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Productivity of the English National Health Service: 2018/19 Update

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Executive Summary

This report updates the Centre for Health Economics' time-series of National Health Service (NHS) productivity growth for the period 2017/18 to 2018/19. This update has not been affected by the COVID-19 pandemic.

NHS productivity growth is measured by comparing the growth in outputs produced by the NHS to the growth in inputs used to produce them. NHS outputs include all the activities undertaken for NHS patients wherever they are treated in England. It also accounts for changes in the quality of care provided to those patients. NHS inputs include the number of doctors, nurses and support staff providing care, the equipment and clinical supplies used, and the facilities of hospitals and other premises where care is provided.

In this update, we implemented the following methodological changes compared to previous years:

- We include in our baseline NHS output and productivity growth measures an adjustment for working and total days (since 2015/16). This adjustment is explained in detail in section 2.4;
- We employ a new dataset to measure activity carried out in the primary care setting, namely the NHS Digital GP appointments data. A detailed description of the new data and the methods used can be found in section 5.6;
- We employ a more precise agency deflator, developed by the Department of Health and Social Care (DHSC) as part of the NHS Cost Inflation Index, to deflate expenditure on agency staff. Further details can be found in sections 6.2.2 and in Appendix C, section 10.1;
- We explicitly account for expenditure on bank staff (since 2015/16) refining both our indirect and mixed input growth measures.

Between 2017/18 and 2018/19, NHS productivity decreased by 0.75% when using the mixed measure of NHS input growth, which includes a direct (volume) growth measure for NHS Staff and an indirect (based on expenditure data) growth measure for materials and capital. The NHS productivity measure was also negative (-0.64%) when relating NHS output growth to a full indirect measure of NHS input growth. The negative growth in NHS productivity registered in 2018/19 was due to a slower growth in NHS output (2.20%) and a concurrent higher increase in NHS input growth (equal to 2.97% and 2.86% respectively for the mixed and indirect input growth measures).

Glossary of acronyms

A&E	Accident & Emergency
AD	Admitted
CCG	Clinical Commissioning Group
CHD	Coronary Heart Disease
CIPS	Continuous Inpatient Spell
CSU	Commissioning Support Unit
DHSC	Department of Health and Social Care
ESR	Electronic Staff Record
EQ-5D	EuroQol five dimensions standardised instrument for measuring generic health status
FCE	Finished Consultant Episode
FOI	Freedom of Information
FTE	Full-time Equivalent
GPPS	GP Patient Survey
HCHS	Hospital and Community Health Services
HES	Hospital Episode Statistics
HRG(4/4+)	Healthcare Resource Group (version 4/4+)
ISHP	Independent Sector Health Care Provider
IAPT	Improving Access to Psychological Therapies
MH	Mental Health
NAD	Not admitted
NHS	National Health Service
ONS	Office for National Statistics
PCA	Prescription Cost Analysis
PCT	Primary Care Trust
PROMs	Patient Reported Outcome Measures
PSSRU	Personal & Social Services Research Unit
QOF	Quality and Outcomes Framework
RC	Reference Costs
RDNA	Regular Day and Night Attendance
TAC	Trust Accounts Consolidation

Contents

1. Introduction

This report forms part of the time series of English National Health Service (NHS) productivity growth calculated at the Centre for Health Economics, University of York. In this report, we focus on growth from 2017/18 to 2018/19. An analysis of the longer time series is also provided where appropriate.[1]

The NHS productivity growth (growth in the value of outputs divided by growth in the expenditure on inputs) is calculated by means of a Laspeyres volume chain index. In this way, different NHS inputs and outputs are valued in terms of their cost in the first (base) year, in order to identify volume changes in the next year. As our method employs a chain index, the base year changes with each new update. We also employ available measures of quality where possible, in recognition that the value of outputs may not be entirely reflected in the cost of their provision, especially outside of a competitive market context. In particular, we use short-term survival rates for both elective and non-elective hospital care, changes in health status and waiting times for elective hospital care only, whilst activity delivered in the primary care setting is adjusted based on the changes regarding blood pressure monitoring. Where possible, we use a direct measure of growth, which is feasible when both unit costs and volumes of each unit of input or output are available. When only expenditure data are available, we disentangle changes in terms of volume and inflation by using appropriate deflators. We use direct measures for all sources of output and for NHS staff. We use indirect measures for bank staff, agency staff, materials, and capital. We also consider a purely indirect measure for inputs, where all labour inputs are considered in terms of expenditure. These methodological approaches are in line with national and international accounts recommendations (Eurostat, 2001).

A brief section on the methods used in calculating Total Factor Productivity of the English health care system is included in this report before presenting our findings for the most recent two financial years, i.e. between 2017/18 and 2018/19. In our 2017/18 NHS productivity update, we investigated the impact on the NHS output and productivity measures of adjusting for working days, as a separate sensitivity analysis. In this update, the working day adjustment forms an integral part of the calculation of our measures of health system productivity growth. We also introduced expenditure information on bank staff in our indirect and mixed input measures as a sensitivity analysis for the update to 2017/18. This now also forms an integral part of our NHS productivity growth measure.

The remainder of the report is organised as follows: first, we consider our findings for productivity growth; we then consider increasingly small constituent parts of this overall result, beginning with NHS outputs and inputs overall. Individual items of NHS outputs and inputs are investigated in Sections 5 and 6, respectively. Throughout, we highlight where artefacts of the data threaten a like for like comparison and how we have managed these cases. Historical results are largely presented as figures in the main text, with tables of figures limited to Appendix A.

Appendix B reports the results of our sensitivity analysis on Mental Health output and its effect on the NHS output and productivity growth measures when Secure Mental Health activity is included in the computation of NHS output and productivity growth.

Finally, in Appendix C we provide a more in-depth description of input deflators used in our analysis, as well as the results for NHS Trusts only outputs, inputs and productivity growth measures.

[1] For a longer time series, since 1998/99, see Bojke et al. (2017).

2. Methods

We measure Total Factor Productivity growth, ΔTFP, of the healthcare system, as the ratio of an output growth index (X) and an input growth index (Z), such that:

$$\Delta TFP=[X/Z] \quad \text{(E1)}$$

In order to estimate Total Factor Productivity, it is necessary to correctly define and measure both output and input indices.

2.1. Output growth

Quantification of health care output is a challenge because patients have varied health care requirements and receive very different packages of care. To address this, it is necessary to classify patients into reasonably homogenous output groupings, such as Healthcare Resource Groups (HRGs) or Reference Cost (RC) categories. Furthermore, in order to aggregate these diverse outputs into a single index, some means of assessing their relative value is required. Usually, prices are used to assess value, but prices are not available for the vast majority of NHS services, which are provided free at the point of use. In common with the treatment of other non-market sectors of the economy in the national accounts, costs are used to indicate the value of health services. Costs reflect producer rather than consumer valuations of outputs, but have the advantage of being readily available (Eurostat, 2001).

As costs are not expected to fully reflect consumers' valuations, Atkinson suggests supplementing costs with information about the quality of non-market goods and services (Atkinson, 2010, Atkinson, 2005). One way of doing this is by adding a scalar to the output index that captures changes over time in different dimensions of quality. Thus, following Castelli et al. (2007), the output growth index (in its Laspeyres form) can be calculated across two time periods as:

$$X^{cq}_{(0,t)} = \frac{\sum_{j=1}^{J} x_{jt} c_{j0} \left[\frac{v_{j0} q_{jt}}{q_{j0}}\right]}{\sum_{j=1}^{J} x_{j0} c_{j0}} \quad \text{(E2)}$$

We define x_j as the number of patients who have output type j, where j=1…J; c_j indicates the cost of output j; q_j represents a unit of quality for output j, and v_j is the value of this unit of quality; and t indicates time with 0 indicating the first period of the time series. Our measures of quality include inpatient and outpatient waiting times, health improvements, survival rates following hospitalisation, and primary care blood pressure management.

2.2. Input growth

Turning to the input growth index (Z), inputs into the health care system consist of labour, material goods and capital. Growth in the use of these factors of production can be calculated directly or indirectly (OECD, 2001). A direct measure of input growth can be calculated when data on the volume and price of inputs are available. In its Laspeyres form, the direct input growth index can be calculated as:

$$Z^{D}_{(0,t)} = \frac{\sum_{n=1}^{N} z_{nt} \omega_{n0}}{\sum_{n=1}^{N} z_{n0} \omega_{n0}} \quad \text{(E3)}$$

where z_n is the volume of input of type n and ω_{n0} is the price of input type n; and t indicates time with 0 indicating the first period of the time series.

However, data about the volume of inputs are rarely available. It is, therefore, common practice to calculate input growth using expenditure data. Changes in expenditure are driven by both changes in the volume of resource use and in prices. Hence, to isolate the volume effect, it is necessary to wash out price changes by converting 'current' monetary values into 'constant' expenditure using an appropriate deflator π_{nt}. This deflator reflects the underlying trend in prices for the input in question, such that $\omega_{nt+1} = \pi_{nt}\omega_{nt}$.

If expenditure data and deflators are available, the input growth index can be specified as:

$$Z^{Ind}_{(0,t)} = \frac{\sum_{n=1}^{N} E_{nt}/\pi_{n0}}{\sum_{n=1}^{N} E_{n0}} = \frac{\sum_{n=1}^{N} z_{nt}\omega_{nt}/\pi_{n0}}{\sum_{n=1}^{N} z_{n0}\omega_{n0}} = \frac{\sum_{n=1}^{N} z_{nt}\omega_{n0}}{\sum_{n=1}^{N} z_{n0}\omega_{n0}} = Z^{D}_{(0,t)} \quad \text{(E4)}$$

This is equivalent to using volume data, provided that deflators correctly capture the trend in prices for each input in question.

2.3. Productivity growth

The above equations show output or input growth over two consecutive periods from a base (0) to a current period (t). Usually, there is interest in assessing productivity growth over longer periods of time. We do this by means of a chained index that involves updating weights in every period, thereby making it possible to account for ongoing changes in the composition of the outputs and inputs being measured (Diewert et al., 2010).

Using the Laspeyres output index as defined in eq. (E2), a chained output index takes the following form:

$$X^{cq}_{(0,T)} = \frac{\sum_{j=1}^{J} x_{jt}c_{j0}\left[\frac{v_{j0}q_{jt}}{q_{j0}}\right]}{\sum_{j=1}^{J} x_{j0}c_{j0}} \times \frac{\sum_{j=1}^{J} x_{jt+1}c_{jt}\left[\frac{v_{jt}q_{jt+1}}{q_{jt}}\right]}{\sum_{j=1}^{J} x_{jt}c_{jt}} \times \cdots \times \frac{\sum_{j=1}^{J} x_{jT}c_{jT-1}\left[\frac{v_{jT}q_{jT}}{q_{jT-1}}\right]}{\sum_{j=1}^{J} x_{jT-1}c_{jT-1}} \quad \text{(E5)}$$

This can be simplified to:

$$X^{cq}_{(0,T)} = X^{cq}_{(0,t)} \times X^{cq}_{(t,t+1)} \times \cdots \times X^{cq}_{(T-1,T)} \quad \text{(E6)}$$

where each link is represented by eq. (E2) for the relevant two consecutive years. An analogous construction applies to the chained input index.

2.4. Working days adjustment

Our measure of productivity growth captures the growth in outputs over growth in inputs between two financial years. However, financial years do not always have the same number of working days, with this number being affected by the number of public holidays in each financial year (e.g. financial years may include between zero and four Easter public holidays) and position of weekends during the year. The total number of days will also vary due to leap years.

It is expected that changes in the number of working days in a given year will impact the level of output produced in the NHS and hence impact the productivity of the system. Therefore, we adjust the Laspeyres output growth measure to capture the effect of changes in the number of working days between pairs of years. Expressions (E7) and (E8) present the Laspeyres output growth formulae (for the cost-weighted measure) with working days (WD) and total days (TD) adjustment respectively. For example, if the number of working days in year *t=0* is smaller than the number of working days in year *t=1,* then the working days adjustment should indicate both lower output and productivity growth

estimates, with respect to the same measures with no working days adjustment. The same logic applies to the total days adjustment.

$$X_{(0,t)}^{wd} = \frac{\sum_{j=1}^{J} \frac{x_{jt} c_{j0}}{\frac{wd_t}{wd_0}}}{\sum_{j=1}^{J} x_{j0} c_{j0}} \quad \text{(E7)}$$

$$X_{(0,t)}^{td} = \frac{\sum_{j=1}^{J} \frac{x_{jt} c_{j0}}{\frac{td_t}{td_0}}}{\sum_{j=1}^{J} x_{j0} c_{j0}} \quad \text{(E8)}$$

Whilst the productivity of all NHS care settings will be affected by the total number of days in a given year, we conjecture that not all the settings will be affected by the total number of working days. Some settings, such as A&E services or non-elective inpatient care, should not be affected by variation in weekends and public holidays, as it is expected that these operate on a 24/7 basis. Finally, the great majority of NHS inputs, for example salaried staff and capital costs, are not affected by the number of working days. Therefore, no adjustment is applied to them. Some materials, e.g. bandages, may be affected. However, their contribution to overall NHS input growth is small, and the effect of not adjusting these inputs for the number of working days is negligible.

Table 1 contains the list of NHS settings, as developed for our NHS output growth measure, and indicates whether the working days or total days adjustment is applied. It is important to note that adjusting for working days, by definition, recognises a change in total days.[2]

Table 1: NHS settings and their working days/total days adjustment

Setting	WD Adjustment	TD Adjustment
Inpatient Elective and Day Cases	x	
Inpatient Non-elective		x
Outpatient	x	
Primary care	x	
Community Prescribing		x
Community Mental Health		x
Community care	x	
A&E		x
Chemo- /Radiotherapy/High Cost Drugs	x	
Specialist Services	x	
Ophthalmology & Dentistry	x	
Radiology	x	
Diagnostic Tests	x	
Rehabilitation	x	
Renal Dialysis		x
Other	x	

[2] A table reporting working and total days for the financial years 2016/17, 2017/18 and 2018/19 is presented in Appendix C, section 10.3.

3. Productivity Growth

Overall NHS productivity growth between 2017/18 and 2018/19 was -0.75% when using the mixed measure and -0.64% using the indirect measure. This is the first negative growth in NHS productivity since 2014/15 – 2015/16.

In Table 2 we present the productivity growth measures, both mixed and indirect, for 2016/17 – 2017/18 and 2017/18 – 2018/19, adjusted for the number of working and total days in both financial years. Productivity growth figures for previous years, beginning with growth from 2004/05 to 2005/06, can be found in Appendix A.

The figures for the 2017/18 – 2018/19 link also reflect the use of the new agency deflator and as such are not directly comparable with the productivity growth rates for the previous link. However, using the Electronic Staff Record (ESR) deflator (see section 10.1 in Appendix C for further details) indicates productivity growth of -0.51% and -0.40%, for the mixed and the indirect measures respectively between 2017/18 and 2018/19. The difference in negative growth can be reconciled to the negative inflation in agency staff costs, which mitigates the negative growth in agency staff expenditure (in real terms) recorded since 2016/17.[3]

Table 2: NHS Productivity Growth[4]

Years	Mixed	Indirect
2016/17 – 2017/18	1.70%	0.54%
2017/18 – 2018/19	-0.75%	-0.64%

The negative growth in NHS productivity registered in 2018/19 is due to both a slower increase in NHS output growth and a concurrent increase in input growth. The details of changes in both NHS outputs and inputs are shown in Figure 1, indexed to 2004/05 – 2005/06.

[3] Agency staff growth (real terms) was equal to -21.56% and -17.74%, respectively for the links 2015/16 – 2016/17 and 2016/17 – 2017/18. This negative growth would have continued if we had applied the same CHE NHS Staff deflator, giving us a growth of -2.65% for agency staff for the link 2017/18 – 2018/19.

[4] The figures reported in Table 2 include the working days adjustment. The productivity growth rates for 2016/17 – 2017/18 differ from those reported in Castelli et al. (2020) as we have re-calculated the input growth for this link to correct for a coding error.

Figure 1: NHS Output and Input Indices (Mixed Method) 2004/05-05/06 to 2017/18-18/19

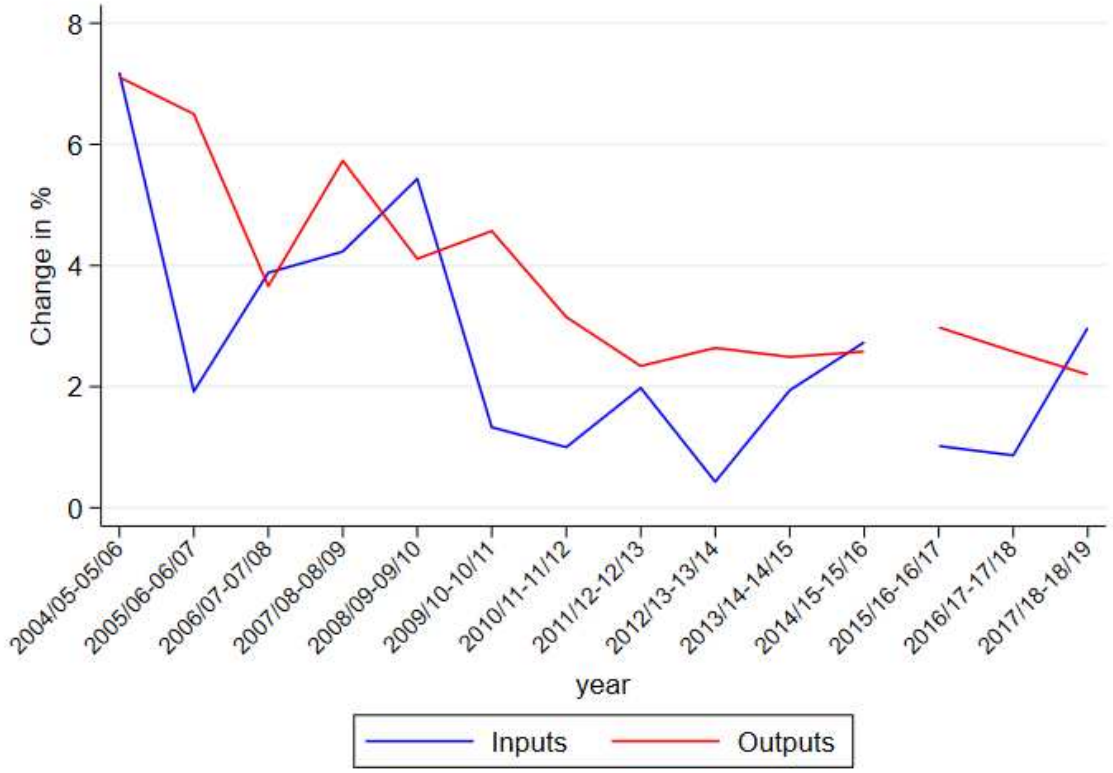
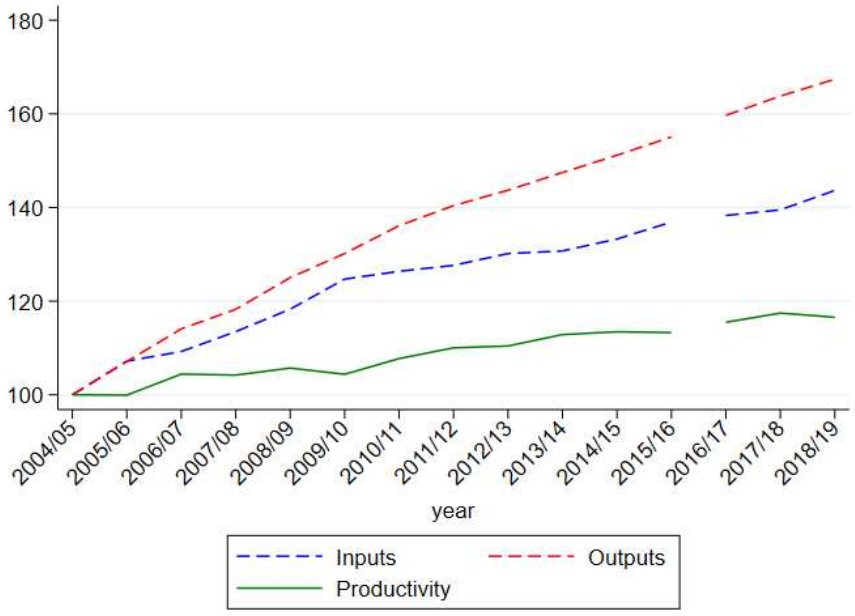


Figure 2 presents the cumulative NHS outputs, inputs and productivity indices over time, using 2004/05 as the index year (year 0). It can be seen from this figure that outputs grew by over 67% between 2004/05 and 2018/19, while inputs grew by just under 44%. As a result, productivity increased by just over 17% by 2017/18, with a decrease recorded in 2018/19. The figure also shows productivity growth has been relatively stable over time, with an average growth rate of 1.11% per annum (mixed method).

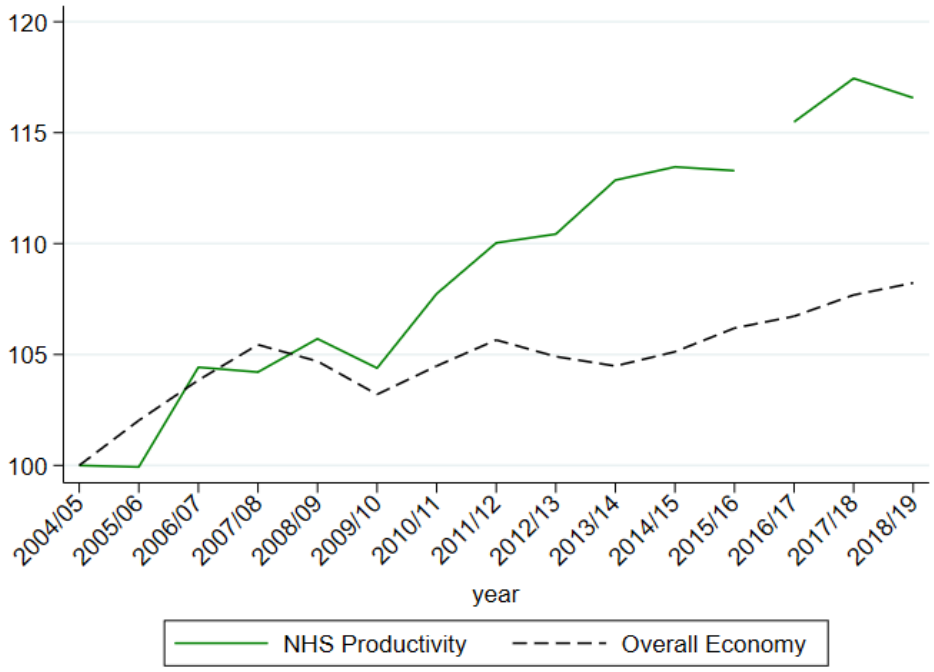
Figure 2: Cumulative NHS Output, Input and Productivity Indices Over Time



A further and final comparison is that between productivity growth of the NHS and growth of the UK economy as a whole. To measure productivity growth in the wider economy, we employ the Gross Value Added per Hour measure, a measure of Labour productivity of the whole economy, produced by the Office of National Statistics (ONS). This is the main productivity measure produced by ONS and while the methodology differs across sectors, the overall objectives are the same as our NHS specific measure.[5,6]

Figure 3 indicates that NHS productivity growth since 2004/05 is still higher than that of the overall economy; however, in the latest financial year it has slowed down compared to that of the overall economy.

Figure 3: Cumulative NHS and Whole Economy Indices over Time



[5] https://webarchive.nationalarchives.gov.uk/20160128204104/http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/national-accounts/gva/relationship-gva-and-gdp/gross-value-added-and-gross-domestic-product.html (last accessed 15/12/2020).

[6] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/labourproductivitytables110andr1 (last accessed 15/12/2020).

4. Overall output and input growth

4.1. Output growth

Output growth is measured by combining activities of different types into a single index, using costs to reflect their values. As shown in Table 3, the cost-weighted working days adjusted output growth amounted to 1.65% between 2017/18 and 2018/19, a decrease of 0.58 percentage points from the previous financial year.

Re-scaling each type of cost-weighted output, where appropriate and feasible, according to changes in survival, health improvements, waiting times, and blood pressure monitoring generates the quality-adjusted index. Output growth after quality adjustment was 2.20% between 2017/18 and 2018/19. This is about 0.55 percentage points higher than the cost-weighted index. It is driven by improvements registered in some of the quality measures; specifically, survival rates for non-elective inpatient care, survival rates for elective and non-elective mental health care, waiting times for mental health patients, one of the two Patient Reported Outcome measures (PROMS), as well as Quality and Outcomes Framework (QOF) achievements in primary care for Stroke, Coronary Heart Disease (CHD) and Hypertension. At the same time deteriorations in quality were observed in waiting times for hospital inpatient activity.

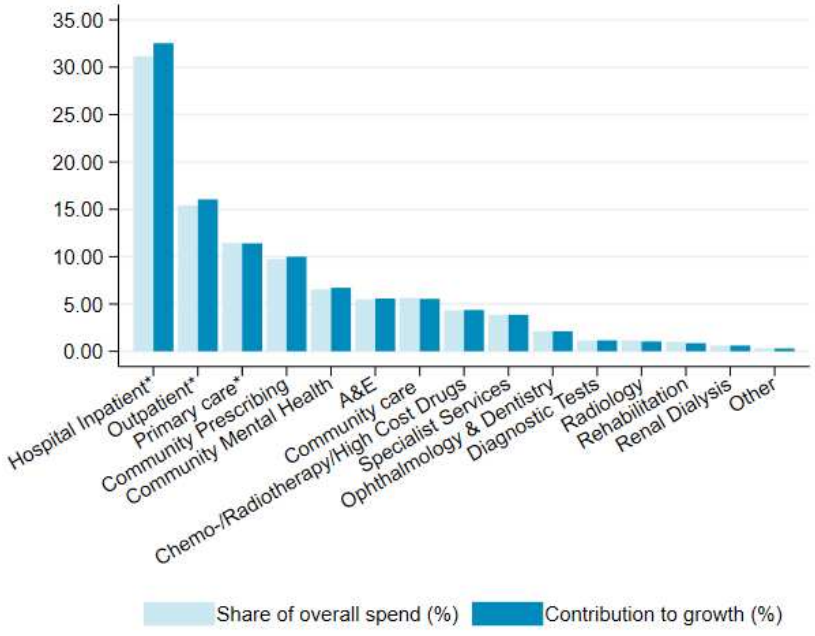
Table 3: Output growth

Years	Cost-weighted Growth (CW)	Quality-adjusted CW growth
2016/17 – 2017/18	2.23%	2.58%
2017/18 – 2018/19	1.65%	2.20%

4.1.1. Contribution by settings

Not all settings contribute equally to the output index. Figure 4 shows the share of overall spend for each of the settings as well as their contribution to growth, calculated as a share of overall spend multiplied by the output growth of the setting. More detailed information about the contribution of each setting can be found in Table 4. A detailed breakdown of output growth for each setting is presented in section 5.

Figure 4: Contribution to output growth by setting, 2018/19



* Hospital Inpatient, Outpatient and Primary Care activity are quality-adjusted.

By far the largest contributor to the output index is Hospital Inpatient activity, with a share of 31% of total spend and 32% of overall output growth. Other sizeable contributors (in order of overall contribution to output growth) are Outpatient activity, Primary care, Community Prescribing and Community Mental Health. All other settings each contributed less than 6% to the total value of output growth.

Table 4: Contribution to output growth by setting, 2018/19

Setting	Growth rate	Setting specific growth index	Value of Activity in 2017/18	Share of overall spend	Contribution to overall growth rate**
Hospital Inpatient*	4.50%	104.50%	29,056,508,816	31.14%	32.54%
Outpatient*	4.09%	104.09%	14,379,934,119	15.41%	16.04%
Primary care*	-0.39%	99.61%	10,678,713,674	11.45%	11.40%
Community Prescribing	2.49%	102.49%	9,095,228,060	9.75%	9.99%
Community Mental Health	2.67%	102.67%	6,109,795,525	6.55%	6.72%
A&E	1.66%	101.66%	5,115,647,464	5.48%	5.57%
Community care	-1.66%	98.34%	5,258,850,345	5.64%	5.54%
Chemo-/Radiotherapy/High Cost Drugs	1.22%	101.22%	4,024,361,358	4.31%	4.37%
Specialist Services	0.17%	100.17%	3,603,609,906	3.86%	3.87%
Ophthalmology & Dentistry	-0.64%	99.36%	1,999,304,846	2.14%	2.13%
Diagnostic Tests	2.01%	102.01%	1,065,314,789	1.14%	1.16%
Radiology	-9.85%	90.15%	1,083,631,013	1.16%	1.05%
Rehabilitation	-13.96%	86.04%	940,152,575	1.01%	0.87%
Renal Dialysis	-0.21%	99.79%	578,078,058	0.62%	0.62%
Other	-3.92%	96.08%	311,433,274	0.33%	0.32%
Total/NHS output growth rate			**93,300,563,822**		**2.20%**

* Hospital Inpatient, Outpatient and Primary Care activity are quality-adjusted. ** The contribution of each setting to growth in 2018/19 is expressed as a percentage of the total output in 2017/18. Where numbers in this column are lower than numbers in the preceding column, this represents negative growth in output for that setting.

4.2. Input growth

Table 5 presents growth in inputs for the last two links, 2016/17 – 2017/18 and 2017/18 – 2018/19 using the mixed and indirect methods. The mixed method, our preferred approach, uses Electronic Staff Record (ESR) data to calculate growth in NHS labour inputs and combines this information with expenditure data from published accounts for the remaining inputs used in the production of health care goods and services. In this new update, we explicitly account for bank staff expenditure, thus allowing us to relax the assumption that growth in bank staff is similar to growth in NHS staff.

The indirect method uses expenditure data for all types of inputs, derived from Hospital Trusts' and other NHS organisations' financial accounts. We use appropriate deflators to obtain an estimate of input volume growth. In 2018/19 a specific deflator for agency staff expenditures was produced by DHSC within the NHS Cost Inflation Index, allowing us to obtain a more precise estimate of agency staff expenditure growth in real terms (see Appendix C for more details on the agency deflator). In our

baseline input growth figures we employed the agency deflator. However, in order to allow comparability with the input growth rates for 2016/17 – 2017/18, we report in Table 5 the growth rates for 2017/18 – 2018/19, employing the previously used ESR deflator for agency staff expenditure, as well as the new agency deflator (indicated by '*').

