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Productivity of the English National Health Service: 2017/18 Update

Adriana Castelli, Martin Chalkley,
James Gaughan,
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CHE Research Paper 171

Productivity of the English National Health Service: 2017/18 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 2016/17 to 2017/18.

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.

Between 2016/17 and 2017/18, NHS productivity grew by 1.26% 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 growth is, however, negative (-0.27%) when relating NHS output growth to a full indirect measure of NHS input growth. This difference is driven in part by how NHS labour inputs are calculated and reflects a continuing trend to substitute the use of agency staff with bank staff, i.e. staff contracted with a particular Trust to work additional shifts or entirely on an ad hoc basis. A sensitivity analysis including expenditure on bank staff indicates productivity growth with the mixed measure to be 0.88%.

For the first time, the report includes an analysis showing the effect of adjusting NHS output and productivity growth for the number of actual days worked, thus reflecting the year-on-year changes in the number of working days. The working days adjustment increases NHS productivity to 2.11%, when using the mixed NHS input growth measure and to 0.57%, when using the indirect NHS input growth measure. The impact is substantive, but the effect is expected to be smoothed out when considering long time series, as is done in this report.

Overall NHS productivity has increased by 17.99% since 2004/15, with year-on-year growth averaging 1.29%. Since 2009/10, NHS productivity growth has also been positive and has improved substantially faster than the overall economy, measured in terms of gross value added per hour worked (i.e. labour productivity).

NHS outputs increased by 1.72% in 2017/18, adding about 0.35 percentage points to the cost-weighted growth rate. Where appropriate and feasible, output growth was adjusted for changes in survival, health improvement, waiting times and blood-pressure monitoring to capture the quality of care. The largest contributor to NHS output growth is hospital Inpatient activity, with a share of over 31% of overall output growth. Other large contributors are hospital Outpatient activity, Primary Care, Community Prescribing and Community Mental Health. Overall, NHS outputs have increased by 63.26% since 2004/05, with year-on-year growth averaging 3.86%.

Increases in NHS outputs have been mirrored by increases in inputs. In 2017/18 NHS inputs show a modest increase of 0.46% when the mixed method is applied, whilst the indirect measure indicates a growth of 2.00%. A breakdown of contributions to the NHS inputs growth rate indicates labour input is the largest contributor to overall growth at over 46%, both when the direct or indirect methods are employed. The second largest contributor, with 23.25%, is materials, followed by primary care and community prescribing, with contribution to growth equal to 12.16% and 7.70% respectively. NHS Inputs have increased by 38.40% since 2004/15 (using the mixed approach), with average annual growth rate equal to 2.55%.

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

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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 2016/17 to 2017/18. We also provide analysis of the longer time series where appropriate. The full series starts with financial year 1998/99 (Bojke et al., 2016a); however, in most cases we consider the series from 2004/05, which is a more comparable period.

We calculate productivity growth (growth in the value of outputs divided by growth in the expenditure on inputs) using a Laspeyres volume index. In this way, different sources of input and output are valued in terms of their cost in a first year, in order to identify volume changes in the next year. 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 and waiting times for elective hospital care and blood pressure monitoring in a primary care setting. 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 is available, we disentangle changes in terms of volume and inflation by using deflators. We use direct measures for all sources of output and for NHS staff. We use indirect measures for materials and capital. We also consider a purely indirect measure for inputs, where labour is also 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 healthcare system is included in this report before presenting our findings for the most recent two financial years, i.e. between 2016/17 and 2017/18. 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. We finally consider the introduction and impact of a working days adjustment in the overall NHS output and productivity measures. Individual items of NHS outputs and inputs are investigated in Sections 5 and 6. 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 results 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 of including Secure Mental Health activity in the computation of NHS output and productivity growth.

2. Methods

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

ΔTFP=[X/Z] (E1)

In order to estimate total factor productivity, it is necessary to correctly define and measure the 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, for which people do not have to pay at 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 (Atkinson, 2005) suggests supplementing costs with information about the quality of non-market goods and services (Atkinson, 2010). 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 (limited to four conditions), survival rates following hospitalisation, and blood pressure management in primary care.

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 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 $\omega_{n0}$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 a 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:

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

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:

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

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

3. Productivity Growth

Productivity growth of the NHS overall between 2016/17 and 2017/18 was 1.26% when using the mixed measure and -0.27% using the indirect measure. Productivity growth observed with the mixed and indirect methods for 2015/16-2016/17 and 2016/17-2017/18 are presented in Table 1. Measures from previous years, beginning with growth from 2004/05 to 2005/06, are set out in Table A 1 located in Appendix A. More details about these two methodologies are set out in Section 4. The gap between these two measures of productivity growth has increased since 2016/17, as shown in Table 1. By definition, the difference in productivity measured by these two approaches is driven by a difference in how labour inputs are calculated. The increased difference between methods seen between 2016/17 and 2017/18 may reflect a continuing trend towards the use of bank staff - staff contracted with a particular Trust to work additional shifts or entirely on an ad hoc basis. Expenditure on this method of employment is reported within the indirect measure but not in the mixed measure, as bank staff are not included in the Electronic Staff Record (ESR). However, the use of mixed measures is to be preferred, following recommendations made in the national accounts that direct measures (such as the ESR) are to be used over indirect measures wherever possible. In addition, the ESR provides much more granular detail about the types of staff employed, which allows for a better understanding of what is behind overall changes in labour input growth.

Table 1: NHS Productivity Growth 2015/16-16/17 to 2016/17-17/18

Years	Mixed	Indirect
2015/16 – 2016/17	2.86%	2.03%*
2016/17 – 2017/18	1.26%	-0.27%

* Productivity growth from the indirect measure differs from that reported in (Castelli et al., 2019) by 0.02 percentage points (2.01 compared to 2.03). This reflects a correction to the pay deflator from 1.01 to 1.04, resulting in a smaller growth in inputs and so higher productivity growth.

Behind productivity growth figures are growth rates in both outputs and inputs. These are presented from 2004/05-2006/07 to 2016/17-2017/18 in Figure 1. This shows that the drop in productivity growth between 2016/17 and 2017/18 compared to 2015/16 and 2016/17 is primarily due to a drop in output growth. The figure also highlights that input growth has remained at a historically low level for a second consecutive financial year.

Figure 1: NHS Output and Input Growth (Mixed Method) 2004/5-5/6 to 2016/17-17/18

Another way to think about input, output and productivity growth over time is presented in Figure 2. This figure uses 2004/05 as an index year and then applies growth rates observed cumulatively. It can be seen from this figure that outputs have grown by over 60% between 2004/05 and 2017/18, while inputs have grown by just under 40%. As a result, productivity has increased by just under 20% in the same period. The figure also shows productivity growth has been relatively stable over time, with an average growth rate of 1.28% per annum.

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

A further comparison which can be made is between productivity growth of the NHS and growth of the U.K. 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.[1,2]

Figure 3 indicates that NHS productivity has improved substantially faster than the overall economy since 2009/10.

Figure 3: Cumulative NHS and Whole Economy Growth over Time

[1] 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 on 12.11.2019)

[2] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/labourproductivitytables110andr1 (Last accessed on 12.11.2019)

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 2, the cost-weighted output growth index increased by 1.33% between 2016/17 and 2017/18.

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. This increased by 1.72% between 2016/17 and 2017/18. This is about 0.35% higher than the cost-weighted index, with improvements registered in some of the quality measures (survival rates, life expectancy and three of the Patient Reported Outcome measures (PROMS)) and deteriorations in others (waiting times and QOF achievement in primary care for Stroke, CHD and Hypertension).

Table 2: Output growth

Years	Cost-weighted Growth (CW)	Quality adjusted CW growth
2015/16 – 2016/17	3.35%	3.51%
2016/17 – 2017/18	1.37%	1.72%

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 contribution to growth, calculated as a share of overall spend multiplied by the output growth of the setting. More detailed information on contribution of each setting can be also found in Table 3. A detailed breakdown of output growth for each setting can be found in Section 5.

Figure 4: Contribution to output growth by setting, 2017/18

By far the largest contributor to the output index is hospital Inpatient activity, with a share of over 31% of both total spend and overall output growth. Other sizeable contributors are Outpatient activity, Primary care, Community prescribing and Community Mental Health. All other settings contribute less than 6% to the total value of output.

Table 3: Contribution to output growth by setting, 2017/18

Setting	Growth rate	Setting specific growth index	Value of Activity (16/17 prices)	Share of overall spend	Contribution to overall growth rate
Hospital Inpatient	2.86%	102.86%	27,956,117,546	31.42%	32.32%
Outpatient*	2.34%	102.34%	13,639,916,658	15.33%	15.69%
Community Prescribing	1.55%	101.55%	9,193,912,893	10.33%	10.49%
Primary care*	0.87%	100.87%	8,938,930,318	10.05%	10.13%
Community Mental Health	-0.98%	99.02%	5,989,209,182	6.73%	6.66%
Community care	-3.39%	96.61%	5,329,232,493	5.99%	5.79%
A&E	1.55%	101.55%	4,818,529,510	5.42%	5.50%
Chemo-/Radiotherapy/High Cost Drugs	9.75%	109.75%	3,845,175,461	4.32%	4.74%
Specialist Services	-0.20%	99.80%	3,456,085,547	3.88%	3.88%
Ophthalmology & Dentistry	-2.36%	97.64%	1,902,442,161	2.14%	2.09%
Radiology	-0.83%	99.17%	1,074,500,650	1.21%	1.20%
Diagnostic Tests	8.10%	108.10%	1,010,243,392	1.14%	1.23%
Rehabilitation	-5.80%	94.20%	959,176,440	1.08%	1.02%
Renal Dialysis	0.77%	100.77%	567,754,893	0.64%	0.64%
Other	4.42%	104.42%	297,787,893	0.33%	0.35%
Total/NHS output growth rate			**88,979,015,037**		**1.72%**

*Hospital inpatient, Primary Care and Outpatient activity are quality adjusted. **The contribution of each setting to growth in 2017/18 is expressed as a percentage of the total output in 2016/17. 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 4 presents growth in inputs from 2004/05-2005/06 to 2016/17-2017/18 using two methods. The mixed method uses Electronic Staff Record data to calculate expenditure on labour input and combines this information with expenditure data from published accounts for remaining inputs used in the production of healthcare goods and services. The indirect method uses accounts (expenditure) data for all types of inputs. The mixed method indicates a very small increase in input growth, similar to the one reported for 2015/16-2016/17. Growth rates of around 0.5% are in notable contrast to increases of at least 1.9% in the previous three years up to 2015/16. Growth in inputs indicated by the indirect method is substantially larger for 2016/17-2017/18 than the mixed method and indicates a growing divergence of the input growth rates reported by the two methods. Potential reasons for this divergence are considered just below.

