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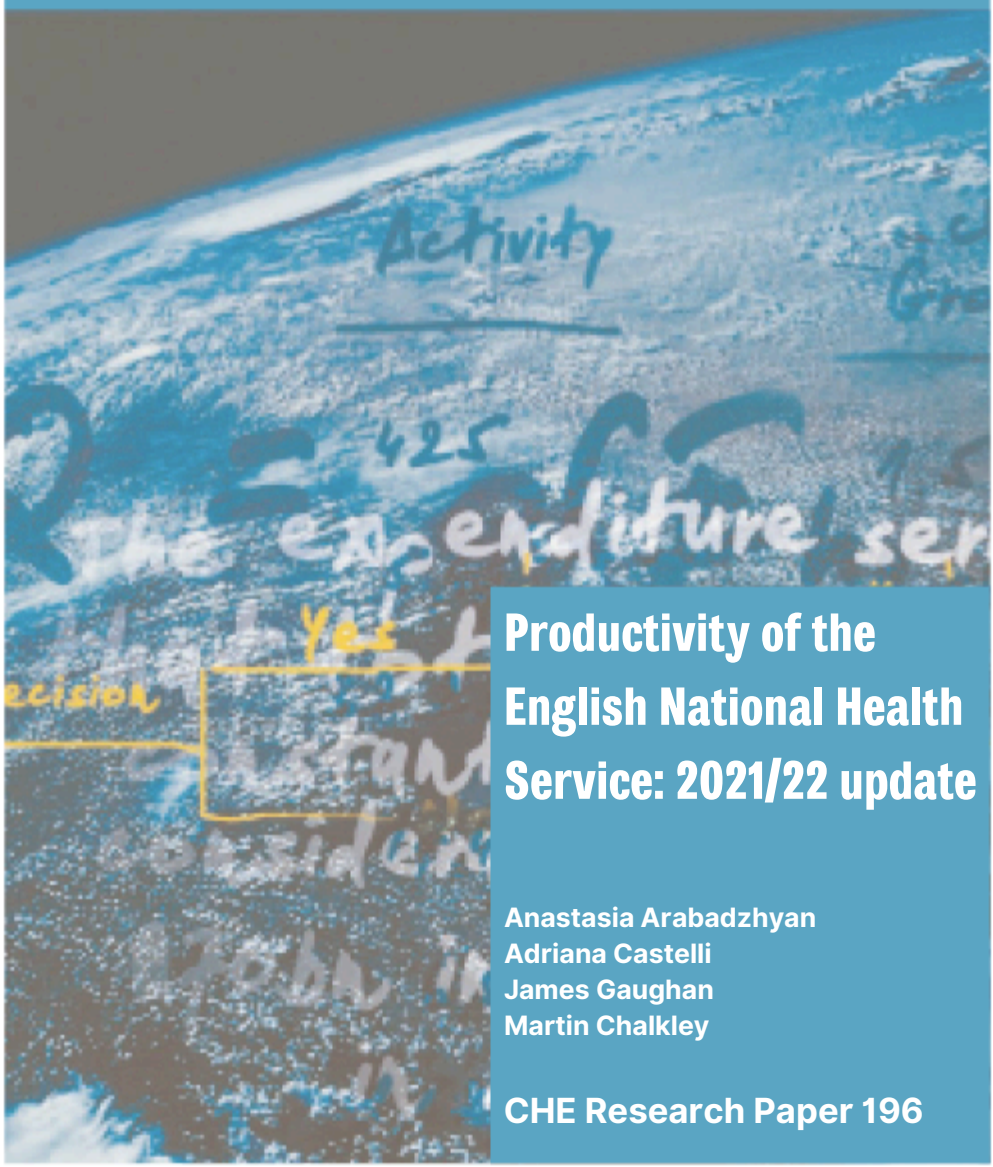

Productivity of the English National Health Service: 2021/22 update

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Background to series
CHE Discussion Papers (DPs) began publication in 1983 as a means of making current research material more widely available to health economists and other potential users. So as to speed up the dissemination process, papers were originally published by CHE and distributed by post to a worldwide readership. The CHE Research Paper series takes over that function and provides access to current research output via web-based publication, although hard copy will continue to be available (but subject to charge).

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Conflicts of interest
No ethical approval was required.

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Summary

Healthcare expenditure is one of the largest elements, and a growing proportion, of public spending. In the context of limited resources, it is essential for patients and policy-makers to understand the return on investment in health care. Productivity, the ratio of output produced to input used, is therefore a key performance metric for the English NHS. In addition, measuring NHS productivity growth is an important tool for assessing future funding needs. Finally, in the aftermath of the COVID-19 pandemic, evaluating the extent to which the NHS has recovered to pre-pandemic levels of productivity is of great policy relevance.

In this report we extend previous investigations into NHS productivity growth carried out at the University of York. Embedded in National Accounting Systems, we use an index number approach, to calculate growth in both NHS inputs, outputs and productivity. Outputs are also adjusted for the quality of care provided. We focus on two time periods: 2020/21 to 2021/22; 2019/20 to 2021/22.

We find NHS productivity grew substantially between 2020/21 and 2021/22 (14% to 15% depending on the method used). However, when compared to 2019/20, productivity in 2021/22 remains substantially lower (by about 13%). This suggests that despite a substantial recovery, a considerable gap between NHS productivity before the pandemic and in 2021/22 still remains.

Executive Summary

This report forms part of the time series of the English National Health Service (NHS) productivity growth calculated at the Centre for Health Economics, University of York. In this update, we focus on growth from 2020/21 to 2021/22. These are the second set of NHS productivity measures that are affected by the COVID-19 pandemic, which negatively impacted the normal provision of healthcare during this time. In 2020/21, NHS providers had strict instructions to only provide emergency care to patients, so that capacity was freed up to deal with patients with SARS-Cov2. In 2021/22, all NHS organisations, including primary care providers, were requested to return to a 'business as usual' provision of healthcare services. However, safety protocols and measures were still heightened compared to provision before the pandemic.

Further, NHS England (2021) set out specific priorities and operational planning guidance, to use the new models of care adopted during the pandemic to deal with the backlog of patients waiting for elective treatment and cancer care; managing the growing demand for mental health services; expanding primary care capacity to enhance accessibility; and bolstering NHS COVID-19 vaccinations while continuing to care for COVID-19 patients. Therefore, in this report we will not only determine how NHS outputs, inputs and productivity compare between 2020/21 and 2021/22, but also investigate how these same metrics compare to pre-pandemic levels, i.e. 2019/20. To this end, we have calculated output, input and productivity growth measures between 2019/20 and 2021/22.

Between 2020/21 and 2021/22, overall NHS output, when adjusted for quality, increased by 19.26%. This is in line with the objectives set out by NHS England to recover care for patients awaiting elective and cancer care. However, the quality of care, as included in our measure, dampens the growth in NHS output, as the simple cost-weighted NHS output growth rate is marginally higher at 19.45%.

NHS inputs grew by 4.49%, when measured using a mixed (direct and indirect) approach, and by 3.55%, when measured using an entirely indirect approach. From 2004/05 to 2021/22, growth in NHS quality adjusted outputs has averaged 3.30% per annum, and that for inputs has averaged 3.11% and 3.2% per annum, respectively for the mixed and indirect approaches. If we consider the period from 2004/05 to 2018/19, i.e. leaving out all financial years affected by the pandemic (2019/20, 2020/21 and 2021/22), average NHS output growth per annum would be 3.76% per annum, average NHS input growth would be 2.64% and 2.71% per annum, respectively for the mixed and indirect approaches.

Given the positive and large growth in NHS outputs, and the more modest growth in NHS inputs between 2020/21 and 2021/22, it is not surprising that NHS productivity shows positive growth at 14.14% when using the mixed measure of NHS inputs growth, and 15.18% using the indirect approach. Similarly to Arabadzhyan et al. (2023), test and trace services were not included as an output, as we did not have access to the full information. So far as these services were delivered by NHS staff as part of their NHS role, the costs of these services would be included in our measure of NHS inputs, but they are not in our measure of NHS outputs. This means that our NHS output and productivity growth measures are likely to

slightly underestimate the true output and productivity growth between 2020/21 and 2021/22.

The only NHS setting showing negative growth between 2020/21 and 2021/22 is Rehabilitation, with most of the other settings having double digits growth. Ophthalmology and Dentistry records a growth of over 112%, which is mainly driven by growth in dentistry care (+140%). This follows a record decrease of the previous year for this setting, when Ophthalmology and Dentistry services saw the largest proportional decrease in output growth (-62.94%) of all NHS settings. The most substantial contribution to overall output growth (36.29% of spend) is within Hospital Inpatient activity, which is in line with the NHS England priorities. Growth in this sector is reported at 24.85%, when using the cost-weighted Laspeyres measure, and 25.11% after quality adjustment. More details are given in section 5.

NHS labour inputs, excluding agency and bank staff, grew by 1.72%, when using the indirect input growth approach and by 3.82% when using the direct input growth approach. NHS labour remains the main contributor (45.67%) to overall NHS input growth and has the highest share of overall spend (44.90%) in 2021/22 (section 7). Materials continue to record positive growth (14.78%) between 2020/21 and 2021/22, and are the second largest contributor to NHS input growth. Capital inputs record a considerable decrease (-23.21%) between 2020/21 and 2021/22, following the sharp increase (24.70%) recorded in the financial year ending in 2021.

Our findings show that NHS outputs and productivity in 2021/22 increased considerably compared to the previous year, and support the governments, Department of Health and Social Care, and NHS England's aim to set the NHS on a path of recovery. However, this is a comparison with a baseline year, 2020/21, affected by major disruptions to healthcare delivery in both elective and emergency care. We therefore also compare productivity in 2021/22 with the pre-pandemic year of 2019/20, to more directly investigate the extent of NHS recovery.

We find that compared to the pre-pandemic year of 2019/20, NHS cost-weighted output growth in 2021/22 is still sluggish, at -1.45%. Adjusting for the quality of care provided decreases growth to -1.53%, an indication that compared to the pre-pandemic year, the quality of care is lower in 2021/22. In contrast, NHS inputs grew between 2019/20 and 2021/22 for both for the mixed (13.58%) and the indirect (12.48%) growth measures. Comparing NHS productivity in 2021/22 to 2019/20 yields negative growth of -13.30% and -12.45%, when using the mixed approach and indirect approach, respectively.

Comparing total factor productivity in the NHS with growth of the UK economy as a whole, as measured by the Gross Value Added per Hour (labour productivity, LP), we find NHS productivity has substantially recovered from 2020/21, but remains below productivity of the UK economy. This is despite NHS productivity being higher than the overall economy in 2019/20 and a slowing down of UK economy growth, as the measures introduced to support workers were gradually discontinued (Office for National Statistics, 2020).

Taking the comparison of 2021/22 with both 2020/21 and 2019/20 together, it can be seen that the NHS has recovered substantially from the initial shock of the COVID-19 pandemic.

However, despite continued increases in costs, output has yet to reach the level of 2019/20 overall, leaving a productivity gap compared to both the pre-pandemic state and the UK economy as a whole.

Finally, taking a longer-term view (from 2004/05 to 2021/22), we calculate the average annual growth rate for NHS outputs, inputs and productivity. Please note that up to 2018/19-2019/20 the mixed approach is used to calculate both NHS inputs and productivity growth rates, whilst the indirect approach is used for the 2019/20-2020/21 and 2020/21-2021/22 links. We find growth in NHS quality adjusted outputs has averaged 3.1% per annum and growth in NHS inputs has averaged 3.11%, with NHS productivity growth averaging -0.02%.

These are still below the average annual growth rates achieved by the NHS before the pandemic, i.e. up to 2018/19, when average NHS quality adjusted output growth per annum was 3.75% per annum, average NHS input growth was 2.63%, and average NHS productivity was 1.09%.

As well as the headline figures described above, we provide an in-depth analysis of each NHS setting, highlighting where appropriate, the specific challenges faced in constructing the output growth measure. For example, around data quality. We also provide month-by-month analyses for those settings for which we have access to monthly data, to track the impact of the pandemic and how the restrictions imposed affected the provision of care (section 6).

The impact of the COVID-19 pandemic is multifaceted and may have differed across parts of the care system. We therefore also consider how NHS outputs and inputs in 2021/22 compared to the pre-pandemic year, 2019/20, in individual care settings. These are included in separate sections for hospital inpatient (section 6.2.8); outpatient (section 6.3.3), and community prescribing (section 6.7.4). Similar comparisons are provided as part of the general discussions for: all other NHS care provided by hospitals (section 6.4.2); primary care (section 6.6); ophthalmology and dentistry (section 6.5), and NHS inputs (section 7.1 for the direct labour growth measure, and section 7.2 for the indirect expenditure measure).

Further highlights of this report:

- New quality indicators (emergency readmissions and hospital acquired infections, Clostridium Difficile (C-Diff) and Methicillin Resistant Staphylococcus Aureus (MRSA): we continue to report the impact of the quality indicators introduced in the 2020/21 NHS Productivity update (Arabadzhyan et al., 2023) as experimental statistics. This can be found in section 3.
- Hospital inpatient activity: detailed comparisons of inpatient total volume, unit cost and expenditure for combined physical and mental health in the inpatient setting for each month of 2020/21 and 2019/20 with 2021/22 are presented in sections 6.2.7 and 6.2.8 respectively.
- Hospital outpatient activity: following the changes implemented in (Arabadzhyan et al., 2023), we continue to include the 80th percentile waiting time information for non-face-to-face outpatient appointments in our quality adjustment for outpatient activity. During the COVID-19 pandemic, the proportion of non-face-to-face first

outpatient appointments rose from a negligible to a small but substantive level. We therefore extended the quality adjustment to this mode of delivery of outpatient care (section 6.3.1);

- Primary Care: Our measure of primary care output includes COVID-19 vaccinations carried out by GPs and/or PCNs. Further, we include month by month comparison to understand how the composition of attended appointments changed in 2021/22 compared to the pandemic period and the pre-pandemic year 2019/20 (section 6.6). To account for the shift to remote consultations (telephone and video/online) during the pandemic, we continue to assign the same cost weight to GP face-to-face appointments, telephone and video/online appointments. Results with alternative weights are reported as a sensitivity check (section 0). We keep applying the waiting times quality adjustment, first introduced in Arabadzhyan et al. (2022), but not the Quality and Outcomes Framework adjustment due to payment protection of indicators;
- Community Prescribing: detailed comparisons of total volume, unit cost and expenditure for each month of 2020/21 and 2019/20 with 2021/22 are included in sections 6.7.3 and 6.7.4 to monitor the effect of the COVID-19 pandemic on prescribing patterns;
- The National Cost Collection (NCC) data are still affected, albeit to a lesser extent, by quality issues, previously summarised in Arabadzhyan et al. (2022). We therefore continue to calculate the output growth in settings covered by the NCC dataset by limiting our analysis to NHS Trusts reporting data in both years, therefore ensuring a like-for-like comparison. This correction is applied for both the 2020/21 – 2021/22 and the 2019/20 – 2021/22 links.

