Figure 1

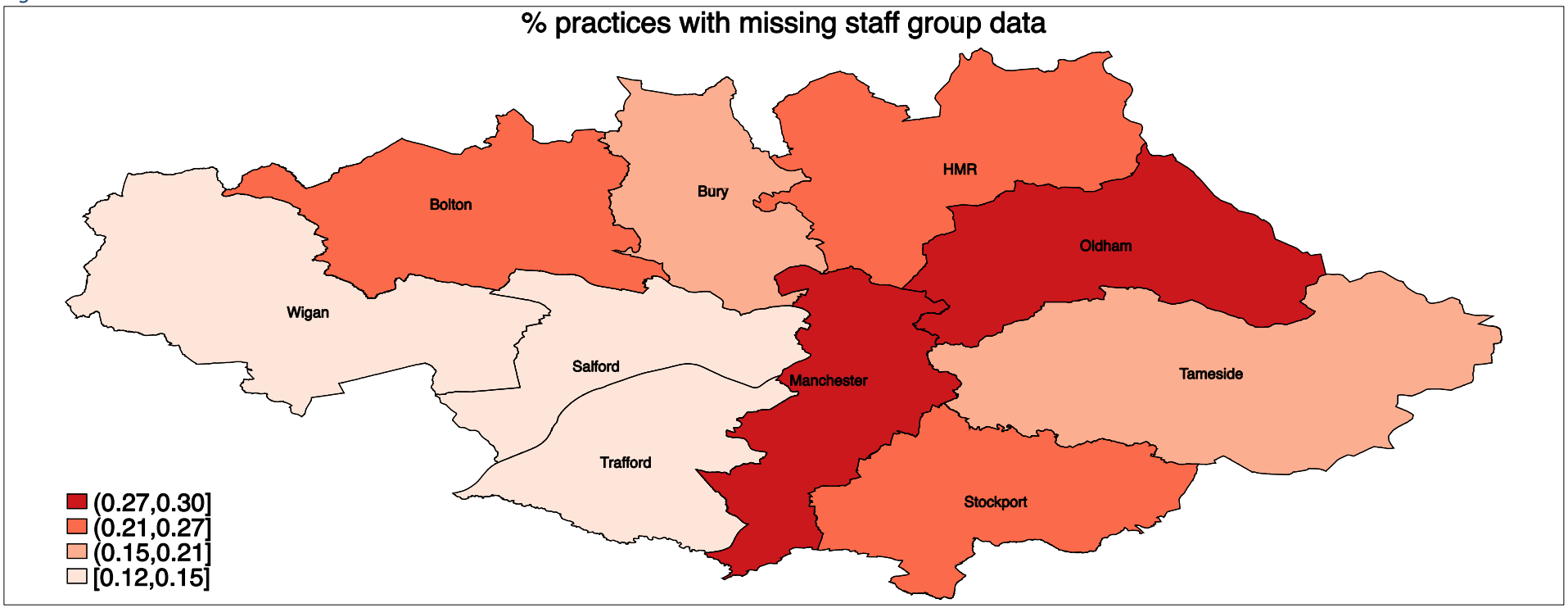
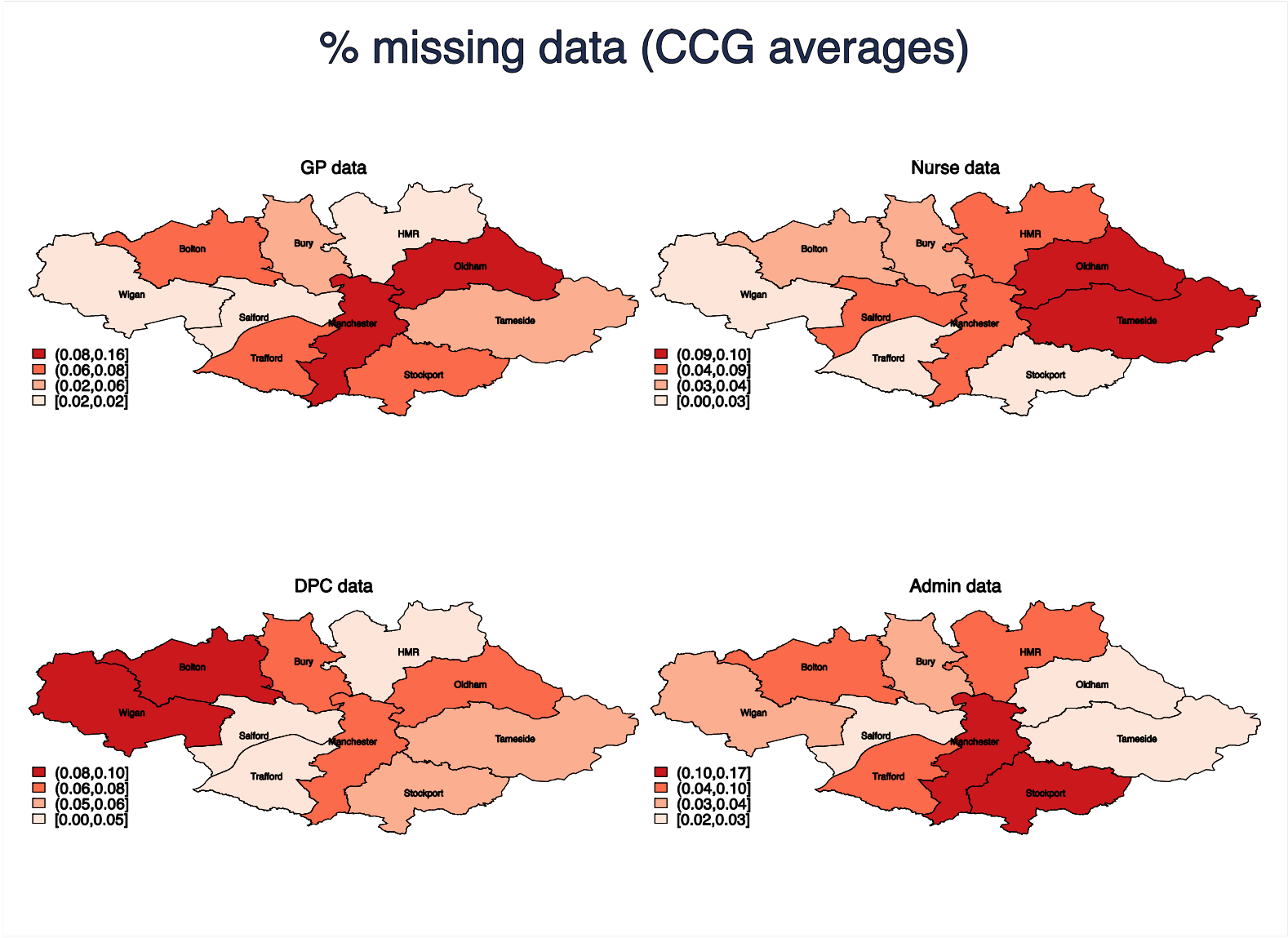