We first compare the latest growth rates (i.e. link 2017/18 – 2018/19) using the ESR deflator with those from the previous two financial years. We note two major differences: (1) the mixed method now indicates a substantially larger increase in input growth (2.72% vs 0.87%); (2) the mixed and the indirect growth rates are more aligned compared to recent previous years. The reason for this convergence may be due to the slowdown in both the negative growth of agency staff expenditure and the positive growth in bank staff expenditure.[7]

Finally, when using the more appropriate agency deflator, we found that the use of agency staff in real terms actually increased (Table 6), as opposed to the figures reported in the previous year. This translated to a higher growth for both the mixed and indirect input growth measures, respectively equal to 2.97% and 2.86%. Importantly, even though more agency staff have been employed in 2018/19, nominal expenditure on agency staff actually fell, which may be an indication of more efficient resource use by health care providers. For example, the influence of policies introduced in 2015 aimed at reducing total spend on agency staff, by introducing cost-per-hour caps (NHS England and NHS Improvement (2019), Monitor (2015)).

Table 5: Input growth[8]

Years	**All NHS**	
	Mixed	**Indirect**
2016/17 – 2017/18	0.87%	2.02%
2017/18 – 2018/19	2.72%	2.61%
2017/18 – 2018/19*	2.97%	2.86%

* Figure produced using the new deflator for agency staff.

A breakdown of contributions to the growth in inputs is presented in Table 6. While the shares of different input types in overall spend and their contribution to growth do not markedly differ from those reported for 2017/18, we now observe an increase in growth rates across all types of inputs, including those that had a negative growth in 2016/17 – 2017/18, i.e. agency, capital and primary care.

[7] For a detailed explanation of one of the reasons potentially leading to the divergence of estimates between the two methods, see page 10 in Castelli et al. (2020).

[8] The baseline mixed method calculation of input growth explicitly accounts for bank staff. Slight discrepancies with the previously published 2016/17 – 2017/18 figures are due to the correction of a coding error.

Table 6: Contribution to input growth, 2018/19

Input type	Growth rate	Setting specific growth index	Value of Activity in 2017/18	Share of overall spend	Contribution to overall growth rate
Labour (Direct) (Labour (Indirect, excl. agency and bank staff))*	2.43% (2.17%)	102.43% (102.17%)	48,331,198	44.09%	45.16% (45.05%)
Agency	8.69%	108.69%	2,406,798	2.20%	2.39%
Bank	13.11%	113.11%	2,974,000	2.71%	3.07%
Materials	1.99%	101.99%	25,218,132	23.01%	23.47%
Capital	7.32%	107.32%	8,209,723	7.49%	8.04%
Primary care	1.15%	101.15%	13,378,869	12.21%	12.35%
Prescribing	2.49%	102.49%	9,095,228	8.30%	8.50%
Total			**109,613,947**		**2.97% (2.86%)**

* Direct: Labour input measured by FTE counts and national average wages provided in the Electronic Staff Record; Indirect: Labour input measured by expenditure on staff, provided in published Trust financial accounts. Figures reported use the new NHS Cost Inflation Index agency deflator.

5. Growth in output categories

5.1. Measuring output

Our NHS output index is designed to capture all activities provided to NHS patients, whether by NHS or private sector organisations.[9] Table 7 summarises the data sources used to measure activity, quality and costs, and also indicates specific measurement issues that have been tackled in constructing the output growth index for 2017/18 – 2018/19. The data and these specific issues are detailed in the remainder of this section. It should be noted that we have two alternative sources of volume of activity for outpatient output: the Hospital Episode Statistics (HES) outpatient dataset, and the Reference Costs (RC) database. In this report, we compare outpatient activity derived from both datasets, but use the HES outpatient figures in our NHS Output growth measure.

Table 7: Summary of NHS output data sources

Output type	Activity source	Cost source	Quality	Notes for 2017/18 & 2018/19 data
Elective	HES	RC	In-hospital survival; health outcomes waiting times	Activity described by HRG4+
Non-elective	HES	RC	In-hospital survival; health outcomes	Activity described by HRG4+
Outpatient	HES (or RC)	RC	Waiting times	Waiting time comes from HES; Two sources of activity data
Mental health	HES & RC	RC	In-hospital survival health outcomes waiting times	Activity described by HRG4+
Community care	RC	RC	N/A	
A&E	RC	RC	N/A	
Other*	RC	RC	N/A	
Primary care	QResearch (up to 2008/09); General Lifestyle Survey (2008/09-09/10); GP patient survey (from 2009/10) NHS Digital Appointments in General Practice data (from Nov 2017)	PSSRU Unit Costs of Health and Social Care + other sources	QOF data	Uplift survey responses by population growth; changes in QOF data No uplift necessary; changes in QOF data
Prescribing	Until 2017/18, Prescription cost analysis system (PCA) From 2018/19, NHS Business Service Authority (BSA)	PCA system	N/A	
Ophthalmic and dental services	NHS Digital	NHS Digital	N/A	

* Radiotherapy & High Cost Drugs, Diagnostic Tests, Hospital/patient Transport Scheme, Radiology, Rehabilitation, Renal Dialysis, Specialist Services

[9] NHS activity provided by non-NHS providers was included in the output growth series up to 2010/11.

5.2. HES inpatient, day case and mental health

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for elective and day case output was 1.84% and for non-elective output was 3.75%, with a combined overall NHS cost-weighted activity output growth of 2.66%.**
- **After adjusting for changes in quality, the total Laspeyres output growth of NHS elective, day case and non-elective activity was 4.48%. The effect of accounting for quality is positive and adds close to two percentage points to the cost-adjusted measure.**

We employ the HES Admitted Patient Care (APC) dataset to identify inpatient (day case, elective and non-elective hospital care) activity. Activity is recorded at the Finished Consultant Episode (FCE) level and includes both physical and mental health inpatient care.[10] In 2018/19, there were around 22.2 million inpatient FCEs, an increase of 3.5% from 2017/18, as also reported by NHS Digital.[11] Table 8 presents activity in terms of FCEs across different provider types. It shows that the vast majority (over 97%) of care is provided by NHS Hospital Trusts, with a small but growing level of care being delivered by Private providers. Details of a longer time trend can be found in Appendix A.

Table 8: Organisational coverage of HES activity, FCEs

Year	NHS Trusts	Private providers	Other	Total
2016/17	20,532,853	590,517	165	21,123,535
2017/18	20,826,151	611,745	192	21,438,088
2018/19	21,571,984	625,734	115	22,197,833

5.2.1. Methodology

We use HRGs to identify different types of NHS activity performed in an inpatient setting. NHS output within each HRG is defined by the number of Continuous Inpatient Spells allocated to each category. Each CIPS consists of one or more FCEs, depending on whether the patient is transferred to the care of a different hospital consultant within the same Trust or a different Trust as part of their care. We construct CIPS following our own algorithm, which is similar to the official algorithm published by NHS Digital.[12,13]

We take the cost of the most expensive FCE, as defined by the RC dataset, as the cost of the overall CIPS (Bojke et al., 2017). For each HRG, the RC dataset provides a cost for day case, elective care and non-elective care activity. As we use unit costs to define the relative value of different activities and day case care is generally considered to provide the same health benefits as elective care when employed appropriately, we take the cost of elective care to also represent the value of day case care in the same HRG[14] (Bojke et al., 2016). Having assigned a cost to each CIPS, we then calculate the national average cost per CIPS in each HRG.

[10] Consistently with previous publications of this series, we continue to exclude patients categorised to HRGs which are not included in the tariff ('Zero Cost HRGs').

[11] https://digital.nhs.uk/data-and-information/publications/statistical/hospital-admitted-patient-care-activity/2018-19 (last accessed 18/01/2021).

[12] https://webarchive.nationalarchives.gov.uk/20180328130852tf_/http:/content.digital.nhs.uk/media/11859/Provider-Spells-Methodology/pdf/Spells_Methodology.pdf (last accessed 21/02/2021).

[13] A note detailing the differences between the CHE and the NHS Digital algorithms to construct CIPS is available as supplementary material published alongside this productivity update.

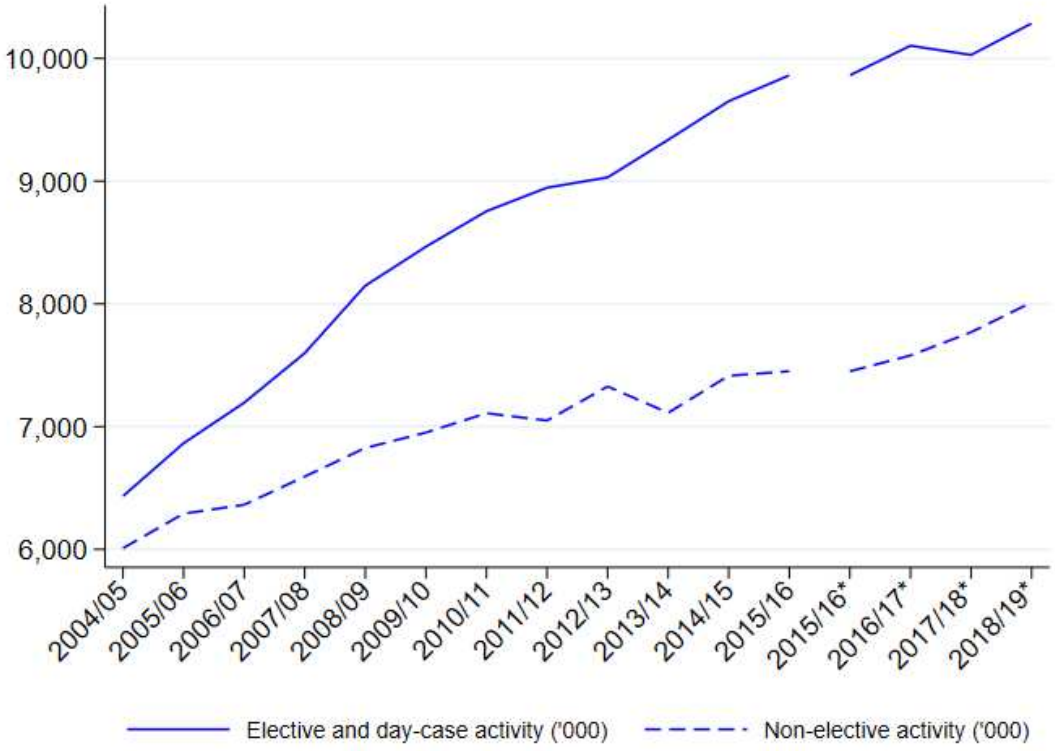
[14] This equal weighting ensures that the output index is not biased downwards if delivery of treatment moves from overnight to day case settings over time.

Some HRGs do not have associated costs in consecutive years, due to new HRGs being introduced (old HRGs being retired). In such cases we deflate (inflate) costs in order to impute missing values (Castelli et al., 2011). Between the years 2017/18 and 2018/19, 27 new HRGs were introduced and 13 were discontinued.

5.2.2. Elective, day case and non-elective activity

Figure 5 presents activity over time for elective care (solid line) and non-elective care (dashed line) for physical health care. Activity grew substantially between 2004/05 and 2018/19 (3.9 million (60%) for elective care and 2 million (33%) for non-elective care). Between 2017/18 and 2018/19 elective activity grew by 257 thousand CIPS (3%), more than overcoming the fall in activity between 2016/17 and 2017/18. Non-elective care rose from 7.8 million to 8 million CIPS between 2017/18 and 2018/19 (3%). Activity information is also presented in Table 9 along with mean costs. This table highlights a relatively sharp rise in the mean cost of non-elective care between 2017/18 and 2018/19 from £1,599 to £1,693 (6%).

Figure 5: Changes in elective and day case and non-elective activity



* The HES variable 'admission method' underwent changes in the coding; thus from 2015/16 we implemented those changes in the methodology used to group FCEs into CIPS.

Table 9: Number of CIPS and average cost for electives and non-electives

Year	Elective and day case activity		Non-elective activity	
	# CIPS	Average cost (£)	# CIPS	Average cost (£)
2016/17	10,103,760	1,569	7,579,909	1,570
2017/18	10,028,398	1,641	7,769,004	1,599
2018/19	10,285,238	1,632	8,012,583	1,693

Between 2017/18 and 2018/19 the cost-weighted and working days adjusted Laspeyres output growth measure for elective and day case output was 1.84% and non-elective output was 3.75%. Combining the two types of care gives an overall NHS cost-weighted activity growth of 2.66%.[15]

5.2.3. Elective, day case and non-elective activity: quality adjustment

We use four metrics to adjust for changes in the quality of care provided in the inpatient setting, which are calculated at the HRG level, and separately for elective and non-elective care. Specifically, we account for:

1. **In-hospital survival rates (1) and Mean Life Expectancy (2)** to capture changes in the expected discounted sum of lifetime Quality Adjusted Life Years (QALYs) conditional on treatment survival. Information on in-hospital survival rate is obtained directly from the HES APC dataset and mean life expectancy is taken from life tables published annually by ONS.[16]
2. **Waiting Times (3)** to account for adverse health implications of delayed treatment along with direct patient dissatisfaction from waiting for care. We use the 80th percentile of waiting time, calculated from HES APC, and apply this as a scaling factor multiplying the health effect (Castelli et al., 2007). This adjustment applies only to elective and day case activity.
3. **Estimated change in health outcomes following hospital treatment (4)** to assess the impact that treatments have on patients' health status over time, we use changes in the ratio of health status before and after care. Smaller ratios represent a larger health improvement associated with the treatment. We use two separate data sources:
    i. Patient Reported Outcome Measures (PROMs) for all patients undergoing unilateral hip and knee replacement.[17] This survey is offered to all patients shortly before surgery and six months following treatment. It includes the generic EQ-5D measure, which can be converted to QALYs through an official valuation from the general population of health states.
    ii. For treatments where no such information is available, we assume that the ratio is constant over time and equal to 0.8 for elective care/day cases and 0.4 for non-elective care (Dawson et al., 2005). We also assign the above constant ratios to CIPS with error code UZ01Z (Castelli et al., 2019).

[15] The cost-weighted output growth for elective and day cases without the working days adjustment was equal to 2.65%, yielding an overall cost-weighted output growth of 3.12%. Please note that non-elective inpatient output is not adjusted for working days.

[16] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/2016to2018 (last accessed 29/01/2021).

[17] From 2018/19, PROMs for varicose vein surgery and groin hernia repair were discontinued.

Table 10 and Table 11 present average values of the measures for the quality elements for the years 2016/17, 2017/18 and 2018/19.

Table 10: Quality adjustment for elective and day case and for non-elective activity

Year	Elective and day case activity			Non-elective activity	
	In-hospital survival rate	Mean life expectancy	80th percentile waiting times	In-hospital survival rate	Mean life expectancy
2016/17	99.94%	22.8	83	97.24%	33.3
2017/18	99.94%	22.7	85	97.27%	32.8
2018/19	99.94%	22.7	86	97.52%	32.7

Table 11: Ratio of pre to post health status, based on EQ-5D

Year	Groin hernia repair	Hip replacement	Knee replacement	Varicose vein removal
2016/17	0.86	0.39	0.46	0.73
2017/18	0.74	0.33	0.41	0.88
2018/19	n/a*	0.34	0.40	n/a*

* Groin hernia repair and varicose vein removal were discontinued from the PROMs survey in 2018/19.

After adjusting for changes in quality, the total Laspeyres output growth of elective, day case and non-elective activity was 4.48%. The effect of accounting for quality is positive and adds close to two percentage points to the cost-adjusted measure.[18] The primary driver of changes in quality adjustment is through improvements in non-elective care. Quality adjustment increases the value of elective care output by around one percentage point but non-elective output by over three percentage points between 2017/18 and 2018/19.

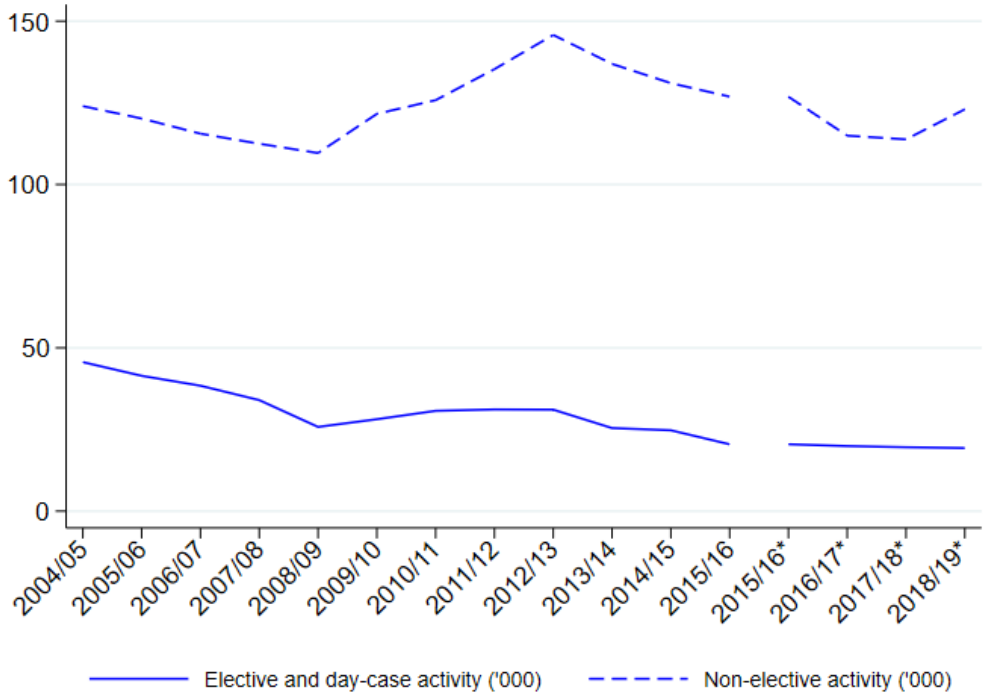
5.2.4. Inpatient mental health

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres mental health inpatient output growth measure was 6.60%.**
- **After accounting for changes in quality, the total Laspeyres output growth of NHS mental health activity becomes 7.37%.**

Figure 6 presents elective and non-elective mental health care activity. A general downward trend was observed in both elective and non-elective care from 2012/13 to 2017/18. Between 2017/18 and 2018/19, activity in elective care continued to fall but non-elective care increased by 9,179 FCEs (8%). Table 12 shows the number of CIPS and average costs for equivalent activity in the years 2016/17 to 2018/19. The activity from this sub-setting is captured by 15 different HRGs: 9 in the 'WD' subchapter (Treatment of Mental Health Patients by Non-Mental Health Service Provider), 2 in the 'AA' subchapter (Nervous System Procedures and Disorders) and 4 in the 'WH' subchapter (Poisoning, Toxic Effects, Special Examinations, Screening and Other Health care Contacts).

[18] The quality-adjusted Laspeyres output growth measure for hospital inpatient output is equal to 4.94% without the working days adjustment.

Figure 6: Number of CIPS for elective, day case and non-elective mental health patients over time



* The HES variable admission method experienced changes in the coding and from 2015/16 we have implemented those changes in the methodology used to group FCE into CIPS.

Table 12: CIPS and average cost for inpatient mental health patients

Year	Elective and day case activity		Non-elective activity	
	# CIPS	Average cost (£)	# CIPS	Average cost (£)
2016/17	19,933	1,450	114,956	1,472
2017/18	19,573	1,440	113,834	1,461
2018/19	19,333	1,474	123,013	1,495

Between 2017/18 and 2018/19, cost-weighted mental health inpatient activity increased by 6.60% when adjusted for the number of working days.[19] While this may seem a substantial proportional increase, largely driven by increased non-elective care activity, the broader implication for inpatient activity more generally is mitigated by the relatively small amount of hospital inpatient activity within mental health care.

5.2.5. Inpatient mental health: quality adjustment

Table 13 presents quality adjustment measures for mental health inpatient care. The same set of quality adjustment measures are used as for inpatient physical care.

[19] The cost-weighted growth in mental health output is equal to 6.71% when not adjusted for working days.

Table 13: Quality adjustments for mental health activity

Year	Elective and day case activity			Non-elective activity	
	In-hospital survival rate	Mean life expectancy	80th percentile waiting times	In-hospital survival rate	Mean life expectancy
2016/17	98.91%	30.3	59	98.04%	25.1
2017/18	99.29%	30.7	54	98.00%	24.6
2018/19	99.50%	31.1	43	98.24%	24.6

Between 2017/18 and 2018/19, all quality measures improved (both life expectancy and survival rates increased, whilst waiting times decreased). The only exception was mean life expectancy for non-elective care, which remained constant. After accounting for changes in quality, output growth from 2017/18 to 2018/19 increased from 6.60% to 7.37% for Mental Health patients treated in acute and general hospitals.[20]

5.3. HES outpatient data

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for outpatient activity was 4.10%.**
- **After adjusting for waiting times, the Laspeyres output growth measure was 4.09%.**

Outpatient activity can be derived from both the HES Outpatient dataset and the RC data. In this section, we present information from our preferred source, the HES Outpatient dataset. This dataset does not include unit cost information, which we derive from the RC data. HES and RC data are not directly comparable due to different recording methods. Section 5.4.3 presents outpatient figures from RC data alone. We have summarised the main differences between the two sources of outpatient data, as well as the costing method applied, in Castelli et al. (2018) and Castelli et al. (2019).

Table 14 shows outpatient activity increased by 4 million attendances (3.6%) between 2017/18 and 2018/19. The mean cost of care also increased by 4.2%, between 2017/18 and 2018/19. Figure 7 shows growth in activity between 2017/18 and 2018/19 returns to the upward trend observed from 2012/13 to 2016/17. The cost-weighted Laspeyres growth in outpatient activity amounted to 4.10%.[21]

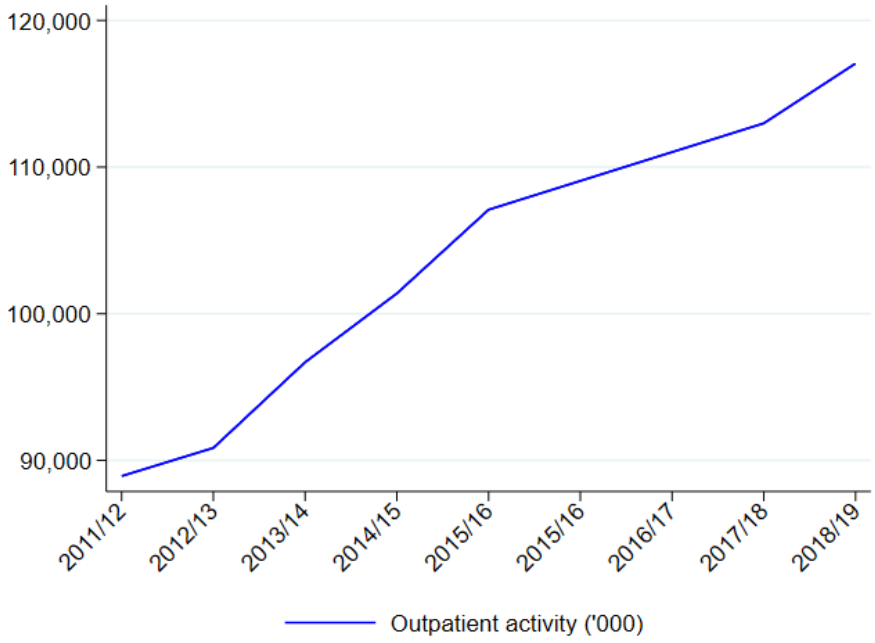
Table 14: HES outpatient volume and average cost over time

Year	HES Outpatient Activity	
	Volume	Average cost (£)
2016/17	112,038,758	121.74
2017/18	112,986,081	127.27
2018/19	117,066,614	132.67

[20] The quality-adjusted mental health Laspeyres output growth rate is equal to 7.48%, when not adjusted for the number of working days.

[21] The cost-weighted growth of outpatient activity is equal to 4.93% when not adjusted for working days.

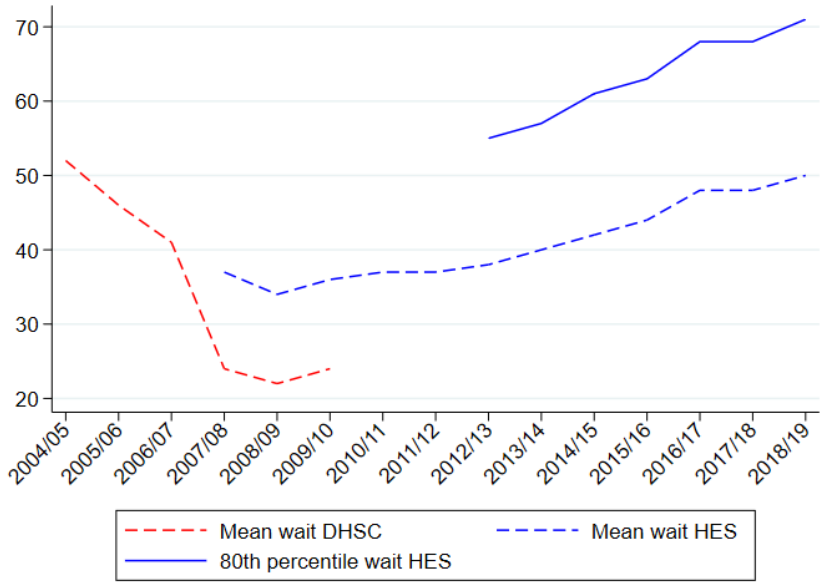
Figure 7: Trends in HES outpatient activity, 2011/12 – 2018/19



5.3.1. HES outpatient: quality adjustment

We observe patient waiting times for outpatient care. Therefore, we adjust for the 80th percentile of waiting times as a measure of quality, as in the inpatient setting. Figure 8 shows that both mean and 80th percentile waiting times have been growing since 2009/10. This general trend continued into 2018/19 after a year of no change between 2016/17 and 2017/18. Mean waits in 2018/19 were 50 days (up from 48 in 2017/18) and 80th percentile of waits was 71 (up from 68 in 2017/18). Therefore, after adjusting for waiting times, growth in outpatient activity was 0.01 percentage points lower at 4.09%.[22] The relatively small impact of the observed change in waiting time is due to the fact that waiting times are discounted and already being at a relatively high baseline in 2017/18.

Figure 8: Trends in outpatient waiting times



[22] The quality-adjusted growth of outpatient activity is equal to 4.92% when not adjusted for working days.

5.4. Reference Costs data

Reference Cost returns are used in the NHS output and productivity series to capture activity delivered outside primary care, outpatient departments and hospital inpatient settings. In particular, we capture activity conducted in accident and emergency (A&E) departments, including Ambulance services, mental health and community care settings, and diagnostic facilities. Activities are reported in various ways: attendances, bed days, contacts and number of tests.

RC returns also provide information on average unit costs for all recorded activities, including activity performed in hospitals and outpatient departments. RC data are checked for both accuracy and activity coverage.

5.4.1. Quality checks

Mandatory and non-mandatory validations of the RC data reported by NHS Trusts have been carried out since their introduction by the then Department of Health in 2011/12 (Department of Health, 2012). These reduced the year-on-year volatility in the information contained in the RC returns.

We also implement our own validation process (Bojke et al., 2014), which focuses on identifying large changes in either volume or unit costs of activity for all non-acute services. In particular, our quality assurance process consists of four steps:

- **Step 1:** We check whether a large change in either the total volume (>500,000 units) or the total value (>£25,000,000) of NHS activity/HRG codes as reported in the RC returns is observed. The check compares volumes of activity, unit costs and total costs of the last two financial years in the national productivity series.

- **Step 2:** We check whether cases of NHS activity/HRG codes, meeting at least one of the criteria in Step 1, do not appear to be genuine. This step may lead to the identification of a subset of HRG/service codes related to NHS activity requiring further investigation. Limited to the HRG/service codes flagged up as requiring further investigation, we implement two further steps.

- **Step 3:** We check whether any of the flagged HRG/service codes are affected by changes in their labelling/definition/categorisation. This step involves cross-checking the set of HRGs with potential quality issues against the HRG codes listed in the HRG4+ Reference Costs Grouper Roots file.[23]

- **Step 4:** If flagged HRG/service codes have not changed in terms of labelling, definition, or categorisation, we analyse the data in greater detail to identify the possible source of the large change in either volume or value of activity.

The most recent quality checks identified one potentially questionable abnormal variation: a substantial decrease of the implied average unit cost of the High Cost Drug (HCD) Glucarpidase (from £58,167 per unit in 2017/18 to £157 per unit in 2018/19). Since no evidence of changes in terms of either labelling, categorisation or other sources of such a drop was found, when reporting the baseline results we included the Glucarpidase HCD in the analysis, but also provided an estimate of the High Cost Drugs setting growth without it as a sensitivity check.

[23] https://digital.nhs.uk/services/national-casemix-office/ (last accessed 27/02/2021).

In the remainder of this section, we present the results for the three most recent financial years of NHS activity captured by the RC returns. Tables reporting the full time series for both activity and average costs can be found in section 8.3, in Appendix A.

5.4.2. Growth in NHS activity captured in Reference Costs data

Between 2017/18 and 2018/19, NHS activity as captured by the RC returns grew by 0.55% if outpatient activity was included, and by 0.41% if it was excluded from the series. This is an even more modest growth than the one observed between 2016/17 and 2017/18 of 0.75%, both being considerably smaller compared to the 2.74% growth (w/o outpatient activity) reported for 2015/16 – 2016/17. After applying the working days adjustment, the figures shrink even further to negative values of -0.003% and -0.049% for the total activity and activity without outpatient setting respectively. The nil growth, however, masks a more varied picture across the settings covered by RC data, as shown in the remainder of this section, where each of the settings is explored in further detail.

5.4.3. Outpatient activity

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres outpatient output growth measure was 0.11%.**

Outpatient activity, as measured in the RC database, is classified into three major groups: consultant-led activity, non-consultant led activity, and procedures. Consultant- and non-consultant led activity represent broadly the same set of outpatient specific HRG-style codes (currency codes beginning with WF). Outpatient procedure codes represent procedure-related HRGs which may appear in other hospital settings. The shares of outpatient activity by the three major groups described have remained fairly stable since 2015/16, with consultant-led activity for Trusts in 2018/19 representing 60% of overall outpatient activity, non-consultant led 24%, and outpatient procedures 16%.