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
NCC	National Cost Collection
NHS	National Health Service
ONS	Office for National Statistics
PCA	Prescription Cost Analysis
PCN	Primary Care Network
PCT	Primary Care Trust
PROMs	Patient Reported Outcome Measures
PSSRU	Personal & Social Services Research Unit
QOF	Quality and Outcomes Framework
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 the 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 2020/21 to 2021/22. These are the second set of NHS productivity measures that are affected by the COVID-19 pandemic, which negatively impacted the normal provision of healthcare during this time. In 2020/21, NHS providers had strict instructions to only provide emergency care to patients, so that capacity was freed up to deal with patients with SARS-Cov2. In 2021/22, all NHS organisations, including primary care providers, were requested to return to a 'business as usual' provision of healthcare services. However, safety protocols and measures were still heightened compared to provision before the pandemic.

Further, NHS England (2021) set out specific priorities and operational planning guidance, to use the new models of care adopted during the pandemic to deal with the backlog of patients waiting for elective treatment and cancer care; managing the growing demand for mental health services; expanding primary care capacity to enhance accessibility; and bolstering NHS COVID-19 vaccinations while continuing to care for COVID-19 patients. Therefore, in this report we will not only determine how NHS outputs, inputs and productivity compare between 2020/21 and 2021/22, but also investigate how these same metrics compare to pre-pandemic levels, i.e. 2019/20. To this end, we have calculated output, input and productivity growth measures between 2019/20 and 2021/22.

NHS productivity growth (growth in the value of outputs divided by growth in the expenditure on inputs) is calculated by means of a Laspeyres volume chain index. In this way, different NHS inputs and outputs are valued in terms of their cost in the first (base) year, in order to identify volume changes in the next year. As our method employs a chain index, the base year changes with each new update. We also employ available measures of quality where possible, in recognition that the value of outputs may not be entirely reflected in the cost of their provision, especially outside of a competitive market context. Specifically, we use short-term survival rates for both elective and non-elective hospital care, changes in health status, and waiting times for elective hospital care only. In addition, activity delivered in the primary care setting is adjusted based on the changes in the time patients wait to see a primary care professional and historically also on changes in blood pressure monitoring.

Similarly to Arabadzhyan et al. (2023), test and trace services were not included as an output, as we did not have access to the full information. So far as these services were delivered by NHS staff as part of their NHS role, the costs of these services would be included in our measure of NHS inputs, but they are not in our measure of NHS outputs. This means that our NHS output and productivity growth measures are likely to slightly underestimate the true output and productivity growth between 2020/21 and 2021/22.

In this report we also consider additional characteristics of health care provided compared to previous reports, by including two new adjustments: emergency readmissions and hospital acquired infections (HAIs), namely Methicillin Resistant Staphylococcus Aureus (MRSA) and Clostridium Difficile (C-Diff). These new quality adjustments are to be considered

experimental, and NHS output and productivity growth measures will be reported both with and without them. See section 3 for further details.

The York NHS outputs, inputs and productivity growth measures follow national and international accounts' recommendations (Eurostat, 2001). In particular, we implement the direct approach of volumes of each unit of input or output included whenever possible, aggregated using their respective unit costs. When only expenditure data are available, we disentangle changes in terms of volume and inflation by using appropriate deflators. Direct measures are used for NHS outputs and for NHS staff. Indirect measures are used for bank staff, agency staff, materials, and capital. Finally, NHS input measures are calculated as both a mixed measure, i.e. using a direct NHS labour growth measure alongside an indirect measure for all other inputs, and a purely indirect measure, where all labour inputs are considered in terms of expenditure.

The remainder of the report is organised as follows: in section 2, we summarise the methods used in calculating the productivity of the English health care system. In section 3, we present the impact of the new experimental quality indicators on the NHS output and productivity growth measures. Our findings for NHS productivity growth are presented in section 4; we then consider increasingly small constituent parts of this overall result, beginning with NHS outputs and NHS inputs in section 5. Individual items of NHS outputs and inputs are investigated in sections 6 and 7, respectively. Historical results are largely presented as graphs in the main text, with tables of figures limited to the Online Appendix.

In section 9.1 in the Appendix, we include a description of input deflators used in our analysis. And in section 9.2, we present the results on NHS output, input and productivity growth for NHS Trusts only.

2. Methods

The growth in Total Factor Productivity of the healthcare system, ΔTFP,[1] is measured as the ratio of an output growth index (X) and an input growth index (Z), such that:

$$\Delta TFP = X/Z \qquad (E1)$$

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

2.1. Output growth

Quantification of health care output is a challenge because patients have varied health care requirements and receive very different packages of care. To address this, it is necessary to classify patients into reasonably homogenous output groupings, such as Healthcare Resource Groups (HRGs) or Reference Cost (RC) categories. Furthermore, to aggregate these diverse

[1] Both X and Z are indices with values around one, for example, 1.05 indicates a 5% increase and 0.98 indicates a 2% decrease. Therefore, the productivity growth calculated using them will also be an index, which can be transformed into a percentage by subtracting 1 and multiplying by 100.

outputs into a single index, some means of assessing their relative value is required. Usually, prices are used to assess value, but prices are not available for the vast majority of NHS services, which are provided free at the point of use. In common with the treatment of other non-market sectors of the economy in the national accounts, costs are used to indicate the value of health services. Costs reflect producer rather than consumer valuations of outputs but have the advantage of being readily available (Eurostat, 2001).

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

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

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

2.2. Input growth

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

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

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

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

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

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

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

2.3. Productivity growth

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

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

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

This can be simplified to:

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

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

2.4. Working days adjustment

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

It is expected that changes in the number of working days in a given year will impact the level of output produced in the NHS and hence impact the productivity of the system. Therefore, we adjust the Laspeyres output growth measure to capture the effect of changes in the number of working and total days between pairs of years. Expressions (E7) and (E8) present the Laspeyres output growth formulae (for the cost-weighted measure) with working days (WD) and total days (TD) adjustment respectively. For example, if the number of working days in year *t=0* is smaller than the number of working days in year *t=1,* then the working days adjustment should indicate both lower output and productivity growth estimates, with respect to the same measures with no working days adjustment. The same logic applies to the total days adjustment.

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

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

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

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

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

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

2.5. Alternative approaches to deal with missing NHS Trusts in the National Cost Collection data

The measurement of NHS output in 2019/20 was affected by data quality issues and missing data in the National Cost Collection (NCC) data series (previously known as the National Reference Costs data), which lead to non-comparability with previous years data. The NCC data are still affected, albeit to a lesser extent, by quality issues, previously summarised in Arabadzhyan et al. (2022). We refer to Arabadzhyan et al. (2022) for in-depth details of the

[2] A table reporting working and total days for the financial years 2018/19 onwards is presented in section 9.3 in the Appendix.

four approaches developed to dealing with missing Trusts data. Here it suffices to say that all approaches made use of the organisational (Trust) level NCC data. However, these data had their own issues because of missing activity (and therefore, unit cost) information, as small numbers (any activity information smaller than eight units) are suppressed by NHS Digital.[3]

Our preferred approach (approach 3 in Arabadzhyan et al. (2022)) is (methodologically) the closest to our traditional measure, that is to directly measure the growth NHS outputs, and it also requires only a minimum set of additional assumptions. Its only shortcoming is that we need to impute missing values for some output categories. Further, our preferred approach makes maximum use of comparable, and high-quality data from Trusts with published NCC data, having met the rigorous data quality standard set by NHS England and NHS Improvement. In fact, NHS Trusts submitting data of insufficient quality do not have their data published in the National Cost Collection data. Limiting our analysis to Trusts reporting data in both years also means we have a like-for-like comparison, which is not the case if Trusts reporting data in only one year are included. For the growth rate estimates to be applicable to the NHS as a whole, we assume that observed data are representative of the NHS as a whole.

In this report, we continue to calculate the output growth in settings covered by the NCC dataset by limiting our analysis to NHS Trusts reporting data in both years, therefore ensuring a like-for-like comparison. This correction is applied for both the 2020/21 – 2021/22 and the 2019/20 – 2021/22 links.

3. Experimental quality adjustment for hospital inpatient activity

3.1. General introduction

While the English National Health Service (NHS) is under perpetual pressure to minimise cost and thus improve levels of productivity (outputs/inputs), it is appropriate to recognise that the quality of care provided also matters to patients. The presence of strong incentives to minimise cost, through a prospective payment system, has the potential to create a race to the bottom in terms of costly quality (Chalkley and Malcomson, 1998). At the same time, the NHS Constitution (2015) aspires to provide the best possible outcomes for patients. However, the quality of care still varies across England, with some of this variation being unwarranted.

Key priorities outlined in both the NHS Five Year Forward View, the Next Steps on the NHS Five Year Forward View[4] and the NHS Long Term Plan[5] are investing in the quality of care provided and reducing any existing gaps. Initiatives such as the Right Care Programme[6] and Getting it Right the First Time[7] have also been introduced, with the aim of achieving better health outcomes.

[3] Note that as of 1st of February 2023 NHS Digital merged with NHS England. However, within this report we will still refer to the organisation as NHS Digital, as the report was finalised before the merger occurred.
[4] NHS Five Year Forward View (last accessed 02/04/2024).
[5] NHS Long Term Plan (last accessed 02/04/2024).
[6] Right Care Programme (last accessed 02/04/2024).
[7] Getting it Right the First Time (last accessed 02/04/2024).

When measuring market output growth, national and international systems of accounts suggest to measure these in terms of the number of commodities produced in a given time period and valued using prices, which not only reflect producers' and consumers' valuation, but also the quality of the commodity measured (Eurostat, 2001). Non-market goods and services, such as the services provided by the NHS, do not usually have prices that reflect their quality. It is therefore recommended that measures of quality are employed in combination with cost data to generate measures as closely related as possible to consumer value. Current practice in accounting for the quality of healthcare services makes use of routinely available information in order to capture the Quality Adjusted Life Years (QALYs) associated with treating patients, by combining information on survival rates, life expectancy and a measure of change in health status before and after treatment. The process of care delivery is also captured by measures of treatment waiting times. This approach may overlook other important characteristics of the quality of healthcare.

A recent review by Bojke et al. (2018) provided the conceptual framework needed to select potentially appropriate characteristics of healthcare goods/services to be included in a measure of NHS output. The Authors assessed quality indicators from the NHS Outcomes Framework indicators and NHS Safety Thermometer[8] indicators against a set of criteria developed by the research team. Depending on the level of consensus among reviewers, a maximum of 17 indicators were short-listed for potential use as quality adjusters for NHS output.

Bojke et al. (2018) identified three quality indicators (negative patient outcomes) as the most likely candidates to be used to augment/extend the quality adjusted NHS output measures: emergency readmissions and two hospital acquired infections[9] (HAIs), Clostridium Difficile (C-Diff) and Methicillin Resistant Staphylococcus Aureus (MRSA). Both of these types of events lead to additional treatment, which the current productivity measure evaluates as additional output, but which de facto do not yield additional benefits to patient care. Our work refines the present NHS output and productivity measure by explicitly recognising activity in response to provider induced need, which does not represent additional value from the perspective of the patient.

The choice of emergency readmissions and HAIs is based on (i) the substantial costs associated with individual cases both financially to the NHS and in disutility for patients; (ii) the potential to identify these cases through both administrative data and separately published information from NHS Digital and/or other public sources. We use methods set out in Dawson et al. (2005) to incorporate these additional measures of quality into our output and productivity growth measure.

3.2. Emergency readmissions

Hospital emergency admissions and readmissions have been rising both in England and elsewhere (Blunt et al., 2010, Podulka et al., 2012, Robinson, 2010, Friebel et al., 2018). A

[8] NHS Safety Thermometers have been discontinued in 2019.

[9] These are also known as healthcare-associated infections (HCAIs). The acronyms HAIs and HCAIs may be used interchangeably in the report.

report by CHKS published in 2011 found that hospital emergency readmissions amounted to £2.2 billion to the NHS - a cost to society that is often described as avoidable.

However, not all emergencies are necessarily avoidable and therefore not all may be reasonable to consider as a sign of poor quality care. It is important to note that rising trends in emergency readmissions can be driven by a range of factors, which do not always point to lower quality of care provided. These include:

- increasing patients' complexity and medical needs;
- changes in clinical practice, including more recent policies to discharge patients to their home, nursing or care home more promptly;
- changes in patients' preferences;
- changes and variation in reporting practices.

The latter is particularly important in explaining variation at Hospital provider level in England. NHS Digital (NHSD) (2019) highlighted potential variations in the recording/reporting of same day emergency care/ambulatory care/zero length of stay emergency admissions. Some Trusts include this activity in the HES Admitted Patient Care (APC) dataset while others record such cases in the HES Outpatient dataset. Only activity recorded in the HES APC dataset is included in the emergency readmissions indicators.[10] Thus, there is a need to distinguish between **avoidable** and **unavoidable** emergency readmissions based on available data, in order to capture readmissions which are likely to represent poor quality.

3.3. Hospital Acquired Infections – MRSA and C-Diff

HAIs pose a serious risk to patients, staff and visitors, increasing morbidity and mortality and incurring significant costs to the NHS. Guest et al. (2020) estimated there were 834,000 HAIs, 28,500 patient deaths, 7.1 million occupied bed days (21% of all NHS bed days) and 79,700 days of absence among front line healthcare professionals in the NHS in 2016/17.