Table 4: Input growth

Years	**All NHS**	
	Mixed	**Indirect**
2015/16 – 2016/17	0.64%	1.46%
2016/17 - 2017/18	0.46%	2.00%

A breakdown of contributions to the growth in inputs is presented in Table 5. It can be seen from this table that the difference between the mixed in indirect methods discussed above are driven entirely by the growth rates calculated for labour, excluding agency staff, using different sources of data and methods. Specifically, the growth rate for labour expenditure, as reported in hospital providers' accounts, is much larger than that of ESR (5.75% compared to 2.36%). As expenditure on labour represents over 40% of total expenditure on inputs, this difference has a major bearing on the overall growth in inputs. As discussed in the 2016/17 version of this report (Castelli et al., 2019), there has been a recent trend away from agency staff (employing temporary staff through an external agency) towards bank staff (employing temporary staff from a pool of employees with specific flexible contracts with the Trust, in some cases in addition to a regular hours contract). Critically, bank staff are not reported as part of totals in ESR but do form part of expenditure on staff in accounts data. Therefore, a continuation of this trend in 2017/18 would lead to an increased divergence in the labour growth rates and be reflected in the overall input growth indicated by the mixed and indirect methods. This explanation is supported by a sharp fall in agency staff in proportional terms from 2016/17 to 2017/18, as observed between 2015/16 and 2016/17.

Table 5: Contribution to input growth 2016/17-17/18

Setting	Growth	Setting specific growth index	Value of Activity (15/16 prices)	Share of overall spend	Contribution to growth
Labour, measured directly (Labour, excluding agency staff, measured indirectly)*	2.36% (5.75%)	102.36% (105.75%)	48,663,883	45.43%	46.50% (48.05%)
Agency	-17.74%	82.26%	2,934,876	2.74%	2.25%
Materials	2.84%	102.84%	24,218,243	22.61%	23.25%
Capital	-6.36%	93.64%	8,675,228	8.10%	7.58%
Primary care	-2.98%	97.02%	13,427,480	12.54%	12.16%
Prescribing	1.37%	101.37%	9,193,913	8.58%	8.70%
Total			**107,113,623**		**0.46% (2.00%)**

* Measured directly: Labour measured by the full-time equivalent counts and national average wages provided in the Electronic Staff Record; Measured indirectly: Labour measured by expenditure on staff, provided in published Trust accounts.

4.3. Working days adjustment

Our measure of productivity growth is defined as the ratio of output over input growth between two (or more) financial years. However, financial years do not always have the same number of working days, see Table 6. The number of working days is influenced by changes in public holidays (e.g. a financial years can contain 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.

Table 6: Total days and working days in the last four financial years

Year	Total days	Working days
2015/16	366	252
2016/17	365	255
2017/18	365	251

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. As a sensitivity analysis, 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 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 day adjustment. The same logic applies to the total days adjustment.

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

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

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. Table 7 contains the list of NHS settings 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.

Table 7: 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*		
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	

*There are no official estimates of volume of activity for the primary care setting. The primary care output growth rates reported in this document are based on our estimation model (see Section 5.6). Our method assumes the same number of total and working days per financial year; hence no adjustment has been made to this setting.

4.3.1. Estimates for the WD/TD adjustment

We apply the adjustment to the periods 2015/16-2016/17 and 2016/17-2017/18 (current link). Table 8 shows the cost adjusted and quality adjusted output growth figures for the working days/total days adjusted measure, as well as the un-adjusted measure that corresponds to the figures reported in Table 2. The WD/TD adjustment produces the expected results. For the link 2015/16-2016/17 the adjustment decreases the output growth estimates by approximately 0.54 percentage points, as the number of working days is greater in 2016/17 than in 2015/16. For the current link, we observe the opposite effect, an increase in the output growth of 0.86 percentage points, the number of working days being smaller in 2017/18 than in 2016/17.

Table 8: Output growth estimates for the WD/TD adjustment

Years		Output Growth	
		Cost Adjusted	**Quality Adjusted**
2015/16-2016/17	**Un-adjusted Main Measure**	3.35%	3.51%
2015/16-2016/17	**WD/TD Adjusted**	2.81%	2.98%
2016/17-2017/18	**Un-adjusted Main Measure**	1.37%	1.72%
2016/17-2017/18	**WD/TD Adjusted**	2.23%	2.58%

Table 9 shows the productivity estimates with and without working days/total days adjustment for the indirect and mixed method, as well as differentiating between the cost and the quality-adjusted productivity growth rates. The adjustment has the expected result: it decreases productivity estimates with respect to the not-adjusted measure for the 2015/16-2016/17 link. The opposite is observed for the current link: there is an increase of 0.89 percentage points with respect to the un-adjusted measure according to our preferred productivity measure - the mixed method quality adjusted output growth.

Table 9: Productivity growth estimates for the WD/TD adjustment

Years		Cost Adjusted Productivity Growth		Quality Adjusted Productivity Growth	
		Indirect Method	**Mixed Method**	**Indirect Method**	**Mixed Method**
2015/16-2016/17	**Un-adjusted Main Measure**	1.87%	2.70%	2.03%	2.86%
2015/16-2016/17	**WD/TD Adjusted**	1.34%	2.16%	1.50%	2.32%
2016/17-2017/18	**Un-adjusted Main Measure**	-0.61%	0.91%	-0.27%	1.26%
2016/17-2017/18	**WD/TD adjusted**	0.23%	1.77%	0.57%	2.11%

4.4. Accounting for bank staff

In calculating growth in inputs, our preferred method uses a mixed approach. That is, we use direct measures of volume and unit prices where possible and indirect measures of expenditure otherwise. In our case, we have access to a direct measure for a wide range of labour, but this does not include bank staff. We are therefore required to assume that growth in permanent staff members is a good proxy for growth in bank staff. This may not hold true in recent years, due to a trend away from agency staff (for which we have expenditure data) and towards bank staff (for which our main measure has no information). We have been given access to the results of a Freedom of Information Request (FOI) for expenditure on bank staff in 2015/16 and 2016/17. 2017/18 expenditure on bank staff is reported in a report on NHS providers by NHS Improvement (NHS Improvement, 2018). Table 10 presents the impact of explicitly including expenditure on bank staff as part of our Productivity measure. We do not use this as our main result, because our focus is on growth between 2016/17 and 2017/18 and the FOI information may not be comparable with the NHS Improvement report. We intend to use bank staff expenditure as part of our main measure in future years.

Table 10: Productivity Estimates with Bank Staff

Years		Cost Adjusted Productivity Growth		Quality Adjusted Productivity Growth	
		Indirect Method	**Mixed Method**	**Indirect Method**	**Mixed Method**
2015/16-2016/17	**Un-adjusted Main Measure**	1.87%	2.70%	2.03%	2.86%
2015/16-2016/17	**Main Measure with Bank Staff Expenditure**	1.87%	2.09%	2.03%	2.25%
2016/17-2017/18	**Un-adjusted Main Measure**	-0.61%	0.91%	-0.27%	1.26%
2016/17-2017/18	**Main Measure with Bank Staff Expenditure**	-0.61%	0.53%	-0.27%	0.88%

By definition, the indirect method is not affected by the introduction of bank staff expenditure, as this approach already uses total expenditure on staff, of which bank staff is one component. However, the inclusion of bank staff expenditure results in a fall in productivity growth when using the mixed method (by around 0.6% between 2015/16 and 2016/17 and 0.4% between 2016/17 and 2017/18). This is due to a higher rate of growth in expenditure on bank staff than other types of staff. When this is explicitly accounted for, input growth is higher, resulting in lower productivity growth. Table 10 also shows that a substantial gap remains between the two methods of measuring input growth after including bank staff, thus suggesting that the shift from agency to bank staff is only a partial explanation for the divergence of productivity measures using the mixed and indirect methods in recent years.

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.[3] Table 11 summarises 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 2016/17 to 2017/18. 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. We compare the outpatient activity in these datasets.

Table 11: Summary of NHS output data sources

Output type	Activity source	Cost source	Quality	Notes for 2016/17 & 2017/18 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)	PSSRU Unit Costs of Health and Social Care	QOF data	Uplift survey responses by population growth; changes in QOF data.
Prescribing	Prescription cost analysis system	Prescription cost analysis system	N/A	
Ophthalmic and dental	NHS Digital	NHS Digital	N/A	

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

[3] 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

HES is the source of data for both the amount of activity and the measures of quality for elective (including day cases) and non-elective activity. This includes mental health care delivered in hospitals.[4] HES is comprised of 21.1m Finished Consultant Episodes (FCEs) in 2016/17 and over 21.4m in 2017/18 – i.e. a 1.5% increase in FCEs. This is in line with the figures reported by NHS Digital.[5]

Table 12: Organisational coverage of HES activity, FCEs

Year	NHS Trusts	Private providers	Others	Total
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

The vast majority of activity captured in HES is performed by hospital Trusts. As shown in Table 12, over 97% of all activity was performed in Trusts in both 2016/17 and 2017/18. The proportion of activity performed by private providers has been gradually increasing over time, and is equal to 2.8% in 2017/18. Full details are available in Appendix A.

5.2.1. Methodology

We convert HES records, defined as Finished Consultant Episodes (FCEs), into Continuous Inpatient Spells (CIPS) using the official algorithm for calculating CIPS as published by NHS Digital.[6] We then count the number of CIPS in each Healthcare Resource Group (HRG), which form the basic means of describing different types of hospital output.

The cost of each CIPS is calculated on the basis of the most expensive FCE within the CIPS, with costs for each HRG derived from the Reference Cost data (Bojke et al., 2013). The non-elective Reference Costs are used to determine the cost of patients treated on a non-elective basis, while we use the elective inpatient Reference Costs to determine the cost of all elective patients, including those treated on a day case basis[7] (Bojke et al., 2016b). Having assigned a cost to each CIPS, we then calculate the national average cost per CIPS in each HRG.

Changes to the HRG system pose some difficulties in constructing the output index because costs are not available for newly recorded (retiring) activities. In such cases we deflate (inflate) costs in order to impute missing values (Castelli et al., 2011). Between the years 2016/17 and 2017/18, 92 new HRGs were introduced, 47 were discontinued and 13 HRGs kept the same code but had a new description.[8]

[4] 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').

[5] https://files.digital.nhs.uk/B3/DCC543/hosp-epis-stat-admi-summ-rep-2017-18-rep.pdf (last access 21/10/2019).

[6] http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=1072 (last access 21/10/2019).

[7] This ensures that elective inpatient and day-case activity are assigned the same cost weight and, hence, are assumed to be of equivalent value, despite the latter being of lower cost. This equal weighting ensures that the output index is not biased downwards if delivery of treatment moves to lower cost forms or settings over time.

[8] Regarding the 13 HRGSs that kept the same code but had a new description: one belongs to the subchapter 'YH' (Musculoskeletal Imaging Interventions); four to 'YJ' (Breast Imaging Interventions); two to 'YL' (Urological Imaging Interventions), one to 'RD' (Diagnostic Imaging Procedures); one to 'RN' (Nuclear Medicine Procedures) and the final four to 'VA' (Multiple Trauma)

5.2.2. Elective, day case and non-elective activity

Elective activity has grown steadily between 2004/05 and 2016/17, as shown by Figure 5. However, between 2016/17 and 2017/18 the number of elective CIPS decreased by 75,364 CIPS (0.7%) (see Table 13). The growth in non-elective activity shows a more erratic pattern over time and for the current link non-elective activity increased by 189,095 CIPS (2.5%).