Table 15: Outpatient activity and cost

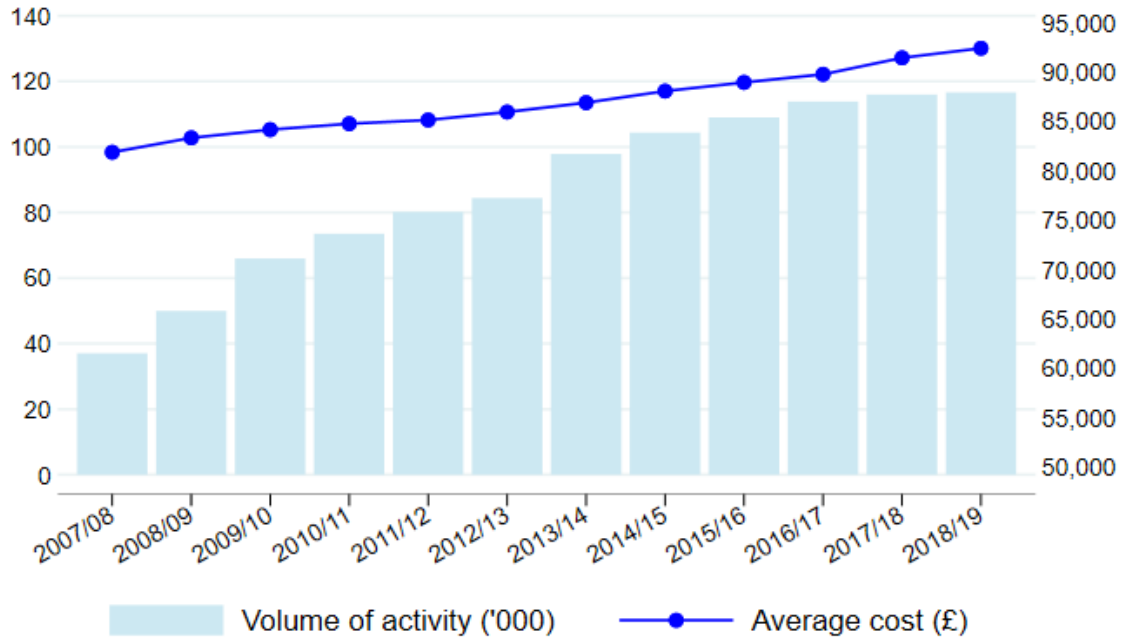
Year	Outpatient	
	Volume of activity	Average cost (£)
2016/17	87,017,943	122
2017/18	87,714,235	127
2018/19	87,944,919	130

The working days adjusted Laspeyres output growth measure for outpatient activity, as captured by the RC data, was 0.11% between 2017/18 and 2018/19, a decrease of 1.41 percentage points compared to 2016/17 – 2017/18.[24]

Figure 9 shows trends in outpatient activity (right-hand side axis) and average unit costs (left-hand side axis), since 2007/08. Outpatient activity and average unit costs, as captured by the RC data, have increased steadily since 2007/08.

[24] The cost-weighted growth of outpatient activity is equal to 0.91% when not adjusted for working days.

Figure 9: Trends in Outpatient activity (right axis) and average costs (left axis), 2007/08 – 2018/19



5.4.4. A&E and ambulance services

- **Between 2017/18 and 2018/19, the cost-weighted Laspeyres output growth measure for A&E services, which includes Ambulance services, was 1.66%.**

Table 16 reports summary statistics for A&E and Ambulance services. A&E services are provided in both Emergency Departments (EDs) and 'Other A&E' departments.[25] Attendance at A&E departments are classified into two types: those where patients are subsequently admitted (AD) and those where patients are not admitted (NAD) to an inpatient ward.

[25] Emergency departments offer a consultant-led 24 hour service with full resuscitation facilities and designated accommodation for the reception of A&E patients, whilst other A&E departments can be either of the following: 'Consultant-led mono specialty accident and emergency services (e.g. ophthalmology, dental) with designated accommodation for the reception of patients'; 'Other type of A&E/minor injury activity with designated accommodation for the reception of accident and emergency patients' and 'NHS Walk-in Centres'. For a definition see https://digital.nhs.uk/binaries/content/assets/website-assets/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics/hes-data-dictionary/dd-ae_v12.pdf, p.15 (last accessed 30/11/2020).

Table 16: A&E and Ambulance services activity and average cost

Sub-setting		2016/17		2017/18		2018/19	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Emergency Departments	AD	3,966,820	238	4,313,593	247	3,738,454	263
	NAD	11,039,457	152	11,100,308	164	12,215,524	171
Other A&E services	AD	472,913	78	280,645	69	48,101	116
	NAD	4,515,570	67	4,255,912	67	4,388,481	72
Ambulance services	Calls	10,238,451	7	10,995,578	7	10,039,191	7
	Hear and treat/refer	806,804	37	886,175	37	799,332	47
	See and treat/refer	2,441,651	181	2,459,394	192	2,480,819	209
	See and treat & convey	5,277,120	247	5,325,368	252	5,421,377	257

The total number of emergency department attendances continued to grow at an increased pace: between 2017/18 and 2018/19 the growth was equal to 3.5%, compared to the 2.7% increase for the 2016/17 – 2017/18 link. However, in contrast to the changes observed in the previous two financial years, the growth was driven by a rise in non-admitted patients (+10%) with the number of subsequently admitted A&E cases decreasing by about 13%. Both changes are more substantial than those observed between 2016/17 and 2017/18.

As regards 'Other A&E services', these show a 2.2% decrease between 2017/18 and 2018/19, continuing the trend observed in the two previous financial years. The overall decrease in 'Other A&E services' masked, however, opposing dynamics for A&E attendances subsequently leading to admitted patient care (a drop of almost 83%)[26] and those not being admitted (3% increase).

Overall, the total volume of A&E activity increased by 2.2% between the two most recent financial years. Differently from the previous years, the number of patients subsequently admitted to a ward as emergency cases fell by 17.58% between 2017/18 and 2018/19, whilst that of patients not admitted to a ward rose by 8.13%.

Ambulance services are measured in terms of calls received for the category 'Calls'; patients for the category 'Hear and treat or refer'; incidents for both the categories of 'See and treat or refer' and 'See and treat and convey'. While 'See and treat or refer' and 'See and treat and convey' categories continued an upward trend (0.87% and 1.8% respectively), 'Calls' and 'Hear and treat or refer' decreased by 8.7% and 9.8% respectively, thus reverting the increasing trend, previously observed, for the totality of ambulance services and resulting in a 4.71% decrease between 2017/18 and 2018/19.

Figure 10 to Figure 13 show trends in activity and their respective average unit costs by type of A&E department from 2007/08 and for Ambulance services from 2011/12. Whilst volumes of A&E activity

[26] Note that the total number of attendances to 'Other A&E services' leading to AD care is small compared to other sub-categories of A&E services.

by type of A&E department are roughly stable over time, an increase is detected in their average unit costs, whether or not these lead to admitted hospital care. Average unit costs for 'Other A&E services' leading to admitted care show some volatility over time, whilst those not leading to admitted care show a moderate increase over time.

Figure 10: Trends of A&E activity (right axis) and related average unit costs (left axis) in ED departments, separately for AD and NAD, 2007/08 – 2018/19

Figure 11: Trends of 'Other A&E services' activity (right axis) and related average unit costs (left axis), separately for AD and NAD, 2007/08 – 2018/19

Figure 12: Volume trends (right axis) in Ambulance services and average unit costs (left axis), separately for 'Calls' and 'Hear and treat or refer' 2011/12 – 2018/19

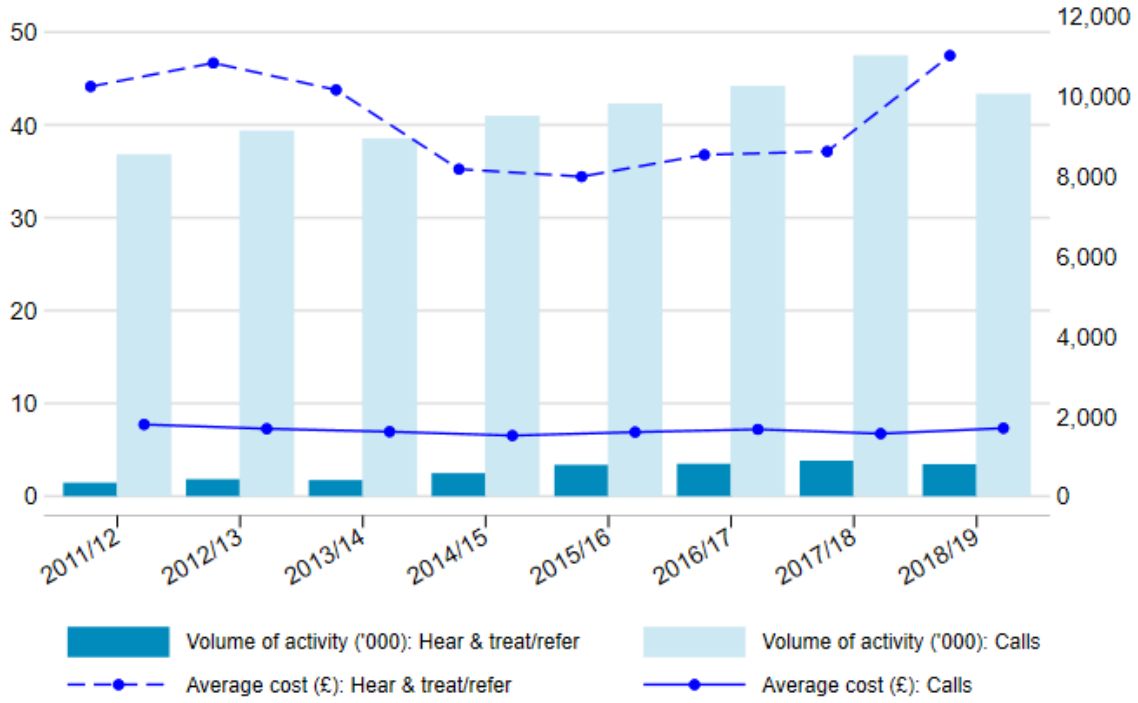
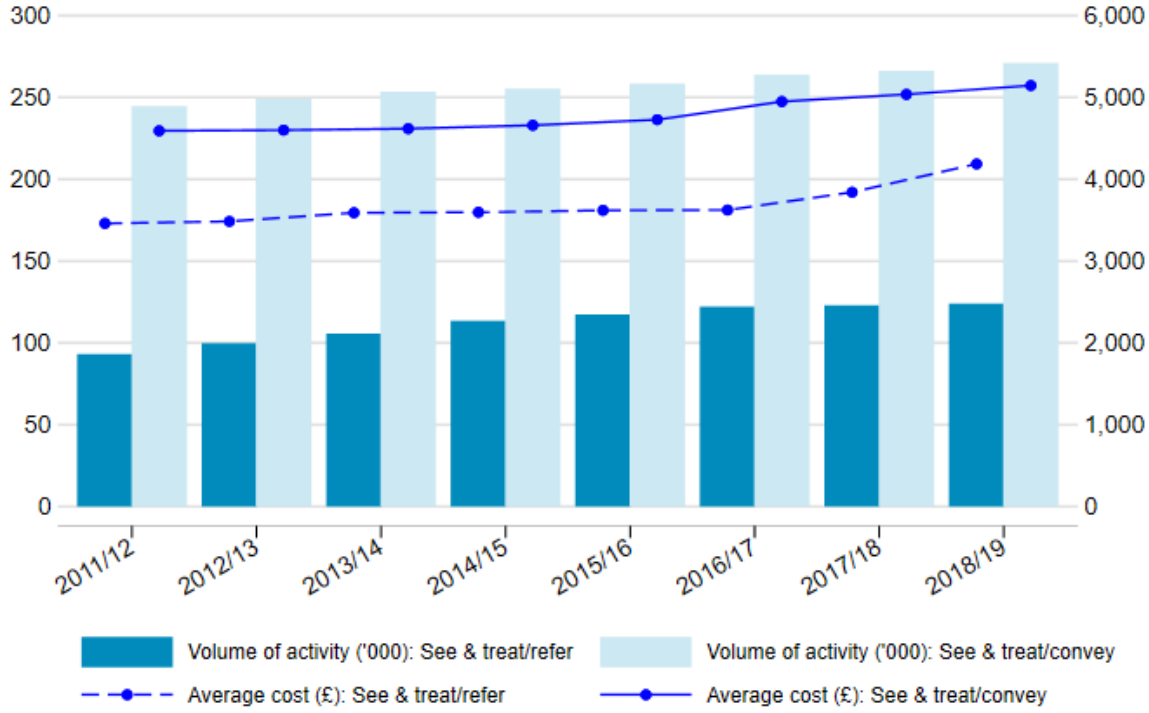


Figure 13: Volume trends (right axis) in Ambulance services and average unit costs (left axis), separately for 'See and treat or refer' and 'See and treat and convey' 2011/12 – 2018/19



The Laspeyres output growth measure for the setting 'A&E services',[27] which includes ambulance services, was 1.66% between 2017/18 and 2018/19, which is slightly higher than the 1.55% growth

[27] Please note that 'A&E services' is not adjusted for working days.

observed in the previous year. This increase was mainly driven by non-admitted A&E attendances to Emergency departments.

5.4.5. Chemotherapy, Radiotherapy & High Cost Drugs

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for Chemotherapy, Radiotherapy & High Cost Drugs was 1.22%.**

Table 17 reports volumes and average unit costs for these three categories. After a substantial increase in 2017/18 (17.1%), Chemotherapy showed a more modest growth in activity of 2.6%, whereas Radiotherapy diverged from the decreasing trend of previous years, yielding a 2.14% positive growth between 2017/18 and 2018/19. High Cost Drugs underwent a wholesale revision in 2017/18, with drugs reported by active ingredient, similar to community prescribing (see section 5.7), which continued in the most recent RC data collection. The volume of High Cost Drugs decreased by 3.12%, contrasting with the positive growth trend of the last 7 years (see Table A 11 in Appendix A).

Table 17: Chemotherapy, Radiotherapy, High Cost Drugs

Setting	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Chemotherapy	2,253,067	605	2,639,406	569	2,707,943	600
Radiotherapy	1,929,548	198	1,921,222	218	1,962,279	213
High Cost Drugs	2,288,895	917	2,557,373	828	2,477,645	799

The categories used to describe Chemotherapy, Radiotherapy, and High Cost Drugs have been subject to substantial revisions over time, which explains some of the variation in trends shown in Figure 14 and Figure 15.

Figure 14: Trends in Chemotherapy and Radiotherapy activity (right axis) and average costs (left axis), 2007/08 – 2018/19

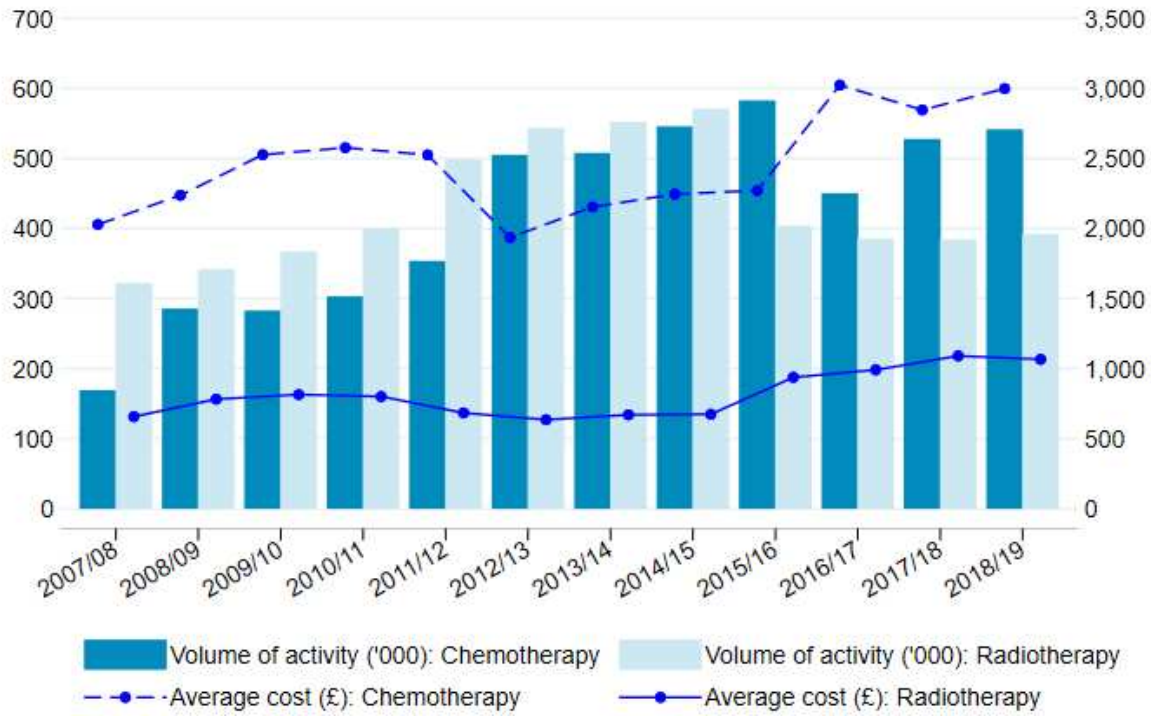
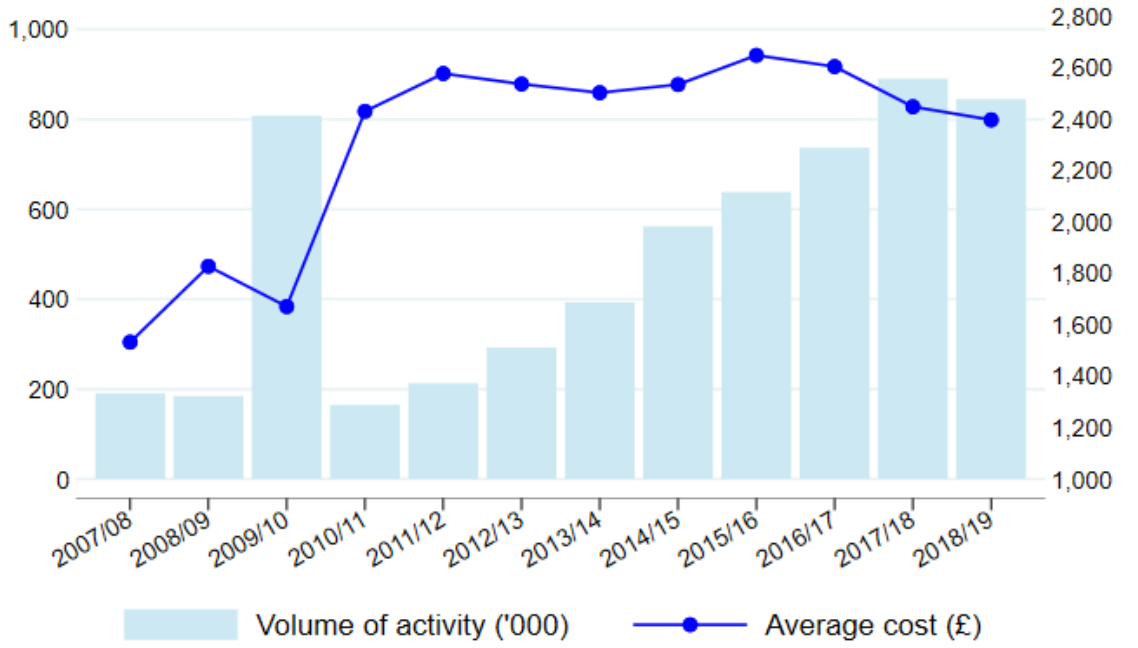


Figure 15: Trends in High Cost Drugs activity (right axis) and average costs (left axis), 2007/08 – 2018/19



Overall, the cost-weighted and working days adjusted Laspeyres output growth measure for Chemotherapy, Radiotherapy & High Cost Drugs was 1.22% between 2017/18 and 2018/19.[28,29]

Table 18 reports the contribution to the 2018/19 growth of each of these settings.

Table 18: Contribution of sub-settings to overall growth of the setting 'Chemo-/Radiotherapy/High Cost Drugs'

Sub-setting	Laspeyres Growth rate	Setting specific growth index	Value of Activity in 2017/18	Share of overall spend	Contribution to overall growth rate
Chemotherapy	2.54%	102.54%	£1,501,616,611	37.3%	38.3%
Radiotherapy	4.14%	104. 14%	£382,974,593	9.5%	9.9%
High Cost Drugs	-0.30%	99.70%	£2,103,116,674	52.2%	52.0%
Total/overall growth rate			**£4,024,361,358**		**1.22%**

5.4.6. Community care

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for Community care activity was 1.66%.**

Community care includes a very diverse array of activities carried out in the community by Allied Health Professionals, Community Rehabilitation Teams, and by Health Visiting and Midwifery personnel, as well as Intermediate Care (incl. crisis responses, care home based services, etc), Medical and Dental care (e.g. community, emergency and general dental services), Nursing (ranging from school-based children's health care service to specialist nursing for various diseases) and wheelchair services for both adults and children.

[28] Excluding Glucarpidase from the analysis yields a very similar working days adjusted Laspeyres growth rate of 1.21%.
[29] The cost-weighted growth of 'Chemotherapy, Radiotherapy and High-Cost Drugs' activity is equal to 2.03% when not adjusted for working days.

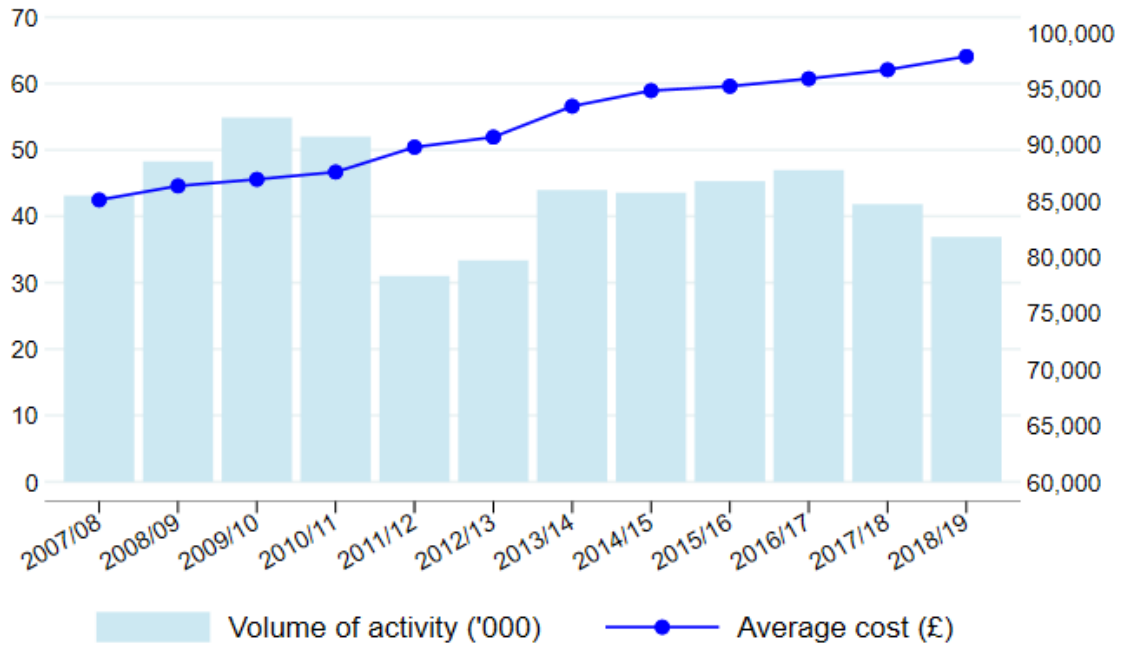
Between 2017/18 and 2018/19, Community care continued to decrease with a drop of 3.44% in the volume of activity, as shown in Table 19, very similar to the previous year. Figure 16 shows trends in community care activity (right-hand side axis) and average unit costs (left-hand side axis), since 2007/08.

The cost-weighted and working days adjusted Laspeyres output growth rate for community care was -1.66% between 2017/18 and 2018/19, indicating that the negative growth was more substantial in community care services with lower average unit costs.[30]

Table 19: Community care activity and average costs

Year	Community care	
	Volume of activity	Average cost (£)
2016/17	87,751,894	61
2017/18	84,708,536	62
2018/19	81,794,290	64

Figure 16: Trends in Community Care activity (right axis) and average costs (left axis), 2007/08 – 2018/19



5.4.7. Diagnostic tests, pathology and radiology

- **Between 2017/18 and 2018/29, the cost-weighted and working days adjusted Laspeyres output growth rates for**
  - **Directly accessed diagnostic services was -3.09%;**
  - **Radiology was -9.85%;**
  - **Directly accessed pathology services was 3.59%.**

[30] The cost-weighted growth of Community Care activity is equal to -0.88% when not adjusted for working days.

Between 2017/18 and 2018/19 the volumes of Directly accessed diagnostic services and Radiology continued the trend of the previous financial year with decreases of 2.11% and 9.25% respectively, which are more considerable than those observed in 2016/17 – 2017/18. In contrast, Directly accessed pathology services showed a positive trend with a total volume increase of 2.06% in 2017/18 – 2018/19.

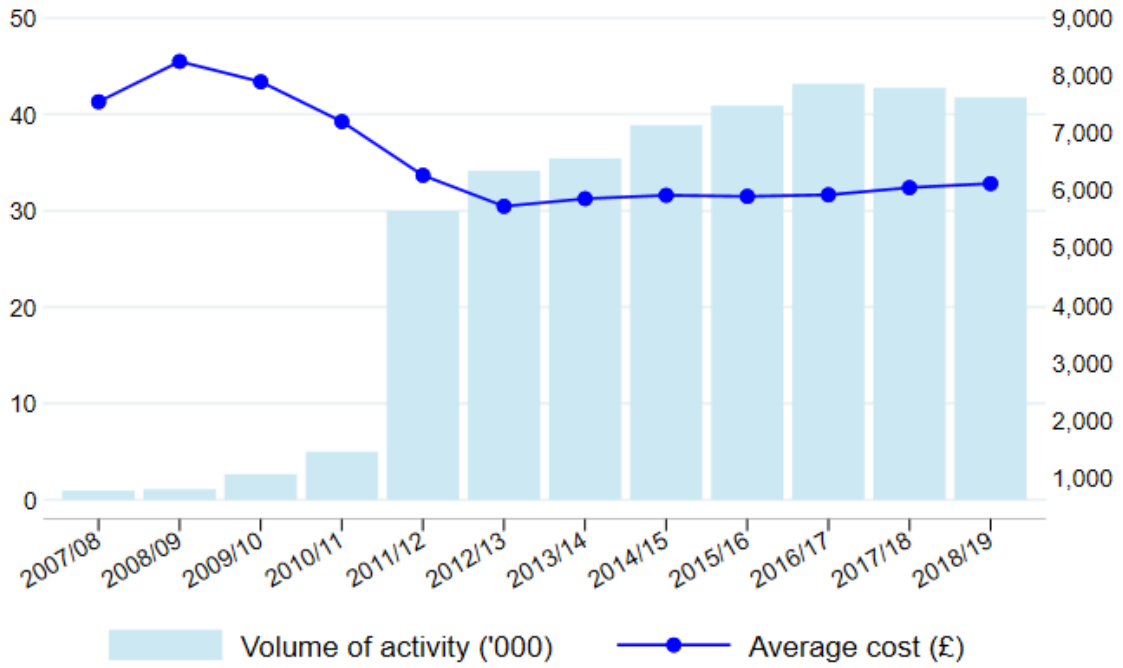
The cost-weighted and working days adjusted Laspeyres output growth rates were -3.09% and -9.85% for Directly accessed diagnostics services and Radiology respectively, whilst the cost-weighted and working days adjusted Laspeyres output growth rate for Directly accessed pathology services was 3.59% between 2017/18 and 2018/19.[31]

Table 20: Directly accessed diagnostic and pathology services and radiology

Setting	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Directly accessed diagnostic services	7,849,470	32	7,777,205	32	7,613,040	33
Directly accessed pathology services	374,847,731	2	417,460,632	2	426,076,050	2
Radiology	11,342,904	95	10,975,838	99	9,961,010	98

Trends in activity (right-hand side axis) and average unit costs (left-hand side axis) for these types of services between 2007/08 and 2018/19 are shown in Figure 17 to Figure 19.

Figure 17: Volume trends (right axis) in Directly accessed diagnostic services and average costs (left axis), 2007/08 – 2018/19



[31] The cost-weighted growth measures when not adjusted for working days are -2.31%, -9.13% and 4.42% respectively for Directly accessed diagnostic services, Radiology and Directly accessed pathology services.