C-Diff and MRSA are the types of infections that have been a particular concern for public health for a substantial period of time. It has been mandatory for NHS acute trusts to report each case of MRSA bacteraemia since the 1st of October 2005; for C-Diff the same requirement has been effective from the 1st of April 2007. These two infections were more likely to be found in acute settings, with mortality rates substantially higher for hospital-onset than for community-onset cases (UK Health Security Agency, 2021), which made them particularly relevant in assessing the quality of acute care; incidence of MRSA and C-Diff are among indicators published within the NHS Outcomes Framework.

3.4. Impact of incorporating new measures on NHS output and productivity growth measures

In this section we present a summary of the volume and costs associated with the two new quality indicators – emergency readmissions and hospital acquired MRSA and C-Difficile (C-Diff) infections, and the impact of including them in the NHS output and productivity growth measure.

[10] Manuscript by NHS Digital.

3.4.1. Emergency readmissions

Table 2 presents the volume and unit cost of avoidable emergency readmissions between 2019/20 and 2021/22. In our previous report, we discussed and presented results for a range of definitions of avoidable emergency readmissions. For this report we present our preferred, blended, method alone. This definition incorporates characteristics of the potentially avoidable readmission presented in Blunt et al. (2015) and the definition most often used in readmission figures published by the NHS.[11] The volume of avoidable emergency readmissions increased by around 17% between 2020/21 and 2021/22, while the unit cost of readmissions fell by around 14%. This may partly reflect a return to higher volumes of patients cared for and reduced average complexity of care following the main part of the COVID-19 pandemic. It is also striking that the volume of readmissions has not reached the level observed in 2019/20. While at face value this may indicate an improvement in the quality of care, it may also be due to the remaining gap in inpatient activity in 2021/22 compared to 2019/20, discussed in more detail below.

Table 2: Volume and unit cost of avoidable emergency readmissions

Year	Volume	Average cost (£)
2019/20	323,294	2,031
2020/21	249,199	2,889
2020/21*	252,637	2,957
2021/22	295,401	2,533

* Figures updated with corrected sorting of FCEs within CIPS. See Methods in Inpatient section for further details.

3.4.2. Hospital Acquired Infections: MRSA and C-Diff

Table 3 presents volumes and unit costs of the hospital acquired infections MRSA and C-Diff. Cases of MRSA have remained low and relatively stable over the years presented (2019/20-2021/22). However, their unit cost is substantial relative to the average for inpatient care.

Table 3: Volume and unit cost of hospital acquired infections

Year	MRSA		C-Difficile	
	Volume	Average cost (£)	Volume	Average cost (£)
2019/20	260	4,000	4,712	1,531
2020/21	279	5,760	4,251	2,109
2020/21*	279	5,760	4,251	2,104
2021/22	233	4,632	5,355	1,865

* Figures updated with corrected sorting of FCEs within CIPS. See Methods in Inpatient section for further details.

The high unit cost of MRSA cases arises partially from patients staying an average of 13 additional days in hospital if they contract this infection, based on external literature. The volume of C-Diff infections rose sharply between 2020/21 and 2021/22 (by around 29%). The

[11] See Indicator specification for more detail (last accessed 02/04/2024).

unit cost of C-Diff fell by around 11% between 2020/21 and 2021/22. However, this remains well above the £1,531 reported in 2019/20. The unit cost of C-Diff from additional days in hospital is more similar to the unit cost for inpatient care overall. However, the total costs of C-Diff infections are over five times larger than that of MRSA due to the higher volumes of C-Diff cases.

3.4.3. Impact on NHS output and productivity growth

In comparing 2021/22 with 2020/21, including avoidable emergency readmissions as a quality adjustment leads to an increase in inpatient growth by 0.2 of a percentage point. This indicates that while both the volume of overall activity and avoidable emergency readmissions have increased between these two years, the overall cost of the readmissions has increased at a slower rate than the value of care in the inpatient setting. The impact of hospital acquired infections is too small to be observed at two decimal points of a percentage point of growth. This is due to the small overall cost of the two HAIs considered, despite substantive volatility in volumes and unit costs observed.

In comparing 2021/22 with 2019/20, including avoidable emergency readmissions and hospital acquired infections as quality adjustment leads to an increase in inpatient growth by 0.04 of a percentage point. Similarly to comparing 2020/21 to 2021/22, the observed difference is almost entirely driven by changes in emergency readmissions.

4. NHS Productivity growth

Overall NHS productivity growth between 2020/21 and 2021/22 was 14.14% when using the mixed measure and 15.18% using the indirect measure. Our preferred measure for the 2021/22 NHS productivity update will be based on the indirect measure. This is because financial accounts appear to correctly reflect the expenditure on NHS staff, as the Department of Health and Social Care noted delays in updating the staff and pay-roll systems by NHS Trusts during the pandemic.

In Table 4 we present productivity growth measures, both mixed and indirect, for the financial years 2019/20 – 2020/21, 2020/21 – 2021/22, and 2019/20 – 2021/22 adjusted for the number of working and total days in both financial years. Productivity growth figures for previous years, beginning with growth from 2004/05 to 2005/06, can be found in the Online Appendix.

Table 4: NHS Productivity Growth[12]

Years	Mixed	Indirect
2019/20 – 2020/21	-22.95%	-24.02%
2020/21 – 2021/22	14.14%	15.18%
2019/20 – 2021/22	-13.30%	-12.45%

[12] Working and total days adjusted figures.

After the stark negative 2019/20 – 2020/21 productivity growth due to the COVID-19 pandemic, the NHS saw a recovery as elective and face-to-face activity were gradually re-introduced in 2021/22. However, this was not enough to counteract the sharp decrease in output during the pandemic year, while a concurrent increase in NHS inputs was also recorded for the 2020/21-21/22 link. When comparing the pre-pandemic financial year, 2019/20, with 2021/22, the resulting productivity growth rates amount to -13.30% and -12.45% when mixed and indirect input growth measures are used respectively. The details of changes in both NHS outputs and inputs are shown in Figure 1 indexed to 2004/05 – 2005/06.

Figure 1: NHS Output and Input Indices 2004/05-05/06 to 2019/20-2021/22[13]

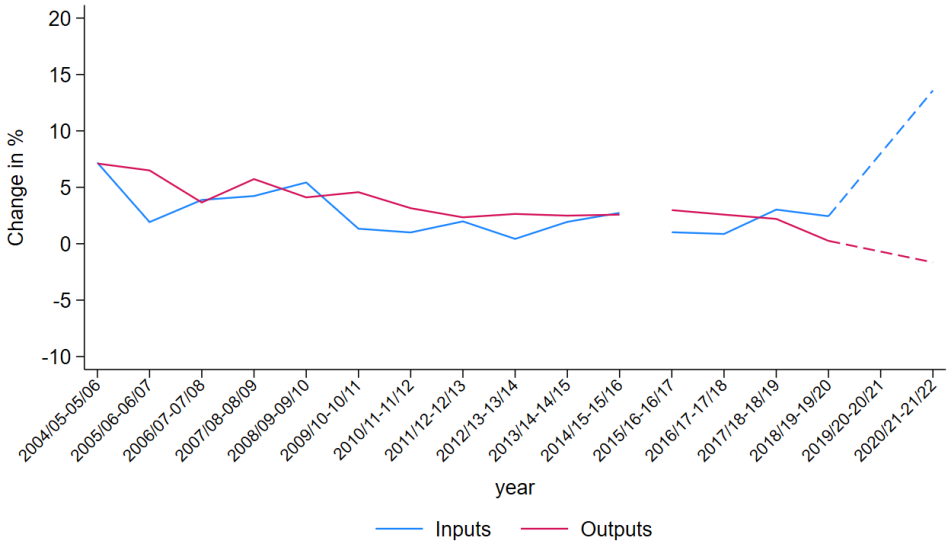
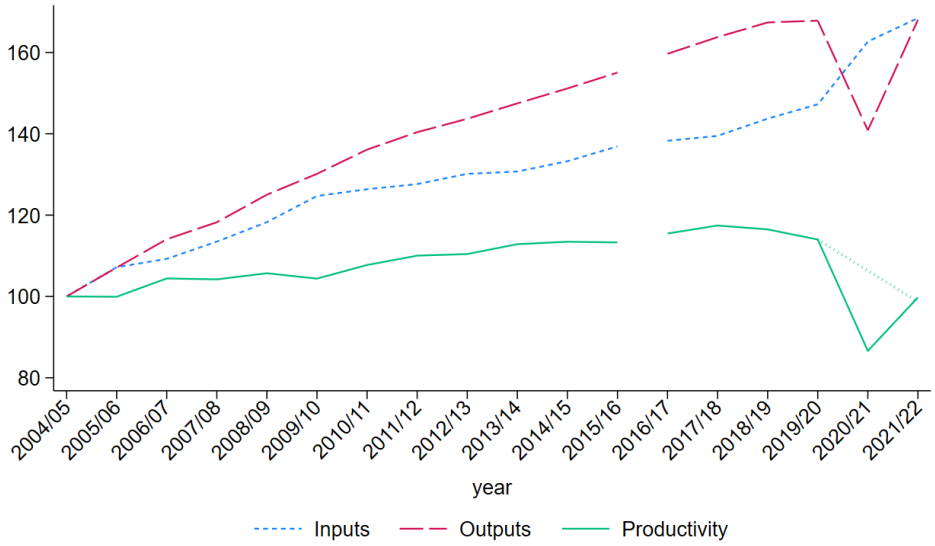


Figure 2 presents the cumulative NHS outputs, inputs, and productivity indices over time, using 2004/05 as the index year (year 0). Differently from Figure 1, the input and output indices are depicted for the 2019/20-20/21 and 2020/21-21/22 separately, while the productivity index is presented for all consecutive links and also the 2019/20-21/22 link. It is evident from the figure that the large decrease in productivity during the pandemic was due to both a massive drop in output growth and substantial positive input growth. Between 2020/21 and 2021/22, outputs saw a significant recovery, although not sufficient to bring productivity growth back to pre-pandemic levels, as inputs saw another increase, albeit much smaller than in the pandemic year. As a result, productivity growth is still below the 2019/20 levels.

[13] The mixed input growth is used as the baseline and depicted in this graph. The 2019/20-20/21 and 2020/21-21/22 growth rates are omitted, and the 2019/20-21/22 growth rates are presented instead (dashed lines). The interruption of the series reflects re-calculation of the figures due to a coding error corrected (first noted in Arabadzhyan et al., 2021).

Figure 2: Cumulative NHS Output, Input and Productivity Indices (2004/05 = 100)[14]



Finally, we compare the productivity growth of the NHS to the growth of the UK economy as a whole. Productivity growth in the wider economy can be measured both using the Gross Value Added per Hour (LP) measure, a measure of Labour Productivity of the whole economy, and the Multi-Factor Productivity (MFP) series, both produced by the Office of National Statistics (ONS). The latter is a measure of productivity comprising all inputs (labour, capital, and materials), but is limited to the market sector. Both are important productivity statistics produced by ONS, and while the methodology differs across sectors, the overall objectives are the same as our NHS specific measure.[15,16,17]

Figure 3 presents the Overall Economy (LP) and Multi-Factor Productivity indices dynamics along with the NHS productivity index. Unsurprisingly, the healthcare sector was deeply affected by the pandemic, hence the substantial reduction in productivity observed in 2020/21. Meanwhile the LP measure did not change in 2020/21, whereas the MFP index in 2020/21 decreased by about 4 points.

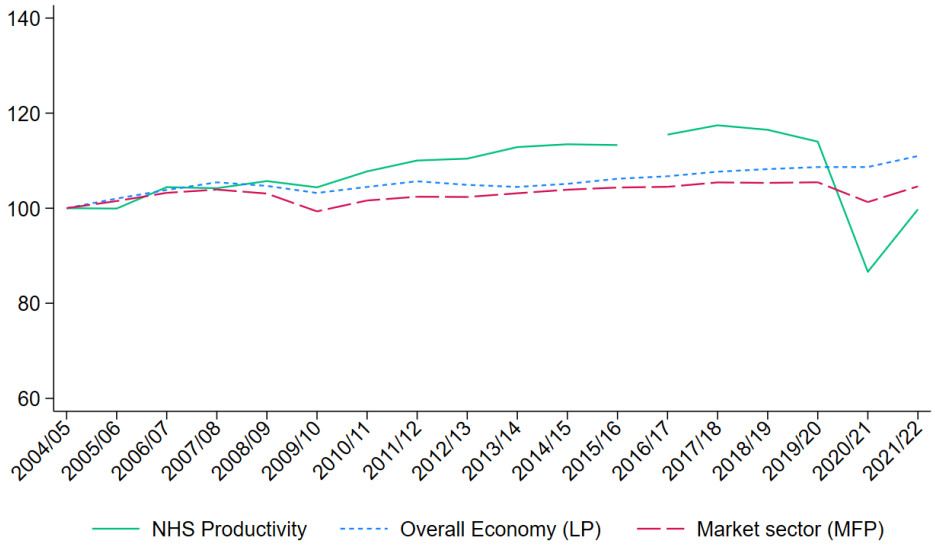
[14] Up to 2018/19-2019/20 the mixed input index is used as the baseline and depicted in this graph, whilst the indirect input index is used for 2019/20-2020/21 link. The interruption of the series reflects re-calculation of the figures due to a coding error corrected (first noted in Arabadzhyan et al., 2021). The dotted line in the "Productivity" series represents the dynamic of the productivity growth between 2019/20 and 2021/22.

[15] See ONS note on GVA and GDP (last accessed 22/03/2024).

[16] See ONS labour productivity data (last accessed 22/03/2024).

[17] See ONS multifactor productivity estimates (last accessed 22/03/2024).

Figure 3: Cumulative NHS productivity, Overall Economy (LP) and Multi-Factor Productivity (MFP) indices



According to ONS,[18] the UK's labour productivity remained relatively stable during the pandemic year due to shifts in the workforce composition balancing out the decline in output per hour during lockdowns. This was due to policies such as the furlough schemes and reduced working hours affecting different groups of workers differently. Those in lower-wage brackets, such as younger individuals and those with fewer qualifications, were disproportionately impacted as they tend to be employed in less skilled roles with lower economic value. Consequently, they were more susceptible to the effects of furlough policies, leading to a reduction in their working hours, which in turn increased the proportion of hours worked by higher-paid employees.