% practices with missing staff group data
Bolton
Bury
HMR
Oldham
Wigan
Salford
Manchester
Tameside
Trafford
Stockport
(0.27,0.30]
(0.21,0.27]
(0.15,0.21]
[0.12,0.15]

Table 1: Practices with complete workforce data in September 2018

CCG	Practices	Complete data	% coverage
NHS Bolton CCG	50	39	78.00
NHS Bury CCG	30	25	83.33
NHS Heywood, Middleton and Rochdale CCG	41	30	73.17
NHS Manchester CCG	89	65	73.03
NHS Oldham CCG	44	31	70.45
NHS Salford CCG	45	39	86.67
NHS Stockport CCG	40	30	75.00
NHS Tameside and Glossop CCG	39	31	79.49
NHS Trafford CCG	32	28	87.50
NHS Wigan Borough CCG	62	53	85.48
Total	**472**	**371**	**78.60**

There was variation in data completeness by CCG area, ranging from 70.45% of practices in NHS Oldham CCG to 87.50% of practices in NHS Trafford CCG. Missing data varied by staff role (Figure 2, see also Appendix 2, Table A 1). For example, NHS Stockport CCG had high levels of completeness for GP, nurse and DPC roles but relatively poorer complete data on administrative roles; whereas NHS Oldham had low levels of complete data on GP, nurse and DPC roles but a high rate of complete data on administrative roles.

Figure 2


% missing data (CCG averages)
GP data
Bolton
Bury
HMR
Oldham
Wigan
Salford
Manchester
Tameside
Trafford
Stockport
(0.08,0.16]
(0.06,0.08]
(0.02,0.06]
[0.02,0.02]
Nurse data
Bolton
Bury
HMR
Oldham
Wigan
Salford
Manchester
Tameside
Trafford
Stockport
(0.09,0.10]
(0.04,0.09]
(0.03,0.04]
[0.00,0.03]
DPC data
Bolton
Bury
HMR
Oldham
Wigan
Salford
Manchester
Tameside
Trafford
Stockport
(0.08,0.10]
(0.06,0.08]
(0.05,0.06]
[0.00,0.05]
Admin data
Bolton
Bury
HMR
Oldham
Wigan
Salford
Manchester
Tameside
Trafford
Stockport
(0.10,0.17]
(0.04,0.10]
(0.03,0.04]
[0.02,0.03]

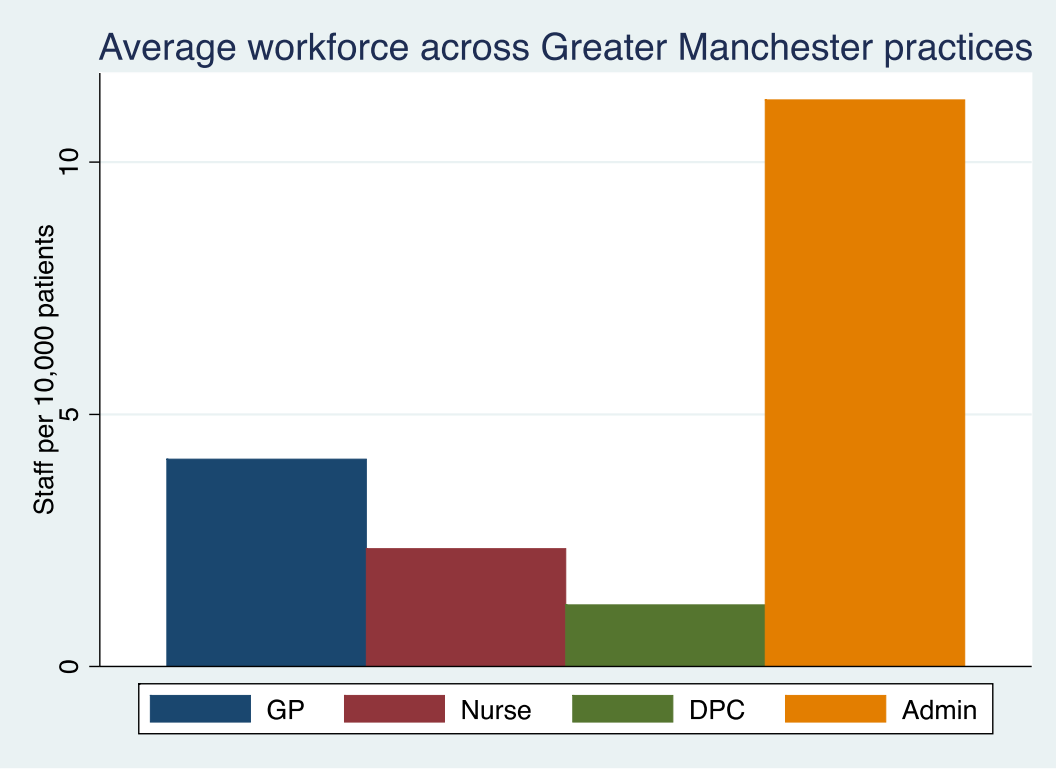
To get a picture of the workforce in general practice, we present figures for those practices that provided complete data for all staff roles. We restrict the analyses to these practices because our primary target is to obtain a picture of the workforce in its entirety; if practices with incomplete data had different configurations of workforce this would skew our picture of the GM baseline. This enabled us to determine how representative practices with complete data were, to understand how generalisable the baseline is.

3.1 Baseline assessment of the general practice workforce across Greater Manchester

The baseline for general practice workforce is calculated based on those 371 practices with complete data across all staff roles.

Across GM there is an average of 4.11 GP FTE per 10,000 registered patients, 2.34 nurses FTE per 10,000, 1.22 DPC FTE per 10,000 and 11.23 administrative staff FTE per 10,000 (Figure 3). These findings are broadly in line with previous data reported by Health Education England[1].