Figure 18: Volume trends (right axis) in Directly accessed pathology services and average costs (left axis), 2007/08 – 2018/19

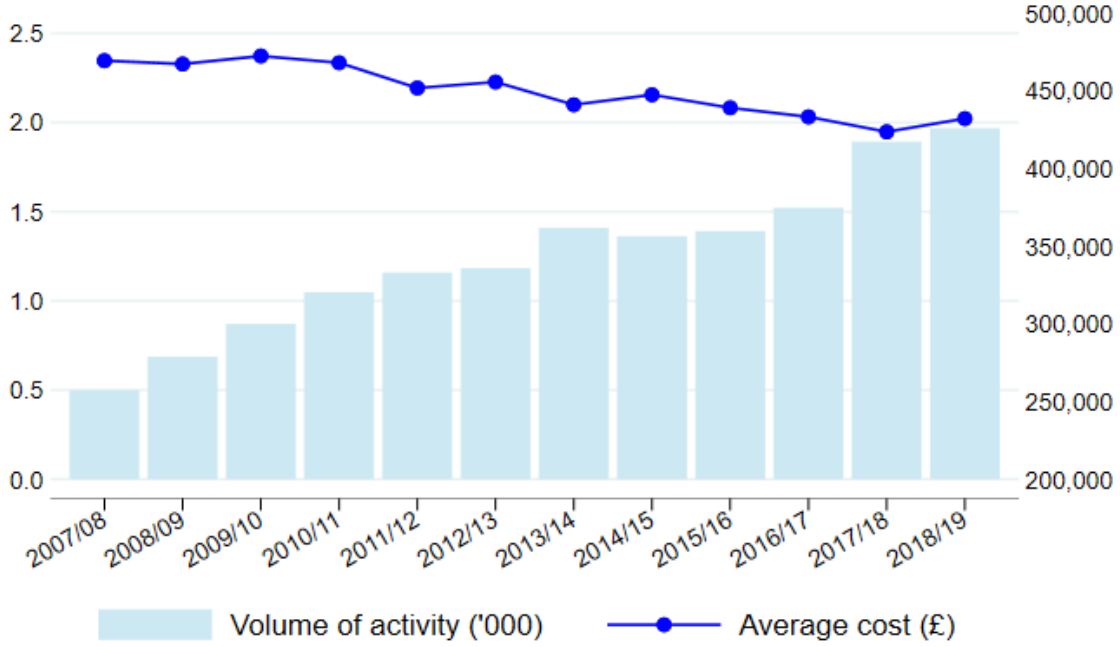
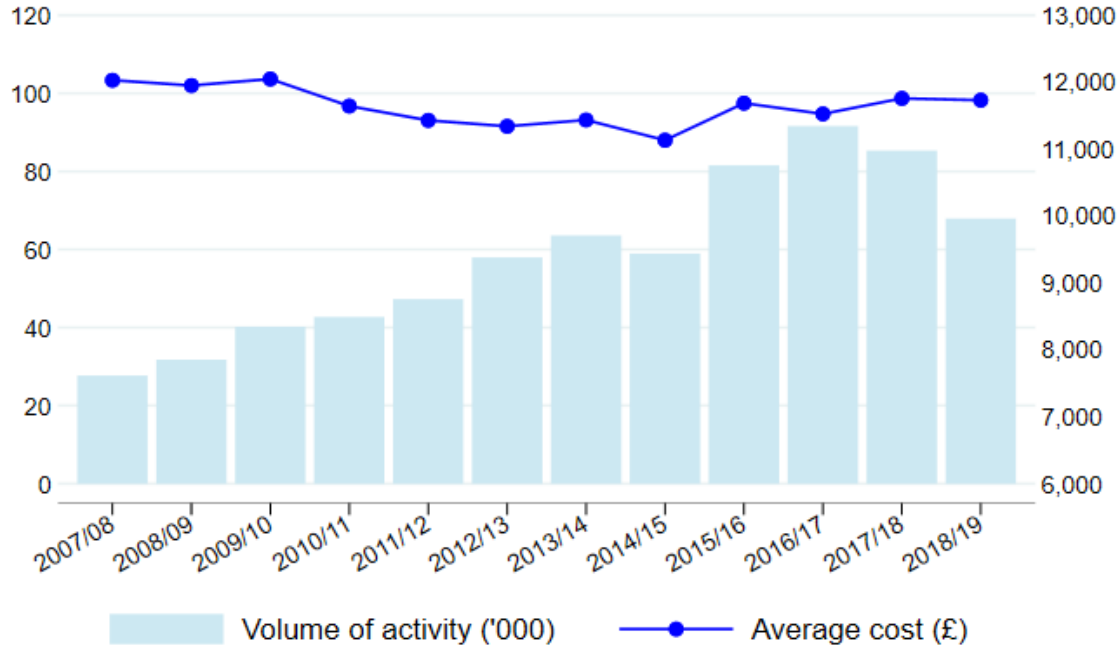


Figure 19: Trends in Radiology activity (right axis) and average costs (left axis), 2007/08 – 2018/19



5.4.8. Community Mental Health

- **Between 2017/18 and 2018/19, the cost-weighted Laspeyres output growth measure for Community Mental Health activity was 2.67%.**

Table 21 reports the activity delivered to community mental health patients over the last three financial years, as reported in their respective RC datasets.

Since 2016/17, unit costs for some secure services data have been collected following a new methodology, and as such are no longer comparable to previous years.[32] We have, therefore, excluded all secure mental health services from the calculation of the Community Mental Health (MH) output growth measure for the years 2015/16 to 2018/19.

However, information received by DHSC from NHS England and Improvement implied that this activity could potentially be re-integrated for the last three financial years but at a different, broader, level of aggregation. We summarise the methods followed and the results of these analyses in Appendix B 'MH secure services – sensitivity analyses'.

In contrast to hospital mental health activity, community mental health care clusters activity decreased by 3.25% between 2017/18 and 2018/19, continuing the trend from previous years. Other mental health activity, which captures services such as Children and Adolescent Mental Health Services, Drug and Alcohol Services, Mental Health Specialist Teams, saw a moderate decrease by 0.44% in the (raw) number of services provided between 2017/18 and 2018/19, which follows a more volatile trend in previous years.

Overall, the cost-weighted Laspeyres output growth rate mitigated the above results with a positive growth of 2.67%; an indication that the reduction of output occurred in less costly MH activity, whereas more expensive activity saw an increase.[33]

[32] Details can be found at https://www.england.nhs.uk/wp-content/uploads/2020/08/1_-_NCC_Report_FINAL_002.pdf (last accessed 27/02/2021).
[33] Please note that Community Mental Health activity is not adjusted for working days.

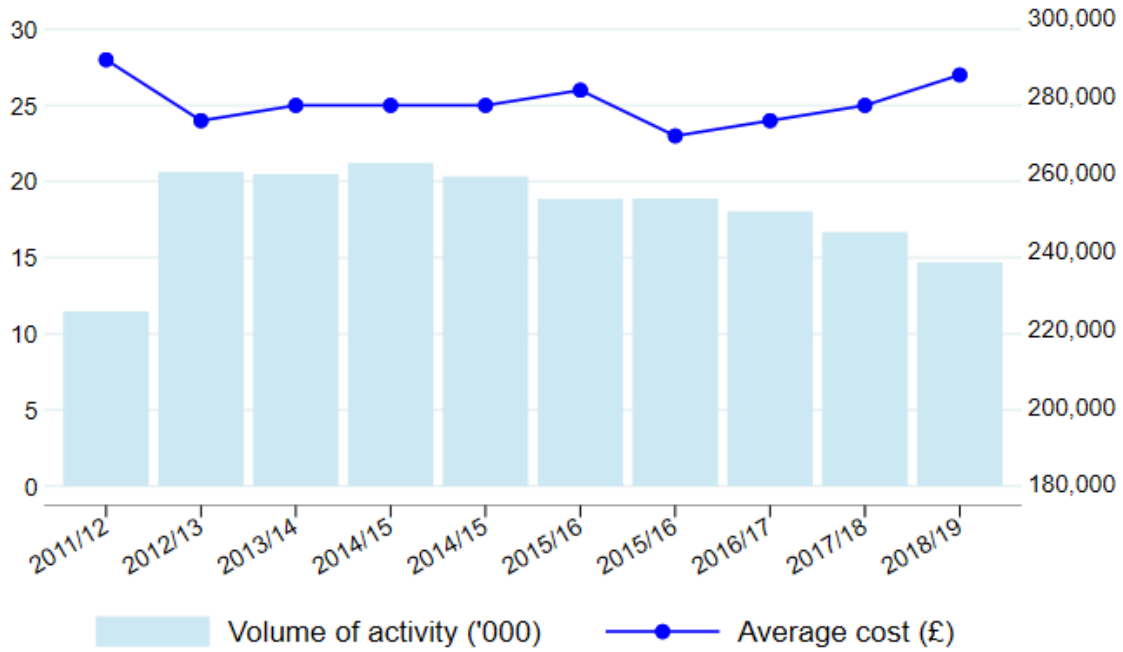
Table 21: Mental Health Care Clusters and other mental health activity

Activity	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Care Clusters						
MH Care Clusters – Admitted Patient Care	5,187,204	404	4,929,918	420	5,206,561	415
MH Care Clusters – Non-Admitted Patient Care	236,183,269	9	231,188,942	9	222,800,832	10
MH Care Clusters – Initial Assessment	822,296	301	873,626	307	990,476	304
Adult IAPT MH Care Clusters	886,645	310	849,228	353	967,759	337
Adult IAPT MH Care Clusters Initial Assessments	726,002	127	781,102	121	912,356	113
Total volume MH Care Clusters	**243,805,416**	**18**	**238,622,816**	**20**	**230,877,984**	**22**
Other Mental Health*						
Children and Adolescent MH Services	2,418,240	234	2,522,873	240	2,685,799	234
Drug and Alcohol Services	1,270,174	110	1,167,114	114	772,933	109
MH Specialist Teams	2,101,077	171	1,916,052	192	2,028,935	206
Secure MH Services	-	-				
Specialist MH Services	424,732	223	501,382	223	592,791	235
Total volume Other MH	**6,214,223**	**187**	**6,107,421**	**200**	**6,080,458**	**209**
Total volume of Community MH activity	**250,019,639**	**24**	**244,730,237**	**25**	**236,958,442**	**27**

* Excludes Admitted Patient care, which is included in the HES inpatient mental health activity (see section 5.2.4).

Figure 20 shows trends in both the average unit costs (left-hand side) and activity (right-hand side) for Community Mental Health activity since 2011/12. Prior to 2011/12, Community Mental Health activity was recorded in a very different way and we decided not to show these years in the Figure below, but the time series from 2004/05 is available in Appendix A section 8.3.

Figure 20: Trends in Community Mental Health activity (right axis) and average costs (left axis), 2011/12 – 2018/19



5.4.9. Rehabilitation and renal dialysis

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for**
  - **Rehabilitation was -13.96%;**
  - **Renal Dialysis was -0.21%.**

The volume of Renal Dialysis activity has been fairly stable and demonstrated a small decrease of 0.05% between 2017/18 and 2018/19, whereas Rehabilitation, in contrast to moderate negative trends observed in previous years, dropped considerably (by -19.79%) in 2018/19 (see Table 22).

The cost-weighted Laspeyres output growth measure for Renal Dialysis was -0.21%, whilst the cost-weighted and working days adjusted Laspeyres output measure for Rehabilitation was -13.96%, making it the setting with the most considerable decrease in cost-weighted output growth between 2017/18 and 2018/19.[34] Its relative contribution to the overall NHS Laspeyres output growth measure was, however, small.

[34] The cost-weighted output growth measure for Rehabilitation activity is equal to -13.27% when not adjusted for working days. Please note that Renal Dialysis activity is not adjusted for working days.

Table 22: Rehabilitation and Renal dialysis

Setting	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Rehabilitation	2,893,451	332	2,865,116	328	2,298,007	378
Renal dialysis	4,240,850	134	4,277,315	135	4,275,328	135

Figure 21 and Figure 22 show trends in activity (right-hand side) and average cost (left-hand side) respectively for Rehabilitation and Renal dialysis, since 2007/08. Trends in Renal Dialysis activity are relatively stable over time: both volumes and average costs of activity have been changing gradually in the past 11 years. Rehabilitation, in contrast, has shown more volatility and a more noticeable increase in average costs over time.

Figure 21: Trends in Rehabilitation activity (right axis) and average costs (left axis), 2007/08 – 2018/19

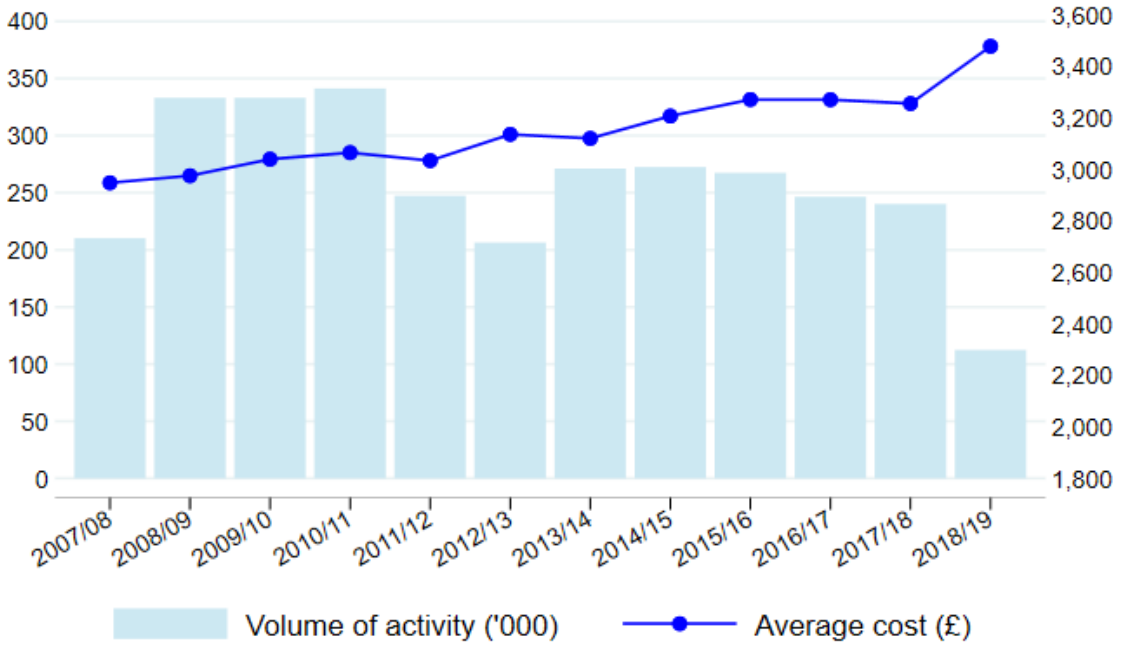
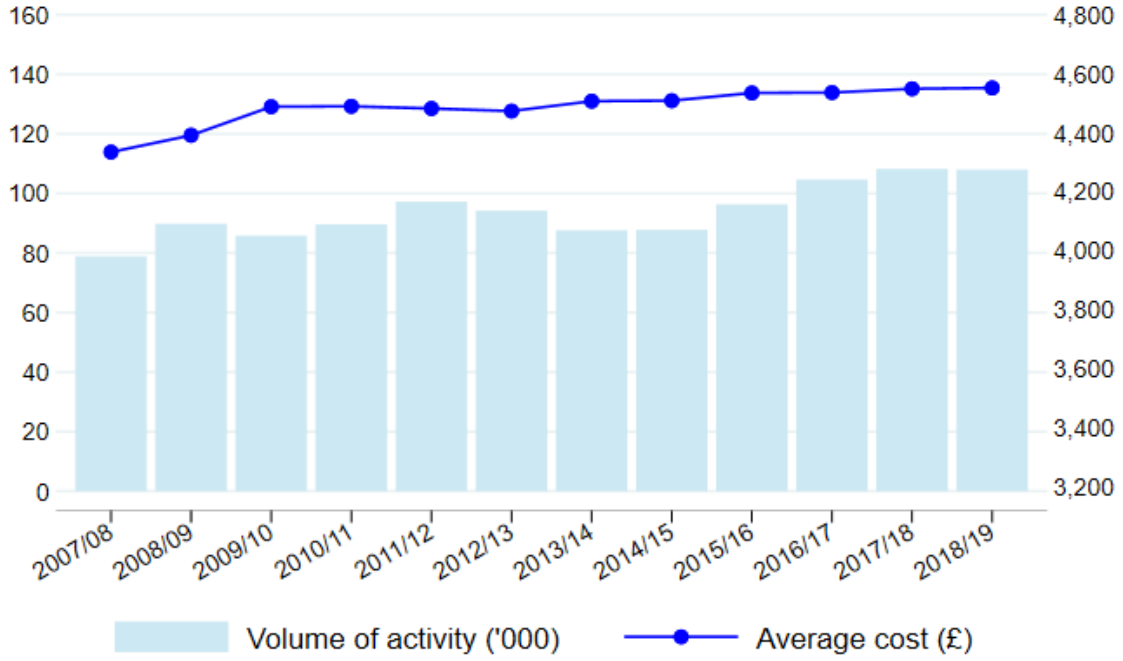


Figure 22: Trends in Renal Dialysis activity (right axis) and average costs (left axis), 2007/08 – 2018/19



5.4.10. Specialist services

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measure for Specialist services was equal to 0.17%.**

The setting Specialist services, as defined in this report, comprises the following services: Critical Care,[35] Specialist Palliative Care, Cystic Fibrosis and Cancer Multi-Disciplinary Team Meetings. Volumes and average unit costs for these activities are reported in Table 23 for the last three financial years.

Table 23: Specialist services

Specialist service	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Critical Care	2,792,536	1,082	2,717,180	1,159	2,698,927	1,218
Specialist Palliative Care	914,564	152	967,805	153	807,252	181
Cystic Fibrosis	11,489	9,198	10,934	9,766	12,208	9,343
Cancer Multi-Disciplinary Team Meetings	1,708,174	111	1,800,465	114	1,922,238	112

The total volumes of Critical Care and Specialist Palliative Care activities decreased by 0.67% and 16.59% respectively, whereas Cystic Fibrosis and Cancer Multi-Disciplinary Team Meetings output rose by 11.65% and 6.76% respectively between 2017/18 and 2018/19. A moderate decrease in Critical Care activities was driven by a fall in Neonatal Care, whilst Adult and Paediatric Care outputs have risen. In 2018/19, Adult Critical Care represented 55% of total Critical Care activities, whilst Neonatal and Paediatric Care represented 38% and 7% respectively.

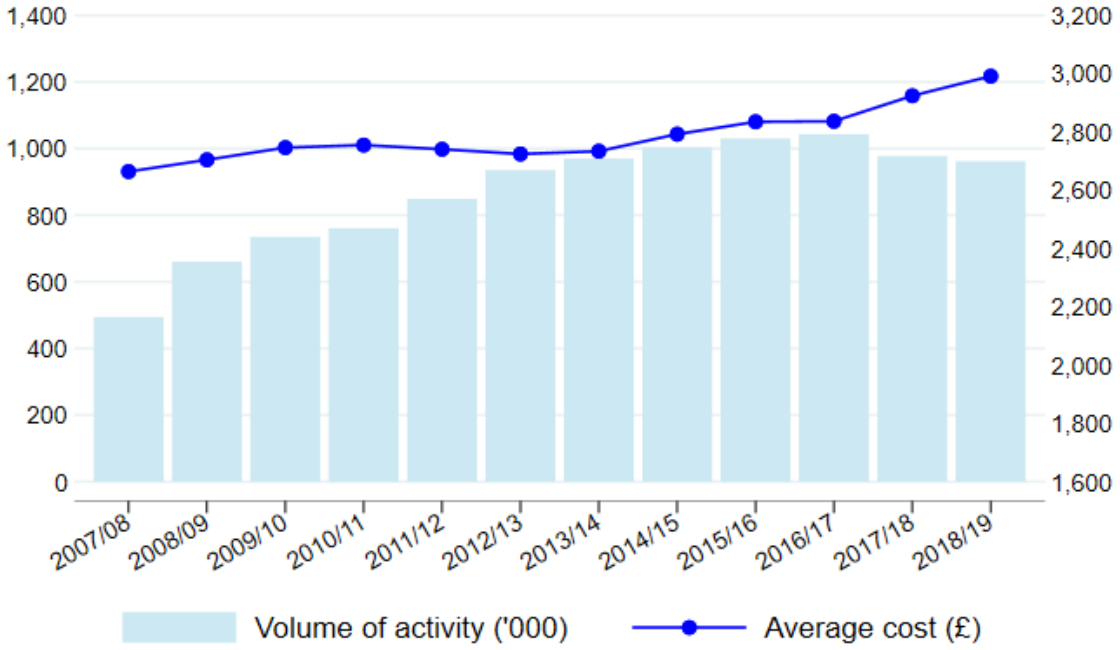
[35] Previous versions of the CHE NHS productivity updates referred to Critical Care under the 'Adult critical care' label.

Between 2017/18 and 2018/19 the cost-weighted and working days adjusted Laspeyres output growth measure for Specialist services as a whole was 0.17%.[36] This was due to the fact that decreases in relatively less costly activities (e.g. Specialist Palliative Care) were offset by increases in more costly ones (e.g. Cystic Fibrosis).

Figure 23 to Figure 26 show trends in volume of activity (right-hand side) and average unit costs (left-hand side) since 2007/08 for Critical Care, Specialist Palliative Care and Cystic Fibrosis, and since 2011/12 for Cancer Multi-Disciplinary Team Meetings respectively. Both the volumes and average costs of Critical Care activity have been rising gradually, though the trend of volume has reversed since 2016/17. Specialist Palliative Care demonstrates a significant growth in volumes and an overall downward trend in average costs, which changed direction in 2018/19.

Growth in Cystic Fibrosis activity has been very volatile over the time period considered, with some of the variation being due to re-categorisations in 2011/12, when the volume dropped sharply and average costs, as a consequence, saw a big spike and have been somewhat volatile since then. Finally, Cancer Multi-Disciplinary Team Meetings continue to show a steady growth in activity since 2011/12, with average unit costs displaying moderate fluctuations.

Figure 23: Trends in Critical Care activity (right axis) and average costs (left axis), 2007/08 – 2018/19



[36] The cost-weighted output growth measure for Specialist services is 0.97%, when not adjusted for working days.

Figure 24: Trends in Specialist Palliative Care activity (right axis) and average costs (left axis), 2007/08 – 2018/19

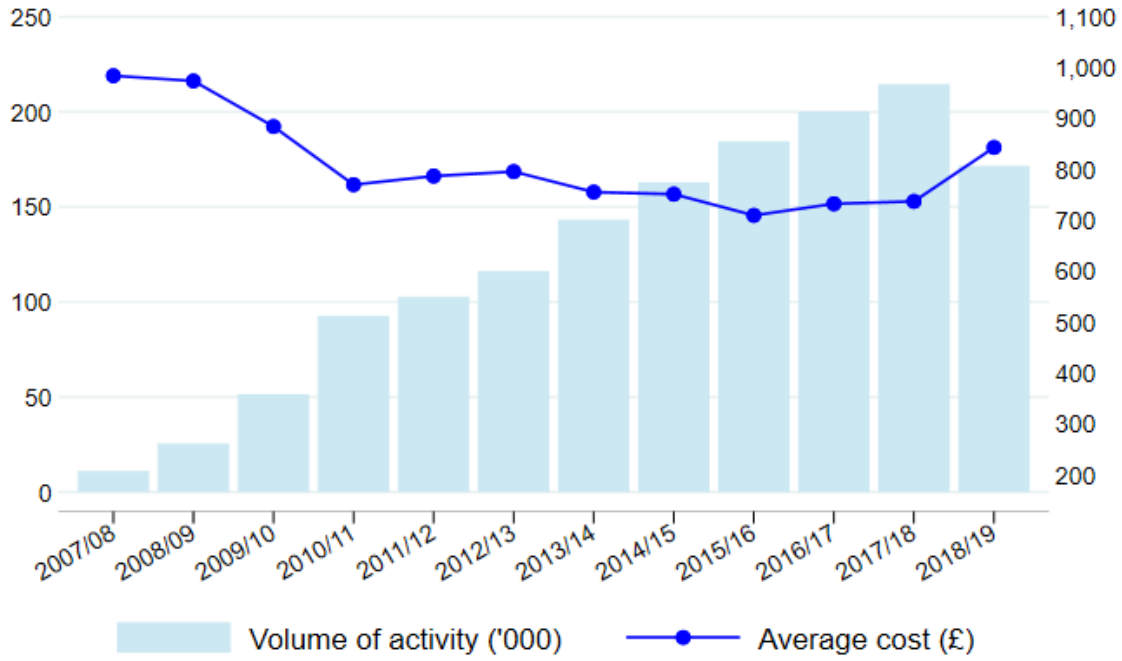


Figure 25: Trends in Cystic Fibrosis activity (right axis) and average costs (left axis), 2007/08 – 2018/19

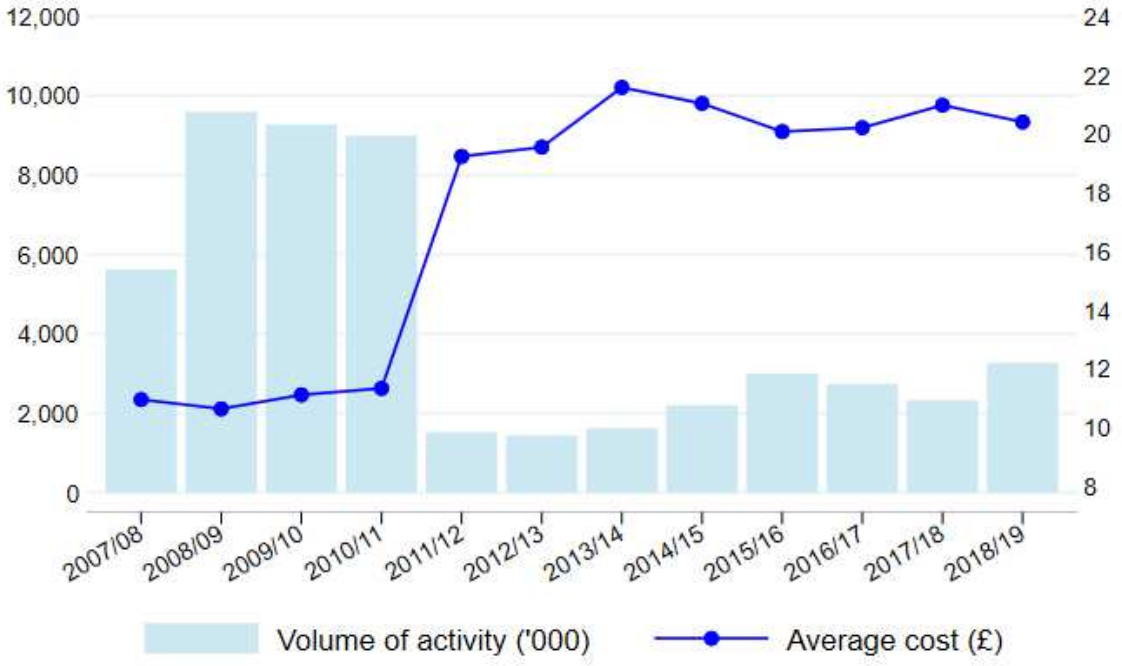
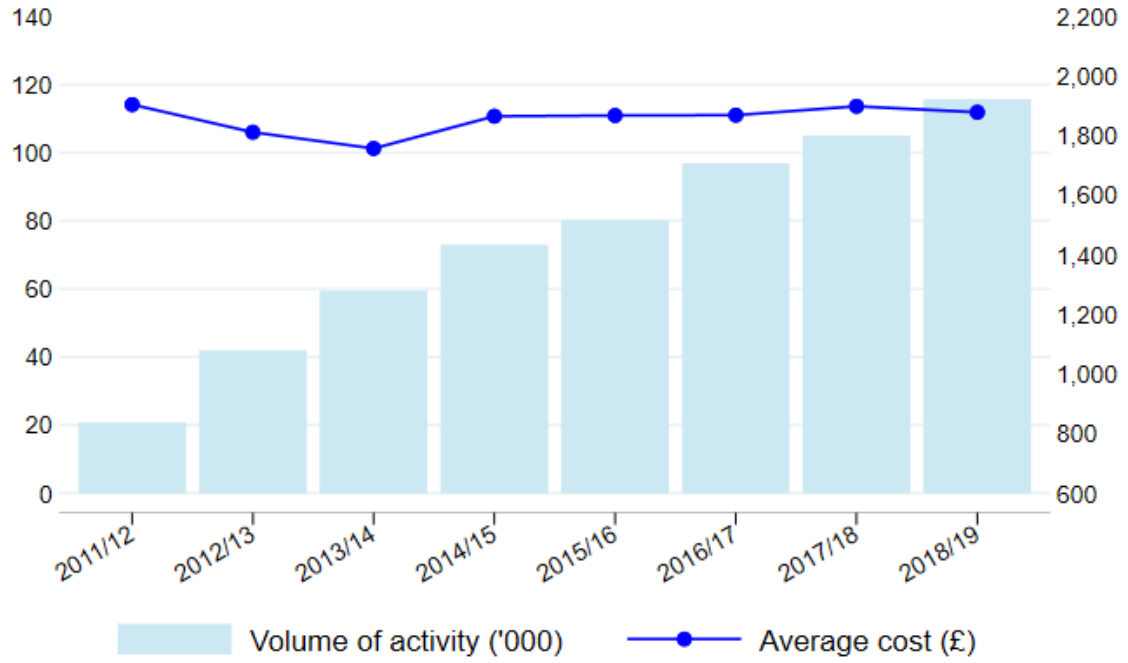


Figure 26: Trends in CMDT activity (right axis) and average costs (left axis), 2007/08 – 2018/19



5.4.11. Other NHS activity

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres growth measure for 'Other NHS' activity was -3.92%.**

Other types of activity reported in the RC are summarised in Table 24. The total volume of Regular Day and Night Attenders (RDNA), similarly to the previous year, showed a 15.48% increase between 2017/18 and 2018/19. In contrast, Day Care Facilities activity decreased by 20.45%, this is an opposite trend to the previous financial year, which saw an increase of 44.7%. The total volume of Audiological services continued the downward trend, recording an even higher negative growth of -7.57% in 2018/19.

Table 24: Other NHS activity

Activity	2016/17		2017/18		2018/19	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Regular Day & Night Attenders	242,322	325	284,842	327	328,946	341
Audiological services	3,452,571	57	3,293,426	58	3,044,139	61
Day Care Facilities	191,547	125	277,092	102	220,424	70

Figure 27 to Figure 29 show trends in volumes of activity (right-hand side) and average costs (left-hand side) for all of the activity reported under 'Other NHS activity' since 2007/08. RDNA shows a positive trend in volumes with more volatile average costs trends, whereas more erratic patterns in activity growth are accompanied by a positive and a negative trend in unit costs for Audiological services and Day Care Facilities respectively.