Regarding the Multifactor Productivity (MFP) growth rate of the overall economy, the ONS article notes the influence of the "allocation effect", which bolstered the economy's growth rate by 6.5 percentage points. This effect helped offset the declines observed in individual industries, particularly in less productive sectors, which experienced more significant contractions compared to sectors with higher productivity levels.

In the post-pandemic period, all measures have shown a rising trend. The MFP index almost reached pre-pandemic levels, whilst the NHS productivity index, albeit still quite lower compared to its pre-pandemic level, shows a significant growth, indicating the system is on the path of recovery.

5. Overall NHS output and NHS input growth

5.1. Output growth

Output growth is measured by combining activities of different types into a single index, using costs to reflect their values. We report in Table 5, the cost-weighted and quality-adjusted output growth measures, both also adjusted for the number of total and working days.

[18] The information was taken from ONS (2020).

Between 2020/21 and 2021/22, the cost-weighted and cost and quality adjusted NHS output growth rates amount to 19.45% and 19.26% respectively, as reported in Table 5. While the growth rates appear very large in relative terms, such growth was not sufficient to reach pre-pandemic output levels. In fact, when comparing 2021/22 with the pre-pandemic 2019/20, the resulting output growth rates are -1.45% (cost-weighted) and -1.53% when adjusted for quality, respectively.

Quality adjusting NHS output has a negative albeit small impact on the overall NHS output growth. Our analyses of the contribution of quality indicators to the overall quality-adjusted NHS output growth measure show that this is mainly driven by life expectancy, while adjusting for survival, PROMS and waiting times have a positive impact on the output growth index for 2020/21 – 2021/22. When comparing 2019/20 with 2021/22, the main negative drivers of quality adjustment are life expectancy and waiting times, while other quality adjustments positively impact the NHS output growth measure.

Table 5: NHS output growth

Years	Cost-weighted Growth (CW)	Quality-adjusted CW growth
2019/20 – 2020/21	-16.69%	-16.05%
2020/21 – 2021/22	19.45%	19.26%
2019/20 – 2021/22	-1.45%	-1.53%

5.1.1. Contribution by settings

Different settings contribute differently to the output growth index. Figure 4 shows the share of overall spend for each of the settings as well as their contribution to growth, calculated as a share of overall spend multiplied by the output growth of the setting, using growth rates obtained when estimating missing Trust activity.

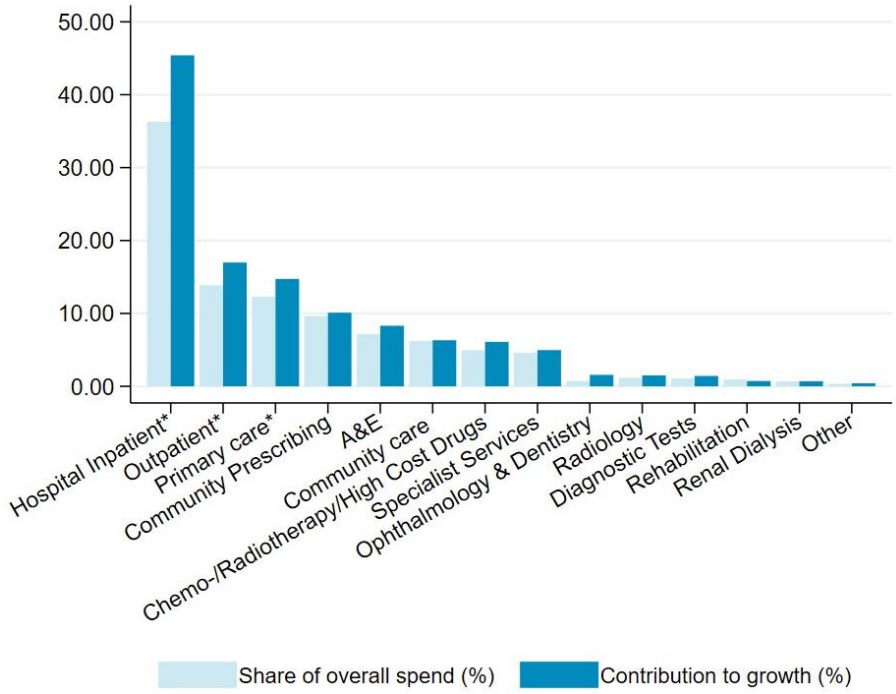
Table 6 and Table 7 include more information on the contribution to overall NHS output growth by setting, for 2020/21 – 2021/22 and 2019/20 – 2021/22 respectively.[19] Similarly to the 2020/21 update, the growth rates for the NHS settings covered by the National Cost Collection data, are obtained following our preferred approach in accounting for missing Trust activity (see section 2.5 of this report or Arabadzhyan et al. (2022) for the full details). The output growth rates for the Hospital Inpatient, Outpatient, Primary Care, Community Prescribing, and Ophthalmology & Dentistry settings are not affected by missing NHS Trusts activity data. Not correcting for missing Trust NCC data will result, on average, in uncorrected growth rates being biased.

Overall, the largest contributor to the output index is Hospital Inpatient activity, with a share of about 45% of overall output growth (36% of total spend) in 2021/22 and 35% (37% of total spend) for the 2019/20 – 2021/22 link. In 2021/22, other sizable contributors (in order of overall contribution to output growth) are Outpatient, Primary Care and Community Prescribing. All other settings each contributed less than 10% to the total value of output growth. For the 2019/20 – 2021/22 link, the picture is very similar, but Primary Care was the

[19] Community mental health setting has been excluded from our analysis (see section 6.4.2 for further detail).

second largest contributor to the output growth rate instead of Outpatient setting. A detailed breakdown of output growth for each setting is presented in section 6.

Figure 4: Contribution to output growth by setting, 2021/22



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

Table 6: Contribution to overall NHS output growth by NHS setting, 2021/22

Setting	Growth	Setting specific growth index	Value of Activity (20/21 prices)	Share of overall spend	Contribution to overall growth rate**
Hospital Inpatient*	25.11%	125.11%	36,222,811,050	36.29%	45.40%
Outpatient*	22.51%	122.51%	13,835,080,000	13.86%	16.98%
Primary care*	19.89%	119.89%	12,263,143,016	12.28%	14.73%
Community Prescribing	4.66%	104.66%	9,631,954,944	9.65%	10.10%
A&E	15.88%	115.88%	7,162,672,498	7.18%	8.31%
Community care	1.73%	101.73%	6,205,576,795	6.22%	6.32%
Chemo-/Radiotherapy/High Cost Drugs	23.18%	123.18%	4,945,211,378	4.95%	6.10%
Specialist Services	8.10%	108.10%	4,591,108,492	4.60%	4.97%
Ophthalmology & Dentistry	112.92%	212.92%	736,190,832	0.74%	1.57%
Radiology	28.24%	128.24%	1,167,467,963	1.17%	1.50%
Diagnostic Tests	28.98%	128.98%	1,100,232,953	1.10%	1.42%
Rehabilitation	-22.37%	77.63%	936,620,170	0.94%	0.73%
Renal Dialysis	2.67%	102.67%	682,870,608	0.68%	0.70%
Other	23.30%	123.30%	342,349,442	0.34%	0.42%
Total/NHS output growth rate			**99,823,290,141**		**19.26%**

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

** The contribution of each setting to growth in 2021/22 is expressed as a percentage of the total output in 2020/21. Where numbers in this column are lower than numbers in the preceding column, this represents negative growth in outputs for that setting.

Table 7: Contribution to overall NHS output growth by NHS setting, 2019/20-2021/22

Setting	Growth	Setting specific growth index	Value of Activity (19/20 prices)	Share of overall spend	Contribution to overall growth rate**
Hospital Inpatient*	-5.86%	94.14%	34,758,117,100	37.10%	34.92%
Primary care*	16.89%	116.89%	11,985,569,329	12.79%	14.95%
Outpatient*	-4.64%	95.36%	12,477,570,000	13.32%	12.70%
Community Prescribing	6.88%	106.88%	9,036,638,208	9.64%	10.31%
A&E	-3.43%	96.57%	5,816,515,054	6.21%	6.00%
Chemo-/Radiotherapy/High Cost Drugs	13.99%	113.99%	4,633,285,519	4.95%	5.64%
Community care	-11.62%	88.38%	5,291,869,689	5.65%	4.99%
Specialist Services	-3.82%	96.18%	3,726,035,018	3.98%	3.82%
Ophthalmology & Dentistry	-24.37%	75.63%	1,993,128,218	2.13%	1.61%
Diagnostic Tests	-9.81%	90.19%	1,061,378,602	1.13%	1.02%
Radiology	-14.34%	85.66%	1,039,758,864	1.11%	0.95%
Renal Dialysis	5.24%	105.24%	612,417,434	0.65%	0.69%
Rehabilitation	-41.83%	58.17%	906,494,092	0.97%	0.56%
Other	-19.41%	80.59%	356,059,845	0.38%	0.31%
Total/NHS output growth rate			**93,694,836,972**		**-1.53%**

* Hospital Inpatient, Outpatient and Primary care activity are quality-adjusted.
** The contribution of each setting to growth in 2021/22 is expressed as a percentage of the total output in 2019/20. Where numbers in this column are lower than numbers in the preceding column, this represents negative growth in outputs for that setting.

5.2. Input growth

Table 8 presents the growth in inputs for the last two links, 2019/20 – 2020/21 and 2020/21 – 2021/22, as well as for the 2019/20 – 2021/22 link, using the mixed and indirect methods.

The indirect method uses expenditure data for all types of inputs, derived from Hospital Trusts' and other NHS organisations' financial accounts. The mixed method uses Electronic Staff Record (ESR) data to calculate growth in NHS labour inputs and combines this information with expenditure data from published accounts for the remaining inputs used in the production of healthcare goods and services.

Table 8: Indirect and Mixed NHS input growth

Years	All NHS	
	Mixed	Indirect
2019/20 – 2020/21	8.95%	10.49%
2020/21 – 2021/22	4.49%	3.55%
2019/20 – 2021/22	13.58%	12.48%

The difference between the mixed and indirect input indices is due to the data sources and so growth rates in NHS labour input differ. Considering the change between 2020/21 and 2021/22, ESR data suggest that NHS staff increased by 3.82%, whilst the equivalent growth rate calculated using expenditure data is 1.72%. This reverses the finding between 2019/20 and 2020/21: the direct NHS labour growth rate was 4.93%, whilst the indirect NHS labour growth rate was 8.3%.

This should not be surprising. In Arabadzhyan et al. (2023), we reported that the direct labour measure might have been affected by delays in updating the staff and pay-roll system of NHS Trusts, during the height of the COVID-19 pandemic, and therefore may have not correctly reported the total number of NHS staff employed by the NHS. The financial accounts of NHS Trusts did, however, reflect the increased expenditure on staff. We had therefore used the indirect NHS input growth measure as our preferred measure to determine NHS productivity growth between 2019/20 and 2020/21.

We expect that staff and pay-roll systems of NHS Trusts correctly report the total number of NHS staff in 2021/22, which may explain the higher growth rate associated with the mixed NHS input growth measure. The growth rate calculated with the direct method may still be affected by data recording issues in the staff and pay-roll system experienced by NHS Trusts in 2020/21. Therefore, we continue to use the indirect NHS input growth measure as our preferred measure to calculate NHS productivity growth between 2020/21 and 2021/22.

When comparing 2019/20 to 2021/22, the above data issue is not relevant, and therefore the mixed NHS input growth measure is used for the headline NHS productivity growth rate estimate. We note that the mixed NHS input growth rate is higher that the indirect one. The source of this difference is the NHS labour input growth rate, with the directly measured NHS labour input growth rate equal to 8.79% and the indirect NHS labour input growth rate equal to 6.37%.

In terms of the major contributors to overall input growth, these were, in order, labour, materials and primary care.

6. Growth in output categories

6.1. Measuring output

Our NHS output index is designed to capture all activities provided to NHS patients, whether by NHS or private sector organisations.[20] Table 9 summarises the data sources used to measure activity, quality and costs. 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 National Costs Collection (NCC) database. In this report, we compare outpatient activity derived from both datasets, but use the HES outpatient figures in our NHS output growth measure. Summaries for each output type and any data issues are detailed in sections 6.2 to 6.7.

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

Table 9: Summary of NHS output data sources

Output type	Activity source	Cost source	Quality
Elective	HES	NCC	In-hospital survival; health outcomes & waiting times
Non-elective	HES	NCC	In-hospital survival & health outcomes
Outpatient	HES (or NCC)	NCC	Waiting times
Mental health	HES & NCC	NCC	In-hospital survival; health outcomes & waiting times
Community care	NCC	NCC	N/A
A&E	NCC	NCC	N/A
Other*	NCC	NCC	N/A
Primary care	QResearch (up to 2008/09); General Lifestyle Survey (2008/09-09/10); GP patient survey (from 2009/10) NHS Digital Appointments in General Practice data (from Nov 2017)	PSSRU Unit Costs of Health and Social Care + other sources	QOF data (up to 2018/19; 2019/20 had a change in the way indicators were recorded; no QOF data collected in 2020/21) Waiting times
Prescribing	Until 2017/18, Prescription cost analysis system (PCA) From 2018/19, NHS Business Service Authority (BSA)	PCA system & BSA	N/A
Ophthalmic and dental services	NHS England	NHS England	N/A

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

6.2. Hospital physical and mental health inpatient

- **Overall cost-weighted and working days adjusted Laspeyres output growth for hospital inpatient activity was 24.85% between 2020/21 and 2021/22.**
- **Measures of quality improved over this period, leading to a growth rate of 25.11% after quality-adjustment.**

Day-case, elective and non-elective hospital inpatient care is calculated from the HES Admitted Patient Care (APC) dataset. Information in this dataset is recorded at the Finished Consultant Episode (FCE) level. An FCE represents a period of treatment under the same

hospital consultant. The dataset includes both physical and mental health inpatient care.[21] In 2021/22, just under 21 million inpatient FCEs are recorded, an increase of 20.6% compared to 2020/21. This is similar to the increase reported by NHS England.[22, 23]

Table 10 presents activity in terms of FCEs across different provider types. In 2021/22, around 97% of FCEs occurred within Trusts, a decrease of one percentage point from 2020/21. FCEs in private providers increased by over 60% between 2020/21 and 2021/22. The proportional change in FCEs carried out by Other providers is dramatic. However, the overall contribution of this category to FCEs remains very small (0.15%). Details of a longer time trend can be found in the Online Appendix.