Figure 3

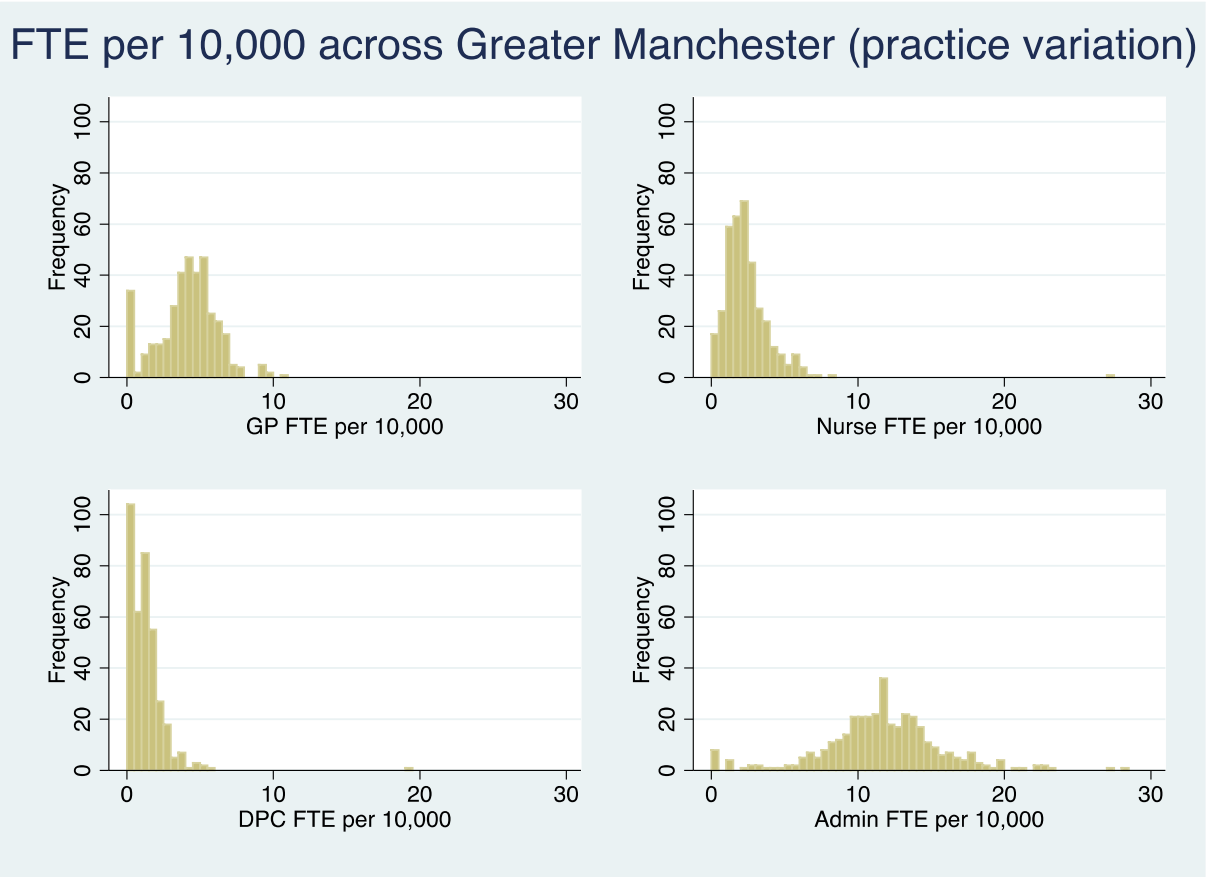


The variation around these averages can be calculated by assessing the volume of FTE per 10,000 across practices and staff roles in GM. The practice-level frequency

[1] Health Education England, Working across the North West, Greater Manchester Primary Care Workforce Report,October 2017.

distribution of FTE per 10,000 registered patients (Figure 4) thus shows the breadth of variation across all practices with complete data in GM.

Figure 4



Nb. One practice reported 70.59 FTE admin staff and is excluded for presentational purposes

The variation in nurse and DPC roles is less than that of GP and administrative roles (Table 2). There are practices that have a large volume of nurses, DPC and administrative staff and some with zero staff in these roles.

Table 2:Average CCG general practice workforce per 10,000 registered patients

CCG	GP	Nurses	DPC	Admin
NHS Bolton CCG	4.53	2.89	1.39	12.37
NHS Bury CCG	3.69	2.21	1.21	10.53
NHS Heywood, Middleton and Rochdale CCG	3.92	2.45	1.37	11.74
NHS Manchester CCG	3.92	1.82	0.95	9.46
NHS Oldham CCG	3.64	2.41	1.32	10.93
NHS Salford CCG	4.14	2.92	1.68	13.24
NHS Stockport CCG	4.79	2.11	1.23	11.34
NHS Tameside and Glossop CCG	3.84	2.23	1.84	11.28
NHS Trafford CCG	4.14	1.83	0.67	10.58
NHS Wigan Borough CCG	4.42	2.88	0.95	12.30

Variation in GP roles across CCGs ranges from 3.64 FTE per 10,000 in NHS Oldham CCG to 4.79 in NHS Stockport CCG (Table 2; Figures 5 and 6). For nurses the range is from 1.82 FTE per 10,000 in NHS Manchester CCG to 2.92 in NHS Salford CCG. For DPC roles the range is from 0.67 FTE per 10,000 in NHS Trafford CCG to 1.84 in NHS Tameside and Glossop CCG. Variation in administrative staff across CCGs is greater than that seen for other staff roles, ranging from 9.46 FTE per 10,000 in NHS Manchester CCG to 13.24 in NHS Salford CCG.