Figure 27: Trends in RDNA activity (right axis) and average costs (left axis), 2007/08 – 2018/19

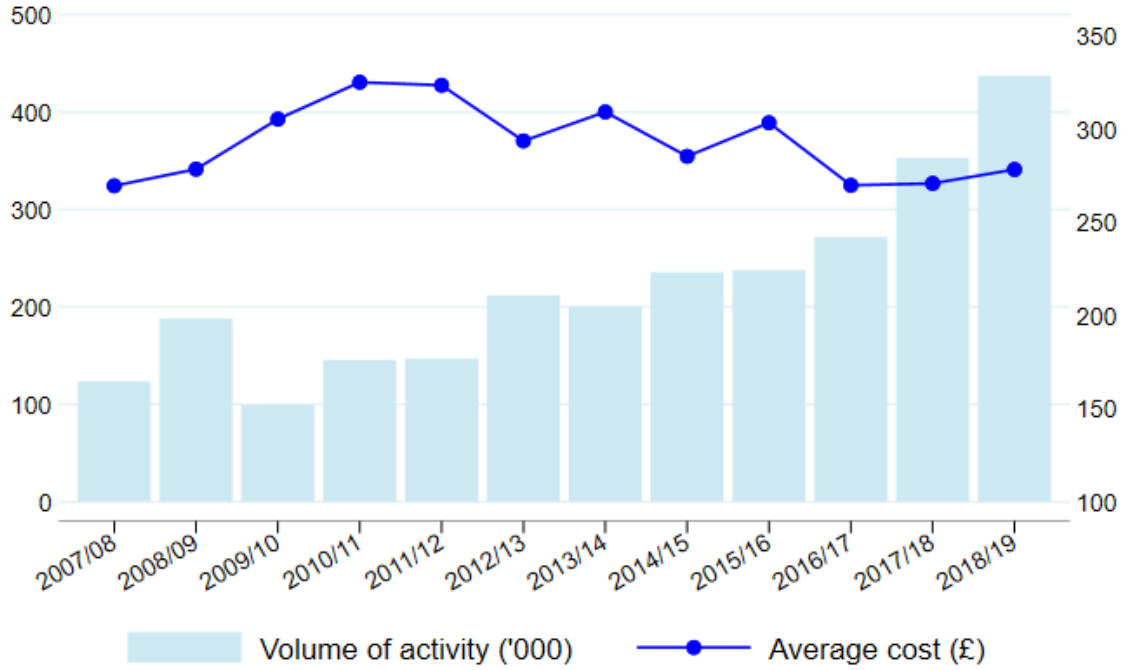


Figure 28: Trends in Audiological activity (right axis) and average costs (left axis), 2007/08 – 2018/19

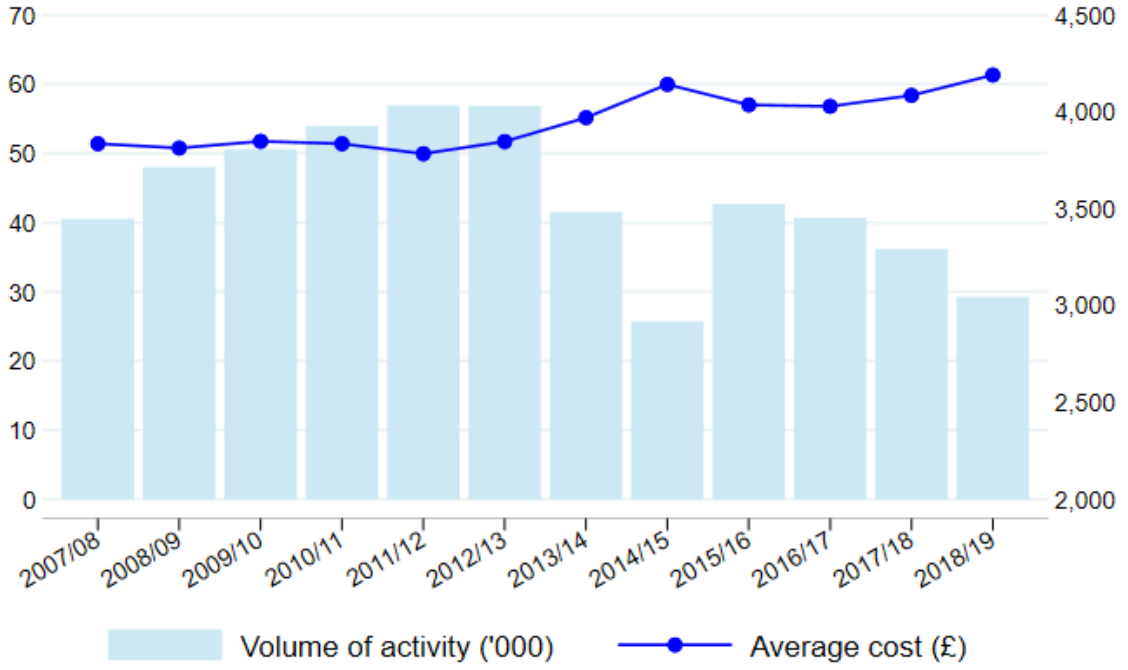
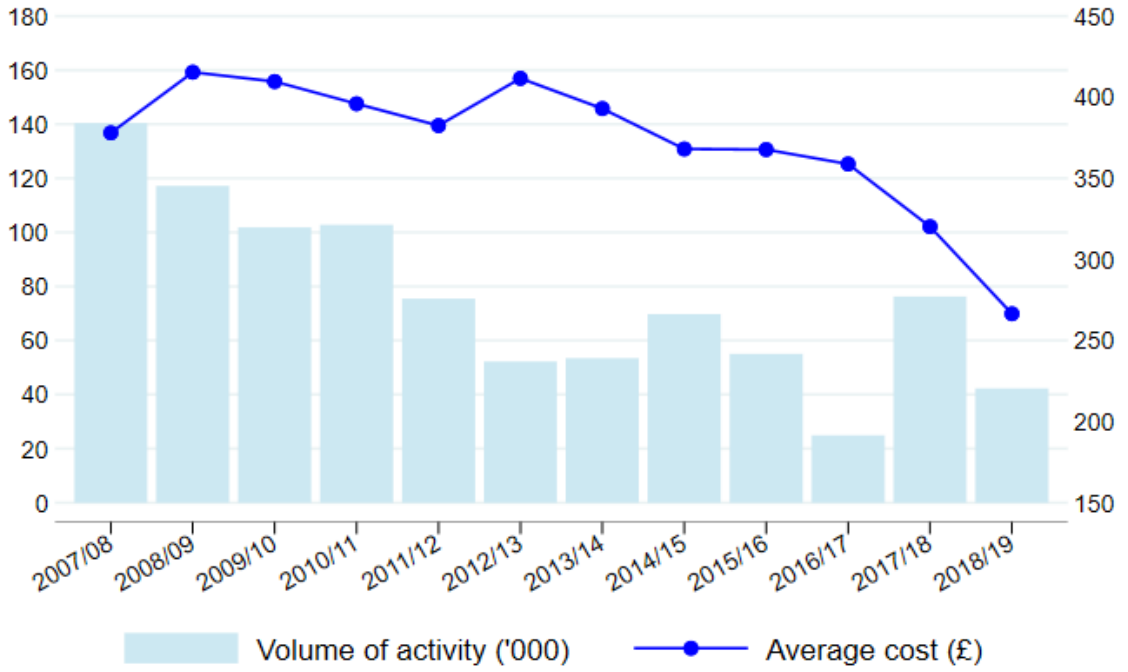


Figure 29: Trends in Day Care Facilities activity (right axis) and average costs (left axis), 2007/08 – 2018/19



Overall, the cost-weighted and working days adjusted Laspeyres output growth measure for 'Other NHS activity' was -3.92% between 2017/18 and 2018/19, mainly driven by the large decrease in the volume of activity carried out in Day Care Facilities, which was not completely offset by the increase in RDNA activity.[37]

5.5. Dentistry and ophthalmology

- **Between 2017/18 and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth measures for**
  - **Ophthalmology was 0.68%;**
  - **Dentistry was -0.94%.**
- **Combining the two activities yielded a growth of -0.64%.**

Information about dentistry[38] (activity and costs) and ophthalmology[39] (activity only) is published by NHS Digital. Table 25 shows the volume of activity and average costs for both types of outputs, with dental activity differentiated into dental bands. For the last three financial years, cost data for Ophthalmological services are provided by the Association of Optometrists.

[37] The cost-weighted output growth measure for 'Other NHS' activity is -3.16%, when not adjusted for working days.
[38] https://digital.nhs.uk/data-and-information/publications/statistical/nhs-dental-statistics/2018-19-annual-report-pas (last accessed 21/01/2021).
[39] https://digital.nhs.uk/data-and-information/publications/statistical/general-ophthalmic-services-activity-statistics/year-ending-march-2019 (last accessed 21/01/2021).

Table 25: Ophthalmology and Dentistry

Activity		2016/17		2017/18		2018/19	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Ophthalmology		12,995,512	21	13,032,582	21	13,225,755	21
Dentistry	**Band 1**	22,939,419	20	22,814,753	21	23,386,880	22
	Band 2	11,080,848	54	10,699,157	56	10,631,216	59
	Band 3	2,082,785	234	1,987,657	244	1,941,217	257
	Urgent	3,664,913	20	3,566,835	21	3,620,927	22
	Other	156,905	20	144,888	21	136,476	22
	Total	**39,924,870**	**40**	**39,213,290**	**42**	**39,716,716**	**43**

The raw volume of ophthalmic services increased in 2018/19 by 1.48%, continuing the positive trend recorded since 2015/16, with average costs remaining unchanged. Dental activity also recorded an overall increase of 1.28% in 2018/19, although with some variation by type of bands. Dental activity in Bands 2 and 3, and 'Other' record a decrease in treatments offered. Average costs of dental activity have increased for all types of dental services.

Combining activity for dental services and ophthalmology, the cost-weighted and working days adjusted Laspeyres output growth measure was -0.64% between 2017/18 and 2018/19.[40]

5.6. Primary care activity

- **Between 2017/18 (part estimated) and 2018/19, the cost-weighted and working days adjusted Laspeyres output growth of primary care activity was -0.41%.**
- **After adjusting for changes in the quality of care, the total Laspeyres output growth of primary care activity was -0.39%. The effect of accounting for quality is positive, albeit very small.**

Previously, and in the absence of routinely collected data for primary care, the NHS productivity updates used the GP Patient Survey to estimate activity in the English primary care setting (Castelli et al., 2020, Castelli et al., 2019). However, since October 2018 NHS Digital has been releasing General Practice (GP) appointments data on a monthly basis, with the first dataset published in October 2018 for the period from November 2017 to October 2018.[41] In this report, we used the new GP appointment data to calculate activity in the primary care setting where available, as part of the NHS output and productivity series. In the remainder of this section, we provide a description of the new NHS Digital GP appointment data and their preparation; we propose two alternative methods to account for missing monthly figures, and finally report the output growth rates of the primary care setting.

5.6.1. NHS Digital General Practice appointments data

Each monthly data release covers the most recent month and updated information on the previous 17 months (18 months in total) and includes activity recorded within the appointment systems for the majority of General Practices across England, with patient coverage of about 94%. The number of

[40] Their cost-weighted output growth measures, when not adjusted for working days, are equal to 1.48% and -0.15%, respectively for Ophthalmology and Dentistry. When combining the two activities, the cost-weighted output growth measure is 0.15%, when not adjusting for working days.

[41] NHS Digital GP appointments data are available at https://digital.nhs.uk/data-and-information/publications/statistical/appointments-in-general-practice/november-2020 (last accessed 22/01/2021).

practices included in the dataset is lower than the total number of practices at the national level because NHS Digital excludes from the dataset inactive and closed practices, practices with an appointment rate below 1 appointment per registered patient per year,[42] as well as practices belonging to a Clinical Commissioning Group (CCG) with less than 2 included practices. Despite an already wide patient coverage, there are plans to further increase it as well as to improve data consistency across participating practices.[43]

NHS Digital releases three separate datasets: (1) a monthly summary of GP appointments data at the national level, (2) a monthly dataset at the CCG level with NHS geographies up to regional local office included, and (3) a CCG-level dataset reporting daily appointment counts in general practices. All three datasets include breakdowns of appointment counts by appointment status (attended, not attended, unknown), health care professional (GP, other practice staff, unknown), mode of appointment (face-to-face, home visit, telephone, video/online, unknown), but only the monthly and daily appointment datasets at CCG level allow for grouping of GP appointment modes by appointment status.[44]

For the purpose of our NHS productivity calculations, we use both datasets (1) and (2). From dataset (1) we use monthly estimates of patient coverage, needed to obtain the estimate of appointment counts at the national level, whereas dataset (2) allows a breakdown by appointment status within each appointment mode. Dataset (1) does not include this level of disaggregation.

Distinguishing among different appointment modes is crucial since consultation types differ in duration, and therefore, have different costs. We exclude appointments that were not attended from the total counts, using the information provided on appointment status. It is worth noting that non-attendance rates exhibit seasonality and vary by appointment mode.

The appointment status shows whether an appointment was attended or not. However, for some cases, amounting to between 3% and 6% of monthly consultations, this information is not available. These appointments are reported as having an 'Unknown' status. Finally, due to a data collection issue, releases covering the period from June 2018 to November 2018, and December 2017 do not have any appointment status information. To deal with this issue, we assume that attendance rates during these months are equal to those in the respective months of the following calendar year (2019).

The GP appointments data include information on the number of appointments led by a GP, other practice staff and ‘unknown’. Knowing the type of health care professional delivering care is potentially useful information, as it allows for the more precise costing of appointments. However, we decided not to use this information for two reasons. First, the data currently only distinguish between GP-led and any other practice staff-led appointments; with both of these two groups of health care professionals comprising several different types of staff. GP-led appointments include appointments delivered by either GP Registrars, Principal GP or locum GPs, whilst ‘other practice staff’ includes an even more heterogeneous group of health care professionals,[45] whose distribution within the group is unknown. Thus, assigning a precise unit cost to such a varied array of health care professionals is

[42] Data releases issued before July 2019 excluded also practices with less than 1000 registered patients.
[43] At the moment activity data entry standards do not exist, and there is considerable variation in appointment management approaches among practices. Data coverage also varies with time: initially, only practices using EMIS and TPP GP systems were included; from April 2019 onwards, releases cover also practices using the Microtest appointment system with data from November 2018; Vision data was first included in the June 2019 release, with data from January 2018 onwards.
[44] All three datasets also include information on time between booking an appointment and actual appointment.
[45] Other practice staff include District Nurse, Counsellor, Chiropodist, Health visitors, Dispenser, to mention a few. A full list is available at https://digital.nhs.uk/data-and-information/publications/statistical/appointments-in-general-practice/appointments-in-general-practice-supporting-information (last accessed 27/02/2021).

not currently possible, because (a) we do not know precisely which health care professionals are treating patients and (b) because of a lack of unit cost data for all types of healthcare professionals. Second, given increasing GP workload and issues around GP shortages, NHS England in its NHS Long Term Plan (NHS England, 2019) and in the new GP contract (BMA & NHS England, 2019) have encouraged a more multi-disciplinary approach in primary care, including the introduction of new professional figures. One of the aims of this new policy is to ease GPs' workload by shifting patient care away from general practitioners and towards other practice staff. This might imply that some of the patients previously seen by a GP (at a higher unit cost) might now be seen by a different health care professional (at a lower cost), so there might be a substitution of more costly GP-led care with less costly other practice staff-led care, but with similar quality of care provided and potentially of the same or similar value to patients. If this were the case,[46] and we were to use different unit costs as weights for GP-led and other practice staff-led appointments, a shift of activity from GPs to other practice staff, would result in a decline or negative growth of cost-weighted primary care activity, whilst the volume of activity and their related outcomes may not *de facto* be changing. For these reasons, our preferred approach is to assume that all primary care services have the same unit costs, independently of the health care professional delivering them. Please note that this assumption may imply an overestimation of the actual costs of providing primary care services and of its related cost-weighted output and cost-weighted and quality-adjusted output measures.

In order to use the most up-to-date GP appointments data, and needing to collate data for the financial years 2018/19 and 2017/18, we use the August 2020 release to get the March 2019 GP appointments data, the July 2020 release for the February 2019 data etc. The last release of GP appointments data used in our time series is the one for April 2019, from which we retrieve the November 2017 GP appointment counts.

5.6.2. Preparation of the GP appointments data

The four steps described below were followed to prepare the GP appointment dataset used for the purposes of measuring NHS output and productivity:

- **Step 1:** We use CCG-level monthly data disaggregated by appointment mode (face-to-face, home visits, telephone, video/online, unknown) and a breakdown by appointment status (attended, not attended, unknown) within each mode. We therefore have N_{mis} primary care consultations of appointment mode *i* with appointment status *s* in month *m*.
- **Step 2:** For cases where appointment mode is 'unknown', we assume that these appointments are distributed across the other appointment modes proportionally to their respective shares in the monthly totals.
- **Step 3:** For cases where the appointment status is 'unknown', we apportion these between 'attended' and 'not attended', for each appointment mode, and then calculate the monthly shares of not attended (*NA*) consultations by appointment mode (S_{mi}^{NA}).
- **Step 4:** To obtain the monthly estimates of primary care activity (i.e. attended appointments) by mode of appointment for the whole of England (PC_{mi}), we multiply the original number of primary care consultations (N_{mis}) by the proportion of attended consultations and correct for patient coverage ($PatCov_m$), using the formula

$$PC_{mi} = \frac{\sum_s N_{mis} \times (1 - S_{mi}^{NA})}{PatCov_m} \quad \text{(E9)}$$

[46] Currently NHS Digital GP appointments data do not show any trends in shifting activity from GP-led to other practice-led, but our assumption is nonetheless valid and grounded in recent policy changes.

5.6.3. Methods to account for missing months in GP appointment data

Finally, a significant issue with the GP appointment dataset is that the earliest available data point is November 2017, while the NHS productivity measure is calculated over the whole financial year (April to March). This means that for the financial year 2017/18, we only have GP appointments data for 5 months. Below we describe two alternative methods that we investigated to estimate missing data for the financial year 2017/18 in this context.

Method A

For each financial year, use only available data. This method requires calculating growth rates for the period from November 2017 to March 2018 and from November 2018 to March 2019. This approach assumes that the growth in GP appointments for the missing 7 months in each year is the same as the one observed between November and March.

Method B

Impute the missing GP appointments data for the period from April 2017 to October 2017 using the data between April 2018 and October 2018. This implies following these three steps:

- **Step 1:** Calculate the ratio of GP appointments for the period April 2018 to October 2018 to those reported between November 2018 and March 2019, by appointment mode (i) and limited to those which have been attended (PC_{mi}, from (E9)), as follows:

$$PC\_ratio_i = \frac{\sum_{m=Apr18}^{Oct18} PC_{mi}}{\sum_{m=Nov18}^{Mar19} PC_{mi}}. \quad \text{(E10)}$$

- **Step 2:** Apply the ratio (E10) to the number of GP appointments over the period November 2017 to March 2018, to obtain an estimate of the number of appointments, for each appointment mode, for the missing months of the 2017/18 financial year, i.e. April 2017 to October 2017.
- **Step 3:** Finally, calculate an estimate of GP appointments for each appointment mode for the full 2017/18 financial year as follows:

$$PC_i^{2017/18} = PC\_ratio_i \times \sum_{m=Nov17}^{Mar18} PC_{mi} + \sum_{m=Nov17}^{Mar18} PC_{mi} \quad \text{(E11)}$$

Method B hinges upon the assumption that for each appointment mode, the shares of appointments of the missing months are constant across financial years.

Our preferred method to impute missing data points is method B since it relies on weaker assumptions and explicitly recognises potential seasonality in appointments.

5.6.4. Assigning unit costs to primary consultations

In order to calculate the primary care cost-weighted and cost-weighted and quality-adjusted output growth measures, we need to use appropriate unit costs for the different types of primary care activity. Since we have assumed that all activity is GP-led, we take the cost of patient contact per minute of GP's time as our primary unit, which we source from the PSSRU 'Unit Costs of Health and Social Care' reports (Curtis and Burns, 2018, Curtis and Burns, 2019).[47] The per-minute cost of GP contact is equal to £4 and £4.30 in 2017/18 and 2018/19 respectively.

[47] The unit costs are taken from the PSSRU "Unit Costs of Health and Social Care" 2018 (p. 127) and 2019 (p.120) (last accessed 27/02/2021).

For the duration of each consultation type, we use different data sources, as summarised in Table 26. Our baseline durations are equal to an average of 9.22 minutes for a face-to-face appointment, an average of 23.4 minutes for a home visit, and an average of 5 minutes for both Telephone and Video/online consultations. All indicated by '*' in Table 26.

While we found little variation across different estimates of the duration of online consultations, there is some variability for face-to-face consultations, and for home visits, whose average duration ranges from 23.4 minutes to 60 minutes. Sensitivity checks to assess the impact of different assumed average durations for face-to-face appointments and home visits on the primary care output growth measure have been carried out and the results can be found in sub-section 5.6.6.

Table 26: Sources of appointment duration estimates by type of appointment

	Source					
GP appointment mode	**National Guideline Centre (2018)**	**Hobbs et al. (2016)**	**Elmore et al. (2016)**	**NHS England (2016)**	**Curtis (2014) (based on GP workload survey[48])**	**Edwards et al. (2017)**
Face to face	10 - 15 mins (mean 12.5 mins)	9.22 mins (mean)*	10.22 mins (mean)	-	-	-
Home visits	40 - 60 mins (mean 50 mins)	-	-	-	23.4 mins*	-
Telephone consultation	-	-	-	4 - 6 mins (mean 5 mins)*	-	-
Video/online	-	-	-	4 - 6 mins (mean 5 mins) [online consultation]*	-	5 mins [online triage]

* Baseline estimates used in the calculation of the primary care cost-weighted output growth measure.

Finally, to obtain the unit costs for each appointment mode, we multiply the per-minute cost of a GP contact by the average appointment duration of each appointment type. Baseline unit costs for each appointment mode are reported in Table 27. Table 27 also reports the estimated number of appointments (by appointment mode), using both Method A and Method B. We also report both the raw output growth and Laspeyres (cost-weighted) output growth rates for the primary care setting for both methods.

[48] Last accessed 27/02/2021.

Table 27: Estimated number of consultations in England, years 2017/18 – 2018/19

GP Appointment mode	Nov 2017 – Mar 2018 (Method A)	Nov 2018 – Mar 2019 (Method A)	Apr 2017 – Mar 2018 (Method B)	Apr 2018 – Mar 2019 (Method B)	Unit cost 2017/18	Unit cost 2018/19
Face-to-Face	103,204,914	103,487,804	244,043,324	244,879,886	36.88	39.65
Home Visit	1,294,164	1,248,564	2,934,276	2,832,825	114.66	121.68
Telephone	17,620,129	17,973,344	41,388,487	42,247,084	20.00	21.50
Video/Online	567,383	607,570	1,333,691	1,429,131	20.00	21.50
Total	**122,686,591**	**123,317,282**	**289,699,777**	**291,388,926**		
Raw growth rate	**0.51%**		**0.58%**			
Laspeyres growth rate	**0.31%**		**0.39%**			

Independently of the approach adopted, the total number of GP consultations increased slightly in 2018/19 compared to 2017/18, with both methods producing very similar raw and Laspeyres cost-weighted growth rates.

5.6.5. Quality adjustment

In 2007, the Department of Health proposed a means of allowing for changes in the quality of care provided by NHS general practice (Derbyshire et al., 2007). The approach utilises data captured as part of the Quality and Outcomes Framework (QOF) under which GPs are rewarded for achieving a range of diverse targets. The following three QOF indicators were selected as providing information about improvements in disease management:

- CHD 6. The percentage of patients with coronary heart disease (CHD) in whom the last blood pressure reading (measured in the last 15 months) is 150/90 or less;
- STROKE 6. The percentage of patients with a history of Transient Ischaemic Attack (TIA) or stroke in whom the last blood pressure reading (measured in the last 15 months) is 150/90 or less;
- BP 5. The percentage of patients with hypertension in whom the last blood pressure (measured in the last 9 months) is 150/90 or less.

Table 28 provides information on the incidence and achievement rates of the three QOF indicators for the financial years 2017/18 and 2018/19. These figures show that the prevalence fell slightly for CHD, did not change for stroke and marginally increased for hypertension. The achievement rates rose for all indicators.

Table 28: Quality adjustment for primary care: prevalence and achievement rates (%)

Year	Prevalence			QOF achievement rate		
	CHD	Stroke	Hypertension	CHD	Stroke	Hypertension
2017/18	3.13	1.77	13.94	92.11	87.40	82.60
2018/19	3.10	1.77	13.96	92.37	87.66	83.01

The expectation is that if disease management in primary care is improving over time, this will be reflected in reduced blood pressure for an increasing proportion of patients with CHD, stroke and hypertension. Reflecting the additional value of care which meets these targets for affected patients, we assign a multiplication factor of 1.3 (Derbyshire et al., 2007, Castelli et al., 2020) to the total number of consultations falling into the remit of the QOF indicators considered and that meet the

quality standard. As we observe prevalence, not count of patients with CHD, stroke and hypertension, a larger number of consultations implies a larger number of patients with QOF relevant conditions, while higher achievement rates translate into a larger number of quality-adjusted consultations. Therefore, a greater number of appointments are observed after quality adjustment, as presented in Table 29. For the first time, we are applying the working days (WD) adjustment to primary care activity. As in 2018/19 there were more working days than in 2017/18, we expect the WD adjustment to dampen the growth in primary care activity (both raw volume growth and cost/cost- and quality-adjusted growth).

Table 29: Quality and working days adjusted growth rates

GP appointment mode	2017/18	2018/19	Raw growth rate	Laspeyres growth rate
Total appointments count	289,699,777	291,388,926	0.58%	0.39%
QA appointments count	303,557,906	305,379,210	0.60%	0.40%
Quality- and WD-adjusted appointments count	303,557,906	302,965,145	-0.20%	-0.39%

Note: Estimates presented are obtained using imputation Method B.

While quality adjusting results in slightly higher raw and Laspeyres growth rates, driven by increased achievement scores, the working days adjustment had the opposite effect, yielding a negative Laspeyres growth rate of -0.39%.[49] This leads to the conclusion that the seemingly increased number of primary care consultations was driven by a higher number of working days in 2018/19 compared to 2017/18. Note that since the methodology to construct the growth estimates for 2017/18 – 2018/19 is entirely different from the one previously adopted, no comparison can be made with growth rates in previous years.

5.6.6. Sensitivity analysis

Finally, we check whether the results obtained are sensitive to the choice of consultation duration by using an alternative estimate for one appointment mode at a time, as presented in Table 30.

Table 30: Sensitivity to consultation duration: alternative estimates for 2017/18 – 2018/19 growth rates

GP appointment mode	Baseline	Sensitivity check 1	Sensitivity check 2	Sensitivity check 3
Face to face	9.22 mins	10.22 mins	12.5 mins	9.22 mins
Home visit	23.4 mins	23.4 mins	23.4 mins	50 mins
Telephone consultation	5 mins	5 mins	5 mins	5 mins
Video/Online	5 mins	5 mins	5 mins	5 mins
Laspeyres growth rate	0.39%	0.38%	0.38%	0.25%
Quality-adjusted Laspeyres growth rate	0.40%	0.40%	0.40%	0.27%
Quality- and WD-adjusted Laspeyres growth rate	-0.39%	-0.39%	-0.40%	-0.52%

Note: Estimates presented in the table were obtained with imputation Method B. The results are very similar when Method A is applied.

[49] The Laspeyres cost-weighted and quality-adjusted output growth measures for Primary care activity are equal to 0.39% and 0.40% respectively, when not adjusted for working days.

Results presented in Table 30 indicate that assuming a duration of either 10.22 or 12.5 minutes for a face-to-face appointment does not alter the baseline growth rates, whereas using a home visits duration equal to 50 minutes instead of 23.4 minutes decreases the growth rates by about 0.13 percentage points.

5.7. Community prescribing

- **Between 2017/18 and 2018/19, the Laspeyres cost-weighted output growth measure for Community prescribing was 2.49%.**[50]

In 2020, responsibility for producing community prescribing data for the Prescription Cost Analysis (PCA) publication moved from NHS Digital to the NHS Business Services Authority (BSA). A new data warehouse was also used from December 2018, leading to a slight improvement in precision of the underlying data. The relevant improvement for the purposes of this work is the inclusion of a further decimal point of accuracy in reporting quantities and expenditure. Data on the number and cost of prescriptions of different drugs are now published monthly and freely available. As with any change in data collection and/or data source, we checked that 2018/19 community prescribing data were comparable with those for 2017/18. To this end, we compared community prescribing data for 2017/18 as published by NHS Digital and by the NHS BSA. Specifically, we aggregated the NHS BSA data to the quarter level to compare it with the data previously provided by NHS Digital.

We found that the total number of observations differs slightly: NHS Digital data for 2017/18 has 93,972 observations compared to the 94,328 observations in the NHS BSA dataset. This difference in observations was consistent across quarters. However, the total number of prescriptions, items prescribed and cost of prescriptions were identical for the financial year 2017/18 as a whole and in each quarter in both data sources. We therefore considered this a very modest reallocation of drug categories, rather than a wholesale change in the scope or type of information provided. The application of the imputation method developed by Castelli et al. (2011), which was explicitly created to account for changes in categorisation within a consistent whole, is sufficient to consider NHS BSA data in 2018/19 comparable to NHS Digital data from 2017/18.

The data include information about the Drug code (PropGenLinkCode), Net Ingredient Cost (NIC), Quantity of Drug Dispensed, and Number of Prescription Items. The data were complete and prices were available for all items and years.

Table 31 reports summary statistics about community prescribing. In 2018/19, 7,755 distinct community prescribed drug items were observed, continuing the small decrease between 2016/17 and 2017/18. While the total number of prescriptions made out rose marginally (by 0.2%), total items prescribed, total expenditure and activity weighted prescription unit costs all fell by 2-3% between 2017/18 and 2018/19. This would suggest that the prescriptions written out contained fewer items each, and that items prescribed were less costly on average in 2018/19 than in 2017/18. The total number of prescriptions and expenditure in 2018/19 is in line with that reported for England for the calendar year of 2018 by NHS Digital.[51] 580 new drug items appeared in 2018/19, amounting to a total expenditure of £11.1 million in 2018/19 prices. 628 drug items were prescribed in 2017/18 and not in 2018/19, representing £1.5 million of expenditure in 2017/18 prices. No data items appear obviously incorrect, we therefore took the data at face value.

[50] Please note that Community prescribing is not adjusted for working days.

[51] https://digital.nhs.uk/data-and-information/publications/statistical/prescription-cost-analysis/2018 (last accessed 28/01/2021).