Table 10: Organisational coverage of HES activity, FCEs

Year	NHS Trusts	Private providers	Other	Total
2019/20	21,736,268	633,558	404	22,370,228
2020/21*	16,993,469	359,880	3,518	17,356,867
2021/22	20,309,952	584,590	32,801	20,927,343

* Correction made to counts in 2020/21. "Other" category previously reported as 2,715 as 803 observations contributed to total observations but were not attributed to any specific category.

6.2.1. Methodology

The differing types of NHS activity performed in an inpatient setting are identified through HRGs. Output within a HRG is the count of Continuous Inpatient Spells (CIPS) allocated to that HRG. A CIPS can contain multiple FCEs. This occurs if a patient is transferred to the care of a different hospital consultant within the same Trust or a different Trust as part of their care. We construct CIPS following our own algorithm, which is similar to the official algorithm published by NHS England.[24,25,26]

The cost of each CIPS is the highest cost reported for an individual FCE within the CIPS (Bojke et al., 2017). Costs are reported in the National Cost Collection (NCC) dataset. The NCC dataset reports a separate unit cost for day-case, elective care, and non-elective care activity for each HRG. As we use unit costs as a proxy for the relative health value of different activities, we acknowledge the significance of appropriate day case care by assigning it equal value as elective care (Bojke et al., 2016).[27] Having assigned a cost to each CIPS, we then calculate the national average cost per CIPS in each HRG.

It can be that some HRGs do not have associated costs in consecutive years, due to new HRGs being introduced (old HRGs being retired). This can also arise if there was no activity in a given

[21] 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').
[22] Hospital Admitted Patient Care Activity, 2021-22 (last accessed 16/10/2023).
[23] NHS Digital merged with NHS England in April 2023, and we reflect this change in this report, although this report covers years prior to the merger.
[24] NHS Digital CIPS and Spells methodology (last accessed 23/02/2024).
[25] A note detailing the differences between the CHE and the NHS Digital algorithms to construct CIPS is available as supplementary material published alongside the NHS productivity update for 2018/19 (Arabadzhyan et al., 2021).
[26] As part of the 2021/22 update, a correction was made in the ordering of FCEs in CIPS construction.
[27] This equal weighting ensures that the output index is not biased downwards if delivery of treatment moves from overnight to day-case settings over time.

HRG for a specific year. In such cases we deflate (inflate) costs in order to impute missing values (Castelli et al., 2011). The second reason for missing cost information is especially important when considering the year 2020/21 for two reasons. First, the general reduction in activity necessitated by the COVID-19 pandemic meant some more rarely performed activities did not occur at all. Second, the cost based grouper published by NHS England to map FCEs to HRGs was not available in 2020/21. We instead used the payment grouper for that year, which uses HRGs from three years previously. That is, HRGs from 2017/18 in mapping HRGs 2020/21. This inflated the number of observations for which imputation was required in comparing the year 2020/21 with 2021/22, when the cost based grouper was again available.

In 2021/22, there were 30 HRGs, which were not included in 2020/21, with a total expenditure of around £1.1 billion. Of these, around 87% of expenditure was for elective care, in line with a restoration of rarer types of elective care activity in 2021/22. 143 HRGs were dropped in 2021/22 compared to 2020/21, amounting to nearly £1.5 billion. This is primarily a reflection of the shift from payment to cost based grouping.

6.2.2. Elective, day-case, and non-elective activity

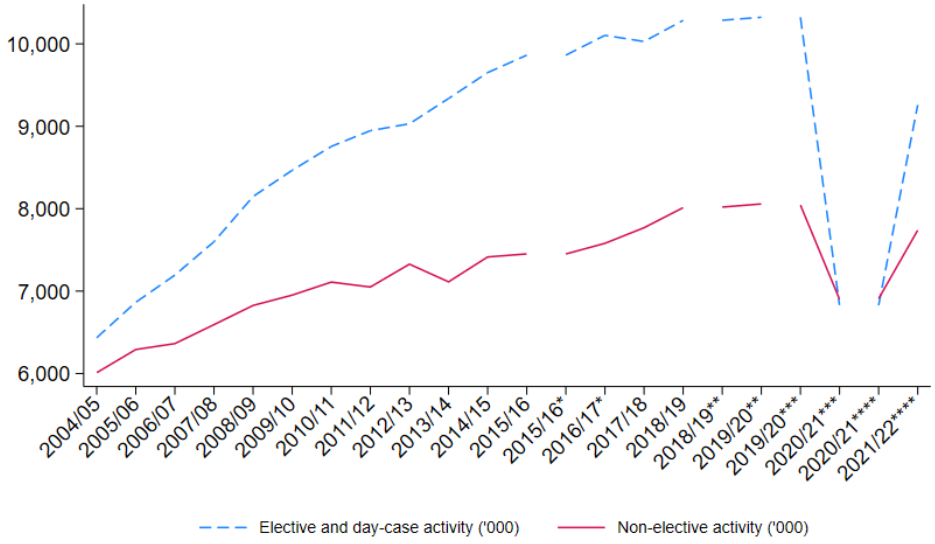
- **Cost-weighted and working days adjusted Laspeyres output growth for elective and day-case physical care was 40.51% between 2020/21 and 2021/22. Non-elective physical care Laspeyres output growth was 9.92% over the same period, leading to overall NHS cost-weighted and working days adjusted activity output growth of 25.01%.**
- **Measures of quality indicated a reduction of nearly 1 percentage point between 2020/21 and 2021/22 for elective and day-case care in physical health, resulting in growth of 39.54%. This was more than compensated by an increase in non-elective physical care by nearly 1.5 percentage points after quality adjustment, leading to 11.39% for non-elective physical care and 25.28% for physical health care overall after adjusting for changes in quality.**

Between 2020/21 and 2021/22, the combined volume of day-case, elective and non-elective physical healthcare rose substantially, by around 24%. This increase was heavily concentrated within elective and day-case care (a 36% increase compared to 12% for non-elective care). This represents very strong growth. However, levels of activity in 2021/22 are still lower than those seen shortly before the COVID-19 pandemic, especially for elective care. Figure 5 highlights this point, showing activity from 2004/05. Against a background of gradually increasing activity from 2004/05 to 2019/20, the volume of elective and day-case activity in 2021/22 is similar to that of 2012/13. Activity in non-elective care in 2021/22 is similar to that of 2016/17. However, it should be noted that this count does not recognise any changes in the value of patient care through case-mix complexity or the quality of care.

Activity information is also presented in Table 11 along with mean unit costs. It can be seen from this table that the mean cost of elective and non-elective care fell substantially between 2020/21 and 2021/22: from £2,601 to £2,275 (equivalent to a 12.53% fall) for elective care and from £2,641 to £2,308 (equivalent to a 14.43% fall) for non-elective care. These are substantial reductions. However, unit costs in 2021/22 remain well above those observed in 2019/20. The fall in unit costs between 2020/21 and 2021/22 is largely related to increased

activity in less complex care, inverting the pattern observed between 2019/20 and 2020/21. The residual difference in costs (between 2019/20 and 2021/22) may in part reflect higher inflation rates. Mean Consumer Price Inflation including housing costs (CPIH) from 2019/20 to 2020/21 was 2.5%. The same figure comparing 2020/21 with 2021/22 was 7.9% (ONS 2023).[28]

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



* The HES variable 'admission method' underwent changes in the coding; thus from 2015/16 we implemented those changes in the methodology used to group FCEs into CIPS.
** Calculation of activity was translated from SAS 9.2 to STATA 17 and minor refinements made, making figures for 2018/19 not comparable with those from 2019/20. See Arabadzhyan et al. (2022), section 6.2.1, for details.
*** Activity calculated with updated patient identifier provided by NHS Digital.
**** Activity calculated with corrected ordering of FCEs within CIPS.

Table 11: 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 (£)
2019/20	10,322,560	1,900	8,044,921	1,852
2020/21	6,830,556	2,542	6,901,554	2,627
2020/21*	6,828,395	2,601	6,907,709	2,641
2021/22*	9,258,555	2,275	7,739,036	2,308

* Measures calculated using corrected ordering of FCEs within CIPS.

Cost-weighted and working days adjusted Laspeyres output growth for elective and day-case physical care output was 40.51% between 2020/21 and 2021/22. Non-elective output grew

[28] See CPIH annual rate (last accessed 09/04/2024).

by 9.92% over the same period, leading to an overall NHS cost-weighted and working days adjusted activity output growth of 25.01% for inpatient physical care.[29] These are similar patterns to the changes in raw volume discussed above.

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

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

1. **In-hospital survival rates and mean life expectancy.** We use information on in-hospital survival rate, which is obtained directly from the HES APC dataset, and mean life expectancy, taken from mid-year life tables published annually by ONS,[30] and combine it with estimate changes in health outcomes following treatment (see subsequent bullet point) to capture changes in the expected discounted sum of lifetime Quality Adjusted Life Years (QALYs) conditional on treatment survival.
2. **Estimated change in health outcomes following hospital treatment** to assess the impact that treatments have on patients' health status over time. We use changes in the ratio of health status before and after care. Smaller ratios represent a larger health improvement associated with the treatment. We use two separate data sources:
    i. Patient Reported Outcome Measures (PROMs) for all patients undergoing unilateral hip or knee replacement.[31] This survey is offered to all patients shortly before surgery and six months following treatment. It includes the generic EQ-5D measure, which can be converted to QALYs through an official valuation from the general population of health states. Change in the ratio of before divided by after procedure EQ-5D QALY scores are used for related HRGs.
    ii. For treatments (HRGs) where no such information is available, or the proportion of activity with PROMs information for a given HRG is small and unlikely to be representative in either year considered (< 100 observations) we assume that the ratio is constant over time and equal to 0.8 for elective care/day-cases and 0.4 for non-elective care (Dawson et al., 2005). We also assign the above constant ratios to CIPS with error code UZ01Z (Castelli et al., 2019).
3. **Waiting times** to account for adverse health implications of delayed treatment along with direct patient dissatisfaction from waiting for care. We use the 80th percentile of waiting time, also calculated from HES APC, and apply this as a scaling factor, multiplying the health effect (Castelli et al., 2007). This adjustment applies only to elective and day-case activity.

Table 12 and Table 13 present average values of the measures for the quality elements for the years 2019/20, 2020/21 and 2021/22. The table highlights that life expectancy has fallen for elective and risen for non-elective patients, on average, between 2020/21 and 2021/22. This follows falls in life expectancy between 2019/20 and 2020/21 for both patient groups.

[29] The total number of days and number of working days were the same in 2020/21 and 2021/22. Therefore, working days adjustment has no impact for this link.
[30] ONS life tables (last accessed 20/02/2024).
[31] From 2018/19, PROMs for varicose vein surgery and groin hernia repair were discontinued.

Waiting time at the 80th percentile has remained the same in 2021/22 as in 2020/21, therefore retaining the sharp increase in wait between 2019/20 and 2020/21. This is in line with the backlog of elective care currently experienced by the NHS and related to the COVID-19 pandemic. Survival rate increased between 2020/21 and 2021/22, though to a smaller extent than the fall observed in survival rate between 2019/20 and 2020/21. It is important to stress that these values are averages and mask considerable variation in the value observed for single HRGs and for each HRG across years. We, therefore, report in Table 12 details of the impact of individual and combinations of quality measures and discuss their implications in section 6.2.6.

Table 12: 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
2019/20	99.96%	22.1	85	98.36%	31.8
2020/21	99.95%	21.9	104	97.82%	30.9
2020/21*	99.93%	21.7	104	96.63%	30.7
2021/22*	99.95%	21.5	104	97.38%	31.5

* Measures calculated using corrected ordering of FCEs within CIPS and updated life tables used for 2020/21 and 2021/22.

Table 13 presents descriptive statistics for patient reported outcome measures (PROMs) for hip and knee replacement. We were not able to incorporate PROMs in our 2020/21-2021/22 update, due to data for 2021/22 not being available. Therefore, for this link, we assumed that the ratio of health gain in both the years 2020/21 and 2021/22 is 0.8 for all elective care, including hip and knee replacement when calculating quality adjustment between 2020/21 and 2021/22.

Table 13: Ratio of pre to post health status, based on EQ-5D

Year	Hip replacement	Knee replacement
2019/20	0.39	0.44
2020/21	0.31	0.50
2021/22*	n/a	n/a

* PROMS not available in 2021/22.

Including adjustments for quality leads to a decrease in elective and day-case output growth by around 1 percentage point to 39.54%, but a larger increase in non-elective care growth of around 1.5 percentage points to 11.39%. Overall, changes in quality indicate an improvement in Laspeyres growth by 0.27 percentage points to 25.28% for physical health.[32]

[32] The quality-adjusted Laspeyres output growth measure for hospital inpatient (physical care) output is the same without working day adjustment, as the number of working days in 2020/21 and 2021/22 is the same.