Figure 5

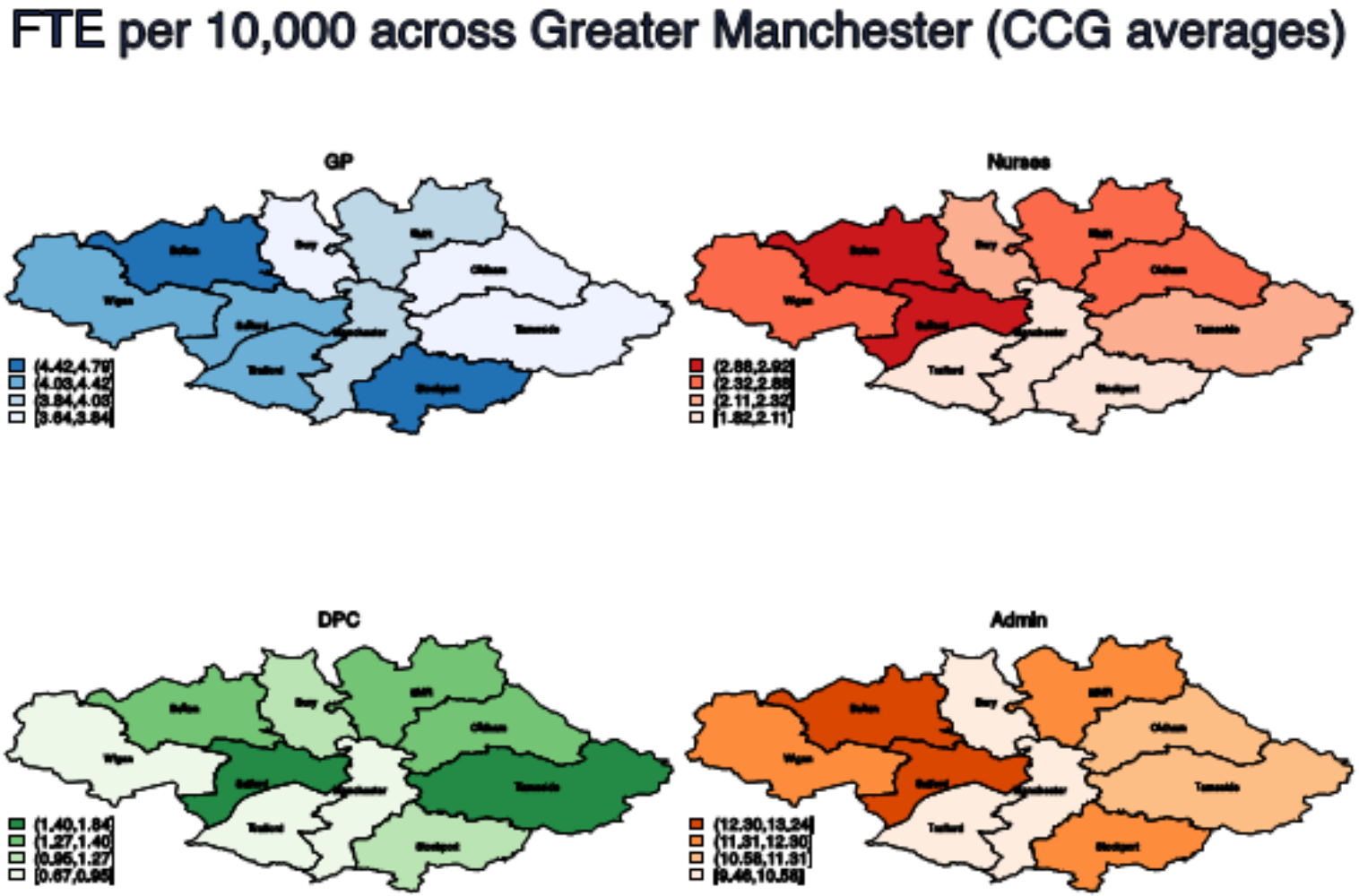
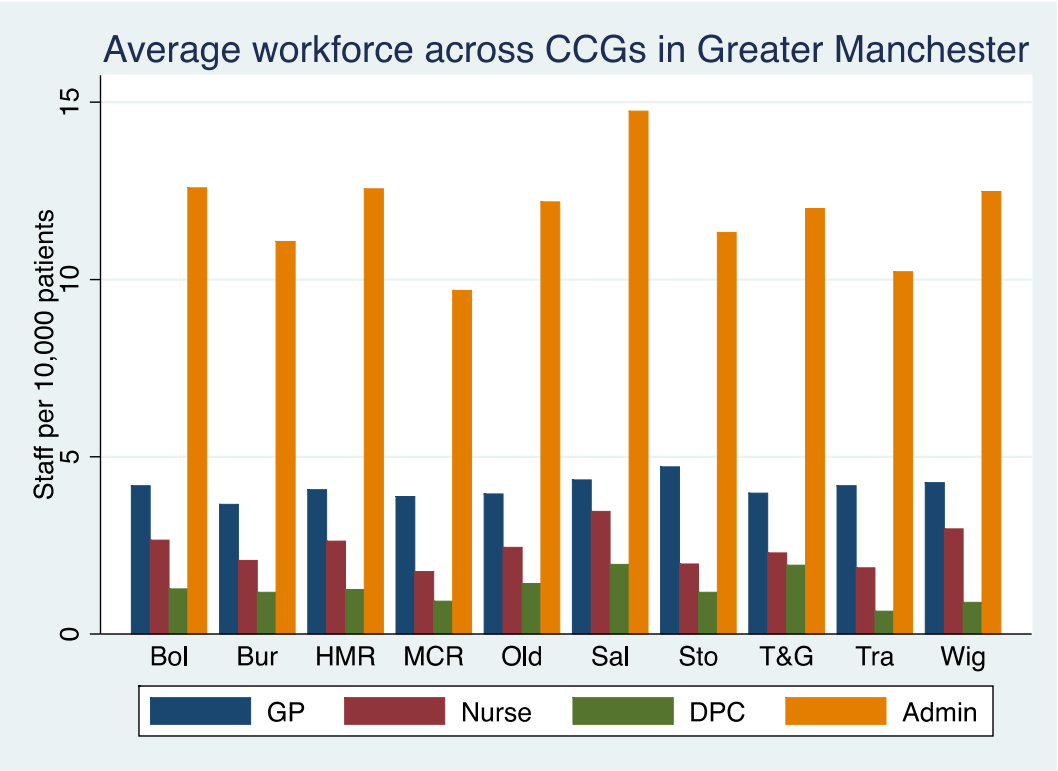

FTE per 10,000 across Greater Manchester (CCG averages)
GP
(4.42,4.79]
(4.03,4.42]
(3.84,4.03]
[3.64,3.84]
Nurses
(2.88,2.92]
(2.32,2.88]
(2.11,2.32]
[1.82,2.11]
DPC
(1.40,1.84]
(1.27,1.40]
(0.95,1.27]
[0.67,0.95]
Admin
(12.30,13.24]
(11.31,12.30]
(10.58,11.31]
[9.46,10.58]

Figure 6 shows the average general practice workforce per 10,000 registered patients for each CCG.

Figure 6



The variation in general practice workforce may reflect either 1) differences in preferred configuration of the practice workforce across CCGs, 2) recruitment and retention variation across CCGs, or 3) differences in populations across CCGs. Whilst the data does not enable an understanding of (1) or (2), we can assess whether certain staff roles are associated with practice and population characteristics to inform the third scenario.

We tested whether there are associations between FTE staff roles per 10,000 patients and a range of explanatory variables (see Appendix 1). Analyses are based on 371 practices with FTE data for each staff role in the September 2018 wave. Appendix 2, Table A 5 gives the estimates from four regressions. We find:

- The number of GPs is positively associated with patient-reported feedback of overall experience with their practice.
- CCG of the practice is not associated with GP FTE suggesting CCG-level workforce initiatives are not driving variation across GM.
- Population need (as measured by age, deprivation, long-term conditions, and weighted population) is not associated with greater GP FTE.

- For nurse, DPC, and administrative roles we find FTE to be positively associated with population need (the proportion of the population aged 65 and over, deprivation and for administrative roles, a small negative association with weighted population). This suggests that variation for these roles across practices and CCGs may reflect differences in relative need for general practice care.
- NHS Salford CCG is positively associated with number of nurse, DPC and administrative roles. NHS Tameside and Glossop CCG is also positively associated with DPC roles. This may suggest these CCGs are more actively or effectively advocating or driving the employment of these roles in the general practice workforce relative to other CCGs in GM.