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

* 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 13: 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 (£)
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

After cost-weighting this activity, we observe -0.63% growth in activity for electives and day cases and a growth of 4.94% for non-elective activity between 2016/17 and 2017/18. Combining both series, the total cost-weighted activity growth amounts to 1.74%.

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

Our measure of hospital output captures growth in both the volume of activity and improvements in quality. We calculate the quality adjustment for each specific HRG, and separately for electives and non-elective care. The quality of hospital activity is measured by four elements:

In-hospital survival rates (1) and Mean Life Expectancy (2): This part of the quality adjustment is designed to capture changes in the expected discounted sum of lifetime Quality Adjusted Life Years (QALYs) conditional on patients surviving treatment. Information on in-hospital survival rate

is obtained directly from HES and mean life expectancy is taken from life tables published annually by ONS.[9]

Waiting Times (3): longer waiting times are considered to have adverse health consequences and formulated as a scaling factor multiplying the health effect (Castelli et al., 2007). This adjustment applies only to elective and day case activity, and is measured by 80th percentile waiting times. Waiting time's information is obtained directly from HES.

Estimated change in health outcomes following hospital treatment (4): We compute the ratio of before and after treatment health status measures. We use changes in the ratios to assess the impact that treatments have on patients' health status over time. Smaller ratios represent a larger health improvement associated with the treatment. Data sources:

i. Patient Reported Outcome Measures (PROMs) for all patients undergoing unilateral hip and knee replacement, varicose vein surgery and groin hernia repair. The PROMs survey includes the EQ-5D questionnaire, which allows responses to be scaled from perfect health (1) to death (0). Patients report their health status before and either three or six months after surgery.
ii. For treatments where no such information is available, we assume that the ratio is 0.8 for elective care and 0.4 for non-elective care (Dawson et al., 2005). We also assign the above constant PROMs ratios to CIPS with error code UZ01Z (Castelli et al., 2019).

Table 14 and Table 15 present average values of the measures for the quality elements for the years 2015/16, 2016/17 and 2017/18.

Table 14: 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
2015/16	99.93%	22.9	80	97.29%	33.5
2016/17	99.94%	22.8	83	97.24%	33.3
2017/18	99.94%	22.7	85	97.27%	32.8

Table 15: Ratio of pre to post health status, based on EQ-5D

Year	Groin hernia repair	Hip replacement	Knee replacement	Varicose vein removal
2015/16	0.79	0.36	0.40	0.77
2016/17	0.86	0.39	0.46	0.73
2017/18	0.74	0.33	0.41	0.88

[6] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/2016to2018 (last accessed 21/10/2019)

Once we take quality into account, the total Laspeyres output growth of elective, day case and non-elective activity is 2.86%. The effect of accounting for quality is positive and adds over one percent to the cost-adjusted measure. The latter figure conceals large variations across the different sub-settings. If considering elective and day cases separately from non-electives activity, we find that the quality-adjusted growth rates between 2016/17 and 2017/18 are -0.38% and 7.25%, respectively.

The quality adjustment for non-elective activity is positive and substantial. We find that the improvement in the quality-adjusted output growth rate for hospital activity is driven mainly by improvements in in-hospital survival rates, as well as life expectancy. The latter might not seem obvious as the mean life expectancy decreased by 0.5 years for non-elective patients in 2017/18. This, however, masks large variations in life expectancy at the HRG level. Our finding therefore reflects a higher concentration of non-elective treatment among younger patients in 2017/18 than in 2016/17.

The quality adjustment for elective activity is of a smaller magnitude but also positive and it is driven by improvements in PROMS (all conditions present smaller ratios excepting varicose vain removal) and life expectancy, which compensate the observed increase in waiting times. In 2017/18 the 80th percentile of waiting time was 85 days: two more days than in 2016/17.

5.2.4. Inpatient mental health

As shown in Figure 6, there has been a declining trend over recent years in the number of patients with mental health problems treated in an elective/day case setting and a non-elective setting. Table 16 shows the number of CIPS and average costs for elective and non-elective mental health activity for the years 2015/16 to 2017/18. 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 Healthcare Contacts).

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 16: CIPS and average cost for inpatient mental health patients

Year	Elective and day case activity		Non-elective activity	
	# CIPS	Average cost (£)	# CIPS	Average cost (£)
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

After cost-weighting mental health activity, we observe an overall decline of -1.10% between 2016/17 and 2017/18. We conjecture that the negative growth observed relates to the fact that we only account for mental health activity performed in non-mental health hospitals, whilst the majority of mental health patients are treated by specialist mental health Trusts.

5.2.5. Inpatient mental health: quality adjustment

As with other inpatient activity, we also account for changes in the quality of inpatient mental health care. We use the same quality adjusters as for other forms of inpatient activity, namely in-hospital survival rates, mean life expectancy and 80th percentile waiting times. These measures are reported in Table 17.

Table 17: 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
2015/16	99.38%	31.6	54	98.63%	26.9
2016/17	98.91%	30.3	59	98.04%	25.1
2017/18	99.29%	30.7	54	98.00%	24.6

In the same way as for other hospital inpatient activity, we also calculate quality adjustment based on the performance in a specific HRG (separately for electives and non-electives). On average, all the quality measures for elective MH activity have improved compared to 2016/17. Patients show greater in-hospital survival rates, greater mean life expectancy and wait shorter periods for treatment. For non-elective MH activity, we observe a deterioration of in-hospital survival rates and a lower mean life expectancy. **Once we take quality into account, output growth from 2016/17 to 2017/18 increases from -1.10% to -0.57% for Mental Health patients treated in hospitals.**

5.3. HES outpatient data

Outpatient activity can be derived from both the HES Outpatients dataset and the RC data. In this section, we present summary statistics for outpatient activity derived from the HES Outpatient dataset. This dataset does not include unit cost information, which we derive from the RC data. A like-for-like comparison between the two datasets is not wholly possible, because the activity data are recorded somewhat differently in each. See section 5.4.2 for RC outpatient figures. See Castelli et al. (2019) and Castelli et al. (2018) for a summary of the main differences between HES and RC Outpatient data, as well as the costing method applied)

As shown in Figure 7, outpatient activity has shown a positive growth trend since 2011/12. Between 2016/17 and 2017/18, however, growth in activity has stagnated. **After cost weighting the activity, the Laspeyres growth in outpatient activity amounts to 2.34%.**

Table 18: HES outpatient volume and average cost over time

Year	HES Outpatient Activity	
	Volume	Average cost (£)
2015/16	107,092,657	118.37
2016/17	112,038,758	121.74
2017/18	112,986,081	127.27

Figure 7: Trends in HES outpatient activity, 2011/12 – 2017/18

5.3.1. HES outpatient: quality adjustment

We allow for changes in the quality of outpatient activity by taking account of changes in waiting times. The 80th percentile waiting time has increased over the years (see Figure 8) and reached a maximum of 68 days in 2016/17. It remains constant in 2017/18. **Hence, accounting for waiting times has no impact on the growth measure (2.34%).**

Figure 8: Trends in outpatient waiting times

5.4. Reference cost data

Reference Cost (RC) returns are used in the NHS output and productivity series to capture activity delivered outside primary care, outpatient departments and in 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.

Reference Costs data are checked for both the accuracy of data reported and activity coverage.

5.4.1. RC: quality checks

Mandatory and non-mandatory validations of the Reference Cost 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 have 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 increases/decreases 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 Reference Cost 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 identify cases of NHS activity/HRG codes, meeting one of the criteria in Step 1, that do not appear to be genuine. This step may lead to the identification of a sub-set of HRG/service codes related to the NHS activity requiring further investigation. Limited to the HRG/service codes flagged up as requiring further investigating, 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 (https://digital.nhs.uk/services/national-casemix-office/).

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 did not highlight any abnormally large variations in either volume or unit costs. Therefore, no further investigations of the RC data were considered necessary.

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, from Appendix A.

5.4.2. Growth in NHS activity captured in Reference Costs data

Between 2016/17 and 2017/18, NHS activity as captured by the Reference Cost returns grew by 0.85% if we include outpatient activity and by 0.75% if outpatient activity is excluded from the series. So this is a very modest growth compared to the one recorded between 2015/16 and 2016/17 of 2.74%, without outpatient activity. This modest growth summarises a more varied picture for different settings, as shown in the remainder of this section where each of the settings covered by RC data is explored in further detail.

5.4.3. Reference Cost Outpatient activity

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 presented has remained fairly stable since 2015/16, with consultant-led activity for Trusts representing just under 60% of overall outpatient activity, non-consultant led just over 25%, and outpatient procedures 15%.

Table 19: Outpatient activity and cost

Year	Outpatient	
	Volume of activity	Average cost (£)
2015/16	85,394,479	120
2016/17	87,017,943	122
2017/18	87,714,235	127

The Laspeyres output growth measure for outpatient activity, as captured by the Reference Costs data, is 1.13% between 2016/17 and 2017/18, a decrease of 1.3% compared to 2015/16 – 2016/17.

The difference between HES and RC measures of outpatient activity growth is about 1.21%, with RC data reporting lower growth than the HES outpatient data. Although both datasets have some quality

issues, our preferred method uses HES, as it is a patient-level dataset as opposed to the more aggregated RC. This allows us to perform more thorough quality checks and so better assures a like-for-like comparison over time.

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.

Figure 9: Trends in Outpatient activity (right axis) and average costs (left axis), 20074/8 - 2017/18

5.4.4. A&E and ambulance services

Table 20 reports summary statistics for A&E and ambulance services.

A&E services are provided in both Emergency Departments (EDs) and Other A&E departments. [10] 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.

Table 20: A&E and ambulance services activity and average cost

Year		2015/16		2016/17		2017/18	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Emergency Departments	AD	4,101,720	219	3,966,820	238	4,313,593	247
	NAD	10,921,696	140	11,039,457	152	11,100,308	164
Other A&E services	AD	473,723	69	472,913	78	280,645	69
	NAD	4,202,986	60	4,515,570	67	4,255,912	67
Ambulance services	Calls	9,794,437	7	10,238,451	7	10,995,578	7
	Hear and treat/refer	782,665	34	806,804	37	886,175	37
	See and treat/refer	2,347,808	181	2,441,651	181	2,459,394	192
	See and treat & convey	5,167,876	236	5,277,120	247	5,325,368	252

The total number of emergency department attendances increased by 2.7% between 2016/17 and 2017/18, with a record growth (8.74%) in the number of people being subsequently admitted to hospital. ED attendances not leading to admitted hospital stays increased only slightly (0.55%) in 2017/18. The growth in ED attendances leading to admitted hospital stays recorded between 2016/17 and 2017/18 is substantial compared to the negative growth of -3.3% calculated between 2015/16 and 2016/17.