6.2.4. Inpatient mental heath

- **The cost-weighted and working days adjusted Laspeyres mental health inpatient output growth measure was -2.21% between 2020/21 and 2021/22.**
- **After accounting for changes in quality, the total Laspeyres output growth of NHS mental health activity fell by around 0.5 of a percentage point to -2.68%.**

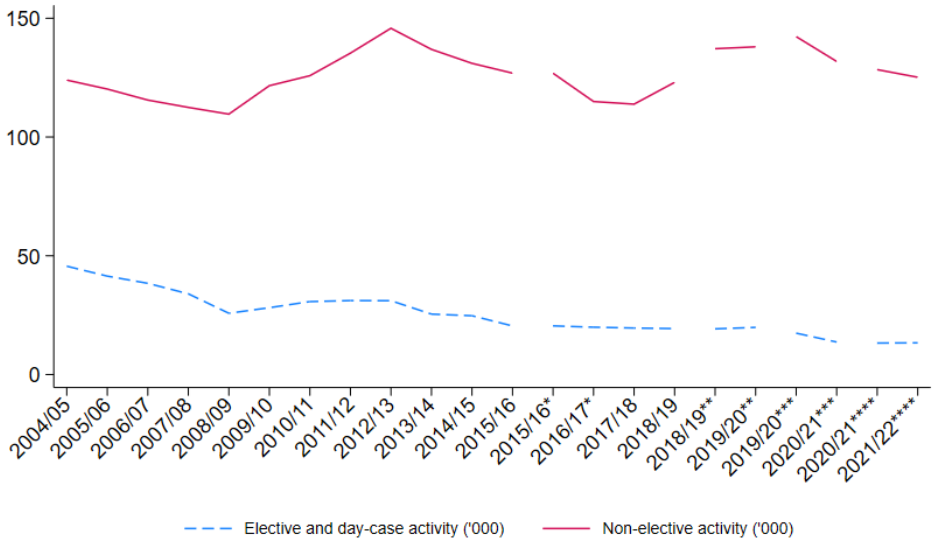
Table 14 shows the number of CIPS and average costs for mental health care activity in the years 2019/20 to 2021/22. This highlights that volume changes in mental health care in the inpatient setting are substantial, but much more modest in proportion and total magnitude than compared to physical health. Figure 6 reinforces the point that compared to physical health (presented in Figure 5), changes in the volume of mental health care were far less dramatic between 2020/21 and 2021/22. The changes were more in line with fluctuations over previous years as also observed between 2019/20 and 2020/21. It is also noteworthy that non-elective mental health care fell in terms of total CIPS between 2020/21 and 2021/22, unlike elective mental health care or either form of physical care provided.

Table 14: CIPS and average cost for inpatient mental health patients

Year	Elective and day-case activity		Non-elective activity	
	# CIPS	Average cost (£)	# CIPS	Average cost (£)
2019/20	17,360	1,494	142,321	1,516
2020/21	13,679	1,506	131,865	1,528
2020/21*	13,258	1,506	128,382	1,528
2021/22*	13,351	1,538	125,165	1,561

* Measures calculated using corrected ordering of FCEs within CIPS and updated life tables used for 2020/21 and 2021/22.

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



* The HES variable 'admission method' underwent changes in the coding; thus from 2015/16 we implemented those changes in the methodology used to group FCEs into CIPS.
** Calculation of activity was translated from SAS 9.2 to STATA 17 and minor refinements made, making figures for 2018/19 not comparable with those from 2019/20. See Arabadzhyan et al. (2022), section 6.2.1, for details.
*** Activity calculated with updated patient identifier provided by NHS Digital.
**** Measures calculated using corrected ordering of FCEs within CIPS.

The cost-weighted and working days adjusted Laspeyres mental health inpatient output growth measure between 2020/21 and 2021/22 was -2.21%.[33] It is striking that this measure continued to fall between 2020/21 and 2021/22, while physical health care rose substantially. This may, in part, reflect a data reporting issue, as completion of HES APC data by mental health Trusts ceased to be mandatory from 2019/20.

6.2.5. Inpatient mental health: quality adjustment

Table 15 presents quality adjustment measures for mental health inpatient care. The same set of quality adjustment measures is used as for inpatient physical care. Compared to 2020/21, survival rates and life expectancy were higher in 2021/22 for patients receiving elective care but lower for patients receiving non-elective care. The fall in mean life expectancy for patients receiving non-elective care of 0.7 of a year is particularly striking. The 80th percentile waiting time fell from 52 to 50 days. As noted in section 6.2.3, these mean values are made up of highly variable values at the HRG level within the year, which also change over time.

[33] The cost-weighted growth in mental health output is equal to -8.88% when not adjusted for working days.

Table 15: 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
2019/20	99.44%	30.9	41	98.22%	24.6
2019/20*	99.63%	30.8	43	99.10%	24.4
2020/21	99.48%	30.9	60	99.05%	23.9
2020/21**	99.25%	30.8	52	97.97%	23.8
2021/22	99.48%	31.1	50	97.90%	23.1

* Activity calculated with the updated patient identifier provided by NHS England.
** Measures calculated using corrected ordering of FCEs within CIPS and updated life tables used for 2020/21 and 2021/22.

After accounting for changes in quality, the total Laspeyres output growth of NHS mental health activity becomes -2.68%.[34] This represents a reduction in quality with an impact of around 0.5 of a percentage point. The impact of individual quality measures is discussed for physical and mental health in the following section.

6.2.6. Breakdown of quality measures for inpatient care

In sections 6.2.3 and 6.2.5 we presented descriptive statistics for quality adjustment measures for inpatient physical and mental health respectively, along with the overall impact of these quality adjustments on Laspeyres growth. Table 16 presents growth rates when adjusting solely for cost (cost-adjusted column) and for different combinations of these quality measures.

The impact of life expectancy as a quality adjustment is consistently negative and is the primary negative driver of quality adjustment. Adjusting for life expectancy alone gives the lowest output growth overall and for all sub-samples of patients. This may reflect a combination of reduced population life expectancy from COVID-19 and an increase in the treatment of older patients in 2021/22 compared to 2020/21.

Adjusting for survival alone indicates an improvement in output growth by around 0.7 of a percentage point for non-elective patients. This drives the overall improvement when adjusting for survival alone of 0.4 of a percentage point for physical health and all patients combined. Adjusting for survival alone indicates much smaller improvements for elective physical health and mental health patients. An improvement in output growth is also observed when including PROMs adjustment (representing health gain). By definition, PROMs values are fixed, as information on health gain for specific conditions was not available. However, this adjustment also magnifies the impact of survival, especially for elective care. This is reflected in the table.

Overall, Table 16 indicates a general improvement in the quality of care provided, though substantially mitigated by reduced life expectancy. The impact of life expectancy is so substantial that overall quality adjustment for elective care is negative. The main driver of

[34] The quality-adjusted mental health Laspeyres output growth rate is equal to -8.78%, when not adjusted for the number of working days.

overall positive quality adjustment is survival, which is magnified by the incorporation of the PROMs adjustment.

Table 16: Quality adjustment breakdown with working day/total day adjustment 2019/20 – 2020/21

NHS Hospital Inpatient	Cost-adjusted	Quality-adjusted (Survival, PROMs, LE & WT)	QA only Survival	QA only Survival + PROMS	QA only LE	QA only WT & LE
Physical + Mental Health Inpatient (all)	24.85%	25.11%	25.26%	25.90%	23.79%	23.94%
Physical Inpatient (all)	25.01%	25.28%	25.42%	26.07%	23.95%	24.10%
Physical Inpatient (Elective)	40.51%	39.54%	40.59%	41.01%	38.69%	39.00%
Physical Inpatient (Non-Elective)	9.92%	11.39%	10.66%	11.53%	9.60%	9.60%
Mental Health Inpatient (all)	-2.21%	-2.68%	-2.13%	-1.99%	-2.90%	-2.89%

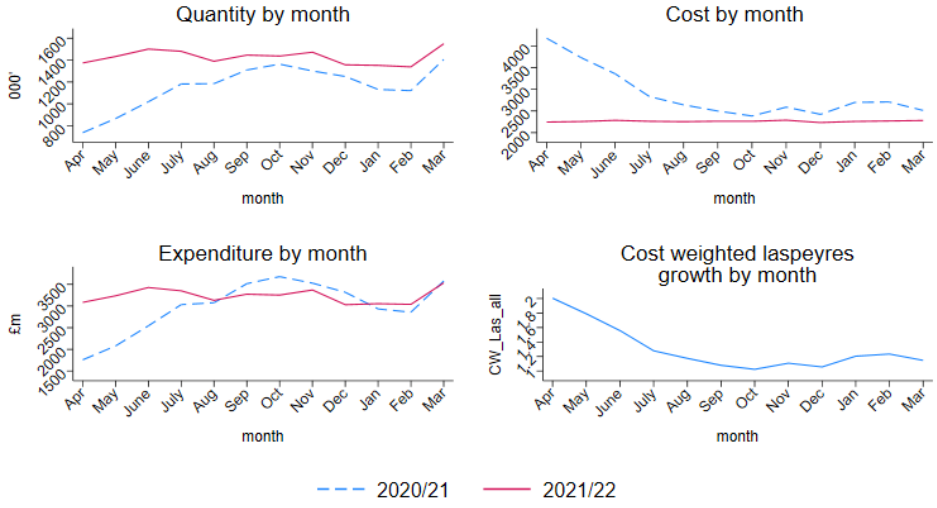
6.2.7. Month by month comparison

A critical feature of the year 2020/21 was the policies introduced in response to the COVID-19 pandemic. Specific policies and broader context had a major impact on activity in the health sector and importantly changed substantially over time. Very broadly, beginning with a national lockdown in late March which was gradually eased over the following months, but then gradually restored until similar restrictions had largely returned by January 2021. The year 2021/22 saw a second gradual removal of policies to mitigate COVID-19, while vaccines were rolled out to most of the English population. While most legal restrictions were removed in July 2021, face masks again became compulsory in December 2021 in response to a further wave of infections. Whilst NHS England also set out as one of its priorities to use the new models of care adopted during the pandemic to deal with the backlog of patients waiting for elective treatment and cancer care, we believe that continuing changes in rates of infection and policies are likely to have had indirect impacts on healthcare activity.

Figure 7 presents total volume, unit cost and expenditure for combined physical and mental health in the inpatient setting for each month of 2020/21 and 2021/22. It also shows the cost-weighted Laspeyres growth rate for the inpatient setting, comparing each month in 2021/22 with its equivalent in 2020/21.

The ‘quantity by month’ graph indicates higher volumes of care in 2021/22 than in any month in 2020/21. The most striking difference is in April. Quantities observed in 2020/21 relate closely to policies seeking to reduce the spread of COVID-19. In contrast, the overall unit cost of activity is consistently lower in 2021/22 than in 2020/21. Again, the difference is most substantial in April. Expenditure over months is more stable in 2021/22 than in 2020/21, similarly to quantity and unit cost. However, expenditure in the autumn of 2020/21 is higher than the equivalent time in 2021/22. This reflects the increased activity in the latter part of 2020 at the higher costs observed in that year, though these differences are smaller than in April. Finally, while Laspeyres growth is positive in all months, it is highest in April, when a period with fewer restrictions is compared against the first national lockdown.

Figure 7: Month by month comparison of inpatient activity 2020/21 and 2021/22



6.2.8. Comparison of 2019/20 with 2021/22

When comparing NHS inpatient outputs reported in 2021/22 to the pre-pandemic year, 2019/10, we find that the cost and working day adjusted inpatient activity fell by 5.50%. This is in line with the 6.56% raw drop in activity volume indicated in Table 11. After adjusting for changes in quality, inpatient growth fell by 0.36 percentage points to -5.86%. The negative impact of quality adjustment is driven by a combination of life expectancy and waiting time. Both adjusters have an individual negative impact overall and for all patients subsamples except for non-elective care, where life expectancy improves slightly and waiting time has no impact by definition. A smaller contrasting impact from quality is through survival, which improves overall and for all subsamples except for non-elective physical health and mental health. These results can be seen in Table 17.

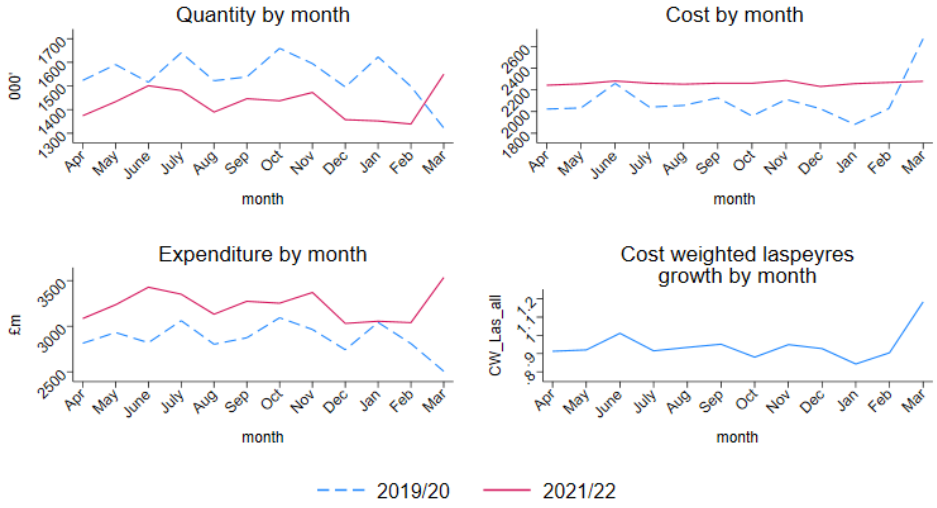
Table 17: Quality adjustment breakdown with working day/total day adjustment 2019/20 – 2021/22

NHS Hospital Inpatient	Cost-adjusted	Quality-adjusted (Survival, PROMs, LE & WT)	QA only Survival	QA only Survival + PROMS	QA only LE	QA only WT & LE
Physical + Mental Health Inpatient (all)	-5.50%	-5.86%	-5.27%	-5.01%	-6.06%	-6.39%
Physical Inpatient (all)	-5.46%	-5.83%	-5.23%	-4.98%	-6.02%	-6.35%
Physical Inpatient (Elective)	-10.47%	-11.84%	-10.36%	-10.20%	-11.57%	-12.15%
Physical Inpatient (Non-Elective)	1.12%	2.08%	1.51%	1.90%	1.28%	1.28%
Mental Health Inpatient (all)	-10.19%	-11.54%	-10.27%	-10.34%	-11.38%	-11.40%

Figure 9 presents month by month comparisons of quantity, unit cost and expenditure for 2019/20 and 2021/22. This highlights some key features of NHS recovery in terms of inpatient activity. First, activity in 2019/20 is higher than in 2021/22 for all months except March. Attempts to minimise elective care had already begun in March 2020. Therefore, higher activity in March 2022 primarily reflects a comparison with a COVID-19 impacted period, which is not the case for other months. Further, expenditure is higher in 2021/22 than in

2019/20 in all months, with the largest difference in March. It is therefore unsurprising that unit costs in 2021/22 are higher than in 2019/20 in all months except March. Finally, Laspeyres growth is negative in all months except March between 2019/20 and 2021/22. All of these findings suggest a gap in productivity, where higher expenditure has been combined with lower activity, even after the direct impact of COVID-19 is removed as far as possible with available data.