3.2 Longitudinal assessment of the general practice workforce over time (Sept 2016-Sept 2018)

Though a baseline assessment of the GM general practice workforce is useful to inform resource planning based on current configurations, a longitudinal assessment showing how the workforce is changing may highlight areas where staff roles are expanding or diminishing over time.

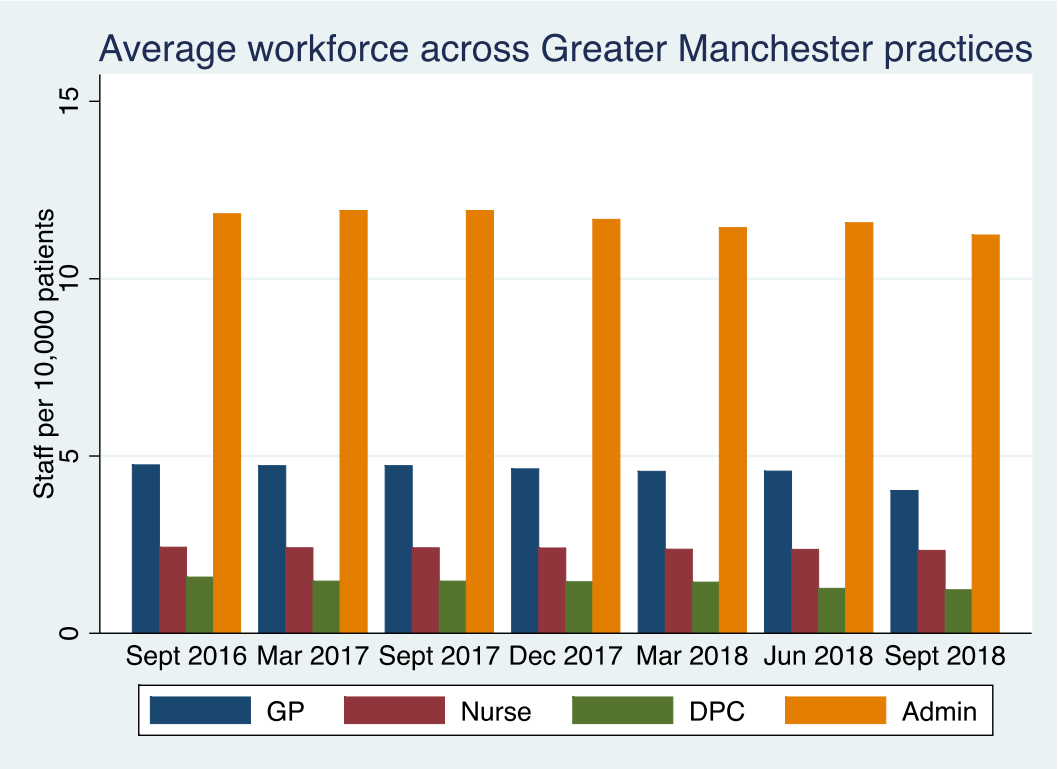
To assess how the workforce has changed over the September 2016 to September 2018 period we compared staff roles FTE per 10,000 across each *General and Personal Medical Services, England* data extract.

This assessment was conducted only for those practices that have complete data across the entire *General and Personal Medical Services, England* dataset (i.e. report complete data over the September 2016 to September 2018 period). This was to ensure any observed changes are actual changes in workforce rather than reflective of different practices reporting in different time points. There were 218 practices in GM with complete data across each period (Appendix 2, Table A 2).

Figures for staff role FTE per 10,000 patients are provided at each extract of the *General and Personal Medical Services, England* data (Figure 7).

Overall there was little change in staffing number for most staff roles per 10,000 patients over the period, except for some evidence of a decrease in GPs and a small decrease in administrative staff. This lack of change in general practice workforce implies that there would be limited value in any future analyses seeking to test for associations between changes in workforce in GM and health service use or outcomes.

Figure 1



3.3 Associations between practice characteristics and reporting of complete data

To investigate whether the baseline and/or longitudinal pictures that are presented may be generalisable across GM and CCG we test whether there are any associations between practice completion and a range of practice-level characteristics using multivariable regression analysis techniques (linear probability model). Characteristics considered are provided in Appendix 2, Table A 6 and include measures to capture relative workforce pressures via patients' reporting of overall experience and experience of making an appointment, patient self-reported health conditions, need for health care via weighted populations (from the resource allocation formula for primary care (medical) allocations) and practice performance on the QOF.

For the findings of this report to be generalisable across GM (in other words, be likely to reflect the general practice workforce for those practices who have not provided complete data), we would want to find no significant association between practice characteristics and missing data. If a characteristic is significantly associated with missing data then this suggests that practices may not be representative of GM in that particular measure.

We tested for associations with practice characteristics and the following measures of missing data:

- Any missing data across all staff roles in September 2018
- Any missing FTE GP/nurse/DPC/admin data in September 2018
- Any missing data through September 2016 to September 2018

The full results from the regression analyses are provided in Appendix 2, Table A 7.

For the ‘Any missing data across all staff roles in September 2018’ data we find:

- Practices with better patient reported overall experience are less likely to have missing data. This implies practices with patients more satisfied with overall experience are overrepresented in the baseline analyses.
- No evidence that practice data completeness is associated with measures for CCG, deprivation, or measures for patient need.
-

For the ‘Any missing data through September 2016 to September 2018’ data we find:

- NHS Bury CCG, NHS HMR CCG, NHS Salford CCG and NHS Tameside and Glossop CCG are under-represented in these analyses since they are positively associated with missing data.
- Evidence that patient reported overall experience is positively associated with incomplete data and that practices with greater need as measured by the weighted population are more likely to have missing data.

The findings from these models should be taken into consideration when considering how representative the baseline and longitudinal analyses in this report are.

We suggest the baseline picture is a good representation of general practice in GM at September 2018. However, we advise caution with the longitudinal analyses since the practices presented are not representative of practices overall in GM in several aspects. Any longitudinal analysis in the future should therefore begin with the June 2018 extract.

4.0 Discussion

The most appropriate source of data to generate a complete baseline assessment of the general practice workforce in GM is the *General and Personal Medical Services, England* dataset, however, this data is incomplete. NHS Digital have worked hard, in conjunction with Health Education England, to improve practice reporting and there have been significant gains in completeness recently, but data issues remain.

This report has worked with the existing data to generate as accurate a baseline as possible for Greater Manchester, to assess factors which might be associated with practice workforce composition, and to examine the longitudinal data from September 2016 and September 2018 to assess the viability of evaluating the impact of changing practice workforce composition historically.