Unlike the growth figure reported for 2015/16 and 2016/17, 'Other A&E services' decreased overall by 9.1% between 2016/17 and 2017/18, with patients being subsequently admitted to an inpatient ward decreasing by just under 41%.[11] 'Other A&E services' not leading to admitted care also decreased by 5.75%.

Overall, the total volume of A&E activity decreased by 0.22% between the two most recent financial years. Similar to previous years, the number of patients subsequently being admitted to a ward as emergency cases has increased (3.48%) between 2016/17 and 2017/18; whilst that of patients not

[10] 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/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics/hospital-episode-statistics-data-dictionary, p.15 (last accessed 23/10/2019)

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

being admitted to a ward decreased by 1.28%. The latter may be an early indication of GP practices not being able to treat more patients with ambulatory care conditions in the most appropriate setting.

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'. Ambulance services continue the increasing trend from previous years, with a growth rate of 4.81% between 2016/17 and 2017/18.

Figure 10 to Figure 12 show trends in activity and their respective average unit costs by type of ED department from 2006/07 and for Ambulance services from 2011/12. Whilst volumes of A&E activity by type of Emergency department are roughly stable over time, an increase is detected in the average unit costs reported for attendances to Emergency departments leading to admitted hospital care, or not. Average unit costs for 'Other A&E services' AD show some volatility over time, whilst those not leading to admitted care show a moderate increase over time.

Figure 10: Trend of A&E activity (left axis) and related average unit costs (right axis) in ED departments, separately for AD and NAD, 2006/07 – 2017/18

Figure 11: Trend of 'Other A&E services activity (right axis) and related average unit costs (left axis), separately for AD and NAD, 2006/07 – 2017/18

Figure 12: Volume trend (right axis) in Ambulance services and average unit costs (left axis), 2011/12 -2017/18

The Laspeyres output growth measure for the setting 'A&E services', which includes ambulance services, increased by 1.55% between 2016/17 and 2017/18.

5.4.5. Chemotherapy, Radiotherapy & High Cost Drugs

Table 21 reports volumes and average unit cost for these three categories. High Cost Drugs underwent a wholesale revision in 2017/18, with drugs reported by active ingredient, similar to community prescribing data derived from the Prescription Cost Analysis (PCA) system (see section 5.7), whilst retaining its usual groupings of 'Admitted patient care', 'Outpatient' and 'Other'. This does not affect, however, the total volumes of activity reported, which shows an increase of 11.73% between 2016/17 and 2017/18, continuing the positive growth recorded in financial year 2016/17. Chemotherapy shows an even larger increase of 17.1%, preceded by a negative growth of -22.7% in 2016/17, whilst Radiotherapy continues its decreasing trend from previous years, although at a lower rate (-0.43%).

Table 21: Chemotherapy, Radiotherapy, High Cost Drugs

Year	2015/16		2016/17		2017/18	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Chemotherapy	2,913,719	454	2,253,067	605	2,639,406	569
Radiotherapy	2,018,956	188	1,929,548	198	1,921,222	218
High Cost Drugs	2,115,966	942	2,288,895	917	2,557,373	828

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 13.

Figure 13: Trends in Chemotherapy, Radiotherapy and High Cost Drugs activity (right axis) and average costs (left axis), 2004/05 – 2017/18[12]

Note: HCD were first reported in the RC dataset in 2007/08.

Overall, the cost-weighted Laspeyres output growth measure for Chemotherapy, Radiotherapy & High Cost Drugs increased by 9.75% between 2016/17 and 2017/18.

[12] Note that HCD underwent a complete overhaul in 2007/08, hence previous data points have not been included.

Table 22 reports the contribution to the 2017/18 growth of each of the settings.

Table 22: Contribution of sub-settings to overall growth of the setting 'Chemo-/Radiotherapy/High Cost Drugs'

Sub-setting	Growth rate	Setting specific growth index	Value of Activity (16/17 prices)	Share of overall spend	Contribution to overall growth rate
Chemotherapy	25.63%	125.63%	£1,362,360,220	35.4%	44.5%
Radiotherapy	2.22%	102.22%	£382,974,593	10.0%	10.2%
High Cost Drugs	0.82%	100.82%	£2,099,840,647	54.6%	55.1%
Total/overall growth rate			**£3,845,175,460**		**9.75%**

5.4.6. Community care

Community care includes a very diverse array of activities carried out in the community by:

- Allied Health Professionals;
- Community Rehabilitation Teams;
- Health Visiting and Midwifery;
- Intermediate Care, including Crisis responses, care home based services, etc;
- Medical and Dental care, for example community, emergency and general dental services;
- Nursing, ranging from school-based children's health core service to specialist nursing for various diseases; and
- Wheelchair services for both adults and children.

Between 2016/17 and 2017/18, RC records a drop in the total volume of community care activity, as shown in Table 23, and equivalent to a negative growth rate of - 3.47%, which follows a positive trend since 2011/12. Figure 14 shows trends in community care activity (right-hand side axis) and average unit costs (left-hand side axis), since 2004/05.

The cost-weighted Laspeyres output growth rate for community care is -3.39% between 2016/17 and 2017/18, an indication that the negative growth has been more substantial in community care services with lower average unit costs.

Table 23: Community care activity and average costs, 2015/16 – 2017/18

Years	2015/16	
	Volume of activity	Average cost (£)
2015/16	86,767,072	60
2016/17	87,751,894	61
2017/18	84,708,536	62

Figure 14: Trends in Community Care activity (right axis) and average costs (left axis), 2004/05 – 2017/18

5.4.7. Diagnostic tests, pathology and radiology

The total volume of Directly accessed diagnostics services and Radiology decreased between 2016/17 and 2017/18, respectively by 0.92%, and 3.24%, following positive growth in the previous two financial years; unlike Direct accessed pathology services continue to show a positive growth, equal to 11.37% in 2017/18, since 2015/16.

The cost-weighted Laspeyres output growth rates were -1.70% and -0.83% for Directly accessed diagnostics services and Radiology respectively, whilst the cost-weighted Laspeyres output growth rate for Directly accessed pathology services has increased by 11.30% over the last two financial years.

Table 24: Directly accessed diagnostic and pathology services and radiology

Year	2015/16		2016/17		2017/18	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Directly accessed diagnostic services	7,467,097	31	7,849,470	32	7,777,205	32
Directly accessed pathology services	359,911,813	2	374,847,731	2	417,460,632	2
Radiology	10,755,438	97	11,342,904	95	10,975,838	99

Trends in activity (right-hand side axis) and average unit costs (left-hand side axis) for these type of services are shown in Figure 15 - Figure 17, from 2004/05 to 2017/18.

Figure 15: Volume trends (right axis) in Directly accessed diagnostic services and average costs (left axis), 2004/05 – 2017/18

Figure 16: Volume trends (right axis) in Directly accessed pathology services and average costs (left axis), 2004/05 – 2017/18

Figure 17: Trends in Radiology activity (right axis) and average costs (left axis), 2004/05 – 2017/18

5.4.8. Community Mental Health

Table 25 reports the activity delivered to community mental health patients over the last three financial years, as reported in their respective Reference Cost datasets.

In 2016/17, the accompanying report to the 2016/17 Reference Cost data stated on p. 7 that 'the methodology for collecting some secure services data was changed to a combination of pathway and cluster; it is no longer viable to compare unit costs across years', and thus adjustment had to be made to the Mental Health data as all secure mental health services have been excluded from the calculation of the Community Mental Health output growth measure for the years 2015/16, 2016/17 and 2017/18.

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

Similar to hospital mental health activity, community mental health care clusters activity has decreased by -2.13% between 2016/17 and 2017/18, continuing the decreasing trend from 2015/16 and previous years. Other mental health activity, which captures services such as Children and Adolescent Mental Health Services, Drug and Alcohol, Mental Health Specialist team has also seen a decrease by -1.72% in the (raw) number of services provided between 2016/17 and 2017/18, which followed a more volatile trend in previous years.

Overall, the cost-weighted Laspeyres output growth rate mitigates the above results with a negative growth of 0.98%; an indication that the reduction of activity has occurred in less costly MH activity.

Table 25: Care clusters and other mental health activity, 2015/16 – 2016/17

Year	2015/16		2016/17		2017/18	
Community Mental Health (MH)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Care Clusters						
MH Care Clusters – Admitted Patient Care	5,269,507	388	5,187,204	404	4,929,918	420
MH Care Clusters - Non-Admitted Patient Care	239,684,860	9	236,183,269	9	231,188,942	9
MH Care Clusters – Initial Assessment	773,308	306	822,296	301	873,626	307
Adult IAPT MH Care Clusters	1,038,873	275	886,645	310	849,228	353
Adult IAPT MH Care Clusters Initial Assessments	602,437	115	726,002	127	781,102	121
Total volume MH Care Clusters	**247,368,985**	**19**	**243,805,416**	**18**	**238,622,816**	**20**
Other Mental Health*						
Children and Adolescent MH Services	1,993,978	255	2,418,240	234	2,522,873	240
Drug and Alcohol Services	1,519,640	105	1,270,174	110	1,167,114	114
MH Specialist Teams	2,111,275	165	2,101,077	171	1,916,052	192
Secure MH Services	-	-	-	-		
Specialist MH Services	352,354	219	424,732	223	501,382	223
Total volume Other MH	**5,977,247**	**183**	**6,214,223**	**187**	**6,107,421**	**200**
Total volume of Community MH activity	**253,346,232**	**23**	**250,019,639**	**24**	**244,730,237**	**25**

* Excludes Admitted Patient care, which is included in Hospital Mental Health

Figure 18 shows trends both in the average unit costs (right-hand side) and activity (left-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 have decided not to show these years in the Figure below, but the whole time series is available in the Appendix.

Figure 18: Trends in Community Mental Health activity (right axis) and average costs (left axis), 2011/12 - 2017/18

5.4.9. Rehabilitation and renal dialysis

The volume of Rehabilitation and Renal Dialysis activity over time is reported in Table 26. Growth in the raw volume of Rehabilitation services was, for a third consecutive year, negative (-1.0%), whilst Renal dialysis activity grew slightly (0.9%), continuing the positive trend since 2015/16. Looking at their cost-weighted Laspeyres output growth measures, we find that Rehabilitation services decreased by -5.80%, an indication that on average more costly rehabilitation services decreased more between 2016/17 and 2017/18. We find that the cost-weighted Laspeyres output growth rate for Renal Dialysis was 0.77% over the same time period.

Table 26: Rehabilitation and Renal dialysis

Year	**2015/16**		**2016/17**		**2017/18**	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Rehabilitation	2,985,717	332	2,893,451	332	2,865,116	328
Renal dialysis	4,157,008	134	4,240,850	134	4,277,315	135

Figure 19 and Figure 20 show trends in activity (right-hand side) and average cost (left-hand side) respectively for Rehabilitation and Renal dialysis, since 2004/05. Renal dialysis shows a stable volume of activity since 2006/7, whilst Rehabilitation has shown some volatility. Average unit costs have, however, increased rapidly for both type of NHS activity, more so for Rehabilitation services.