Figure 8: Month by month comparison of inpatient activity 2019/20 and 2021/22



Overall, findings for inpatient care suggest that inpatient has substantially recovered between 2020/21 and 2021/22, in large part due to a return to a more standard form of care following the COVID-19 pandemic. However, by all measures used, recovery was not complete by 2021/22, with a substantial residual gap in inpatient activity growth.

6.3. Hospital outpatient setting

- **The cost-weighted and working days adjusted Laspeyres output growth measure for outpatient activity was 22.53% between 2020/21 and 2021/22.**
- **After adjusting for waiting times, the Laspeyres output growth measure was 22.54%.**

We drew on two sources of data for measuring growth in the outpatient setting, following the same approach as in previous productivity reports. Our preferred approach, set out in this section, is to use the HES Outpatient (OP) dataset to calculate activity and the National Cost Collection (NCC) for unit costs of that activity.

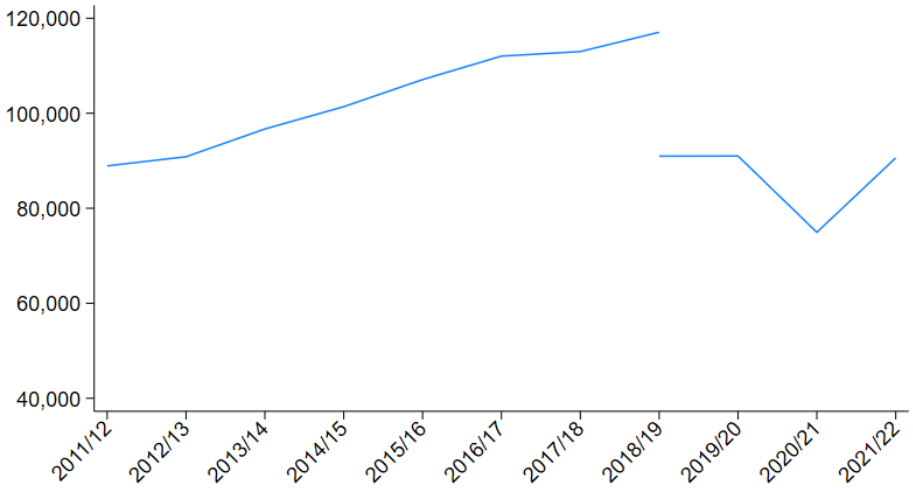
Table 18 shows outpatient activity returned to around 2019/20 levels in 2021/22. This represents a substantial increase, of 20.89%, between 2020/21 and 2021/22. The mean cost of care fell by 10.15%. The average cost of outpatient care in 2021/22 was still substantively above that of 2019/20, at 20.98%. This may suggest a broad return to activity levels possible before the COVID-19 pandemic, but at a higher cost. One factor explaining increased costs is the increase in general inflation within the British economy observed in the latter part of the 2021/22 financial year.

Table 18: HES outpatient volume and average cost over time

Year	HES Outpatient Activity	
	Volume	Average cost (£)
2019/20	91,004,047	137.11
2020/21	74,941,740	184.61
2021/22	90,596,980	165.87

Figure 9 reinforces the observation that the increase in activity from 2020/21 to 2021/22 represents a return to similar levels of activity to that observed immediately before the COVID-19 pandemic.

Figure 9: Trends in HES outpatient activity (000'), 2011/12 – 2021/22



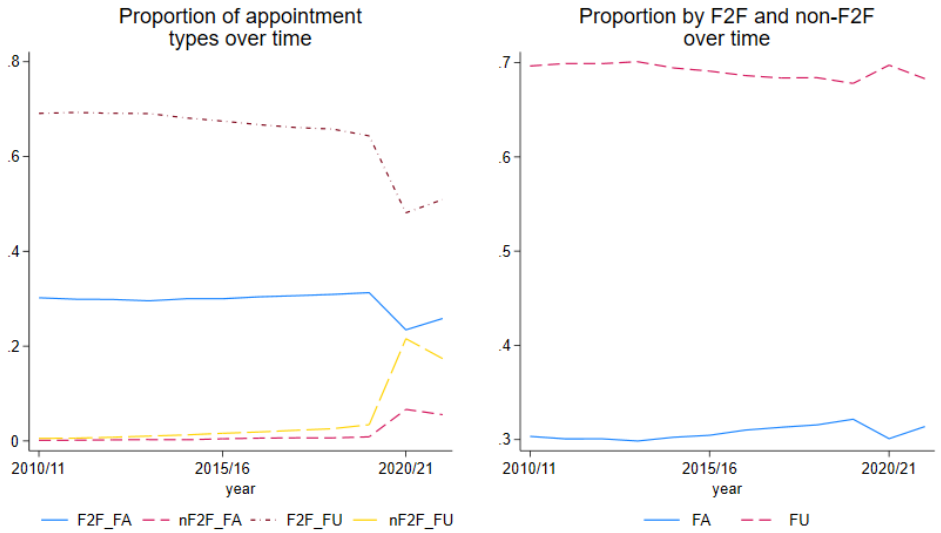
The cost-weighted Laspeyres growth in outpatient activity amounted to 22.53%, between 2020/21 and 2021/22. The larger increase in cost-weighted growth than volume suggests a shift towards more complex and costly care in 2021/22 compared to 2020/21. This may reflect a distribution of patients in 2021/22, more similar to practice before the pandemic, as the opposite relationship between raw volume growth and Laspeyres volume growth was observed between 2019/20 and 2020/21 (see Arabadzhyan et al. (2023)).

6.3.1. HES outpatient: quality adjustment

Similarly to the hospital inpatient setting, we adjusted outpatient activity for the 80th percentile of waiting times. In previous reports we focused on first time face-to-face outpatient appointments only when calculating waiting time. In response to the COVID-19 pandemic, the proportion of non-face-to-face first outpatient appointments rose from a negligible to a small but substantive level. This can be seen in Figure 10, which shows the proportion of face-to-face first appointments, face-to-face follow-up appointments, non-face-to-face first appointments and non-face-to-face follow-up appointments over time. This figure also highlights that while the proportion of appointments which are non-face-to-face fell slightly between 2020/21 and 2021/22, this shift is substantially smaller than the one towards non-face-to-face appointments between 2019/20 and 2020/21. This is in line with the NHS Long Term Plan, which includes aims to increase the amount of care provided digitally

across all forms of acute care, including reducing face-to-face appointments to minimise patient inconvenience in terms of travel (NHS England, 2019). Similar prioritisation of digitalising care has also been highlighted in more recent prioritisation and operational planning guidance (NHS England, 2021). Therefore, in this report we treat the 80th percentile of all first appointment waiting times as our primary quality adjustment measure for outpatient care, reporting the impact considering face-to-face first appointments alone as a sensitivity analysis.

Figure 10: Proportion of outpatient appointments by type



Mean and 80th percentile waiting times are presented in Table 19. Between 2020/21 and 2021/22, mean waiting times for all first appointments increased by 1 day (57 to 58), while 80th percentile waiting times fell by 2 days (76 to 74). Considering face-to-face first appointments alone, mean and 80th percentile waiting times both increased: by 2 days (from 55 to 57) for mean waiting times, and by 4 days (from 67 to 71) for the 80th percentile waiting time measure. With the exception of 80th percentile waiting time for face-to-face first appointments, changes between 2020/21 and 2021/22 were smaller than between 2019/20 and 2020/21. This may be an indication of a more protracted impact of the COVID-19 pandemic on waiting times, also reflected in backlogs created by the pandemic which had not begun to reduce by March 2022.

After adjusting for waiting times of first appointments and working days, growth in outpatient activity increased marginally (by 0.01 percentage point) to 22.54%.[35] When using the change in 80th percentile of face-to-face first appointments, quality and working day adjusted growth fell marginally (by 0.02 percentage point) to 22.51%. The impact of adjusting for waiting time as a quality measure is very limited, despite a substantive change in 80th percentile of waiting time. This is because the negative impact of waiting time is discounted and waiting times were already at a relatively high level in 2020/21.

[35] As the number of working days in 2020/21 and 2021/22 are the same, working day adjustment does not impact on this growth rate.

Table 19: Mean and 80th percentile outpatient waiting times

Year	Face-to-face first appointments		All face-to-face appointments	
	Mean	80th Percentile	Mean	80th Percentile
2019/20	48	68	48	67
2020/21	55	67	57	76
2021/22	57	71	58	74

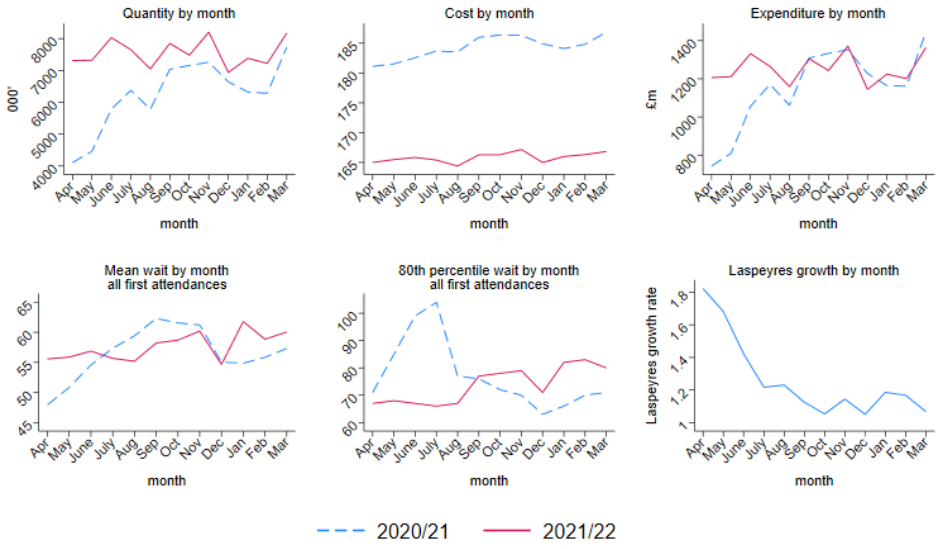
6.3.2. Month by month comparisons

Figure 11 presents month by month comparisons of unit costs, expenditure, waiting times and Laspeyres growth rate along with activity level. Mean unit costs (costs by month) indicate persistently lower unit costs in 2021/22 over the full financial year. Activity and expenditure were initially substantially higher (April and May 2021 compared to April and May 2020), but more similar in value when comparing other months. This reflects the large drop in outpatient care during the first months of the pandemic (April-May 2020).

Both mean and 80th percentile waiting times for first appointments indicate a gradual upward trend during the months of 2021/22. More volatility was observed in 2020/21, especially in the 80th percentile of waiting time. This finding aligns with the shifts in types of care provided during lockdowns (2020/21) and potentially increased capacity to treat patients in 2021/22 whose care was of necessity delayed during 2020/21. However, it is also noteworthy that the longest 80th percentile waiting time in 2021/22 was below that of 2020/21.

Finally, the Laspeyres growth rate was consistently above one, indicating growth in all month by month comparisons. The most dramatic growth rate was, as might be expected, in April. Here a relatively standard practice is compared to the initial COVID-19 lockdown, when hospitals were asked to postpone as much care as possible.

Figure 11: Activity, Expenditure, Waiting Time and Laspeyres Index by month – 2020/21 and 2021/22 comparison



6.3.3. Comparison of 2019/20 with 2021/22

The COVID-19 pandemic had large and multifaceted impacts on activity, especially in the year 2020/21. In this sub-section, we compare activity in the year 2019/20 with that in 2021/22, to ascertain the extent to NHS outpatient activity has already and might continue to recover.

Table 18 shows that activity in 2021/22 was 0.45% lower than in 2019/20, though the unit cost of activity was 20% higher. However, cost weighted and working day adjusted Laspeyres volume growth between 2021/22 and 2019/20 was -4.63%. This suggests that while case-mix complexity increased between 2020/21 and 2021/22, it had not yet returned to that of 2019/20 within the outpatient setting. Table 19 indicates that between 2019/20 and 2021/22, all measures of waiting time used as quality adjusters worsened, which is reflected in a reduction in output growth by 0.01 percentage point to -4.64% when measuring quality in terms of face-to-face first appointments. The impact of quality adjustment is similar to that found when comparing outpatient activity for 2021/22 with 2020/21.

6.4. National Cost Collection data

The National Cost Collection[36] (NCC) data are used in the NHS output and productivity series to capture health care activity delivered outside the primary care and hospital inpatient and outpatient settings. In particular, it captures 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.

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

The 2021/22 NCC publication was not accompanied by any supporting documentation, which typically includes information on settings or sub-settings of healthcare activity which are not comparable with previous years due to changes in data collection, grouping or any other quality related issues. We therefore rely solely on our internal data quality checks to determine data comparability across years.

Overall, we find the 2021/22 cost collection data to be reconcilable with those produced for both 2020/21 and 2019/20, with a few exceptions. Cystic Fibrosis activity[37] is not provided in the 2021/22 main collection publication, but has been provided in the 'Organisation level source data part 3' supplement, possibly due to data quality issues. We therefore excluded Cystic Fibrosis services from the growth rate calculation, but provide the figures of total volume and average unit cost in the relevant table.

Differently from all the previous years, in the 2021/22 collection the small number suppression rule (suppressing activity volumes and unit costs if activity volume is below 8) is now applied not only to provider-level data, but also to the national level NCC data. We treat

[36] Previously known as the National Reference Cost data.

[37] Please note that Cystic Fibrosis activity was also not reported in the 2019/20 NCC data, while it was reported in the 2020/21 NCC data.

these data points as missing, since these represent very low volumes of activity, with an insignificant share in the total value of a healthcare setting, and therefore a negligible effect on their respective output growth rates.