4.1 Baseline assessment of the general practice workforce across Greater Manchester

The baseline picture provided in this report is based on 78.60% of practices in GM. There are 4.11 FTE GPs, 2.34 FTE nurses, 1.22 FTE DPC, and 11.23 FTE administrative staff per 10,000 registered patients across GM.

A practice can infer what their workforce would look like if they followed this average by populating their practice list size to the formulae in Box 1.

Box 1: Formulae for practices to determine staff roles per 10,000 to be in line with the GM average

GP:	4.11 x (practice list size/10,000) = FTE GP to be in line with GM
Nurse:	2.34 x (practice list size/10,000) = FTE Nurse to be in line with GM
DPC:	1.22 x (practice list size/10,000) = FTE DPC to be in line with GM
Administrative:	11.23 x (practice list size/10,000) = FTE Admin to be in line with GM

Example, a practice with 6,000 patients on its list would have: 4.11 x (6,000/10,000) = 2.47 FTE GPs if it was in line with the general picture across GM.

Our analyses suggest that there will be practices and CCGs that have greater or fewer staff numbers than the GM average.

We tested whether staff role FTE was associated with particular CCGs, practice level factors such as Quality and Outcome Framework performance, and patient characteristics. We found evidence that nurse, DPC and administrative FTE figures are positively associated with the age of the patient population and deprivation suggesting some of the variation across practices and CCGs may reflect differences

in populations served. However, a similar effect was not observed for GP FTE suggesting the variation here may reflect recruitment and retention issues. We also found positive associations of nurse, DPC and administrative staff FTE with NHS Salford CCG and a positive association between NHS Tameside and Glossop CCG and DPC FTE which may suggest these CCGs may be advocating or actively attempting to configure the general practice workforce with these roles relative to other CCGs in GM.

Our baseline analyses are broadly representative across practices in relation to deprivation, population need, CCG, and measures of patient satisfaction related to the ability to make an appointment. We have found evidence that the baseline assessment may over-represent those practices with patients reporting positive overall experience with their practice.

4.2 Longitudinal assessment of the general practice workforce over time (Sept 2016-Sept 2018)

We provided a longitudinal picture of general practice workforce over the period. This was done to assess whether there is sufficient variation to evaluate the impact of changes in general practice workforce (for example, to examine whether introductions of DPC roles impact on a measure of health service use or health outcomes).

We found little evidence of changes in the general practice workforce over the September 2016 to September 2018 period, with the exception of GPs and administrative staff roles (the numbers of both roles declined over the period). We also found that such longitudinal analysis may be based on an unrepresentative sample of practices in GM given practices with complete data across the period, incomplete longitudinal data were associated with particular CCGs, patients' overall experience with their practice and population need (weighted population).

For these reasons we suggest further monitoring is required to see if changes in nurse and/or DPC FTEs occur and that analyses should start from the June 2018 extract from the *General and Personal Medical Services, England* dataset since earlier extracts have generalisability concerns.

5.0 Summary and Implications

This report has highlighted the following:

1. *General and Personal Medical Services, England* data give the most complete picture available of staff employed in general practice in GM, however the data is hampered by incompleteness. The generalisability of findings is limited as baseline and longitudinal analyses are based on practices with complete data only (78.60%, 317 practices and 46.19%, 218 practices respectively). This could lead to misrepresentation of the current workforce in GM and should be considered if the data are used to inform future workforce strategies.
2. There is variation in data completeness across CCGs in GM; this variation is not associated with practice characteristics or CCG-specific factors but is associated with patient reported feedback on overall experience with their practice (which may be associated with practice pressures/capacity). Additional support/input may be required for practices with incomplete data, in order to reduce the number of gaps.
3. There is variation across and within CCGs in GM and this variation differs by staff role.
4. GP FTE appears to not reflect CCG-specific factors, or practice or population differences, suggesting that variations here may reflect local challenges in recruitment and retention. This may identify practices in relative greater need of support with recruitment and retention.
5. We find some evidence that the variations in nurse, DPC and administrative roles are associated with measures of population need (age, deprivation) and also CCG-level factors. Future evaluations may wish to investigate why CCG differences are evident for these roles.
6. Any assessment of the impacts of expanding nurse or DPC staff in general practice in GM is not feasible at present, due to the limited variation in staffing numbers over time.
7. There are representativeness issues with any longitudinal assessment with the current data, suggesting any longitudinal analysis in the future should begin with the June 2018 extract.

6.0 Appendices

Appendix 1: Methodology and Data

NHS Digital produce general practice workforce statistics covering all staff employed in general practice via their quarterly *General and Personal Medical Services, England* data releases.[2] There are two main data sources that contribute to the data:

i) extracts from the National Workforce Reporting System (NWRS) populated by practice submissions via the Primary Care Web Tool (PCWT) Workforce Census and;
ii) HEE region submissions on behalf of practices via the workforce Minimum Data Set Collection Vehicle (wMDSCV).

For the latest extract (September 2018), 19.6% of practices in England had data submitted via HEE, 79.2% via the PCWT and 1.3% submitted no data.[3] The data containing all staff were released bi-annually from September 2016 until September 2017; subsequently data has been released each quarter. There have been seven releases thus far: September 2016, March 2017, September 2017, December 2017, March 2018, June 2018, and September 2018.

The main challenge with conducting an audit of the general practice workforce has been the identification of accurate and complete data. Whilst the *General and Personal Medical Services, England* data give the most complete picture available of all staff employed in general practice, there are nonetheless issues with data completeness.

Completeness depends on two factors, i) zero data submitted via the PCWT and hence extracted from the NWRS or ii) the removal of records by NHS Digital. NHS Digital remove records where incomplete data is given on job role, contracted hours or working hours have a non-zero value and where staff group is not populated or identifiable from the provided job role.[4] Where such an instance arises, data for the entire staff group in that practice is treated as incomplete. NHS Digital do provide estimates for these incomplete records, but these are currently at a CCG level and require assumptions that the values can be inferred by applying average workforce values in England. Since this report concerns GM, CCG, and general practice level assessment we only present data based on those practices with valid, complete records submitted via the PCWT and extracted from the NWRS.

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[2] *General and Personal Medical Services, England* data is available here: https://digital.nhs.uk/data-and-information/publications/statistical/general-and-personal-medical-services/

[3] A detailed discussion on the quality of the *General and Personal Medical Services, England* data can be found here: https://files.digital.nhs.uk/C6/7AF8FE/GPW%2C%20Data%20Quality%20Statement.pdf

[4] See page 4 of: https://files.digital.nhs.uk/C6/7AF8FE/GPW%2C%20Data%20Quality%20Statement.pdf

Baseline assessment: Methodological notes

Average Full Time Equivalent (FTE) figures per 10,000 registered patients for practices with complete data at a GM and CCG level were calculated by summing FTE volumes across practices in an area and dividing by the sum of registered patients in those practices. For GM level data this involved summing staff role (e.g. GP) FTE for the 371 practices with complete data and dividing this by the sum of the registered patients across these 371 practices.