Figure 19: Trends in Rehabilitation activity (right axis) and average costs (left axis), 2004/05 - 2017/18

Figure 20: Trends in Renal Dialysis activity (right axis) and average costs (left axis), 2004/05 - 2017/18

5.4.10. Specialist services

The setting Specialist services, as defined by us, comprises of the following services: Adult critical care, Specialist palliative care, Cystic Fibrosis and Cancer multi-disciplinary team meetings. Volumes and average unit costs for these activities are reported in Table 27 for the last three financial years.

Table 27: Specialist services

Year	2015/16		2016/17		2017/18	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Adult Critical Care	2,777,403	1,081	2,792,536	1,082	2,717,180	1,159
Specialist palliative Care	855,702	146	914,564	152	967,805	153
Cystic Fibrosis	11,845	9,100	11,489	9,198	10,934	9,766
Cancer Multi-Disciplinary Team Meetings	1,517,387	111	1,708,174	111	1,800,465	114

The total volume of Adult Critical Care services decreased by -2.7% and that of Cystic Fibrosis by -4.83%, whilst Specialist Palliative Care and Cancer Multi-Disciplinary Team Meetings activity increased by 5.82% and 5.4% respectively between 2016/17 and 2017/18.

Unsurprisingly, the cost-weighted Laspeyres output growth measure for Specialist services decreased by -0.20%; the overall negative growth is due to the decrease in activity of the more costly Adult Critical Care and Cystic Fibrosis.

Figure 21 - Figure 24 show trends in volume of activity (right-hand side) and average unit costs (left-hand side) since 2004/05 for Adult Critical Care and Cystic Fibrosis, and since 2006/07 and 2011/12 for Specialist Palliative Care and Cancer Multi-Disciplinary Team Meetings respectively. The volume of activity for Adult Critical Care has continuously increased, as have average unit costs, over the time period considered. Total volume of activity for Specialist Palliative care has experienced a sharp increase since it was first reported in the Reference Cost returns in 2006/07, whilst average unit costs have steadily decreased over the same time period. Growth in Cystic Fibrosis activity has been very volatile over the time period considered, with some of the volatility being due to some re-categorisations in 2011/12; also that their average unit costs saw a big spike in growth in 2011/12, and have been somehow volatile since then. Finally, Cancer Multi-Disciplinary Team Meetings show an increasing growth in activity since 2011/12, with average unit costs displaying a more volatile trend.

Figure 21: Trends in Adult critical care activity and average costs, 2004/05 - 2017/18

Figure 22: Trends in Specialist Palliative care activity (right axis) and average costs (left axis), 2004/05 - 2017/18

Figure 23: Trends in Cystic Fibrosis activity (right axis) and average costs (left axis), 2004/05 - 2017/18

Figure 24: Trends in CMDT activity (right axis) and average costs (left axis), 2004/05 - 2017/18

5.4.11. Other NHS activity

Other types of activity reported in the Reference Costs are summarised in Table 28. The total volume of Regular Day and Night Attenders (RDNA) and Day care facilities activity increased by 17.5% and 44.7% respectively in 2017/18, continuing the trend from the previous financial year. The total volume of Audiological services has continued a decreasing trend from previous financial years, recording an even higher negative growth of -4.6% in 2017/18.

Table 28: Other NHS activity

Year	2015/16		2016/17		2017/18	
	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Regular day & night attenders	224,523	389	242,322	325	284,842	327
Audiological services	3,523,847	57	3,452,571	57	3,293,426	58
Day care facilities	241,756	131	191,547	125	277,092	102

Figure 25 - Figure 27 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 2004/05**. RDNA and Audiological services show some volatility in both volumes of activity and average unit costs reported over the time period considered, whilst Day Care Facilities have seen a decreasing trend in the total volumes of activity until 2016/17, and a somewhat more erratic trends in average unit costs over time.**

Figure 25: Trends in RDNA activity and average costs, 2004/05 - 2017/18

Figure 26: Trends in Audiological activity and average costs, 2004/05 - 2017/18

Figure 27: Trends in Day Care Facilities activity (right axis) and average costs (left axis), 2004/05 - 2017/18

Overall, the cost-weighted Laspeyres output growth measure for 'Other NHS activity' increased by 4.42% between 2016/17 and 2017/18, mainly driven by the big increase in the volume of activity carried out in Day Care Facilities.

5.5. Dentistry and ophthalmology

Information about dentistry[13] (activity and costs), and ophthalmology[14] (activity only), are published by NHS Digital. Table 29 shows the volume of activity and average costs for both types of activity, with dental activity differentiated into dental bands. For the last three financial years, cost data for Ophthalmological services are those provided by the Association of Optometrists.

Table 29: Ophthalmology and Dentistry

Year		2015/16		2016/17		2017/18	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Ophthalmology		12,979,762	21	12,995,512	21	13,032,582	21
Dentistry	**Band 1**	22,437,889	19	22,939,419	20	22,814,753	21
	Band 2	11,251,942	51	11,080,848	54	10,699,157	56
	Band 3	2,129,467	223	2,082,785	234	1,987,657	244
	Urgent	3,693,752	19	3,664,913	20	3,566,835	21
	Other	169,831	19	156,905	20	144,888	21
	Total	**39,682,881**	**39**	**39,924,870**	**40**	**39,213,290**	**42**

Ophthalmic activity increased slightly, 0.29%, between financial years 2016/17 and 2017/18. As the average costs have not changed since 2010/11, the cost-weighted output growth measure is simply the growth in the volume of activity, continuing the positive trend recorded since 2015/16. Growth in dentistry continues the negative trend started between 2013/14 and 2014/15, with negative growth of -0.68%.

Combining activity for dental services and ophthalmology, the cost-weighted Laspeyres output growth measure is -2.36% between 2016/17 and 2017/18, continuing the negative trend since 2014/15.

5.6. Primary care activity

Since 2009/10, we have estimated activity in the English Primary Care setting using the GP Patient Survey. In 2017/18, the survey underwent a major update in its questionnaire. Hence, the two surveys are not comparable, with the main differences between the two surveys described below. We also propose a conservative estimate for primary care output growth between 2016/17 and 2017/18.

For 2016/17, we drew on two questions from the GP Patient Survey 2017 to calculate primary care activity:

- question 1 'When did you last see a GP (for which the shortest available option was in the past three months)'; and
- question 2 'When did you last see a nurse (for which the shortest available option was in the past three months)'.

[13] https://digital.nhs.uk/data-and-information/publications/statistical/nhs-dental-statistics/2018-19-annual-report-pas (last accessed 04/12/2019).

[14] https://digital.nhs.uk/data-and-information/publications/statistical/general-ophthalmic-services-activity-statistics/year-ending-31-march-2018/gosactivity1718 (last accessed 04/12/2019).

The 2018 survey included the following key questions, the closest equivalents to the questions given above from the 2017 survey:

- question 23 'When was your last general practice appointment (for which the shortest time period option available is within the past 3 months)'; and
- question 24 'Who was your last general practice appointment with?'. Options for this question include GP and Nurse.

It is also explicitly noted in the 2018 survey that respondents should consider only their most recent appointment.

Further, the sample of patients covered by the survey has also changed between the latest two surveys. In 2018, patients aged 16 and 17 were included for the first time. Each respondent was asked to provide demographic information, including an age group of 16-17. However, it is not possible to identify answers from a comparative sample to previous surveys, as we do not have access to individual level responses.

Table 30 sets out the key questions and percentage of respondents selecting relevant options in the 2017 and 2018 surveys. This is the information we use to estimate the number of consultations in each year. At face value, these figures might indicate a sharp drop in patients attending a primary care appointment in the past three months (51.96% in 2018 while the sum of GP and nurse appointments in 2017 suggests a rate of 86.19%). However, there may be a high correlation between having a GP appointment in the past three months and having a nurse appointment in the same period. Such a correlation is not possible to observe from the 2017 survey. Further, the 2018 figures indicate a shift towards GP appointments compared to nurse appointments. However, this might reflect respondents being more likely to mark a GP appointment when only one appointment can be reported. Therefore, as it is not possible to directly compare 2017 and 2018 responses, we assume that responses reported in 2017 are a good proxy for what responses would have been to the same questions in 2018. We combine these response rates from 2017 with QResearch data from 2008/09 to provide an estimate of the distribution of Primary Care consultations in 2017/18.

Table 30: Responses to key questions from 2017 and 2018 GP patient surveys

Question	Option	Year	% of respondents
When was your last GP appointment?	Past 3 months	2017	50.32%
When was your last nurse appointment?	Past 3 months	2017	35.87%
When was your last general practice appointment?	Past 3 months	2018	51.96%
Who was your last general practice appointment with?	GP	2018	70.04%
Who was your last general practice appointment with?	Nurse	2018	22.94%

Table 31 reports the estimated percentage of respondents who had a GP and nurse appointment in the past three months, drawing on information provided in Table 30. These percentages are then used to calculate the number of consultations, also presented in Table 31. The final two columns of Table 31 report population and population and quality-adjusted estimated number of consultations. Details about population and quality adjustments are given in subsequent paragraphs. The results indicate a small increase in the number of consultations due to changes in population distribution and quality, both in a positive direction in 2017/18 compared to 2016/17. The common number of consultations

before population and quality adjustment in 2016/17 and 2017/18 is due to this figure being drawn entirely from the responses (held constant by assumption) and QResearch (taken from 2008/09).

Table 31: CHE GPPS based measure of volume of consultations 2015/16 to 2017/18

Year/Method	Respondents who saw a GP in past 3 months	Respondents who saw a nurse in the past 3 months	Number of consultations	Population adjusted number of consultations	Population and quality adjusted number of consultations
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

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

Population adjustment combines the most recent age-gender specific number of primary care consultations taken from QResearch in 2008 with population estimates for 2017/18. To make the adjustment, it is assumed that the relationship between GPPS responses and the number of consultations/head for each age-gender combination is constant over time.

Figure 28 presents the average number of consultations across ages along with age distributions in 2008/09 and 2017/18. The figure highlights a higher propensity for older people to make use of primary care and an increase in the concentration of elderly people between the two time points. Taken together, we would therefore expect an increase in the number of primary care consultations provided after population adjustment, as reflected in Table 31.

Figure 28: Share of population attending GP consultations (right axis) and average number of consultation (left axis)

Table 32 provides information from 2016/17 and 2017/18 on the incidence and achievement rates of three QOF indicators. This is the information used to account for changes in the quality of Primary Care activity. These figures show that the prevalence fell slightly for coronary heart disease (CHD) and rose slightly for stroke and hypertension. The achievement rate fell slightly for all indicators.

When estimating the number of consultations after adjusting for quality, the aim is to generate the value of total consultations, which is done by giving a weight of 1.3 to the estimated number of consultations falling into the remit of the QOF indicators considered. Therefore, as we observe prevalence, not count of patients with CHD, stroke and hypertension, a larger estimated population adjusted number of consultations implies a larger number of patients with QOF relevant conditions. This is why a higher number of consultations is observed after quality adjustment in Table 31, despite the slight fall in average quality shown in Table 32, shown as a lower QOF achievement rate for all conditions.