Table 31: Community prescribing, summary data 2016/17 – 2018/19

Year	Unique drug codes observed	Total Prescriptions	Total items prescribed	Total Spend	Activity weighted prescription unit cost (£)	Activity weighted prescribed item unit cost (£)
2016/17	8,147	1,108,965,909	92,167,433,244	£9,193,912,893	8.29	0.100
2017/18	7,803	1,106,431,880	89,638,486,058	£9,095,228,060	8.22	0.101
2018/19	7,755	1,109,084,896	87,947,789,280	£8,833,869,014	7.96	0.100

Volume and price indices for community prescribing are reported in Table 32. The Paasche Price index fell between 2017/18 and 2018/19, continuing a trend which has been observed since 2004/05.[52] Also as observed in previous years, the Laspeyres volume index was positive, though the increase from 2017/18 to 2018/19 was the smallest observed, with the exception of growth between 2016/17 and 2017/18. Given that we observed a fall in the total number of units prescribed, the recorded small increase in the volume growth index was an indication of a shift to prescribing higher cost items, which was also suggested by the marginal increase in the unit cost of items prescribed as shown in Table 31. The unit costs observed in 2018/19 do not affect the Laspeyres volume index, which holds prices constant at the base year. Clinicians could shift towards prescribing drugs which were relatively expensive in a previous year because the price of this item fell in the current year. This might happen if a patent expires or a new generic enters the market at the time and would allow for a volume increase if the same budget was expended. This type of mechanism can also reconcile a negative Paasche price index and the marginally positive unit cost change. In this case, a redistribution of volume to a drug which was relatively expensive in a previous year would not put upward pressure on the Paasche price index, but a drop in price for such a drug would put downward pressure on the index and the volume shift would put upward pressure on unit costs, which are calculated in current terms.

Table 32: Community prescribing: price and volume indices 2015/16 – 2018/19

Years	Paasche Price Ratio	Laspeyres Volume Ratio
2015/16 – 2016/17	0.9300	1.0644
2016/17 – 2017/18	0.9742	1.0155
2017/18 – 2018/19	0.9477	1.0249

Taking the base year as 2004/05, trends in the volume and prices of items prescribed are shown in Figure 30. This figure indicates a small fall in volume between 2017/18 and 2018/19, continuing the direction observed in the previous link. Average prices also fell marginally.

[52] See Table A 25 for earlier equivalent figures, beginning from 2004/05.

Figure 30: Price and volume changes for community prescribed pharmaceuticals

5.7.1. Potential drivers of price changes in Community Prescribing

The CHE Paasche price index for Community Prescribing for the financial years 2017/18 and 2018/19 showed a sharp decrease of around 5%. In this section we summarise our investigation of the potential drivers of this price change, by considering three different breakdowns of the available Community Prescribing data:

1. Analysis of price changes across the full set of Community Prescribing;
2. Analysis of price changes by British National Formulary (BNF) chapters;
3. Identification of high expenditure drugs with large price reductions.

5.7.1.1. Analysis of price changes across the full set of Community Prescribing

The simplest available explanation for a mean reduction in price is a general reduction across the full set of community prescriptions. However, expenditure on drugs is extremely skewed, indicating that the behaviour of prices where expenditure is high is likely to drive the overall mean. Table 33 sets out the Paasche price indices for deciles of expenditure: that is from the 10% of drugs for which combined expenditure is lowest to the 10% of drugs on which total expenditure is highest.

Table 33: Paasche Price Index by deciles of total expenditure in 2018/19

Deciles of total spend	Min spend	Max spend	Paasche Price Index
Bottom decile	0.05	201.92	0.838
2nd decile	202.22	1,009.76	0.996
3rd decile	1,010.79	3,965.45	0.983
4th decile	3,968.51	11,943.83	1.009
5th decile	11,953.40	33,478.14	0.959
6th decile	33,499.62	97,333.43	0.998
7th decile	97,365.79	269,117.30	0.992
8th decile	271,543.80	734,255.40	0.957
9th decile	734,413.90	2,294,966.00	0.921
Top decile	2,295,529.00	267,000,000.00	0.950

Several key conclusions can be drawn from Table 33. First, the high degree of skewness in total expenditure on different drugs. While each decile contains the same number of unique drugs, it is clear that the overall Paasche index will be most strongly influenced by the top decile, which has a Paasche price index very similar to the overall price index for Community Prescribing. Second, with the exception of the lowest decile, price reductions are generally larger in the higher deciles of expenditure. Finally, this table does not indicate a general reduction in price across all drugs. If this were the case, we would expect to observe similar Paasche price ratios in all deciles.

5.7.1.2. Analysis of price changes by BNF chapters

A second possible explanation for a reduction in mean price is that prices fell sharply for a specific group of drugs. The BNF is organised into 23 chapters, which group specific sets of drugs used to treat different types of medical conditions. Table 34 sets out expenditure and Paasche price indices for each of the 23 chapters of the BNF.

Table 34: Total expenditure and Paasche Price Index by BNF Chapter 2018/19

BNF Chapter	Chapter Description	Total spend	Paasche Price Index
1	Gastro-Intestinal System	450,000,000.00	0.976
2	Cardiovascular System	1,260,000,000.00	0.939
3	Respiratory System	1,020,000,000.00	0.946
4	Central Nervous System	1,480,000,000.00	0.822
5	Infections	193,000,000.00	0.931
6	Endocrine System	1,390,000,000.00	0.952
7	Obstetrics, Gynaecology and Urinary-Tract Disorders	332,000,000.00	0.926
8	Malignant Disease and Immunosuppression	187,000,000.00	0.959
9	Nutrition and blood	661,000,000.00	1.025
10	Musculoskeletal and Joint Diseases	196,000,000.00	1.160
11	Eye	181,000,000.00	1.164
12	Ear, Nose and Oropharunx	70,200,000.00	1.004
13	Skin	267,000,000.00	1.002
14	Immunological Products and Vaccines	132,000,000.00	1.286
15	Anaesthesia	25,300,000.00	0.978
18	Preparations used in Diagnosis	10,237.50	0.999
19	Other Drugs and Preparations	28,900,000.00	0.811
20	Dressings	175,000,000.00	1.025
21	Appliances	406,000,000.00	1.002
22	Incontinence Appliances	57,800,000.00	1.008
23	Stoma Appliances	326,000,000.00	1.015

Note: Chapters 16 and 17 contain no drugs.

As in Table 33, Paasche price ratios are highly variable between chapters. Similarly, chapters with the highest expenditure indicate ratios close to or below the overall mean. Chapter 4 is especially striking, reporting the highest expenditure (around £1.5 million) and one of the lowest price indices (0.822).

5.7.1.3. Identification of high expenditure drugs with large price reductions

A third and final potential explanation is that a handful of very high expenditure drugs drive the mean. Table 35 presents the list of drugs for which expenditure is over £15 million (roughly the top 1% of expenditure on individual drugs) and for which the Paasche price index is less than 0.9. These may cause the strongest downward pressure on the overall ratio. These drugs are concentrated within Chapters 2, 3, 4 and 6. The names of drugs associated with the listed BNF codes are provided in Appendix D. The presence of drugs in a range of chapters having an important downward pressure on the price suggests there is not a single drug or closely related group which drives the overall result.

Table 35: Drugs with over £15 million expenditure and Paasche Price Indices under 0.9

BNF Code	Chapter	Expenditure	Paasche Price Indices
0302000K0AM	3	70,291,421	0.808
0302000N0BG	3	59,062,698	0.799
0302000K0AU	3	42,827,165	0.817
0302000N0BF	3	34,465,727	0.830
0212000L0AA	2	29,855,079	0.551
0103050P0AA	1	28,991,571	0.855
0407010H0AM	4	27,974,324	0.725
0601022B0AS	6	27,348,223	0.862
0408010G0AB	4	26,134,801	0.789
0603020J0AD	6	24,775,152	0.584
0602010V0BW	6	23,749,060	0.771
0206020A0AA	2	21,288,734	0.589
0212000B0AB	2	19,313,537	0.878
0408010A0AB	4	18,156,879	0.599
0601022B0AV	6	17,057,717	0.850
0103050L0AA	1	16,935,760	0.892
0602010V0BZ	6	15,157,256	0.760

In terms of what causes the sharp drop in price, the ending of a patent may be one likely possibility. However, the ending of a patent does not necessarily mean the immediate emergence and widespread use of a generic drug at lower price. Even if a basic manufacturing patent expires, commercial availability of a generic drug might be held up by the presence of patents related to other elements of the same drug, extensions or other changes to patents made by court judgements and variation in patent law across international boundaries (Regional Drug and Therapeutics Centre (2020), p. 78). Such issues can be complex and long running, as highlighted by the series of court cases around Duoresp Spiromax for example (Businesswire, 2014). Therefore, the relationship between patent expiry and price reductions, while clear in general, is a complex one to pin down for specific cases.

The general findings above suggest several important drugs, in terms of volume or price, have fallen sharply in price between 2017/18 and 2018/19. The overall finding of a notable reduction in price follows a trend of recent years. This may reflect a stronger downward pressure from the ending of patents compared to general inflation and the introduction of new patented formulations.

6. Growth in input categories

6.1. Direct labour growth measure

- **Between 2017/18 and 2018/19, the cost (salary)-weighted Laspeyres volume growth for NHS staff was 2.43%.**

From 2007/08 the direct labour growth measure is calculated using the Electronic Staff Record (ESR) data, provided by NHS Digital.[53,54,55] This dataset contains monthly provider level Full Time Equivalent (FTE) counts for over 500 categories of labour (occupation codes) and covers all staff employed by the NHS excluding agency and bank staff.[56] Due to precautions taken with the reporting of cells with small numbers, the aggregate figures we obtain will not match precisely with those published by NHS Digital using the same ESR data. [57,58]

Staff earnings data cover the same staff groups and organisations as counts of staff, and it is used as the basis for the dataset of national average pay at the occupation code level, provided by NHS Digital. Basic pay is reported per head and per FTE, whilst non-basic pay is reported per head only. Therefore, as in Castelli et al. (2019) and other recent reports, we construct total pay per FTE as the sum of basic pay per FTE and non-basic pay per head times the ratio 'basic pay per FTE/basic pay per head'. This method of imputation relies on the assumption that for each occupation code, the ratio of 'basic pay per FTE/basic pay per head' is a good proxy for the ratio of 'non-basic pay per FTE/non-basic pay per head'.

Further, from November 2016, information about FTE staff and earnings by category is reported separately for 'core' and 'wider' services. Core services are made up of hospital Trusts and commissioning bodies. Wider services are made up of central support services such as NHS England. In order to be comparable, we calculate (1) the sum of FTE staff within each occupation code across core and wider providers and (2) a weighted average of wages for each occupation code in core and wider providers, using the proportion of FTE staff in each of the two groups of providers as weights. If wage information is only available for either 'core' or 'wider' services providers, we assume this wage also reflects the average for equivalent staff in the other organisation group.

Table 36 shows the number of organisations reporting FTE counts information by organisation type. At face value, these figures indicate a decrease in both Clinical Commissioning Groups (CCGs) and Trusts. The fall in the number of CCGs and Trusts is due to mergers. Specifically, in the financial year 2018/19, some CCGs formally merged with their neighbours into a single organisation. The number of Commissioning Support Units (CSUs) remained the same between 2017/18 and 2018/19. Changes between 2017/18 and 2018/19 in the number of organisations continued existing trends.[59] Table 36 also reports total expenditure on staff by organisation type. Expenditure is calculated as the product of FTE staff employed in each occupation code and the national average total earnings from each

[53] Before 2007/08, the number of staff was extracted from the Workforce Census.
[54] More precisely, we use data from the NHS iView database (https://digital.nhs.uk/services/iview-and-iviewplus (last accessed 30/05/2020)), which is constructed from the ESR and NHS combined Payroll and Human Resources System.
[55] In March 2016, the data collection method for ESR was updated, leading to improved quality. These changes are discussed in more detail in Castelli et al (2018).
[56] We drop ESR returns made by private providers, NHS Arm's-length bodies, Special Health Authorities and other NHS bodies that report to the ESR but do not fall in the included categories (e.g. Sussex Health Informatics Service (YDD81)). GP Practices do not report to ESR.
[57] If a provider-staff group cell contains fewer than 5 staff, the provider reports 0 or 5 at random.
[58] https://digital.nhs.uk/data-and-information/publications/statistical/nhs-workforce-statistics (last accessed 30/05/2020).
[59] A time series of equivalent information from 2010/11 is presented in Table A 26.

occupation code. Differences in expenditure between 2017/18 and 2018/19 broadly reflect a continuation of existing trends.[60] The total expenditure for CCGs increased due to higher expenditure/CCG. There is also a sharper increase in NHS England expenditure. The increase in expenditure among Trusts was greater than in most recent years. See Table A 27 for historic trends in expenditure by provider type from 2010/11 to 2018/19.

Table 36: Number of reporting organisations and expenditure by type 2016/17 – 2018/19

Organisation type	2016/17		2017/18		2018/19	
	Orgs	Exp (£m)	Orgs	Exp (£m)	Orgs	Exp (£m)
CCGs	204	722	205	849	186	895
CSUs	8	211	4	154	4	168
NHS England	1	173	1	201	1	228
Non-geographical staff	1	57	1	72	1	72
NHS Trusts	239	37,492	234	38,062	231	39,942

Note: CCGs: Clinical Commissioning Groups; CSUs: Commissioning Support Units; Non-Geographic Central Staff, code AHO. £m: Expenditure in millions of pounds.

Table 37 reports the number of FTE staff employed by Trusts and other NHS organisations (hereafter non-Trusts) by broad categories for each year from 2016/17 to 2018/19.[61] These figures show that the majority of staff are employed by hospital Trusts and the largest employee group is that of 'Nursing, midwifery and health visiting staff and learners'. The ratios of different staff categories were stable over the past three years.

Table 37: Count of FTE staff employed by category

NHS Staff type	2016/17		2017/18		2018/19	
	Trust	Non-Trust	Trust	Non-Trust	Trust	Non-Trust
Medical staff	105,565	1,111	108,729	1,246	111,896	1,442
Ambulance staff	27,451	1	28,403	1	29,271	3
Administration and estates staff	218,700	38,830	222,946	42,730	228,686	42,471
Health care assistants and other support staff	133,050	2,137	136,183	2,020	139,600	1,201
Nursing, midwifery and health visiting staff and learners	362,774	3,913	362,564	4,075	368,418	4,249
Scientific, therapeutic and technical staff and health care scientists	173,399	3,708	178,698	4,697	184,949	5,108
Unknown and Non-funded staff	4,194	148	4,314	164	4,529	184
Total	**1,025,133**	**49,848**	**1,041,837**	**54,933**	**1,067,349**	**54,658**

Notes: Data are taken from organisational returns of Electronic Staff Records. When there are 5 or fewer people employed in an occupational group, organisations report either 5 or 0 at random; these totals therefore will differ from those derived from national level data.

Figure 31 shows the growth in FTE staff by the same broad staff categories from 2016/17 to 2017/18 and 2017/18 to 2018/19 in Trusts. Growth was slower between 2017/18 and 2018/19 for medical and

[60] A time series of equivalent information from 2010/11 onwards is presented in Table A 27.
[61] Table A 28 provides a longer time series of staff employed within Trusts from 2007/08 to 2018/19.

ambulance staff than between 2016/17 and 2017/18, but faster for all other categories. Positive growth was seen for all categories. A residual group of unknown and unfunded staff (0.4% of the FTE total in 2018/19) is not included in the figure.

Figure 31: Growth in FTE staff by group 2016/17 to 2018/19 in Trusts

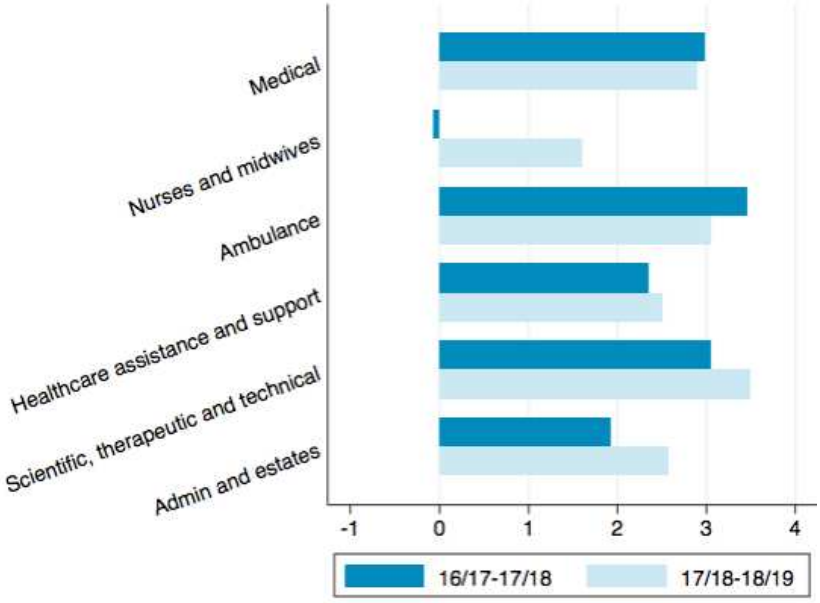


Figure 32 provides equivalent information for growth in staff employed by other NHS organisations. It indicates much larger and variable percentage changes in staff numbers over time. Of note is the further decrease (-40% between 2017/18 and 2018/19 as opposed to -5% in the previous two financial years) in the number of FTE classified as 'health care assistance and support staff'. Ambulance FTE staff grew by 200% between 2017/18 and 2018/19, meaning an increase from 1 to 3 FTEs. For a more readable figure, we did not include the ambulance staff group. As shown in Table 37, large(r) proportional changes in non-Trust staff numbers are more likely but have a much smaller impact on employment in the NHS as a whole than equivalent proportional changes of employment by Trusts, due to the far smaller absolute number of staff employed by other NHS organisations.

Figure 32: Growth in FTE staff by group 2016/17 to 2018/19 in non-Trusts

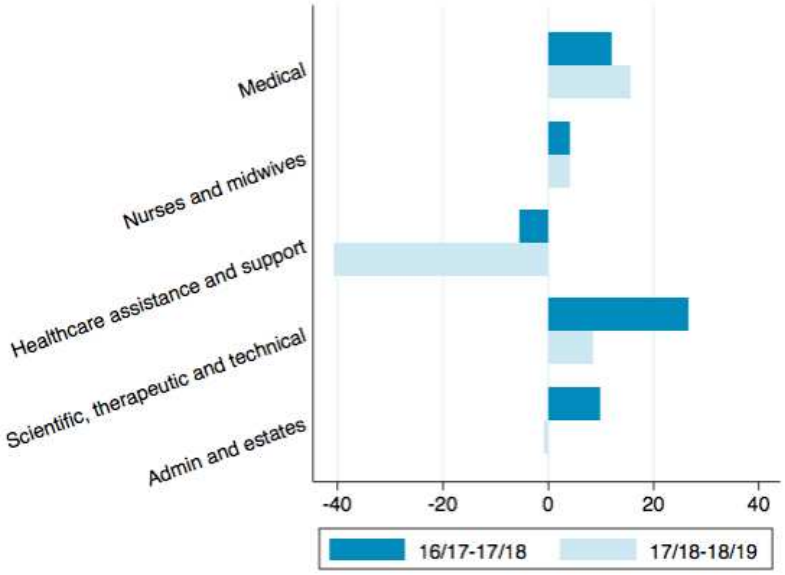


Table 38 presents nominal expenditure growth and Laspeyres volume growth in labour for the NHS overall and for Trusts alone from 2016/17 to 2018/19.[62] Laspeyres volume indices indicated growth of 2.43% overall and 2.52% for the group of Trusts between 2017/18 and 2018/19. These growth rates were larger than between 2016/17 and 2017/18. Nominal expenditure grew by more than 2 percentage points between 2016/17-17/18 and 2017/18-18/19. This applies to both the NHS as a whole and to Trusts only. This reflects an increase in the unit cost of staff, supported by a Paasche price growth rate of 2.4% for Trusts and the NHS overall, and an increase in the number of FTEs.

Table 38: Growth in direct labour 2016/17 – 2018/19

Years	Nominal expenditure growth		Laspeyres volume growth	
	All*	Trusts	All*	Trusts
2016/17 – 2017/18	2.04%	1.52%	2.36%	1.88%
2017/18 – 2018/19	4.84%	4.94%	2.43%	2.52%

* All NHS organisations.

6.2. Indirect and mixed NHS input growth measures

- **Between 2017/18 and 2018/19, the indirect growth rate for NHS inputs was 2.97% and the mixed NHS input growth rate was 2.86%.**

6.2.1. Expenditure data sources

We employ data from published financial accounts to determine expenditure on inputs by NHS England and NHS Trusts. We aggregate items of expenditure from each account to broad categories of Labour, Materials and Capital. Labour covers expenditure on staff wages and other payments for work. Materials consist of assets which are expected to be consumed within the financial year they are purchased. Capital consists of expenditure on assets which are expected to be retained and used in multiple years. By using these broad categories, we are able to generate comparable figures over time and across organisations, despite differences in the precise reporting requirements of different organisations and changes in these requirements over time.

Expenditure of NHS England is reported in the annual reports and accounts of the Department of Health and Social Care (DHSC).[63] Reporting of this information has been consistent in recent years, as shown in Table 39. The items of expenditure used to calculate Labour, Materials and Capital in the 2017/18 – 2018/19 accounts are presented in Table 40. Neither DHSC accounts nor the accounts published by NHS Trusts include expenditure on agency staff and bank staff. We obtain agency staff expenditure directly from the DHSC. Bank staff expenditure has been obtained as a result of a Freedom of Information (FOI) request in 2015/16 and 2016/17, whilst expenditure, for more recent financial years, is taken from a report on NHS providers by NHS England and NHS Improvement.[64,65]

[62] See Table A 29 for the equivalent series from 2007/08 to 2018/19.
[63] https://www.gov.uk/government/publications/dhsc-annual-report-and-accounts-2018-to-2019 (last accessed on 16/12/2020).
[64] https://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2014-10-22/211600/ (last accessed 16/12/2020).
[65] Information on NHS bank staff expenditure for 2018/19 is reported in https://improvement.nhs.uk/documents/5404/Performance_of_the_NHS_provider_sector_for_the_quarter_4_1819.pdf, whilst that for 2017/18 is reported in https://improvement.nhs.uk/documents/2852/Quarter_4_2017-18_performance_report.pdf (last accessed 16/12/2020).

Table 39: Sources of expenditure information 2013/14 – 2018/19

Years	Foundation Trusts	Non-Foundation Trusts	NHS England/CSUs/CCGs
2013/14 – 2016/17	Consolidated NHS Financial Trusts Accounts	Financial monitoring and accounts	DHSC Annual Reports and Accounts
2017/18 – 2018/19	Trust accounts consolidation		

We also use Trust level accounts for all NHS Trusts and Foundation Trusts. Each FT and Non-FT publishes accounts annually, with a specified set of items of expenditure. In 2017/18, the system of accounts published by all Trusts was overhauled and unified, so that items of expenditure across FTs and Non-FTs could be harmonised. Prior to 2017/18, FTs and non-FTs published accounts with differing expenditure items, though they covered the same types of information in aggregate. Table 39 reports the sources of expenditure data used.

Table 40: Categorisation of operating expenditure items from TACs

Organisation	Labour	Materials	Capital
NHS Foundation Trusts and Non-Foundation Trusts Source: TAC	• Staff and executive directors costs • Non-executive directors	• Purchase of services • Supplies and services – clinical • Supplies and services – general • Drugs costs • Consultancy • Establishment • Transport • Audit services and other remuneration • Clinical negligence costs • Research and development • Education and training • Redundancy costs • Legal fees • Insurance • Early retirement costs • Car parking and security • Hospitality • Other losses and special payments • Other	• Premises • Depreciation • Amortisation • Impairments • Operating lease expenditure • Changes to operating expenditure for on-SoFP and off-SoFP IFRIC 12 schemes • Inventories written down (net including drugs) • Provisions arising/released in year
CCGs/NHS England Group Source: DHSC Annual Report and Accounts	• Staff costs	• Consultancy services • Transport • Clinical negligence costs • Establishment • Education, training & conferences • Supplies and services – general • Inventories consumed • Research & development expenditure • Other	• Premises • Impairment of receivables • Rentals under operating leases • Depreciation • Amortisation • Impairments & reversals • Interest charges

Note: Items of expenditure for Foundation Trusts and Non-Foundation Trusts are taken from accounts of 2017/18. The items used in previous years can be found in Table A 30.

6.2.2. Expenditure on inputs

This section describes nominal input data, which is converted to real terms using appropriate deflators, the NHS Cost Inflation Index and the CHE ESR deflator for NHS Staff. For further details on the deflators used see section 10.1 in Appendix C.[66]

Table 41 presents current expenditure on Labour, Materials and Capital of the NHS England Group from 2016/17 to 2018/19. Expenditure on all input categories continued to increase, with the most notable nominal increase in Materials of 12.5% in 2018/19.

Table 41: Current expenditure by NHS England Group (£000)

Year	Labour	Materials	Capital
2016/17	1,781,455	1,714,391	470,188
2017/18	1,843,108	1,747,863*	518,621
2018/19	1,949,260	1,965,603	564,040

* Figure does not correspond to the one reported in the previous edition of the productivity update after a coding error has been corrected.

Expenditure on Labour, Materials and Capital among NHS Trusts is reported in Table 42. As the published accounts for Trusts were completely overhauled in 2017/18, figures for 2016/17 and 2017/18 are both derived from the 2017/18 TAC accounts for the sake of comparability. Expenditure on Labour and Materials continued to grow between 2017/18 and 2018/19, as has been the case in previous years. In contrast, Capital expenditure exhibits a more volatile trend, but also represents a much smaller proportion of Trust expenditure compared to both Labour and Materials expenditures.

Table 42: Current expenditure by NHS Trusts (£000)

Year	Labour	Materials	Capital
2016/17	49,817,304	22,540,716*	8,205,040
2017/18	51,868,888	23,470,269*	7,691,102
2018/19	54,467,368	24,381,034	8,460,613

* Figures do not correspond to the ones reported in the previous edition of the productivity update after a coding error has been corrected.

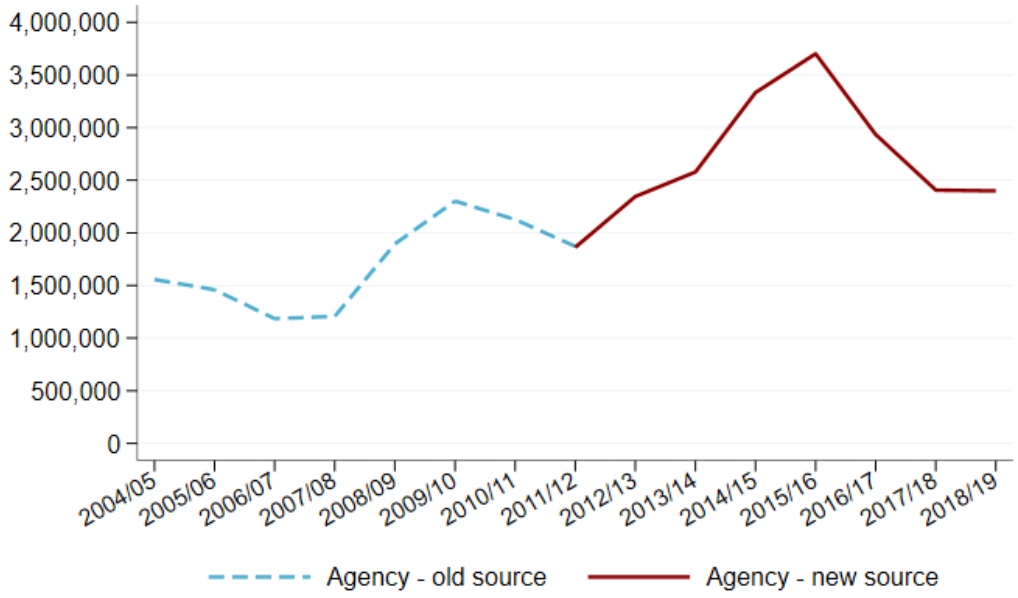
NHS expenditure on all input items from 2016/17 to 2018/19 is summarised in Table 43. The table includes the sum of Labour (NHS Staff including bank staff and agency staff), Materials and Capital across NHS Trusts and NHS England Group. Expenditure on Primary Care and Community Prescribing (Prescribing) are also included. Details about the source of information of Community Prescribing are given in section 5.7. The table shows expenditure on inputs is dominated by NHS Staff and Materials, both of which increased by a roughly similar amount between 2017/18 and 2018/19, similar to the previous year's growth. Capital and Primary Care expenditures saw an increase as well, as opposed to the 2016/17 – 2017/18 link, whereas expenditure on agency staff and Community Prescribing continued the downward trend. We also note that although expenditure on bank staff continued to rise, the decrease in agency staff current expenditure, as shown in Figure 33, was very moderate in 2018/19, as opposed to the previous years.

[66] A summary of NHS input growth in real terms is presented in section 2.2.

Table 43: Total NHS current expenditure 2016/17 – 2018/19 (£000)

Year	NHS Staff	Agency	Material	Capital	Prescribing	Primary Care	TOTAL
2016/17	48,663,883	2,934,876	24,255,107	8,675,228	9,193,913	13,427,480	107,150,486
2017/18	51,305,198	2,406,798	25,218,132	8,209,723	9,095,228	13,378,869	109,613,947
2018/19	54,016,983	2,399,645	26,346,637	9,024,653	8,833,869	13,934,642	114,556,430

Figure 33: Expenditure on agency staff



7. Concluding remarks

NHS productivity fell by -0.75% between 2017/18 and 2018/19 when applying our preferred 'mixed' method, just under 2.5 percentage points lower than the growth rate registered between 2016/17 and 2017/18. The indirect productivity measure also shows negative growth, but at a slightly lower rate (-0.64%). The fall in productivity growth observed between 2017/18 and 2018/19 was primarily driven by a sharp increase in input growth, which more than offset the (slower) growth in NHS outputs recorded over the same time period.

NHS quality- and working days-adjusted output growth was 2.20% between 2017/18 and 2018/19, slightly lower than the 2.58% growth reported between 2016/17 and 2017/18. Input growth for both the mixed and indirect measures records a historical high at 2.97% and 2.86% respectively. Similar growth rates in inputs were last recorded in 2015/16.