Longitudinal assessment (Sept 2016-Sept 2018): Methodological notes

The longitudinal analysis of the GM general practice workforce is restricted to the 218 practices with complete data at each time point (Appendix 2, Table A 2).

Associations between practice characteristics and staff FTE volume

We test whether there are any associations between practice staff FTE and a range of practice-level characteristics using multivariable regression analysis techniques (linear probability model). This was performed to assess what factors were associated with variations in FTE. Characteristics considered include measures to capture relative workforce pressures via patients' reporting of overall experience and experience of making an appointment, patient self-reported health conditions, need for health care via weighted populations (from the resource allocation formula for primary care (medical) allocations) and practice performance on the QOF (Appendix 2, Table A 3).

Associations between practice characteristics and reporting of complete data

We test whether there are any associations between practice completion and a range of practice-level characteristics using multivariable regression analysis techniques (linear probability model). This is performed for baseline assessments (any missing data and missing data by staff role in September 2018) and for the longitudinal assessment (any missing data through September 2016 to September 2018).

Characteristics considered include measures to capture relative workforce pressures via patients' reporting of overall experience and experience of making an appointment, patient self-reported health conditions, need for health care via weighted populations (from the resource allocation formula for primary care (medical) allocations) and practice performance on the QOF (Appendix 2, Table A 3).

Any significant predictor for practice completion would suggest our analyses may over- or under-represent such practices in accordance with a given variable. For example, if the proportion of list size aged 65 years plus was a significant predictor for incomplete data, the inference would be that the baseline analysis may not reflect the workforce for those practices with relatively older patients on their lists.

The summary statistics for practice characteristics are provided in Table A 6. Outputs from the regressions are contained in Table A 7.

Appendix 2: Summary Statistics and Regression Results

Table A 1 Data completeness by staff role

CCG	Practices	GP data	Nurse data	DPC data	Admin data	Patient size	Complete data
NHS Bolton CCG	50	47 (94.00%)	48 (96.00%)	45 (90.00%)	45 (90.00%)	1 (2.00%)	39 (78.00%)
NHS Bury CCG	30	29 (96.67%)	29 (96.67%)	28 (93.33%)	29 (96.67%)	2 (6.67%)	25 (83.33%)
NHS Heywood, Middleton and Rochdale CCG	41	40 (97.56%)	39 (95.12%)	39 (95.12%)	39 (95.12%)	5 (12.20%)	30 (73.13%)
NHS Manchester CCG	89	81 (91.01%)	84 (94.38%)	82 (92.13%)	80 (89.89%)	0 (0.00%)	65 (73.03%)
NHS Oldham CCG	44	37 (84.09%)	40 (90.91%)	41 (93.18%)	43 (97.73%)	1 (2.27%)	31 (70.45%)
NHS Salford CCG	45	44 (97.78%)	41 (91.11%)	43 (95.56%)	44 (97.78%)	0 (0.00%)	39 (86.67%)
NHS Stockport CCG	40	37 (94.87%)	40 (100.00%)	38 (95.00%)	33 (82.50%)	1 (2.50%)	30 (75.00%)
NHS Tameside and Glossop CCG	39	37 (94.87%)	35 (89.74%)	37 (94.87%)	38 (97.44%)	2 (5.13%)	31 (79.49%)
NHS Trafford CCG	32	30 (93.75%)	31 (96.88%)	32 (100.00%)	30 (93.75%)	0 (0.00%)	28 (87.50%)
NHS Wigan Borough CCG	62	61 (98.39%)	61 (98.39%)	57 (91.94%)	60 (96.77%)	1 (1.61%)	53 (85.48%)
Total	472	443 (93.86%)	448 (94.92%)	442 (93.64%)	441 (93.43%)	13 (2.75%)	371 (78.60%)

DPC: Direct Patient Care

Patient size refers to data being present on the practices registered patient list size

Table A 2 Practices with complete data for each extract (September 2016 to September 2018)

CCG	Practices	Complete data	% coverage
NHS Bolton CCG	50	22	44.00
NHS Bury CCG	30	18	60.00
NHS Heywood, Middleton and Rochdale CCG	41	20	48.78
NHS Manchester CCG	89	32	35.96
NHS Oldham CCG	44	18	40.91
NHS Salford CCG	45	22	48.89
NHS Stockport CCG	40	22	55.00
NHS Tameside and Glossop CCG	39	29	74.36
NHS Trafford CCG	32	12	37.50
NHS Wigan Borough CCG	62	23	37.10
Total	472	218	46.19

Table A 3 Practice characteristics that may be associated with completion of workforce data

Characteristic	Rationale	Source
CCG	Strength of CCG assistance in completion	NHS Digital: CCG associated with practice from workforce dataset[5]
Proportion of list size aged 65 plus	Older populations may require different resources and represent different pressures on time affecting scope to submit data	NHS Digital: practice registered patient list size[6]
QOF 2017/18 performance	QOF may reflect record keeping and/or processes that may reflect capacity to complete workforce returns	NHS Digital[7]
Proportion patients residing in most deprived IMD quintile	Practices with more deprived patients may have greater pressures and lower capacity to return workforce data	GP Patient Survey[8]
Proportion of patients reporting "Very Good" or "Fairly Good" for overall experience of making an appointment	Poor experience of making an appointment may reflect capacity issues in the practice	GP Patient Survey
Proportion of patients reporting "Very Good" or "Fairly Good" for overall experience of their practice	Poor overall experience of the practice may reflect capacity issues	GP Patient Survey
Proportion of patients reporting a long-term physical or mental health conditions, disabilities or illness	Sicker patients may represent greater pressure for practices and less capacity to complete workforce returns	GP Patient Survey
Weighted population	Weighted populations used to calculate primary medical care budget shares reflect variations in the need for health care over and above size. More needier populations may provide less capacity to complete workforce returns	NHS England: Primary Care (medical) weighted populations[9]

[5] https://digital.nhs.uk/data-and-information/publications/statistical/general-and-personal-medical-services/
[6] https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/general-practice-data-hub/patients-registered-at-a-gp-practice
[7] https://qof.digital.nhs.uk/
[8] http://gp-patient.co.uk/about
[9] https://www.england.nhs.uk/allocations/