Table 32: Quality adjustment for primary care (%) 2016/17-17/18

Year	Prevalence			QOF achievement rate		
	CHD	Stroke	Hypertension	CHD	Stroke	Hypertension
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

Unit cost information for different types of primary care activity are taken from PSSRU publications. Figures for the most recent three years are presented in Table 33. Unit costs have been stable over this period and in earlier years. The equivalent series from 2004/05 is presented in Appendix A.

Table 33: PSSRU unit costs for consultation types (£) 2015/16-17/18

Year	GP Home visit	GP Telephone	GP Surgery	GP Other	Practice Nurse
2015/16	114	15[a]	36[b]	36	11
2016/17	114	15	37	37	11
2017/18	114	15	37	37	11

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

Table 34 presents unadjusted, population adjusted and population and quality adjusted Laspeyres Primary Care growth rates for 2015/16-16/17 and for 2016/17-17/18. Population and quality-adjusted growth is lower than population-adjusted growth, as would be expected from Table 32. When comparing 2015/16 to 2016/17, changes in population distribution between 2016/17 and 2017/18 are the main drivers of growth in primary care output.

Table 34: Laspeyres growth rates for primary care

Years	Unadjusted growth rate	Population adjusted growth rate	Population and quality adjusted growth rate
2015/16-2016/17	0.18%	0.86%	0.89%
2016/17-2017/18	0.00%	0.88%	0.87%

5.7. Community prescribing

The source of information for community prescribing is the Prescription Cost Analysis (PCA) system, supplied by the Prescription Pricing Authority via the NHS Digital Prescription Drugs Team. The data

are based on a full analysis of all prescriptions dispensed in the community. Categories of prescriptions are defined by their chemical composition. The data include information about the Drug code (PropGenLinkCode), Net Ingredient Cost (NIC), Quantity of Drug Dispensed, and Number of Prescription Items. The data are complete and prices are available for all items and years.

Table 35 reports summary statistics about community prescribing. The number of different drugs reported fell between 2016/17 and 2017/18 by 344 (4.22% of the 2016/17 figure), following several recent years of growth.[15] However, some variation in number of categories is due to zero counts for rarely used drugs in some years, rather than definitional changes which are more stable over time. The number of prescriptions, total expenditure in current terms and unit cost of prescriptions all fell slightly, each by around 1%, between 2016/17 and 2017/18. These figures indicate a fall in the number of prescriptions and a slightly larger decrease in expenditure than those published in the 2018 Official Statistics Reports on Prescription Cost Analysis (Prescribing & Medicines Team, 2018). This may reflect in part the period covered by the report and our analysis (calendar year and financial year respectively). The number of items prescribed also fell, and more steeply than the number of prescriptions between 2016/17 and 2017/18. At the same time, the unit cost of items rose marginally. This indicates physicians prescribed a smaller number of slightly more expensive items in each prescription, though all of these effects are modest. Five hundred and thirty nine new drug items appeared in 2017/18, amounting to expenditure of £10.5 million in 2017/18 prices. In 2016/17, 883 drug items were prescribed and not in 2017/18, representing £5.4 million of expenditure in 2016/17 prices. There are no data items which appear obviously incorrect and we therefore take the data at face value.

Table 35: Community prescribing, summary data 2015/16-2017/18

Year	Unique drug codes observed	Total Prescriptions	Total items prescribed	Total Spend	Activity weighted prescription unit cost (£)	Activity weighted prescribed item unit cost (£)
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

Volume and price indices for community prescribing are reported in Table 36. The Paasche Price index fell between 2016/17 and 2017/18, continuing a trend which has been observed since 2004/05.[16] Also as observed in previous years, the Laspeyres volume index is positive, though the increase from 2016/17 to 2017/18 is the smallest observed. Given that we observe a fall in the total number of units prescribed, the recorded small increase in the volume growth index is an indication of a shift to prescribing higher cost items, which is also suggested by the marginal increase in the unit cost of items prescribed as shown in Table 35. The unit costs observed in 2017/18 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 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

[15] See Table A 20 for a historic trend from 2004/05-2017/18.

[16] See Table A 25: Community prescribing: price and volume growth 2004/05-2017/18 for earlier equivalent figures, beginning from 2004/05.

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 36: Community prescribing: price and volume growth 2015/16-2017/18

Years	Paasche Price Ratio	Laspeyres Volume Ratio
2015/16 - 2016/17	0.9300	1.0644
2016/17 - 2017/18	0.9742	1.0155

Taking the base year as 2004/05, trends in the volume and prices of items prescribed are shown in Figure 29. This figure indicates a small fall in volume after several years of continuous but modest growth. In contrast, a small increase in average price is observed of a similar magnitude to other increases and decreases of recent previous years.

Figure 29: Price and volume changes for community prescribed pharmaceuticals

Note: * 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.

6. Growth in input categories

6.1. Direct labour

Since 2007/08[17] we have calculated direct labour growth from Electronic Staff Record data, provided by NHS Digital.[18,19] 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.[20] Due to precautions taken for cells with small numbers,[21] the aggregate figures we report will not match precisely with those published by NHS Digital from the ESR.[22]

Staff earnings data covers the same staff groups and organisations as counts of staff. This information is the basis for a dataset of national average pay at the occupation code level, provided by NHS Digital. Basic pay is reported per head and per FTE. Non-basic pay is reported per head only. Therefore, as in Castelli et al. (2019) and other recent previous years, we construct total pay per FTE as basic pay per FTE and non-basic pay per head times (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 non-basic pay per FTE/non-basic pay per head.

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 with data from April-October 2016, 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, where proportion of FTE staff in the two groups of providers act as weights. If a wage is only available for one of core or wider providers, we assume this wage also reflects the average for equivalent staff in the other organisation group.

Table 37 shows the number of organisations reporting direct labour information by organisation type. At face value, these figures indicate an increase in Clinical Commissioning Groups (CCGs) and a fall in Commissioning Support Units (CSUs) and Trusts. The rise in CCGs reflects an increase in the number of CCGs reporting to ESR. The fall in the number of Trusts is due to mergers and take-overs. Changes between 2016/17 and 2017/18 in the number of organisations continue existing trends.[23] Table 37 also reports total expenditure on staff by organisation type. Expenditure is calculated from the product of FTE staff employed in each occupation code and the national average total earnings from each occupation code. Differences in expenditure between 2016/17 and 2017/18 broadly reflect a continuation of existing trends[24]. While increased total expenditure from CCGs is due to both higher expenditure/CCG and more CCGs reporting, the first of these is the main driver of growth between

[17] Before 2007/08, the number of staff was extracted from the Workforce Census.

[18] More precisely, we use data from the NHS iView database (https://digital.nhs.uk/services/iview-and-iviewplus (last accessed 25.07.2019)), which is constructed from the ESR and NHS combined Payroll and Human Resources System.

[19] 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).

[20] 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.

[21] If a provider-staff group cell contains fewer than 5 staff, the provider reports 0 or 5 at random.

[22] https://digital.nhs.uk/data-and-information/publications/statistical/nhs-workforce-statistics (last accessed 25.07.2019)

[23] A time series of equivalent information from 2010/11 is presented in Table A 26.

[24] A time series of equivalent information from 2010/11 onwards is presented in Table A 27.

2016/17 and 2017/18, as only one additional CCG reported in 2017/18 compared to 2016/17. There is also a sharper increase in NHS England and non-geographic staff expenditure, though both remain within the range of previous reported figures. The increase in expenditure among Trusts was more modest than in recent previous years. See Table A 27 for historic trends in expenditure by provider type from 2010/11 to 2017/18.

Table 37: Number of reporting organisations and expenditure by type 2015/16-17/18

Organisation type	2015/16		2016/17		2017/18	
	Orgs	Exp (£m)	Orgs	Exp (£m)	Orgs	Exp (£m)
CCGs	201	618	204	722	205	849
CSUs	11	261	8	211	4	154
NHS England	1	171	1	173	1	201
Non-geographical staff	1	8	1	57	1	72
PCTs	0	0	0	0	0	0
SHA	0	0	0	0	0	0
NHS Trusts	249	36,319	239	37,492	234	38,062

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; £m: Expenditure in millions of pounds.

Table 38 reports the number of FTE staff employed by Trusts and outside Trusts by broad categories for each year from 2015/16 to 2017/18.[25] These figures show employment within the NHS is predominantly by hospital Trusts and the largest employee group is of Nursing, midwifery and health visiting staff and learners. The ratios of different staff categories have remained stable over the past three years.

Table 38: Count of FTE staff employed by category

NHS Staff type	2015/16		2016/17		2017/18	
	Trust	Non-Trust	Trust	Non-Trust	Trust	Non-Trust
Medical staff	104,009	927	105,565	1,111	108,729	1,246
Ambulance staff	26,008	1	27,451	1	28,403	1
Administration and estates staff	213,880	37,092	218,700	38,830	222,946	42,730
Health care assistants and other support staff	126,549	1,598	133,050	2,137	136,183	2,020
Nursing, midwifery and health visiting staff and learners	359,826	3,708	362,774	3,913	362,564	4,075
Scientific, therapeutic and technical staff and healthcare scientists	167,438	3,618	173,399	3,708	178,698	4,697
Unknown and Non-funded staff	3,757	148	4,194	148	4,314	164
Total	1,001,467	47,092	1,025,133	49,848	1,041,837	54,933

Notes: Data 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 at random; these totals therefore will differ from those derived from national level data.

Figure 30 shows the growth in FTE staff by the same broad staff categories from 2015/16 to 2016/17 and 2016/17 to 2017/18 in Trusts. Growth was faster between 2016/17 and 2017/18 for medical staff than between 2015/16 and 2016/17, but slower for all other categories. Positive and relatively even growth is seen for all categories, with the exception of nursing and midwifery staff, where a slight

[25] Table A 28 provides a longer time series of staff employed within Trusts from 2007/08 to 2017/18.

reduction is observed between 2016/17 and 2017/18. A residual group of unknown and unfunded staff (0.4% of the FTE total in 2017/18) is not included in the figure. Figure 31 provides equivalent information for growth in staff employed outside of Trusts but within the NHS. It indicates much larger and variable percentage changes in staff numbers over time. In particular, healthcare assistance and support staff grew by over 30% between 2015/16 and 2016/17 but then fell by over 5% between 2016/17 and 2017/18. 2017/18 also saw a sharp increase in scientific, therapeutic and technical staff employed outside Trusts. However, as shown in Table 38 large proportional changes in non-Trust staff numbers are more likely and 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 employees not employed by Trusts.