Faster growth in inputs was due to a generalised increase in all types of inputs. NHS staff input was the largest contributor, followed by Materials, to overall NHS input growth; however, agency staff and Capital input had the highest growth rates in 2018/19, albeit being only modest contributors toward overall NHS input growth.

For the first time, we explicitly accounted for expenditure on bank staff (backdating our series to 2015/16) in both our indirect and mixed input growth measures. The wider use of bank staff in the NHS followed the introduction in 2015 by NHS England and NHS Improvement (then Monitor) of a cap on the hourly cost of agency staff, in a bid to curb rising expenditure on agency staff and to support Trusts in encouraging a return to permanent and bank working (NHS England and NHS Improvement (2019), Monitor (2015)). Expenditure on bank staff continued to rise and was generally linked to a concurrent decrease in agency staff spending. However, in 2018/19, it appears that the decrease in nominal spending on agency staff, as shown in Figure 33, was very moderate compared to previous years. In fact, when translated into real terms, using the specific agency deflator of the NHS Cost Inflation Index, expenditure on agency staff showed a positive growth of 8.69%.[67]

The decision to employ a more precise deflator to deflate expenditure on agency staff was based on the assumption that agency staff costs may follow a different growth pattern compared to NHS providers' staff costs, and that these differences should be accounted for. Looking at the data, we found that agency staff costs have been decreasing whilst NHS Staff costs continued to increase.[68] In fact, if we were to use the ESR deflator – reflecting changes in NHS staff costs – NHS input growth would be smaller (2.72% for the mixed measure and 2.61% for the indirect measure) implying a less negative NHS productivity growth (-0.51% for the mixed measure and -0.40% for the indirect measure).

In the 2017/18 NHS productivity update (Castelli et al., 2020) we included a sensitivity analysis on working days adjustment in light of the fact that financial years do not always have the same number of working and total days, and that this will impact on the level of NHS output produced and hence NHS productivity. As from this update, the working and total days adjustment is part of our baseline measures, across all NHS settings.

[67] The NHS Cost Inflation Index was developed by the Department of Health and Social Care in collaboration with NHS England and NHS Improvement, the Centre for Health Economics at the University of York, and the Office for National Statistics with the aim of offering a more appropriate measure of inflation specific to the input costs faced by the NHS.
[68] Further details can be found in Appendix C, section 10.1.

Finally, in this update, we improved our measure of Primary Care output, previously relying on estimates of primary care growth derived from the GP Patient Survey, by using the new NHS Digital GP appointments data.

Overall quality-adjusted NHS output growth was 2.20% – a smaller growth rate compared to last year's growth rate. Of the three largest categories in terms of output value, inpatient and outpatient care had growth rates of 4.5% and 4.09% respectively, between 2017/18 and 2018/19; whilst primary care registered a negative growth. The latter growth rate is, however, not comparable to previous years because of the mentioned change in the data source. Between them, these NHS output settings represented over 50% of output value generated by the NHS.

It is also noteworthy that Community Mental Health experienced a positive growth (also seen in Hospital Mental Health output) after the decrease recorded in the previous link. For the second year running, the largest reported negative growth was for the 'Rehabilitation' setting (-13.96%). However, this care setting represented just over 1% of the total value of NHS output, and so had a modest impact on the overall NHS output growth.

The quality of care provided, measured in terms of waiting times, survival rates and life expectancy within inpatient care and blood pressure monitoring of three common conditions in primary care, improved overall between 2017/18 and 2018/19, which was reflected in about 0.58 percentage points higher values of NHS output and productivity growth when compared to the cost-adjusted output growth and related NHS productivity growth measures. This is a substantive impact in the context of an overall negative productivity growth and a larger quality improvement than seen between 2016/17 and 2017/18. The impact of quality on NHS output and productivity growth came almost entirely from the inpatient setting, where quality improvements in the delivery of inpatient care added about 1.81 percentage points to the growth in NHS output, with most of the improvements being achieved in emergency care. Waiting times for outpatient visits deteriorated in 2018/19 compared to the previous year, which was reflected in the slightly lower (-0.01 percentage points difference) of its quality-adjusted growth rate. Quality in Primary Care continued to improve, as recorded in the QOF achievement rates, but overall figures are not comparable to previous Primary care output growth measures.

When considering NHS Trusts-only productivity separately from that of the NHS as a whole, we observed lower output growth between 2017/18 and 2018/19 compared to the previous link (2.63% compared to 3.03%), but higher input growth (though limited to the mixed method), which translated into overall lower productivity growth. As a result, we observed negative Trusts-only productivity growth between 2017/18 and 2018/19 compared to positive growth recorded for the previous two years.

However, when comparing Trusts growth rates with those for the whole NHS, we find that much of the increase in NHS inputs can be reconciled to growth in inputs for Trusts. In fact, both the mixed method (3.22%) and the indirect method (3.00%) input growth rates were higher than the respective growth rates for the NHS as a whole. However, given the higher growth in outputs, Trusts-only productivity was higher for both measures compared to the one for the NHS as a whole, albeit being still negative.

Finally, a comparison of NHS productivity growth with that of the wider UK economy indexed to 2004/05 showed that the former was still higher; however, in the latest financial year it slowed down compared to that of the overall economy.

8. Appendix A

8.1. Historic tables for productivity, output and input growth

Table A 1: Historical series of NHS Productivity Growth

Years	Mixed	Indirect
2004/05 – 2005/06	-0.07%	0.01%
2005/06 – 2006/07	4.50%	5.07%
2006/07 – 2007/08	-0.21%	-0.04%
2007/08 – 2008/09	1.44%	1.43%
2008/09 – 2009/10	-1.25%	-1.63%
2009/10 – 2010/11	3.21%	3.74%
2010/11 – 2011/12	2.13%	2.38%
2011/12 – 2012/13	0.36%	-0.28%
2012/13 – 2013/14	2.20%	2.07%
2013/14 – 2014/15	0.53%	0.95%
2014/15 – 2015/16	0.04%	-0.19%
2014/15 – 2015/16[69]	-0.15%	-0.58%
2015/16 – 2016/17*	1.94%	1.71%
2016/17 – 2017/18*	1.70%	0.54%
2017/18 – 2018/19*	-0.75%	-0.64%

* Productivity growth obtained using working days adjusted output and explicitly accounting for bank staff when calculating input growth.

Table A 2: Historical series of NHS output growth

Years	Cost-weighted Growth (CW)	Quality-adjusted CW growth
2004/05 – 2005/06	6.53%	7.11%
2005/06 – 2006/07	5.88%	6.50%
2006/07 – 2007/08	3.41%	3.66%
2007/08 – 2008/09	5.34%	5.73%
2008/09 – 2009/10	3.44%	4.11%
2009/10 – 2010/11	3.61%	4.57%
2010/11 – 2011/12	2.38%	3.15%
2011/12 – 2012/13	2.58%	2.34%
2012/13 – 2013/14	2.37%	2.64%
2013/14 – 2014/15	2.53%	2.49%
2014/15 – 2015/16	2.16%	2.58%
2015/16 – 2016/17*	2.81%	2.98%
2016/17 – 2017/18*	2.23%	2.58%
2017/18 – 2018/19*	1.65%	2.20%

* Working days adjusted output.

[69] The Mixed and Indirect NHS Productivity growth rates for the years 2014/15 – 2015/16 have been updated to reflect the methodological change in assigning PROMs values to activity with a UZ01 code for hospital inpatients. More details are provided in Castelli et al. (2019).

Table A 3: Historical series of NHS input growth

Years	All NHS	
	Mixed	Indirect
2004/05 – 2005/06	7.19%	7.10%
2005/06 – 2006/07	1.92%	1.36%
2006/07 – 2007/08	3.88%	3.70%
2007/08 – 2008/09	4.23%	4.24%
2008/09 – 2009/10	5.43%	5.83%
2009/10 – 2010/11	1.33%	0.80%
2010/11 – 2011/12	1.00%	0.75%
2011/12 – 2012/13	1.98%	2.63%
2012/12 – 2013/14	0.43%	0.55%
2013/14 – 2014/15	1.94%	1.52%
2014/15 – 2015/16	2.59%	2.82%
2014/15 – 2015/16*	2.73%	3.18%
2015/16 – 2016/17**	1.02%	1.25%
2016/17 – 2017/18**	0.87%	2.02%
2017/18 – 2018/19**	2.97%	2.86%

* Updated to reflect previously missing Trusts and the shift of impairments from materials to capital expenditure.

** Figures for mixed method are obtained accounting for bank staff. Note that discrepancies with previously published figures for the indirect NHS input measures are due to corrections of a coding error.

8.2. Historic tables for HES inpatient day case, mental health and outpatient data

Table A 4: Historical series of Organisational coverage of HES activity in FCEs

Year	NHS Trusts	Private providers	Other	Total
2012/13	18,649,728	406,078	13,754	19,069,560
2013/14	19,061,786	470,454	1,873	19,534,113
2014/15	19,639,539	537,998	3,501	20,181,038
2015/16	20,049,753	557,574	1,204	20,608,531
2016/17	20,532,853	590,517	165	21,123,535
2017/18	20,826,151	611,745	192	21,438,088
2018/19	21,571,984	625,734	115	22,197,833

Table A 5: Historical series of Number of CIPS & average cost for electives and non-electives HES inpatient data

Year	Elective and day case activity			Non-elective activity	
	# CIPS	Average cost (£)		# CIPS	Average cost (£)
2004/05	6,433,933	1,031		6,009,802	1,210
2005/06	6,864,612	1,041		6,291,117	1,241
2006/07	7,194,697	1,036		6,363,388	1,244
2007/08	7,598,796	1,091		6,593,136	1,237
2008/09	8,148,229	1,147		6,826,035	1,354
2009/10	8,465,757	1,227		6,951,379	1,413
2010/11	8,755,081	1,263		7,109,358	1,460
2011/12	8,946,909	1,287		7,049,528	1,498
2012/13*	9,030,530	1,341	1,465	7,327,228	1,532
2013/14	9,336,918	1,373	1,501	7,112,856	1,555
2014/15	9,651,505		1,523	7,414,368	1,569
2015/16	9,862,587		1,590	7,451,526	1,577
2015/16**	9,862,566		1,590	7,450,701	1,577
2016/17	10,103,760		1,569	7,579,909	1,570
2017/18	10,028,396		1,641	7,769,004	1,599
2018/19	10,285,238		1,632	8,012,583	1,693

* From 2012/13, we use unit costs for elective inpatient care, instead of the activity weighted average unit cost of both elective inpatient care and day cases.

** From 2015/16, CIPS are calculated using the new CIPS methodology, following the changes in the HES variable 'admission method'.

Table A 6: Historical series of Number of CIPS and average cost for electives and non-electives HES inpatient Mental Health data

Year	Elective and day case activity		Non-elective activity	
	# CIPS	Average cost (£)	# CIPS	Average cost (£)
2004/05	45,624	689	123,983	1,012
2005/06	41,439	673	120,203	1,012
2006/07	38,408	656	115,560	1,012
2007/08	33,993	1,141	112,475	1,364
2008/09	25,792	1,133	109,636	1,319
2009/10	28,143	1,195	121,610	1,365
2010/11	30,714	1,297	125,823	1,445
2011/12	31,142	1,318	135,315	1,318
2012/13	31,078	1,358	145,787	1,358
2013/14	25,438	1,368	136,916	1,385
2014/15	24,757	1,384	131,029	1,401
2015/16	20,478	1,396	126,899	1,417
2015/16*	20,483	1,396	126,867	1,417
2016/17	19,933	1,450	114,956	1,472
2017/18	19,573	1,440	113,834	1,461
2018/19	19,333	1,474	123,013	1,495

* From 2015/16, CIPS are calculated using the new CIPS methodology, following the changes in the HES variable 'admission method'.

Table A 7: Historical series of Volume and average costs for HES outpatient data

Year	All providers (excl. ISHP and 'Other providers')	
	Volume of activity	Average cost (£)
2011/12	88,926,968	114
2012/13	90,850,009	116.98
2013/14	96,690,559	117.18
2014/15	101,382,540	118.26
2015/16	107,092,657	118.37
2016/17	112,038,760	121.74
2017/18	112,986,081	127.27
2018/19	117,066,614	132.67

8.3. Historic tables for Reference Costs data

Table A 8: Historical series of Volume and average costs of Outpatient data

Year	Outpatient			
	All providers		Trusts only	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2007/08	69,679,600	94	61,508,362	98
2008/09	74,421,017	98	65,804,814	103
2009/10	80,093,906	101	71,115,142	105
2010/11	81,301,615	105	73,621,984	107
2011/12	-	-	75,826,947	108
2012/13	-	-	77,222,725	111
2013/14	-	-	81,699,802	114
2014/15	-	-	83,856,229	117
2015/16	-	-	85,394,479	120
2016/17			87,017,943	122
2017/18			87,714,235	127
2018/19			87,944,919	130

Table A 9: Historical series of Volume and average costs of Accident & Emergency data

Year	Emergency departments				Other A&E services			
	AD		NAD		AD		NAD	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2006/07	3,464,869	107	10,327,147	83	281,135	50	3,900,718	36
2007/08	3,326,719	121	9,058,765	89	531,498	70	3,769,765	43
2008/09	3,566,642	129	9,708,958	95	1,000,986	49	4,184,796	49
2009/10	4,047,176	134	10,075,701	103	1,090,650	49	3,628,469	50
2010/11	4,004,868	141	9,881,747	108	1,145,125	62	3,800,261	55
2011/12	4,040,760	157	10,405,762	108	616,812	83	3,253,452	52
2012/13	4,345,100	160	10,292,933	115	362,656	90	3,426,231	59
2013/14	4,218,480	177	10,189,225	127	494,549	80	3,639,355	59
2014/15	4,050,701	206	10,636,666	133	446,779	65	3,972,875	61
2015/16	4,101,720	219	10,921,696	140	473,723	69	4,202,986	60
2016/17	3,966,820	238	11,039,457	152	472,913	78	4,515,570	67
2017/18	4,313,593	247	11,100,308	164	280,645	69	4,255,912	67
2018/19	3,738,454	263	12,215,524	171	48,101	116	4,388,481	72

Table A 10: Historical series of Volume and average costs of Ambulance services data

Year	Ambulance services							
	Calls		Hear and treat or refer		See and treat or refer		See and treat and convey	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2011/12	8,530,563	8	338,022	44	1,862,892	173	4,895,376	230
2012/13	9,120,422	7	423,821	47	1,997,327	174	4,984,296	230
2013/14	8,926,215	7	400,005	44	2,113,757	180	5,069,806	231
2014/15	9,491,159	7	575,168	35	2,270,229	180	5,107,902	233
2015/16	9,794,437	7	782,665	34	2,347,808	181	5,167,876	236
2016/17	10,238,451	7	806,804	37	2,441,651	181	5,277,120	247
2017/18	10,995,578	7	886,175	37	2,459,394	192	5,325,368	252
2018/19	10,039,191	7	799,332	47	2,480,819	209	5,421,377	257

Table A 11: Historical series of Volume and average costs of Chemotherapy, Radiotherapy and High Cost Drugs data

Year	Chemotherapy		Radiotherapy		High Cost Drugs	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2004/05	777,312	363	1,622,278	113		-
2005/06	763,806	432	1,634,156	126		-
2006/07	1,642,444	280	1,743,490	123	26,277,491	17
2007/08	846,425	406	1,613,135	132	1,332,996	305
2008/09	1,428,561	448	1,710,525	157	1,322,354	473
2009/10	1,414,872	505	1,835,695	163	2,412,988	384
2010/11	1,515,845	515	2,001,798	161	1,288,460	818
2011/12	1,769,727	505	2,492,431	137	1,372,131	902
2012/13	2,525,935	387	2,717,024	127	1,511,644	878
2013/14	2,540,353	431	2,760,237	134	1,687,711	859
2014/15	2,729,954	449	2,855,371	135	1,982,162	877
2015/16	2,913,719	454	2,018,956	188	2,115,966	942
2016/17	2,253,067	605	1,929,548	198	2,288,895	917
2017/18	2,639,406	569	1,921,222	218	2,557,373	828
2018/19	2,707,943	600	1,962,279	213	2,477,645	799

Table A 12: Historical series of Volume and average costs of Community Care data

Year	Community care	
	Volume of activity	Average cost (£)
2004/05	75,673,792	39
2005/06	85,092,838	38
2006/07	83,895,139	40
2007/08	85,470,688	42
2008/09	88,513,663	45
2009/10	92,412,727	46
2010/11	90,724,524	47
2011/12	78,315,576	50
2012/13	79,709,044	52
2013/14	85,975,592	57
2014/15	85,733,534	59
2015/16	86,767,072	60
2016/17	87,751,894	61
2017/18	84,708,536	62
2018/19	81,794,290	64

Table A 13: Historical series of Volume and average costs of Diagnostic Tests data

Year	Directly accessed diagnostic services		Directly accessed pathology services		Radiology	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2004/05	369,988	44	180,676,234	3	5,152,720	31
2005/06	465,622	44	221,966,384	2	5,784,605	33
2006/07	735,569	137	236,269,050	2	23,918,500	59
2007/08	776,368	41	257,249,379	2	7,614,437	103
2008/09	804,607	46	278,917,852	2	7,852,498	102
2009/10	1,063,744	43	300,010,031	2	8,347,404	104
2010/11	1,458,025	39	320,418,662	2	8,491,834	97
2011/12	5,640,762	34	333,108,317	2	8,758,136	93
2012/13	6,339,016	30	335,941,593	2	9,381,616	92
2013/14	6,553,727	31	361,952,265	2	9,709,456	93
2014/15	7,128,172	32	356,528,477	2	9,440,280	88
2015/16	7,467,097	31	359,911,813	2	10,755,438	97
2016/17	7,849,478	32	374,847,731	2	11,342,904	95
2017/18	7,777,205	32	417,460,632	2	10,975,838	99
2018/19	7,613,040	33	426,076,050	2	9,961,010	98

Table A 14: Historical series of Volume and average costs of Community Mental Health data

Year	Community mental health		
	Volume of activity	Volume of activity	Average cost (£)
2004/05	16,389,891		164
2005/06	17,738,894		170
2006/07	19,259,205		167
2007/08	21,751,043		153
2008/09	22,674,811		157
2009/10	23,440,616		161
2010/11	24,341,950		159
2011/12*		224,329,080	28
2012/13		260,266,214	24
2013/14		259,659,214	25
2014/15		262,460,243	25
2014/15		259,036,112	25
2015/16		253,275,018	26
2015/16		253,346,232	23
2016/17		250,019,639	24
2017/18		244,730,237	25
2018/19		236,958,442	27

* Due to the reclassification of activity in Community Mental Health, data from 2011/12 are not directly comparable with those reported in previous years. Hence, Community mental health activity was excluded from the calculations of both the Community Mental Health and the overall NHS output growth indices for the pair of years 2010/11 to 2011/12.

Table A 15: Historical series of Volume and average costs of Rehabilitation and Renal Dialysis data

Year	Rehabilitation		Renal dialysis	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2004/05	4,095,087	178	8,232,432	52
2005/06	4,509,489	185	6,819,136	64
2006/07	3,028,598	241	4,200,298	104
2007/08	2,732,048	259	3,980,793	114
2008/09	3,277,757	265	4,091,245	120
2009/10	3,277,430	279	4,050,658	129
2010/11	3,314,085	285	4,088,817	129
2011/12	2,897,721	278	4,166,150	129
2012/13	2,715,650	301	4,135,914	128
2013/14	3,002,512	298	4,069,460	131
2014/15	3,008,889	317	4,070,447	131
2015/16	2,985,717	332	4,157,008	134
2016/17	2,893,451	332	4,240,850	134
2017/18	2,865,116	328	4,277,315	135
2018/19	2,298,007	378	4,275,328	135

Table A 16: Historical series of Volume and average costs of Specialist services data

Year	Critical care		Specialist palliative care		Cystic fibrosis		Cancer multi-disciplinary team meetings	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2004/05	2,184,333	828	-	-	16,317	1,919	-	-
2005/06	2,197,135	895	-	-	13,704	2,316	-	-
2006/07	2,468,777	840	93,880	269	13,944	2,290	-	-
2007/08	2,165,060	931	208,410	219	15,383	2,349	-	-
2008/09	2,354,447	967	262,305	216	20,756	2,116	-	-
2009/10	2,439,661	1,003	359,121	192	20,323	2,468	-	-
2010/11	2,470,065	1,011	512,972	162	19,942	2,631	-	-
2011/12	2,570,571	998	550,417	166	9,852	8,476	837,418	114
2012/13	2,669,343	984	600,848	169	9,735	8,709	1,079,297	106
2013/14	2,708,897	992	701,439	158	9,990	10,213	1,279,567	101
2014/15	2,746,664	1,044	775,488	157	10,767	9,810	1,434,580	111
2015/16	2,777,403	1,081	855,702	146	11,845	9,100	1,517,387	111
2016/17	2,792,536	1,082	914,564	152	11,489	9,198	1,708,174	111
2017/18	2,717,180	1,159	967,805	153	10,934	9,766	1,800,465	114
2018/19	2,698,927	1,218	807,252	181	12,208	9,343	1,922,238	112

Table A 17: Historical series of Volume and average costs of 'Other NHS' activity data

Year	Regular day and night admissions		Audiological services		Day care facilities		Hospital at home/Early discharge schemes*	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
2004/05	122,447	248	1,902,390	41	735,070	124	434,698	73
2005/06	177,131	245	1,692,721	40	649,963	131	593,586	60
2006/07	179,927	271	2,905,175	50	439,932	135	470,737	74
2007/08	164,651	324	3,447,049	51	384,048	137	405,271	73
2008/09	198,573	341	3,716,333	51	345,371	159	522,047	68
2009/10	152,079	393	3,807,539	52	319,706	156	495,961	81
2010/11	176,169	431	3,927,780	51	321,386	148	364,352	91
2011/12	176,877	428	4,033,290	50	275,819	140	323,213	113
2012/13	210,984	371	4,030,693	52	237,040	157	285,754	108
2013/14	204,831	400	3,483,549	55	239,032	146	-	-
2014/15	223,302	355	2,918,029	60	266,333	131	-	-
2015/16	224,523	389	3,523,847	57	241,756	131	-	-
2016/17	242,322	325	3,452,571	57	191,547	125	-	-
2017/18	284,842	327	3,293,426	58	277,092	102	-	-
2018/19	328,946	341	3,044,139	61	220,424	70	-	-

* Hospital at Home services are now captured under Community Intermediate Care activities in the Community Care setting.

8.4. Historic tables for Dentistry and ophthalmology

Table A 18: Historical series of Volume and average costs of Ophthalmological Services data

Year	Ophthalmology		
	Volume of activity	Average cost (£)	Average cost (£) - New source
2004/05	10,148,978	33	
2005/06	10,354,682	35	
2006/07	10,484,922	36	19
2007/08	11,047,890	28	19
2008/09	11,278,474	28	20
2009/10	11,811,651	28	20
2010/11	11,938,529	28	21
2011/12	12,305,727	28	21
2012/13	12,339,253	28	21
2013/14	12,787,430	28	21
2014/15	12,764,485	28	21
2015/16	12,979,762	28	21
2016/17	12,995,512	28	21
2017/18	13,032,582	28	21
2018/19	13,225,755	28	21

Table A 19: Historical series of Volume and average costs of Dental Services data

Year	Dentistry										
	Band 1		Band 2		Band 3		Urgent		Other		Total
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	
2004/05*											2,241,095,331
2005/06*											2,433,471,413
2006/07	19,012,890	16	10,687,669	42	1,529,129	189	2,881,205	16	939,871	16	1,096,089,020
2007/08	19,275,334	17	10,991,870	46	1,684,537	198	3,133,209	17	901,975	17	1,219,391,145
2008/09	19,803,371	17	11,489,585	46	1,859,524	198	3,343,459	17	930,279	17	1,289,383,127
2009/10	20,346,012	17	11,699,635	46	2,086,179	198	3,509,055	17	948,634	17	1,355,827,865
2010/11	20,718,874	17	11,804,774	46	2,187,483	198	3,615,027	17	918,371	17	1,388,081,816
2011/12	20,886,648	17	11,862,329	46	2,217,060	198	3,685,411	17	919,217	17	1,400,506,136
2012/13	21,016,444	18	11,750,849	48	2,239,287	209	3,712,031	18	603,054	18	1,475,353,493
2013/14	21,685,314	18	11,801,493	49	2,232,243	214	3,852,470	18	190,216	18	1,519,077,159
2014/15	22,028,232	19	11,446,920	51	2,177,960	219	3,780,401	19	178,531	19	1,535,805,234
2015/16	22,437,889	18.8	11,251,942	51.3	2,129,467	222.5	3,693,752	18.8	169,831	18.8	1,545,498,706
2016/17	22,939,419	20	11,080,848	54	2,082,785	234	3,664,913	20	156,905	20	1,611,200,931
2017/18	22,814,753	21	10,699,157	56.3	1,987,657	244	3,566,835	21	144,888	21	1,634,392,550
2018/19	23,386,880	22	10,631,216	59	1,941,217	257	3,620,927	22	136,476	22	1,712,543,539

* Units of Dental Activity (UDAs) are reported from 2006/07 onwards. For the financial years 2004/05 and 2005/06, we calculated UDAs by multiplying the respective volumes of activity by the average weight of dental course treatments in 2006/07 (Bojke et al., 2015).

8.5. Historic tables for Primary care activity

The figures for Primary care activity reported in Table A 20, Table A 21 and Table A 23 use data derived from the General Practice Patient Survey data, which were used to estimate change in primary care activity up until 2017/18. A new source of data is now used – see section 5.6 in the main report for further details.

Table A 20: Historical series for CHE GPPS based measure of volume of consultations data

Year	Patients who report having seen a GP in previous 3 months	Patients who report having seen a nurse in previous 3 months	Number of consultations	Population adjusted number of consultations	Quality and population adjusted number of consultations
		QR			
2004/05				265,600	274,122
2005/06				283,100	293,733
2006/07				293,000	305,517
2007/08				292,500	305,291
2008/09				300,400	313,815
		GLS			
2009/10	53.55%		300,400	300,400	313,988
		GPPS			
2010/11	52.37%		293,517		303,355
2011/12	54.00%		303,820		317,893
		Population Adjustment*			
2011/12	54.00%		303,764	319,661	334,468
2012/13	54.83%		308,433	327,301	342,667
2013/14	54.28%		305,328	328,199	343,942
		Age & Gender Adjustment			
2013/14**	54.28%	35.91%	301,253	314,366	329,415
2014/15**	53.28%	35.86%	298,024	313,865	328,965
2015/16**	51.47%	34.81%	288,092	306,093	321,736
2016/17	50.32%	35.87%	287,569	313,792	328,841
2017/18***	50.32%	35.87%	287,569	316,558	331,701

* The population adjustments are based on estimates for England only, and since 2013/14 these have also been adjusted for age and gender.

** Up to 2013/14, the number of consultations was based on those reporting they had seen a GP within the previous 3 months. From 2013/14 onwards, the number also includes those who had seen a primary care nurse. As a baseline, this calculation also takes the number of consultations reported by QResearch for the 2008/09 financial rather than calendar year (303,900,000) (http://content.digital.nhs.uk/pubs/gpcons95-09 (last accessed 27/02/2021)).

*** 2017/18 responses assumed to be the same as in 2016/17.

Table A 21: Historical series for PSSRU unit costs for consultation types (£) data

Year	GP Home visit	GP Telephone	GP Surgery	GP Other	Practice Nurse	Other Consultations
2004/05	69	30	24	24	10	15
2005/06	69	27	24	24	10	15
2006/07	55	21	34	34	9	14
2007/08	58	22	36	36	11	15
2008/09	117	21	35	35	11	14
2009/10	120	22	36	36	12	17
2010/11	121	22	36	36	13	25
2011/12	110	26	43	43	14	25
2012/13	114	27	45	45	13	25
2013/14	114	28	46	46	14	25
2014/15	114	27	44	44	14	25
2015/16	114	15[a]	36[b]	36	11	N/A
2016/17	114	15	37	37	11	N/A
2017/18	114	15	37	37	11	N/A

[a] Estimates extracted from a telephone triage GP-led cost estimates; [b] Duration of GP consultation contact has been reduced from 11.7 to 9.22 minutes.