Table A 4 Summary statistics for September 2018 FTE volume models

Variable	Number practices	Mean	Minimum	Maximum
GP FTE per 10,000	371	4.12	0.0000	10.69
Nurse FTE per 10,000	371	2.42	0.0000	27.45
DPC FTE per 10,000	371	1.24	0.0000	19.36
Admin FTE per 10,000	371	11.82	0.0000	70.59
NHS Bolton CCG	371	0.1051	0.0000	1.0000
NHS Bury CCG	371	0.0674	0.0000	1.0000
NHS Heywood, Middleton and Rochdale CCG	371	0.0809	0.0000	1.0000
NHS Manchester CCG	371	0.1752	0.0000	1.0000
NHS Oldham CCG	371	0.0836	0.0000	1.0000
NHS Salford CCG	371	0.1051	0.0000	1.0000
NHS Stockport CCG	371	0.0809	0.0000	1.0000
NHS Tameside and Glossop CCG	371	0.0836	0.0000	1.0000
NHS Trafford CCG	371	0.0755	0.0000	1.0000
NHS Wigan Borough CCG	371	0.1429	0.0000	1.0000
QOF performance	371	0.9636	0.6589	1.0000
% patients aged 65+	371	0.1532	0.0072	0.8961
Experience of making appointment	371	0.7375	0.3750	1.0000
Overall experience with practice	371	0.8752	0.5921	0.9905
% with long-term condition	371	0.5217	0.2473	1.0000
% in most deprived tertile	371	0.4957	0.0000	1.0000
Weighted population	371	6276.19	1283.59	19127.55

Table A 5 Regression results for September 2018 volume of staff FTE

	FTE GP per 10,000	FTE Nurse per 10,000	FTE DPC per 10,000	FTE Admin per 10,000
NHS Bolton CCG	0.242	0.718	0.492	1.255
NHS Bury CCG	-0.054	0.029	0.350	-0.069
NHS HMR CCG	0.063	0.464	0.311	0.776
NHS Manchester CCG	0.253	0.472	0.445	-0.337
NHS Oldham CCG	0.036	0.460	0.616	0.744
NHS Salford CCG	0.313	1.451**	1.059**	2.790*
NHS Stockport CCG	0.353	-0.346	0.301	-0.150
NHS Tameside and Glossop CCG	-0.067	0.076	0.944**	0.246
NHS Trafford CCG (base)	-	-	-	-
NHS Wigan Borough CCG	-0.072	0.481	-0.104	0.078
QOF performance	0.040	2.372	0.476	-0.725
% patients aged 65+	1.882	16.576***	12.487***	42.124***
Experience of making appointment	-1.044	2.032	-0.542	2.417
Overall experience with practice	6.245*	-4.251*	-2.543	-6.694
% with long-term condition	2.62	1.800	-0.438	2.423
% in most deprived tertile	-0.506	1.117*	1.109**	4.732***
Weighted population	<0.001	<0.001	<0.001	-0.0002***
Constant	-2.046	-1.875	0.868	7.57
N	371	371	371	371

*** p<0.001, ** p<0.010, *p<0.050

Results from Ordinary Least Squares regressions of staff FTE per 10,000

Table A 6 Sample summary statistics for complete data submission models

Variable	Number practices	Mean	Minimum	Maximum
Any missing (Sept 2018)	465	0.2022	0.0000	1.0000
GP missing (2018)	465	0.0602	0.0000	1.0000
Nurse missing (2018)	465	0.0495	0.0000	1.0000
DPC missing (2018)	465	0.0645	0.0000	1.0000
Admin missing (2018)	465	0.0645	0.0000	1.0000
Any missing (all extracts)	465	0.4688	0.0000	1.0000
NHS Bolton CCG	465	0.1054	0.0000	1.0000
NHS Bury CCG	465	0.0645	0.0000	1.0000
NHS Heywood, Middleton and Rochdale CCG	465	0.0774	0.0000	1.0000
NHS Manchester CCG	465	0.1914	0.0000	1.0000
NHS Oldham CCG	465	0.0946	0.0000	1.0000
NHS Salford CCG	465	0.0968	0.0000	1.0000
NHS Stockport CCG	465	0.0860	0.0000	1.0000
NHS Tameside and Glossop CCG	465	0.0839	0.0000	1.0000
NHS Trafford CCG	465	0.0688	0.0000	1.0000
NHS Wigan Borough CCG	465	0.1312	0.0000	1.0000
QOF performance	465	0.9623	0.6193	1.0000
% patients aged 65+	465	0.1498	0.0072	0.8961
Experience of making appointment	465	0.7337	0.3750	1.0000
Overall experience with practice	465	0.8684	0.5205	0.9905
% with long-term condition	465	0.5197	0.2473	1.0000
% in most deprived tertile	465	0.5147	0.0000	1.0000
Weighted population	465	6119.65	1169.95	19127.55

Table A 7 Regression results for practice completion

	Any missing (Sept 2018)	GP missing (2018)	Nurse missing (2018)	DPC missing (2018)	Admin missing (2018)	Any missing (all extracts)
NHS Bolton CCG	0.029	-0.054	-0.024	0.098	0.002	0.208
NHS Bury CCG	0.035	-0.037	0.015	0.066	-0.023	0.280*
NHS HMR CCG	-0.030	-0.088	0.014	0.037	-0.026	0.312*
NHS Manchester CCG	0.077	-0.035	0.015	0.070	0.011	0.093
NHS Oldham CCG	0.088	0.046	0.035	0.048	-0.059	0.200
NHS Salford CCG	-0.044	-0.077	0.053	0.048	-0.050	0.269*
NHS Stockport CCG	0.137	0.021	-0.020	0.055	0.117*	0.194
NHS Tameside and Glossop CCG	0.027	-0.048	0.069	0.036	-0.041	0.483***
NHS Trafford CCG (base)	-	-	-	-	-	-
NHS Wigan Borough CCG	-0.027	-0.060	-0.015	0.074	-0.028	0.139
QOF performance	-0.183	0.022	-0.206	0.171	-0.024	0.602
% patients aged 65+	-0.063	-0.066	-0.039	-0.081	0.225	-0.716
Experience of making appointment	0.499	0.083	0.419**	0.226	0.136	-0.459
Overall experience with practice	-1.389***	-0.522**	-0.882***	-0.638*	-0.382	1.024*
% with long-term condition	0.112	0.036	-0.080	0.095	-0.184	0.034
% in most deprived tertile	0.066	0.080	-0.006	-0.007	0.069	-0.222
Weighted population	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001***
Constant	1.145**	0.424	0.746**	0.214	0.328	-0.895
N	465	465	465	465	465	465

*** p<0.001, ** p<0.010, *p<0.050
Results from linear probability models (Ordinary Least Squares)
Analyses are based on 465 practices rather than the 472 in the September 2018 data due to the lack of explanatory variable measures for new practices introduced into the data at the September 2018 wave

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