Figure 30: Growth in FTE staff by group 2015/16 to 2017/18 in Trusts

Figure 31: Growth in FTE staff by group 2015/16 to 2017/18 in non-Trusts

Table 39 presents nominal expenditure growth and Laspeyres volume growth in labour for the NHS overall and for Trusts alone from 2015/16 to 2017/18.[26] Laspeyres volume indices indicate growth of 2.36% overall and 1.88% for the group of Trusts between 2016/17 and 2017/18. We observe the same overall Laspeyres volume growth in direct labour from 2016/17 to 2017/18 as between 2015/16 and 2016/17. This is surprising but appears to be a result of chance, as the Laspeyres volume index for Trusts only and both growth figures for nominal expenditure (overall and Trust) between 2016/17 and 2017/18 differ from equivalent figures for 2015/16 to 2016/17. Overall growth in direct labour among Trusts was slower between 2016/17 and 2017/18 than between 2015/16 and 2016/17, implying growth in non-Trust organisations was higher. This is supported by Table 38 and Figure 31, where a substantial increase in scientific, therapeutic and technical staff is observed, the second largest employment group in terms of FTEs. Unusually, nominal expenditure growth between 2016/17 and 2017/18 was lower than the Laspeyres volume growth rate. This applies to both the NHS as a whole and to Trusts. This reflects a reduction in the unit cost of staff, reflected in a Paasche price growth rate of -0.3% for Trusts and the NHS overall. While it is unlikely that the cost of employing the same staff fell on average between 2016/17 and 2017/18, the unit cost of staff overall can fall if the concentration of less highly paid staff in the labour force as a whole increased.

Table 39: Growth in direct labour 2015/16-17/18

Years	Nominal expenditure growth		Laspeyres volume growth	
	All*	Trusts	All*	Trusts
2015/16 – 2016/17	3.42%	3.19%	2.36%	2.19%
2016/17 – 2017/18	2.04%	1.52%	2.36%	1.88%

* All NHS organisations.

[26] See Table A 29 for the equivalent series from 2007/08 to 2017/18.

6.2. Expenditure data

We employ data from published 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 consists 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[27]. Reporting of this information has been consistent in recent years, as shown in Table 40. The items of expenditure used to calculate Labour, Materials and Capital are presented in Table 41.

Table 40: Sources of expenditure information 2014/15-2017/18

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	Trust accounts consolidation		

[27] https://www.gov.uk/government/publications/dhsc-annual-report-and-accounts-2017-to-2018 (last accessed on 08.10.2019)

Table 41: Categorisation of operating expenditure items from TACs

Organisation	Labour	Materials	Capital
NHS Foundation Trusts and Non-Foundation Trusts Source: Trust Accounts Consolidation	• 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

* 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.

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, such that items of expenditure are common across FTs and Non-FTs. 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 40 sets out the accounts published in each year by FTs and Non-FTs. Table 41 presents the items of expenditure mapped to Labour, Materials and Capital in 2017/18 accounts.

The reconfiguration of Trust accounts in 2017/18 means these accounts are not directly comparable with accounts published in 2016/17. Therefore, we calculate growth in Trust expenditure on inputs by comparing 2017/18 figures presented in 2017/18 accounts with 2016/17 figures reported in the same 2017/18 accounts.

Neither DHSC Accounts nor accounts published by NHS Trusts include expenditure on agency staff. We instead use figures provided directly by DHSC on agency staff expenditure.[28]

6.3. Expenditure on inputs

Table 42 presents expenditure on Labour, Materials and Capital of the NHS England Group from 2015/16 to 2017/18. Expenditure in Labour and Materials in 2017/18 indicates a continuation of a relatively smooth upward trend in expenditure. Expenditure on capital has been more volatile in relative terms but represents less than half the expenditure on either of the other categories throughout the period presented.

Table 42: Current expenditure by NHS England Group (£000)

Year	Labour	Materials	Capital
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	1,736,050	518,621

Expenditure on Labour, Materials and Capital among NHS Trusts is presented in Table 43. As the published accounts for Trusts was completely overhauled in 2017/18, expenditure reported in 2016/17 accounts is not comparable with expenditure reported in 2017/18 accounts. Therefore, figures for 2016/17 are presented twice in Table 43, first from 2016/17 accounts, then the figures reported for 2016/17 in the 2017/18 accounts. In calculating growth in expenditure between 2016/17 and 2017/18, figures for 2016/17 and 2017/18 in accounts from 2017/18 are considered. Expenditure in Labour and Materials continued to grow between 2016/17 and 2017/18, as it has been the case in several previous years. Capital fell sharply in proportional terms in the most recent link but, as for the NHS England Group, represents a much smaller proportion of Trust expenditure than either Labour or Materials.

Table 43: Current expenditure by NHS Trusts (£000)

Year	Labour	Materials	Capital
2015/16	48,748,162	23,644,352	13,129,827
2016/17	50,479,070	24,765,135	14,324,055
2016/17*	52,051,824	23,082,814	8,506,017
2017/18*	54,232,484	23,958,542	8,060,168

* Expenditure from TACs (Trust accounts consolidation)

NHS expenditure on all input items from 2015/16 to 2017/18 is summarised in Table 44. The table includes the sum of Labour (NHS Staff + Agency), Materials and Capital across NHS Trusts and NHS England Group. Expenditure on Primary Care and community prescribing (Prescribing) are also included. Details about the sources of information for Primary Care and Prescribing are given on pages 41 and 44 respectively. The table shows expenditure on inputs is dominated by NHS Staff and Materials, both of which increased by a similar amount between 2016/17 and 2017/18 as they did between 2015/16 and 2016/17. Expenditure in all other input categories fell between 2016/17 and

[28] https://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2014-10-22/211600/ (Last accessed 08.10.2019)

2017/18 but by modest amounts in absolute terms compared to NHS Staff and Materials expenditure. The largest proportional drops in expenditure are observed for Agency Staff and Capital. However, these represent the smallest proportions of overall expenditure. Further, the drop in Agency staff, shown in Figure 32, may reflect a shift from Agency to Bank staff, which are captured in the NHS Staff category.

Table 44: Total NHS current expenditure 2015/16-17/18 (£000)

Year	NHS Staff	Agency	Material	Capital	Prescribing	Primary Care	TOTAL
2015/16	46,787,408	3,702,409	25,604,358	13,632,724	9,288,425	13,759,292	112,774,617
2016/17	49,325,649	2,934,876	26,479,526	14,794,243	9,193,913	13,427,480	116,155,687
2016/17*	48,663,883	2,934,876	24,218,243	8,675,228	9,193,913	13,427,480	107,113,623
2017/18*	51,305,198	2,406,798	25,170,216	8,209,723	9,095,228	13,378,869	110,241,405

* Expenditure on Labour, Materials and Capital among NHS Trusts is taken from TACs (Trust accounts consolidation)

Figure 32: Expenditure on agency staff

7. Concluding remarks

We find that NHS productivity grew by 1.26% between 2016/17 and 2017/18 when applying our preferred 'mixed' method. This represents a sharp decrease in the growth rate reported for 2015/16-2016/17 using the same measure (2.86%). The difference in growth rates between 2015/16-2016/17 and 2016/17-2017/18 is even larger when using our 'indirect' measure (-0.27% compared to 2.03%). The fall in productivity growth observed between the two links is primarily driven by a fall in output growth. Quality-adjusted output growth was 1.72% between 2016/17 and 2017/18, compared to 3.51% between 2015/16 and 2016/17. Input growth by both the mixed and indirect measures is more stable between the two links, though the mixed method indicates a fall from 0.64% to 0.46%, while the indirect measure indicates an increase from 1.46% to 2.00%.

As already noted, while both the mixed and indirect productivity measures indicate a fall in growth in 2016/17-2017/18 compared to 2015/16-2016/17, this difference is larger with the indirect method than the mixed method. This continues a trend of diverging results between the mixed and indirect approaches seen in 2015/16-2016/17. The divergence may reflect a trend towards replacing agency staff with bank staff. We do not observe bank staff in the ESR dataset which is used in the mixed measure, though we do observe expenditure on agency staff and include it in both the mixed and indirect measures. The accounts information used in the indirect measure does include expenditure on bank staff as part of total expenditure on staff. Therefore, a shift from agency to bank staff will put downward pressure on input growth as measured by the mixed method compared to the indirect method. Between 2016/17 and 2017/18, expenditure on agency staff continued to decrease by 17.74%, following a previous decrease of 21.53% between 2015/16 and 2016/17. Further, from a sensitivity analysis using expenditure on bank staff, we find productivity growth with the mixed measure falls from 1.26% to 0.88%.

The decrease observed in the overall growth in NHS outputs reflects a near universal reduction in growth rates of contributing care settings. Of the three largest categories in terms of output value, inpatient care grew by 2.9% in 2016/17-2017/18, compared to 3.6% in the previous link. Outpatient care grew by 2.3% compared to 5.3% and community prescribing grew by 1.5% compared to 6.4%. Between them, these categories represent over 50% of output value generated by the NHS. It is also noteworthy that Community Care and Community Mental Health experienced negative growth in 2016/17-2017/18 after growing in the previous link. The largest reported negative growth is for rehabilitation (5.8%). However, this care setting represents only 1.08% of the value of output, and so has a modest impact on the growth in NHS output overall.

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 2016/17 and 2017/18. This is reflected in higher values of output growth and productivity growth by around 0.35% when comparing quality-adjusted and cost-adjusted output and productivity growth. This is a substantive impact in the context of relatively low productivity growth in 2016/17-2017/18 and is also a larger quality improvement than seen between 2015/16 and 2016/17. The impact of quality on output and productivity growth comes almost entirely from the inpatient setting, where growth in output value is over 1% higher (2.86% compared to 1.74%) when quality is adjusted for. Quality in Primary Care is marginally lower in 2017/18 (0.7% compared to 0.88% growth with and without quality adjustment between 2016/17 and 2017/18).

The major element of input growth is in Labour, which therefore is the main driver of the overall rate. The impact of Labour is discussed earlier in this section. The growth in other contributing elements is more volatile over time but has a smaller impact on overall input growth. Most notably, the increase

in Capital (+4.29%) and decrease in Materials (-0.62%) expenditure seen in 2015/16-2016/17 are both reversed and overturned in 2016/17-2017/18, now respectively equal to -6.36% for Capital and +2.84% for Materials.

This year we have investigated the impact of adjusting NHS output growth measures for the number of working days. In 2017/18 the total number of actual days worked was smaller at 251, a difference of four working days, compared to 2016/17. We find that adjusting for days worked increases the quality-adjusted output growth measure to 2.58%, an increase of 0.86 percentage points compared to the un-adjusted measure. This in turn is reflected in an increase of the corresponding NHS productivity growth rate to 2.11% (an increase of 0.89 percentage points) when considering the mixed method and to 0.57% (a 0.26 percentage points increase) of the indirect quality adjusted productivity growth rate.

When considering Trust productivity separately from that of the NHS as a whole, we observe slightly higher NHS output growth between 2016/17 and 2017/18 compared to the previous link (1.97% compared to 1.72%). This translates to a similar improvement in productivity growth using the mixed measure (1.40% compared to 1.26%) but a larger negative growth rate when using the indirect measure (-0.86% compared to -0.27%). This reflects the even more important role played by the ESR and so the shift from agency to bank staff when considering Trust activity alone.