Table A 22: Historical series for Quality adjustment for primary care data (%)

Year	Prevalence			QOF achievement		
	CHD	Stroke	Hypertension	CHD	Stroke	Hypertension
2004/05	3.57	1.63	10.41	78.6	73.13	64.33
2005/06	3.57	1.66	11.48	84.44	81.22	71.05
2006/07	3.54	1.61	12.49	88.86	86.92	77.62
2007/08	3.5	1.63	12.79	89.41	87.51	78.35
2008/09	3.47	1.66	13.13	89.68	87.88	78.56
2009/10	3.44	1.68	13.35	89.77	88.12	78.72
2010/11	3.4	1.71	13.52	90.16	88.57	79.3
2011/12	3.38	1.74	13.63	90.14	88.61	79.65
2012/13	3.4	1.7	13.68	90.57	89.26	80.79
2013/14	3.29	1.72	13.73	91.27	89.84	83.09
2014/15	3.25	1.73	13.79	91.98	88.17	83.61
2015/16	3.2	1.74	13.81	91.89	87.63	82.9
2016/17	3.15	1.75	13.83	92.43	88.06	83.36
2017/18	3.13	1.77	13.94	92.11	87.40	82.60
2018/19	3.10	1.77	13.96	92.37	87.66	83.01

Table A 23: Historical series of primary care growth

Years	Unadjusted Growth rate	Population adjusted growth rate	Population and quality-adjusted growth rate
2004/05 – 2005/06		6.59%	7.15%
2005/06 – 2006/07		3.50%	4.01%
2006/07 – 2007/08		-0.17%	-0.07%
2007/08 – 2008/09		2.70%	2.79%
2008/09 – 2009/10		0.00%	0.06%
2009/10 – 2010/11	-2.61%	-1.11%	-0.99%
2010/11 – 2011/12	3.83%	4.66%	4.70%
2011/12 – 2012/13	1.54%	2.39%	2.45%
2012/13 – 2013/14	-1.01%	0.27%	0.37%
2013/14 – 2014/15	-1.07%	-0.16%	-0.14%
2014/15 – 2015/16	-3.33%	-2.48%	-2.51%
2015/16 – 2016/17	-0.18%	-0.86%	-0.89%
2016/17 – 2017/18	0.00%	0.88%	0.87%

8.6. Historic tables for Community prescribing

Table A 24: Historical series of Community prescribing

Year	Unique drug codes observed	Total Prescriptions	Total items prescribed	Total Spend	Activity weighted prescription unit cost (£)	Activity weighted prescribed item unit cost (£)
2004/05	8,779	691,948,868	61,657,885,237	£8,094,174,944	11.7	0.124
2005/06	8,535	733,010,929	64,042,525,435	£8,013,483,226	10.93	0.126
2006/07	8,218	762,631,738	67,468,607,795	£8,250,323,893	10.82	0.119
2007/08	8,769	803,297,137	70,369,213,090	£8,303,500,918	10.34	0.117
2008/09	8,276	852,482,281	73,093,309,000	£8,376,264,432	9.83	0.114
2009/10	8,072	897,727,347	77,363,704,790	£8,621,421,130	9.6	0.108
2010/11	7,860	936,743,859	81,139,818,758	£8,880,735,344	9.48	0.106
2011/12	7,856	973,381,568	83,740,259,688	£8,777,964,802	9.02	0.106
2012/13	7,699	1,001,825,994	84,155,589,191	£8,397,492,181	8.38	0.104
2013/14	7,353	1,031,703,347	85,248,941,535	£8,540,423,964	8.28	0.099
2013/14*	7,809	1,039,535,998	88,367,797,837	£8,703,169,718	8.37	0.098
2014/15	7,926	1,071,065,672	90,023,427,433	£8,942,734,216	8.35	0.099
2015/16	8,021	1,087,838,465	91,268,963,611	£9,288,424,660	8.54	0.102
2016/17	8,147	1,108,965,909	92,167,433,244	£9,193,912,893	8.29	0.100
2017/18	7,803	1,106,431,880	89,638,486,058	£9,095,228,060	8.22	0.101
2018/19	7,755	1,109,084,896	87,947,789,280	£8,833,869,014	7.96	0.101

* In February 2017, NHS Digital released a new set of prescribing data to include previously omitted drug codes. The 2012/13 – 2013/14 growth figures for prescribing are based on the earlier data; whilst the 2013/14 – 2014/15 growth figures are based on the new data.

Table A 25: Historical series of Community prescribing Price and Volume growth

Years	Paasche Price Ratio	Laspeyres Volume Ratio
2004/05 – 2005/06	0.9014	1.0984
2005/06 – 2006/07	0.9659	1.0659
2006/07 – 2007/08	0.9376	1.0735
2007/08 – 2008/09	0.9485	1.0636
2008/09 – 2009/10	0.9626	1.0693
2009/10 – 2010/11	0.9833	1.0476
2010/11 – 2011/12	0.9564	1.0335
2011/12 – 2012/13	0.9284	1.0356
2012/13 – 2013/14	0.9855	1.032
2013/14 – 2014/15*	0.9869	1.0411
2014/15 – 2015/16	0.9993	1.0394
2015/16 – 2016/17	0.9300	1.0644
2016/17 – 2017/18	0.9742	1.0155
2017/18 – 2018/19	0.9477	1.0249

* In February 2017, NHS Digital released a new set of prescribing data to include previously omitted drug codes. The 2012/13 – 2013/14 growth figures for prescribing are based on the earlier data; whilst the 2013/14 – 2014/15 growth figures are based on the new data.

8.7. Historic tables for direct labour

Table A 26: Historical series of NHS organisations reporting ESR data

Year	Organisation Type						
	CCGs	CSUs	NHS England	Non-geographical staff	PCTs	SHA	NHS Trusts
2010/11	n/a	0	0	0	147	10	248
2011/12	n/a	0	0	1	142	10	260
2012/13	9	0	1	1	132	10	260
2013/14	152	24	1	1	40	2	251
2014/15	202	25	1	1	26	0	249
2014/15*	202	22	1	1	10	4	249
2015/16	201	11	1	1	0	0	249
2016/17	204	8	1	1	0	0	239
2017/18	205	4	1	1	0	0	234
2018/19	186	4	1	1	0	0	231

Note: CCGs: Clinical Commissioning Groups; CSUs: Commissioning Support Units; Non-Geographic Central Staff, code AHO; PCTs: Primary Care Trusts; SHA: Strategic Health Authorities; n/a not applicable.
* This row corresponds to NHS staff numbers for the financial year 2014/15 updated to the new methodology implemented by NHS Digital in March 2016.

Table A 27: Historical series of Expenditure (£000) on NHS staff by organisation type

Year	Organisation Type						
	CCGs	CSUs	NHS England	Non-geographical staff	PCTs	SHA	NHS Trusts
2010/11	0	0	0	0	5822	133	28,809
2011/12	0	0	0	157	3742	114	31,761
2012/13	7	0	1	143	1329	110	33,753
2013/14	434	318	221	76	89	0.4	34,510
2014/15	535	306	205	71	1	0	35,820
2014/15*	530	333	202	16	0.15	0.32	35,131
2015/16	618	261	171	8	0	0	36,319
2016/17	722	211	173	57	0	0	37,492
2017/18	849	154	201	72	0	0	38,062
2018/19	895	168	228	72	0	0	39,942

* This row corresponds to NHS staff numbers for the financial year 2014/15 updated to the new methodology implemented by NHS Digital in March 2016.

Table A 28: Historical series of count of FTE staff employed by category in NHS Trusts

	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2014/15[b]	2015/16	2016/17	2017/18	2018/19
GPs[a]	33,730	34,043	36,085	35,243	35,319	35,871	36,294	n/a	n/a	n/a	n/a	n/a	n/a
GP Practice staff	75,085	73,292	72,153	73,306									
GP Practice staff – new method				82,802	84,609	85,546	87,114	n/a	n/a	n/a	n/a	n/a	n/a
Medical staff	84,811	90,460	93,393	95,531	99,331	100,878	100,797	104,189	102,764	104,009	105,565	108,729	111,896
Ambulance staff	21,149	23,084	24,489	25,056	24,908	24,566	24,757	25,381	25,028	26,008	27,451	28,403	29,271
Administration and estates staff	237,264	243,018	262,479	263,723	250,539	242,980	239,359	245,504	208,961	213,880	218,700	222,946	228,686
Health care assistants and other support staff	101,114	106,406	112,710	114,786	116,643	116,018	119,138	123,870	121,564	126,549	133,050	136,183	139,600
Nursing, midwifery and health visiting staff and learners	366,520	372,132	379,841	380,114	377,948	363,781	366,246	372,060	359,221	359,826	362,774	362,564	368,418
Scientific, therapeutic and technical staff and health care scientists	141,754	150,056	159,538	165,454	168,750	164,312	165,683	173,536	165,188	167,438	173,399	178,698	184,949
Unknown and Non-funded staff	4,327	3,595	3,462	3,351	3,055	2,652	2,423	0	3,544	3,757	4,194	4,314	4,529
Total	1,065,754	1,096,086	1,144,150	1,239,366	1,161,102	1,136,604	1,141,811	1,044,540	986,270	1,001,467	1,025,133	1,041,837	1,067,349

Notes: FTE data up to 2006/07 are taken from the Workforce Census data. FTE data from 2007/08 onwards are taken from organisational returns of Electronic Staff Records. When there are 5 or less people employed in an occupational group, organisations report either 5 or 0; these totals therefore will differ from those derived from national level data.

[a] Data for GPs and GP practice staff are not available from ESR; Workforce Census data are used instead; there were also changes in counting of GP Practice staff, therefore data from 2010/11 onwards are not comparable to previous years. NHS Digital stopped reporting the GP figures in 2014/15.

[b] This column corresponds to NHS staff numbers for the financial year 2014/15 updated to the new methodology implemented by NHS Digital in March 2016.

Table A 29: Historical series of direct NHS Labour growth

Years	Nominal expenditure growth		Laspeyres volume growth	
	All*	Trusts	All*	Trusts
2007/08 – 2008/09	7.61%	7.21%	4.14%	3.77%
2008/09 – 2009/10	7.03%	6.55%	4.54%	4.15%
2009/10 – 2010/11	2.62%	3.70%	1.42%	2.95%
2010/11 – 2011/12	2.91%	10.25%	0.10%	7.26%
2011/12 – 2012/13	-1.21%	6.27%	-1.97%	5.50%
2012/13 – 2013/14	0.87%	2.24%	0.38%	1.71%
2013/14 – 2014/15	3.67%	3.80%	2.80%	2.92%
2014/15 – 2015/16	3.17%	3.38%	1.32%	1.47%
2015/16 – 2016/17	3.42%	3.19%	2.36%	2.19%
2016/17 – 2017/18	2.04%	1.52%	2.36%	1.88%
2017/18 – 2018/19	4.84%	4.94%	2.43%	2.52%

* All NHS organisations.

8.8. Historic tables for expenditure on inputs

Table A 30: Materials and capital items pre-2017/18

Organisation	Materials	Capital
Foundation Trusts and NHS Trusts *Source: Financial Monitoring & Accounts Consolidated NHS Financial Trusts Accounts*	• Services from Other NHS Trusts • Services from PCTs • Services from Other NHS Bodies • Services from Foundation Trusts • Purchase of Health care from Non-NHS Bodies • Supplies & Services – Clinical • Supplies & Services – General • Consultancy Services • Transport • Audit fees • Other Auditors Remuneration • Clinical Negligence • Research & Development (excluding staff costs) • Education & Training • Establishment • Other	• Premises • Impairments & Reversals of Receivables • Inventories write downs • Depreciation • Amortisation • Net Impairment of Property, Plant & Equipment • Net Impairment of Intangible Assets • Net Impairment of Financial Assets • Net Impairment for Non-Current Assets held for sale • Net Impairments for Investment Properties
CCGs/NHS England Group *Source: DH Annual Report & Accounts*	• Consultancy Services • Transport • Clinical Negligence Costs • Establishment • Education, Training & Conferences • Supplies & Services – Clinical • Supplies & Services – General • Inventories consumed • Research & Development Expenditure • Other	• Premises • Impairment of Receivables • Rentals under operating leases • Depreciation • Amortisation • Impairments & reversals • Interest Charges

Table A 31: Historical series of current expenditure by PCTs and NHS England Group (£000)

Organisation	Year	Labour	Materials	Capital
PCTs	2007/08	6,701,228	2,617,114	1,174,841
	2008/09	7,478,953	2,526,610	1,247,997
	2009/10	8,230,341	2,623,459	1,703,974
	2010/11	7,175,399	2,638,638	1,171,813
	2011/12	2,328,314	2,052,029	892,604
	2011/12*	2,358,373	860,860	1,721,795
	2012/13*	1,938,770	885,265	1,814,809
NHS England Group	2013/14*	1,529,067	1,420,027	696,400
	2014/15*	1,726,006	1,457,798	536,383
	2015/16*	1,741,655	1,960,006	502,897
	2016/17*	1,781,455	1,714,391	470,188
	2017/18*§	1,843,108	1,747,863	518,621
	2018/19*	1,949,260	1,965,603	564,040

* Data up to 2010/11 are taken from Financial Returns and from 2011/12 onwards from DH Annual Report and Accounts. Material and capital items are identified differently in each source.

§ Figure for Materials is different from the one previously published due to the correction of a coding error.

Table A 32: Historical series of current expenditure by hospital (£000)

Year	Labour	Materials	Capital
2007/08	30,884,556	10,140,836	6,452,630
2008/09	33,435,219	11,322,441	6,340,019
2009/10	35,983,781	12,115,273	6,529,977
2010/11	38,222,951	12,961,217	6,839,898
2011/12	42,647,889	14,941,588	7,278,435
2011/12*	42,701,684	17,477,370	12,097,485
2012/13*	43,797,935	19,681,855	12,377,259
2013/14*	45,360,562	21,108,612	13,217,703
2014/15*	46,847,155	21,983,076	12,747,384
2014/15*§	47,170,735	22,125,031	12,787,098
2015/16*§~	48,748,162	23,644,352	13,396,241
2015/16*§~ξ	48,748,162	22,486,985**	8,223,306**
2016/17*	50,479,070	23,478,496**	8,978,553**
2016/17*-	49,817,304	22,540,716**	8,205,040
2017/18*-	51,868,888	23,470,269**	7,691,102
2018/19*-	54,467,368	24,381,034	8,460,613

* For NHS Trusts, data up to 2011/12 are derived from Financial Returns; for 2011/12 and following years data are derived from Financial Monitoring and Accounts. Material and capital items are identified differently in each source.

§ Figures updated to include previously missing Trusts.

~ Figures updated to reflect shift of 'impairments' from intermediates to capital.

ξ Capital updated to reflect the use of expenditure figures from the 2016/17 accounts for financial year 2015/16.

- Expenditure from TACs (Trust Accounts Consolidated).

** Discrepancies with previously published figures are due to the corrections of a coding error.

Table A 33: Historical series of Total NHS current expenditure (£000)

Year	NHS Staff	Agency	Materials	Capital	Prescribing	Primary Care	DH Admin	TOTAL
2004/05	31,334,252	1,557,282	8,757,990	5,115,514	8,094,175	9,569,836	278,000	64,707,050
2005/06	33,926,746	1,459,936	10,271,344	5,839,664	8,013,483	11,162,141	262,000	70,935,314
2006/07	35,177,509	1,185,244	11,378,727	6,568,363	8,250,324	11,209,422	229,000	73,998,589
2007/08	36,561,167	1,207,654	13,036,200	7,784,592	8,303,501	11,697,639	226,000	78,816,753
2008/09	39,264,185	1,895,423	13,991,803	7,426,031	8,376,264	12,074,672	242,958	83,271,336
2009/10	42,104,673	2,302,578	14,911,074	7,635,390	8,621,421	12,683,418	241,608	88,500,162
2010/11	43,513,839	2,127,889	16,077,609	8,025,361	8,880,735	12,962,081	212,245	91,799,759
2011/12	43,360,622	1,872,598	17,221,673	8,265,079	8,777,965	13,250,874	453,000	93,201,811
2011/12*	43,457,477	1,862,385	19,154,991	13,892,358	8,777,965	13,250,874	453,000	100,849,049
2012/13*	43,654,591	2,345,552	21,442,537	14,273,017	8,397,492	13,419,803	457,000	103,989,992
2013/14*	44,310,698	2,578,931	22,528,639	13,914,103	8,540,424	13,294,670	n/a	105,167,465
2013/14**					8,703,170			105,330,221
2014/15**	45,239,355	3,333,806	23,440,874	13,283,767	8,942,734	13,460,552	n/a	107,701,088
2014/15**§	45,562,935		23,582,829	13,323,481			n/a	108,206,337
2015/16**§~ξ	46,787,408	3,702,409	25,604,358	13,632,724	9,288,425	13,759,292	n/a	113,041,031
2015/16**§~ξ			24,446,991’	8,726,203’			n/a	106,710,729’
2016/17**	49,325,649	2,934,876	25,192,887’	9,448,741’	9,193,913	13,427,480	n/a	109,523,546’
2016/17**-	48,663,883		24,255,107’	8,675,228			n/a	107,150,486’
2017/18**-	51,305,198	2,406,798	25,218,132’	8,209,723	9,095,228	13,378,869	n/a	109,613,947’
2018/19**-	54,016,983	2,399,645	26,346,637	9,024,653	8,833,869	13,934,642	n/a	114,556,430

* Prior to 2011/12, data for NHS Trusts are taken from Financial Returns, from 2011/12 onwards from Financial Monitoring and Accounts. Agency costs, material and capital items are identified differently in each source.

** In February 2017, NHS Digital released a new set of prescribing data to include previously omitted drug codes. The 2013/14 and 2014/15 expenditure figure for prescribing are based on the new data.

§ Figures updated to include previously missing Trusts.

~ Figures updated to reflect the shift of impairment from intermediates to capital.

ξ Capital updated to reflect the use of expenditure figures from the 2016/17 accounts for financial year 2015/16.

- Expenditure from TACs (Trust Accounts Consolidated).

’ Discrepancies with previously published figures are due to the corrections of a coding error.

9. Appendix B

9.1. Mental Health Secure Units – sensitivity analysis

In 2016/17, a new methodology to calculate Mental Health secure services data was introduced in the Reference Costs collection, moving to a combination of pathway and cluster. The accompanying report to the 2016/17 Reference Costs data (NHS Improvement, 2017) advised that it was no longer possible to compare unit costs for this type of mental health services. The same advice was included in the report accompanying the Reference Costs data for 2017/18 and 2018/19 (NHS Improvement (2018), NHS England & NHS Improvement (2020)).

All Mental Health activity pertaining to 'Secure Units', identified by the labels 'High/Medium/Low Secure Mental Health Care Cluster', 'High/Medium/Low Secure Mental Health Care Cluster Initial Assessment' and 'Secure Mental Health Services' were therefore removed from the output growth calculations for the setting 'Community Mental Health' and from the overall NHS output growth measures for the links 2015/16 – 2016/17, 2016/17 – 2017/18 and 2017/18 – 2018/19.

In this section, we carry out a sensitivity analysis, re-introducing all Secure Mental Health activity into our series, based on the method proposed by DHSC.

Table B 1 below summarises Secure Mental Health activity by the broad categories – High/Medium/Low Secure Unit – for care clusters and care clusters initial assessment and Other Secure Mental Health activity, which is categorised by pathways – Child and Adolescent Secure services (low and medium), and high dependency secure provision, further disaggregated into Learning Disabilities, Mental Health or Psychosis, Mental Health or Psychosis and Personality Disorder.

We found that the reporting of secure mental health care by care clusters and care cluster initial assessment, as grouped by high, medium and low as originally suggested by DHSC, did not produce plausible growth rates for the years 2016/17 – 2017/18. We therefore developed a second approach, as documented in Castelli et al. (2020), and reported its findings as a sensitivity analysis.

For the current update, we followed again both approaches, i.e. the one proposed by DHSC and the one proposed in Castelli et al. (2020) and report their findings as sensitivity analyses here.

Unlike in the previous update, for the 2017/18 – 2018/19 link the DHSC method yielded plausible growth rates for the aggregated High, Medium and Low Secure Units. Therefore, we report the impact on NHS productivity growth induced by including Secure Units calculated with both approaches. The two approaches yielded similar 'Community Mental Health' setting growth rates.

Table B 2 presents the effects of including Secure Mental Health activity in the 'Community Mental Health' setting output growth rate, as well as the impact of their inclusion in the overall NHS output growth (quality- and working days-adjusted figure) and NHS productivity growth, both for the mixed and indirect methods for the years 2017/18 – 2018/19, for the two approaches mentioned.

Table B 1: Summary statistics for Mental Health Secure Units activity

Activity	2016/17		2017/18		2018/19	
	Volume of activity	Weighted average unit cost (£)	Volume of activity	Weighted average unit cost (£)	Volume of activity	Weighted average unit cost (£)
High Secure Mental Health Care Cluster (HSMHCC)	138,470	769	215,417	727	208,053	751
High Secure Mental Health Care Cluster Initial Assessment (HSMHCCIA)	491	179,899	14,893	496	114	1,044
Total HSMH	***138,961***	***1,402***	***230,310***	***712***	***208,167***	***751***
Medium Secure Mental Health Care Cluster (MSMHCC)	709,649	487	692,374	504	686,193	527
Medium Secure Mental Health Care Cluster Initial Assessment (MSMHCCIA)	28,734	895	15,568	892	8,153	1,844
Total MSMH	***738,383***	***503***	***707,942***	***512***	***694,346***	***543***
Low Secure Mental Health Care Cluster (LSMHCC)	489,632	450	484,865	455	492,753	486
Low Secure Mental Health Care Cluster Initial Assessment (LSMHCCIA)	13,991	1,081	4,177	2,116	2,507	3,312
Total LSMH	***503,623***	***468***	***489,042***	***469***	***495,260***	***501***
Total MH Secure Units	**1,380,967**		**1,427,294**		**1,397,773**	
Other Secure Mental Health Units	**29,492**	**1,097**	**29,693**	**1,207**	**30,524**	**1,293**
Overall MH Secure Units Total	**1,410,459**		**1,456,987**		**1,428,297**	

Table B 2: Mental Health Secure units setting specific, overall NHS Output and Productivity growth rates

Approach			Community Mental Health (preferred estimate)	Community Mental Health + Mental Health Secure Units CC and CC IA	Community Mental Health + Mental Health Secure Units CC and CC IA + Other Mental Health Secure Units
DHSC approach	**Setting specific growth rate**		**2.667%**	2.084%	2.074%
	Overall NHS Output growth (with quality and working day adjustment)		**1.640%**	1.601%	1.600%
	NHS Productivity	**Mixed**	**-1.291%**	-1.330%	-1.330%
		Indirect	**-1.183%**	-1.221%	-1.222%
Castelli et al. (2020) approach	**Setting specific growth rate**		**2.667%**	2.096%	2.086%
	Overall NHS Output growth (with quality and working day adjustment)		**1.640%**	1.602%	1.601%
	NHS Productivity	**Mixed**	**-1.291%**	-1.329%	-1.330%
		Indirect	**-1.183%**	-1.221%	-1.221%

Including Mental Health Secure Units activity had a negative effect on the overall NHS output and NHS productivity growth measures: overall NHS output growth fell by 0.038 to 0.040 percentage points, decreasing both the mixed and indirect NHS productivity growth rates by 0.038 to 0.039 percentage points. As appears from the above results, the two approaches were very similar and the differences produced by the inclusion of Other Mental Health Secure Units are negligible.

However, since unit costs within High, Medium and Low clusters were extremely volatile (see Table B1), we preferred to exclude secure units from the main analysis.

10. Appendix C

10.1. Deflators

In order to construct a Laspeyres volume growth measure for NHS inputs, expenditure reported in the most recent year needs to be deflated (see section 2.2 for methodological details). This is to purge any changes in expenditure due to changes in prices. Because inflation rates can vary for different sources of expenditure, we use the most appropriate and disaggregated measures available.

We employed specific deflators for four categories of expenditure (Materials and Capital are considered as a homogenous category) until 2015/16. From 2016/17 and limited to Community Prescribing, we use the direct Laspeyres output growth, instead of deflating its expenditure.[70] In 2018/19 we incorporated a specific deflator for agency staff. The various categories of expenditure and deflators used from 2013/14 onwards are summarised in Table C 1.

Table C 1: Sources of deflator data

<table>
<tr><th>Years</th><th>Labour</th><th>Materials & Capital</th><th>Primary Care</th><th>Prescribing</th></tr>
<tr><td>2013/14 – 2014/15</td><td rowspan="3">ESR deflator</td><td rowspan="2">Hospital and Community Health Services (HCHS) deflator</td><td rowspan="2">Pay and Price deflator
0.1 + 0.4*ESR deflator + 0.4*HCHS deflator</td><td rowspan="2">PCA / NHS BSA</td></tr>
<tr><td>2014/15 – 2015/16</td></tr>
<tr><td>2015/16 – 2016/17</td><td rowspan="2">NHS Cost Inflation Index: Provider Non-Pay Index (NHSCII-PNPI)</td><td rowspan="2">NHS Cost Inflation Index: General Practice Index (NHSCII-GPI)</td><td rowspan="2"></td></tr>
<tr><td>2016/17 – 2017/18</td><td rowspan="2">ESR deflator and Agency deflator (from NHSCII)</td></tr>
<tr><td>2017/18 – 2018/19</td></tr>
</table>

The deflators applied to Labour and Prescribing expenditure were constructed using the ESR dataset and Prescribing data (PCA, NHS BSA) respectively, and implied calculating the Paasche price index for these two NHS inputs.

The Hospital and Community Health Services deflator and Pay and Price deflator were provided by DHSC. In 2016/17, the Pay and Price deflator was discontinued and we replaced it with a combination of ESR and HCHS deflators. In 2017/18, the DHSC created a set of new deflators – known as the NHS Cost Inflation Index[71] – from which we use specific deflators for Materials and Capital and Primary Care. We use the Provider Non-Pay Index to deflate expenditure on Materials and Capital, and the General Practice Index to deflate expenditure on primary care. The Provider Non-Pay index (PNPI) is calculated by weighting several sub-components – various expenditure categories in the providers accounts. Each of them is deflated using the most appropriate available deflator: components of Producer Price Index, Services Producer Price Index, Consumer Price Index, etc. and their combinations are used to construct item-specific deflators. As regards the General Practice Index, it is computed as a weighted average of the staff and non-staff subcomponents. The former is calculated using GP and other staff earnings data provided by NHS Digital, whereas intermediate consumption is deflated using the Consumer Price Index, including the owner occupiers' housing costs (CPIH) published by ONS.

[70] This approach yields a more precise real input growth rate of the sector. However, we still calculate and report the deflator for Prescribing to give an idea of the price dynamics in this expenditure category in the recent years.

[71] Details on the methodology behind the index can be found at https://www.pssru.ac.uk/pub/uc/uc2019//NHS-Cost-Inflation-Index.docx (last accessed 27/02/2021). For a comparison of HCSC and NHSCII see p.154 of https://www.pssru.ac.uk/pub/uc/uc2019/sources-of-information.pdf (last accessed 27/02/2021).

In addition, starting from 2018/19, a separate deflator for agency staff was produced within the NHSCI index. The data, collected by NHS England and NHS Improvement from all NHS Trusts, cover NHS trusts' agency staff spending and the number of shifts worked, thus allowing one to calculate the change in the cost of an agency staff shift. Therefore, the agency staff deflator assumes that the length of an agency staff shift is constant, which we deem reasonable.[72] In 2018/19 agency expenditures accounted for about 2.8% of total NHS providers nominal expenditures, being the 6th largest expenditure category. Thus, it is important to understand more closely how agency staff costs vary over time, and reflect this back into our measures of NHS input and NHS productivity growth. This is particularly important when agency staff costs have different growth rates than NHS provider staff costs, as shown in Table C 2.

Table C 2 shows deflation figures for each category of expenditure from 2016/17 – 2017/18 to 2017/18 – 2018/19. These figures indicate that between 2017/18 and 2018/19 all input categories were subject to an increase in costs of a similar magnitude, with the exception of prescribing and agency expenditures. The figures also indicate a high level of variability in price changes of non-pay items.

Table C 2: Deflator values 2016/17 – 2018/19

Years	Labour	Materials and Capital	Primary Care	Prescribing
2016/17 – 2017/18	-0.31%	1.05%	2.63%	-2.47%
2017/18 – 2018/19	2.36% (-9.01%)	2.43%	2.87%	-5.23%

Note: agency deflator in brackets.

10.2. NHS Trust-only productivity measures

While the main body of our research concerns the calculation of productivity growth for the whole NHS, we also produced an NHS Trusts-only productivity growth measure. Differently from how the figures were produced last year (Castelli et al., 2020), we calculated the NHS Trusts-only mixed method growth measures to explicitly account for bank staff. As shown in Table C 3, considering only activity delivered by NHS Trusts, the working days and quality-adjusted output index increased to 2.63% (as opposed to the 2.20% growth for the overall NHS output).

Trusts specific input growth was equal to 3.22% using the mixed method and 3.00% using the indirect method, when applying the agency-specific deflator. This was higher than the respective growth rates for the NHS as a whole. However, given the higher growth in outputs, Trusts-only productivity was higher for both measures compared to the one for the NHS as a whole, albeit still being negative. See Table C 3 for full details.

[72] As highlighted by ONS (https://www.ons.gov.uk/economy/economicoutputandproductivity/publicservicesproductivity/methodologies/methodologicaldevelopmentstopublicserviceproductivityhealthcare2021update (last accessed 27/02/2021)), discussions with the NHS experts suggest agency staff shift lengths have been stable in recent years.

Table C 3: Input, output and productivity growth, Trusts only

Years	Quality and working days adjusted output growth		Input growth	Productivity growth
2016/17 – 2017/18	3.03%	*Mixed*	1.08%	1.93%
		Indirect	2.86%	0.17%
2017/18 – 2018/19	2.63%	*Mixed*	2.89%	-0.25%
		Indirect	2.67%	-0.04%
2017/18 – 2018/19*	2.63%	*Mixed*	3.22%	-0.57%
		Indirect	3.00%	-0.36%

* Figures produced using the new agency deflator.

Applying the ESR deflator to agency expenditure had the effect of reducing input growth rates by 0.32 percentage points for both the indirect and mixed methods. This translated into a reduction of the negative Trusts-only productivity growth by 0.31 percentage points for both indirect and mixed measures (see Table C 3).

Finally, when comparing with growth rates for the previous financial years (using the ESR deflator), we found that the indirect input growth rates were of similar magnitude, whilst those for the mixed method were starkly different (much higher in 2017/18 – 2018/19).

10.3. Working and Total Days

Total days and working days for the last three financial years are reported in Table C 4.

Table C 4: Total days and working days in the last three financial years

Year	Total days	Working days
2016/17	365	255
2017/18	365	251
2018/19	365	253

11. Appendix D

Table D 1: BNF Codes and Drug Names

BNF Code	Chapter	Drug name(s)
0302000K0AM and 0302000K0AU*	3	Duoresp Spiromax Fobumix Easyhaler Symbicort Turbohaler
0302000N0BG and 0302000N0BF*	3	AirFluSal Inhaler Aloflute inhaler Combisal inhaler Sereflo inhaler Seretide 250 Evohaler Sirdupla inhaler
0212000L0AA	2	Ezetimibe Ezetrol
0103050P0AA	1	Losec Mepradec Omeprazole
0407010H0AM	4	Anadin paracetamol Boots paracetamol Lloyds paracetamol Mandanol Panadol actifast Panadol adv Paracetemol Paravict
0601022B0AS and 0601022B0AV*	6	Bolamyn Diagemet Glucient Glucophage Meijumet Metabet Metformin Metuxtan Sukkarto Yaltormin
0408010G0AB	4	Gabapentin Neurontin
0603020J0AD	6	Mydrocort Mydrocortone
0602010V0BW and 0602010V0BZ*	6	Eltroxin Levothyrox
0206020A0AA	2	Amlodipine Amlostin Istin
0212000B0AB	2	Atorvastatin Lipitor
0408010A0AB	4	Keppra Levetiracetam
0103050L0AA	1	Lansoprazole

* Different codes distinguish dosage only.

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