Finally, comparing the productivity growth of the NHS with that of wider U.K. economy as a whole, we find that NHS productivity has improved substantially faster than the overall economy since 2009/10.

8. Appendix A

8.1. Historic tables for productivity, output and input growth

Table A 1: NHS Productivity Growth 2004/05 to 2017/18

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[29]	-0.15%	-0.58%
2015/16 – 2016/17	2.86%	2.03%*
2016/17 – 2017/18	1.26%	-0.27%

* Productivity growth from the indirect measure differs from that reported in (Castelli et al., 2019) by 0.02 percentage points (2.01 compared to 2.03). This reflects a correction to the pay deflator from 1.01 to 1.04, resulting in a smaller growth in inputs and so higher productivity growth.

Table A 2: Historical 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	3.35%	3.51%
2016/17 – 2017/18	1.37%	1.72%

[29] 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 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	0.64%	1.46%
2016/17 - 2017/18	0.46%	2.00%

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

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

Table A 4: 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

Table A 5: Historical series of Number of CIPS and 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

* In previous years we calculated the cost for elective and day case activity as a weighted average between cost of elective and day case activity, but since 2012/13 we switched to using elective costs only. ** Figures reflect 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

** Figures reflect the new CIPS methodology, following the changes in the HES variable 'admission method'.

Table A 7: Historical series for Volume and average cost over time 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

8.3. Historic tables for Reference cost data

Table A 8: Historical series for RC 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

Table A 9: Historical series for 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	118	9,708,958	99	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

Table A 10: Historical series for 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

Table A 11: Historical series for 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	559	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

Table A 12: Historical series for 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

Table A 13: Historical series for 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	7,849,470	32	374,847,731	2	11,342,904	95
2017/18	7,777,205	32	417,460,632	2	10,975,838	99

Table A 14: Historical series for 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

Note: Due to the reclassification of activity in Community Mental Health, data from 2011/12 are not directly comparable with data 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 for 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

Table A 16: Historical series for Specialist services data

Year	Adult 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

Table A 17: Historical series for '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	-	-

Note: 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 for 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

Table A 19: Historical series for 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

8.5. Historic tables for Primary care activity

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

Notes: * 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'd 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).
*** 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

Notes: [a] Estimates extracted from a telephone triage GP-lead 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

Table A 23: Laspeyres growth rates for primary care 2004/05-2017/18

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: Community prescribing, summary data 2004/05-2017/18

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

Note: * 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: Community prescribing: price and volume growth 2004/05-2017/18

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

Note: * 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: Number of reporting organisations by type 2010/11-17/18

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

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: Expenditure (£000) on staff by organisation type 2010/11-2017/18

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
201718	849	154	201	72	0	0	38,062

*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: Count of FTE staff employed by category in Trusts 2007/08-2017/18

	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
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
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
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
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
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
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
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
Scientific, therapeutic and technical staff and healthcare 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
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
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

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: Growth in direct Labour measure, 2007/08 – 2017/18

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%

* All NHS organisations.

8.8. Historical 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 Healthcare 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: Current expenditure by PCTs and NHS England Group, 2007/08-2017/18 (£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	1,736,050	518,621

* 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.

Table A 32: Current expenditure by hospital Trusts 2007/08-17/18 (£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	23,644,352	13,129,827
2016/17*	50,479,070	24,765,135	14,324,055
2016/17*-	49,817,304	22,503,852	8,205,040
2017/18*-	51,868,888	23,434,166	7,691,102

Notes: * 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).

Table A 33: Total NHS current expenditure 2005/05-17/18 (£000)

Year	NHS Staff	Agency	Material	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	3,333,806	23,582,829	13,323,481	8,942,734	13,460,552	n/a	108,206,337
2015/16**§~	46,787,408	3,702,409	25,604,358	13,899,138	9,288,425	13,759,292	n/a	113,041,031
2015/16**§~ξ	46,787,408	3,702,409	25,604,358	13,632,724	9,288,425	13,759,292	n/a	112,774,617
2016/17**	49,325,649	2,934,876	26,479,526	14,794,243	9,193,913	13,427,480	n/a	116,155,687
2016/17**	48,663,883	2,934,876	24,218,243	8,675,228	9,193,913	13,427,480	n/a	107,113,623
2017/18**	51,305,198	2,406,798	25,170,216	8,209,723	£9,095,228	13,378,869	n/a	110,241,405

* 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.

9. Appendix B

9.1. Mental Health Secure Units - sensitivity analysis

In 2016/17, a new methodology to calculate some secure services data was introduced in the Reference Cost collection, moving to a combination of pathway and cluster. The accompanying report to the 2016/17 Reference Cost data advised that it was no longer possible to compare unit costs for these type of mental health services. The same text was included in the report accompanying the Reference Costa data for 2017/18.

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' and from the overall NHS output growth measures for the links 2015/16 – 2016/17 and 2016/17 – 2017/18.

We carry out a sensitivity analysis, re-introducing all Secure Mental Health activity into our series, based on a 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, did not produce plausible growth rates. We have thus proceeded to group activity across care clusters and care clusters initial assessment and across the high, medium and low secure units. The effects of including Secure Mental Health activity in the Community Mental Health setting output growth rate are reported in Table B 2, as well as the impact of their inclusion in the overall NHS output growth (quality adjusted figure) and NHS productivity growth, both for the mixed and indirect methods for the years 2016/17 – 2017/18.

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

Year	2016/17		2017/18	
	Volume of activity	Act. weighted average unit cost (£)	Volume of activity	Act. weighted average unit cost (£)
High Secure Mental Health Care Cluster (HSMHCC)	138,470	769	215,417	727
High Secure Mental Health Care Cluster Initial Assessment (HSMHCCIA)	491	179,899	14,893	496
Total HSMH	***138,961***	***1,402***	***230,310***	***712***
Medium Secure Mental Health Care Cluster (MSMHCC)	709,649	487	692,374	504
Medium Secure Mental Health Care Cluster Initial Assessment (MSMHCCIA)	28,734	895	15,568	892
Total MSMH	***738,383***	***503***	***707,942***	***512***
Low Secure Mental Health Care Cluster (LSMHCC)	489,632	450	484,865	455
Low Secure Mental Health Care Cluster Initial Assessment (LSMHCCIA	13,991	1,081	4,177	2,116
Total LSMH	***503,623***	***468***	***489,042***	***469***
Total MH Secure Units	**1,380,967**		**1,427,294**	
Other Secure Mental Health Units	**29,492**	**1,097**	**29,693**	**1,207**
Overall MH Secure Units Total	**1,410,459**		**1,456,987**	

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

		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
Setting specific growth rate		**-0.9839%**	-0.4911%	-0.4607%
Overall NHS Output growth (with quality adjustment)		**1.7231%**	1.7562%	1.7583%
NHS Productivity	Mixed	**1.2608%**	1.2937%	1.2958%
	Indirect	**-0.2703%**	-0.2378%	-0.2358%

Including Mental Health Secure Units activity has a positive effect on the overall NHS Output and NHS Productivity growth measure: overall NHS output growth increases between 0.0331 and 0.0352 percentage points, whilst the mixed and indirect NHS productivity growth rates increase by between 0.0329 and 0.0350 percentage points and 0.0325 and 0.0345 percentage points respectively.

10. Appendix C

10.1. Deflators

Where we use expenditure data, it is necessary to deflate expenditure reported in the later year of each pair to construct a Laspeyres Volume Index. This is to remove changes in expenditure due to changes in prices. Inflation rates can vary for different sources of expenditure. Therefore, we aim to use the most appropriate and disaggregated measure available. We employ specific deflators for five distinct categories of expenditure. The categories of expenditure and deflators used from 2013/14 onwards are set out in Table C 1

The deflators applied to Labour and Prescribing expenditure are constructed as part of preparing the Electronic Staff Record (ESR) and Prescribing Cost Analysis (PCA) datasets respectively. 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 NHS Cost Inflation Index - from which we use specific deflators for Materials and Capital and Primary Care.

Table C 1: Sources of deflator data

Years	Labour	Materials & Capital	Primary Care	Prescribing
2013-14/14-15	ESR deflator	Hospital and Community Health Services (HCHS) deflator	Pay and Price deflator	PCA
2014-15/15-16			0.1 + 0.4*ESR deflator + 0.4*HCHS deflator	
2015-16/16-17				
2016-17/17-18		NHS Cost Inflation Index: Provider Non-Pay Index (NHSCI - PNPI)	NHS Cost Inflation Index: General Practice(NHSCI-GPI)	

Table C 2 shows deflation figures for each category of expenditure from 2013/14-2014/15 to 2016/17-2017/18. These figures indicate the slight deflation in the cost of Labour is unusually low. The figures also indicate a high level of variability in the price changes of non-pay items. Finally, the PCA deflator used for prescribing between 2015/16 and 2016/17 was an outlier.

Table C 2: Deflator values 2013/14-2017/18

Years	Labour	Materials and Capital	Primary Care	Prescribing
2015/16-2016/17	1.04%	3.90%	2.08%	-7.00%
2016/17 - 2017/18	-0.31%	1.05%	2.63%	-2.47%

10.2. Trust only productivity measures[30]

While the main body of our text concerns a full-NHS measure of productivity, we also produce a Trusts-only productivity growth measure. As shown in Table C 3, considering only activity delivered by Trusts only, the quality-adjusted output index rises to 1.92%. The same table shows how the difference between our two methods for identifying growth in inputs is even larger when considering Trusts alone. The mixed method indicates growth of 0.56%, while the indirect approach indicates input growth of 2.86%. As discussed for the main analysis, the difference between inputs growth indices produced by the mixed and indirect methods can be partially explained by the use of bank staff. Finally, the same table indicates productivity growth among Trusts alone of 1.35% when applying the mixed method but -0.91% when using the indirect method to measure input growth. As in the main analysis, this represents a fall in productivity growth and a widening in the difference between mixed and indirect methods in 2016/17-17/18 compared to 2015/16-16/17.

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

Years	Quality adjusted output growth		Input growth	Productivity growth
2015/16 – 2016/17	3.60%	*Mixed*	1.14%	2.42%
		Indirect	2.33%	1.23%
2016/17 – 2017/18	1.97%	*Mixed*	0.56%	1.40%
		Indirect	2.86%	-0.86%

* The growth in inputs reported for both the mixed and indirect measure in 2015/16-16/17 differ from the figures reported in (Castelli et al., 2019) (1.14% instead of 1.15% and 2.33% instead of 2.35% respectively). This reflects a correction to the pay deflator from 1.01% to 1.04%, which puts downward pressure on input growth. For the same reason, the productivity measure indicated by the indirect method in the same year also differs slightly (1.23% compared to 1.22%), as downward pressure on input growth is equivalent to upward pressure on productivity growth.

[30] The Trust only productivity growth measure does not include the expenditure data on bank staff.

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