Community Mental Health activity continues to be omitted from our analysis. NHS Trusts continue to report mental health activity in both the old format and as Patient Level Information and Costing System (PLICS), and we have no information on the consistency of data recording across the two formats between 2020/21 and 2021/22. Further, we note substantial changes in the way mental health provider spells in the PLICS format and activity for Secure Mental Health Services have been recorded in the financial year 2021/22 as compared to 2020/21. Therefore, we are unable to obtain meaningful estimates of the Community Mental Health setting output growth rate, because of comparability issues with the format of the data collected (Arabadzhyan et al., 2022).

In section 6.4.1, we present the results of our internal data quality checks, whereas section 6.4.2 reports detailed overviews of activity and unit costs trends, and output growth for each NHS setting, as captured by the NCC data, i.e. not corrected for the number of Trusts.

6.4.1. Quality checks

Following our own validation process (Bojke et al., 2014), we identify large changes in either volume or unit costs of activity for all non-acute services. In particular, our quality assurance process consists of four steps:

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

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

- **Step 3:** This step has normally included a cross-check of flagged up HRG codes against the codes listed in the HRG4+ Reference Costs Grouper Roots file. However, since 2019/20 NHS England has not been publishing an updated HRG4+ Reference Costs Grouper Roots file, and therefore, all checks were carried out via web searches and careful reading of the NCC costing guidance publication.[38]
- **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 any potential large changes in either volume or value of activity.

[38] NCC 2021 costing guidance (last accessed 11/11/2023).

Differently from previous years' updates, we follow this validation process not only for the financial years 2020/21 and 2021/22, but also between 2021/22 and 2019/20.

Similarly to 2020/21, the 2021/22 data are characterised by a very large number of categories flagged up as large changes in either value (total cost) and/or volume (units) of activity, compared to any of the previous years' checks. Below we describe which settings and individual service categories within these settings were flagged up as having a large value and/or volume change, and the likely reasons behind them. Some of the large changes recorded are due to the impact of the COVID-19 pandemic and the lockdown policies that were implemented.

A&E and ambulance

First, we note that in 2021/22 the activity for Emergency Departments and Other A&E Services has been coded differently compared to both 2020/21 an 2019/20. The grouping of A&E activity as either 'admitted', 'non-admitted' or 'unknown' categories, as per previous NCC data collection, is no longer present in 2021/22. We needed, therefore, to aggregate these respective figures for both 2019/20 and 2020/21 to allow for a meaningful comparison.

Further, A&E and ambulance is one of the settings for which we found the largest value and volume changes for a single service. Between 2021/22 and 2020/21, large positive changes in both value and volume were found for less costly emergency medicine services, which had previously experienced a greater decrease during the pandemic. Certain shifts were observed for ambulance services as well: negative for 'See and treat or refer' and positive for 'See and treat/convey'. This might reflect the shift of those cases which during the pandemic would be seen and treated only without conveying the patient to an emergency department to the 'See and treat/convey' category. As these changes are expected, we use the data as given. When comparing 2021/22 with 2019/20, for quite a few categories in the A&E setting we found a large positive value change, but in most cases this was caused by the rise in unit costs, while activity volumes in many cases were lower in 2021/22.

A large positive volume change was detected for the 'Other' ambulance category, which includes calls. This is likely due to the change in the costing guidance for 2021/22, which suggests that "a duplicate call relating to a previously recorded call […] should be submitted on an unrelated row(s) of data recorded as incident currency 04", whereas previously it was suggested that calls related to previously recorded incident(s) should be absorbed into that incident's cost, rather than recorded separately. For comparability purposes we remove this category when calculating growth rates, reported in Table *21*.

Chemotherapy, Radiotherapy, High Cost Drugs and Devices

Large value changes were detected for some chemotherapy activities, possibly driven by both a process of re-categorisation of these activities and post-pandemic recovery. We also note that several High Cost Drugs currencies were flagged as new activity with large values. Having conducted further investigation, we found that one of them, Onasemnogene Abeparvovec, was introduced in 2021/22. We therefore exclude this drug when calculating growth rates for the setting, but keep all activity when presenting average volume and unit costs in section 6.4.2. For other high cost drugs which appear as new activity, we found that they had been approved by NICE and available on the NHS prior to 2021/22. It is possible that these drugs

had not been used before but substituted other treatments in 2021/22, and we therefore include them in the analysis.

Outpatient

In the outpatient setting, large value and volume changes are driven mostly by the shifts between face-to-face and non-face-to-face activities. When comparing 2021/22 with the pandemic year, we observe large positive value and volume changes for some face-to-face activity types accompanied by negative value changes for activity types performed as non-face-to-face (remotely). This is in line with our expectations about a return to normal working practice. Yet, this reversal of the pandemic trend has not been complete yet. In fact, when comparing outpatient activity in 2021/22 with that in 2019/20, our quality assurance procedure flags up large positive value and volume changes for some non-face-to-face activities and negative for some face-to-face ones. This suggests that some of the changes in healthcare provisions, which were implemented to contain the spread of the SARS-CoV-2 virus, remained. As these are expected, we use the data in the analysis as given.

Community care

Similarly to the outpatient setting, between 2020/21 and 2021/22 some of the healthcare services delivered in the community saw substantial changes in both value and/or volume due to the switches between face-to-face and remote care, most often partially moving back from a remote delivery mode to a face-to-face one. When comparing community care activity between 2021/22 and 2019/20, we also detected large value and volume changes with face-to-face activities delivered in lower volumes in 2021/22 compared to 2019/20, while remote consultations were more frequent – a lingering effect of the COVID-19 pandemic . We also note that the unit costs of most types of activity in 2021/22 are closer to the 2020/21 figures than to the 2019/20 ones.

Finally, some community care activity (home and bed based intermediate care services, adult face-to-face district nurse contact, some health visitor contact types), show a large decrease in volumes when comparing 2021/22 with both 2020/21 and 2019/20. Some of these changes might be due to the fact that a new currency ‘No currency data available’ was introduced in 2021/22, under which large activity volumes have been recorded. Since we suspect that some of the large volume changes mentioned above are likely due to re-categorisation of activity, we do not exclude any of the community care categories from the analysis.

Specialist services

Large value changes between 2021/22 and 2020/21 were mainly detected in the sub-setting ‘critical care’, driven by a decrease in volume of some adult critical care currencies, but an increase in paediatric care, which is likely the result of fewer COVID-19 patients, and a restored ability to deliver care to children. Comparing 2021/22 to 2019/20, it emerges that critical care overall has a much higher value in 2021/22. This seems in most cases to be driven by the combination of both larger volumes and higher unit costs.

Diagnostic tests

Large changes in diagnostic services were only detected for volume, while their unit costs remained stable. Between 2021/22 and 2020/21, we found mostly positive large volume changes for some of the currencies, reflecting a bounce back from the pandemic period.

However, when comparing 2021/22 with 2019/20, we still find mostly negative large volume changes, an indication that diagnostic tests activity has still not recovered to pre-pandemic levels.

Radiology

Similarly to diagnostic tests, ultrasound scans have seen a large increase in both volume and value between 2021/22 and 2020/21, but a decrease between 2021/22 and 2019/20.

Rehabilitation

Differently from other activity types, some types of rehabilitation activity were affected by a large decrease in their volumes in 2021/22 compared to the previous year. This is in line with the general trend for the Rehabilitation setting, and we suspect that this may be due to moving some of the activity to other settings (Community Care, Primary Care, Outpatient), rather than a drastic drop in rehabilitation services provision.

Finally, similarly to the previous NHS productivity updates, we also provide the estimates of the growth rates corrected for the number of Trusts included in the core NCC schedule. In 2019/20, 209 out of 223 providers were included in the dataset, in 2020/21 this number went up to 215 out of 216 organisations, while in 2021/22 208 out of 213 Trusts were included in the cost collection.[39] Failing to account for the different number of providers submitting data in different years may result in an underestimation of the growth rates for the 2020/21-2021/22 link, and, generally, an overestimation for the 2019/20-2021/22 link. Both uncorrected and corrected growth rates are reported in Table 21.

6.4.2. Growth in NHS activity captured in the National Cost Collection data

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

Table 20 provides an overview of the activity volumes and average unit costs for the last three years, as measured by the original NCC data. Note that Community Mental Health setting was excluded from the analysis, similarly to the previous year.[40] Table *21* presents raw volume growth rates, Laspeyres volume growth rates derived from the NCC data as is, and Laspeyres volume growth rates adjusted for the number of Trusts present in the two financial years, for two links: 2020/21-2021/22 and 2019/20-2021/22.

As appears from Table 20, activity volumes have gone up in 2021/22 compared to 2020/21, an indication of a recovery of activity, but in most cases this has not been enough to reach

[39] The difference in the total number of NHS Trusts between financial years is due to several mergers and acquisitions, which involved Trusts present in the dataset in all years. The only Trust missing from the 2020/21 collection (University Hospitals of Leicester NHS Trust) was missing from 2019/20 and 2021/22 collections as well.

[40] Activity and unit costs data for Community Mental Health have undergone a complete overhaul in 2019/20, mainly because the 2019/20 Mental Health data within the NCC collection are largely based on PLICS (Patient Level Information and Costing System), with some providers submitting data in the old format (see p.10 in NHS England & NHS Improvement (2021)). The transition process is still ongoing, and since PLICS is not costing activity in the same way as the previous costing methodology, direct year-to-year comparisons are not possible even for total quanta. For historic trends in Community Mental Health activity see Table A14 in the Online Appendix.

the pre-pandemic levels. While for a large number of services we saw a decrease in unit costs in 2021/22 as compared to 2020/21, the unit costs in 2021/22 are generally higher than in 2019/20, and in fact, closer to the 2020/21 levels. This may reflect the fact 2021/22 was still partly affected by the pandemic, but also that the funding of the NHS remained at a very high level.

Table 20: Activity volumes and average unit costs for the settings measured by NCC

NHS setting		2019/20		2020/21		2021/22	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Outpatient		84,849,738	137	72,213,955	187	84,986,789	170
Community Care		76,106,927	70	72,359,084	86	73,310,146	79
Directly accessed diagnostic services		7,053,907	36	4,588,685	52	6,318,767	41
Directly accessed pathology services		392,755,757	2	306,866,304	3	385,602,765	2
Radiology		11,524,610	90	7,829,191	149	10,020,705	131
Rehabilitation		2,250,425	403	1,630,522	574	1,223,867	516
Renal dialysis		4,240,238	144	4,411,120	155	4,506,408	152
A&E and Ambulance							
Emergency Departments	AD	2,911,499	314	13,417	333	-	-
	NAD	10,238,989	185	41,134	187	-	-
	Unknown	2,317,415	206	12,163,403	340	-	-
	Total	15,467,903		12,217,954		15,601,148	281
Other A&E services	AD	93,774	170	23,869	174	-	-
	NAD	3,834,871	76	1,032,662	111	-	-
	Unknown	603,672	81	2,113,039	141	-	-
	Total	4,532,317		3,169,570		4,490,255	108
Ambulance Services	Hear and treat/refer	950,906	52	793,116	85	1,238,673	63
	See and treat/refer	2,705,547	206	2,919,214	268	2,652,954	268
	See and treat & convey	5,362,217	292	4,881,719	357	4,929,780	390
	Other	1,778,309	70	1,590,487	90	3,341,620	50
Chemotherapy, Radiotherapy, High Cost Drugs and Devices							
Chemotherapy		2,606,064	657	2,547,729	805	2,932,618	657
Radiotherapy		1,855,549	238	1,562,053	353	1,623,628	339
High Cost Drugs		2,774,471	756	2,627,691	766	3,492,206	774
High Cost Devices		467,130	933	273,129	1,261	365,412	1,503
Specialist Services							
Critical Care		2,483,865	1,347	2,218,159	1,864	2,362,589	1,753
Specialist Palliative Care		860,467	181	761,030	259	823,770	219
Cystic Fibrosis		-	-	51,770	1,352	50,103	1,212
Cancer Multi-Disciplinary Team Meetings		1,890,595	118	1,775,556	146	2,034,490	139
Other NHS activity							
Regular Day & Night Attenders		331,177	378	240,476	483	267,445	403
Audiological services		3,062,711	74	2,175,264	100	2,615,431	90
Day Care Facilities		93,698	167	45,078	346	70,000	276

Notes: the figures for Cystic Fibrosis for 2021/22 were excluded from the main collection, but included in the Organisation level source data part 3 supplement. The data provided is on the national level. A large jump in the Ambulance Services 'Other' category activity volume is due to different recording rules in 2021/22, so the volumes and unit costs are not directly comparable with 2020/21 and 2019/20.

Table 21 suggests that in all NHS settings there was a positive growth between 2020/21 and 2021/22, with the exception of Rehabilitation, for which a large negative growth in activity was recorded in the last two years. The largest increases were recorded for Diagnostic Tests and Radiology (28.98% and 28.24% respectively, when corrected for the number of providers). Between 2020/21 and 2021/22, the working / total days adjusted Laspeyres

output growth for NHS activity corrected for the number of providers was 15.65% if the outpatient setting is included, and 11.91% otherwise. However, the 2019/20-2021/22 growth rates showed a negative dynamic for all settings except for Renal Dialysis and Chemotherapy, Radiotherapy and High Cost Drugs and Devices. For the 2019/20-2021/22 link, the working / total days adjusted Laspeyres growth rate of activity measured by NCC and corrected for the number of Trusts was -5.17%, and -4.12% when the outpatient setting was excluded. This suggests that while the NHS is recovering from the pandemic downturn, pre-pandemic levels of activity have not been reached yet. In the remainder of this section we describe in more detail the activity structure and other relevant information, where applicable.

Table 21: Raw volume and Laspeyres growth rates for the settings measured by NCC

NHS setting	2020/21-2021/22			2019/20-2021/22		
	Raw volume growth rate	Laspeyres growth rate	Laspeyres growth rate corrected for # of Trusts	Raw volume growth rate	Laspeyres growth rate	Laspeyres growth rate corrected for # of Trusts
Outpatient	17.69%	20.76%	23.21%	0.16%	-4.85%	-7.31%
Community Care	1.31%	-1.51%	1.73%	-3.67%	-8.71%	-11.62%
Diagnostic Tests	25.84%	24.48%	28.98%	-1.97%	-6.77%	-9.81%
Directly accessed diagnostic services	37.70%	31.15%	43.26%	-10.42%	-11.95%	-15.15%
Directly accessed pathology services	25.66%	22.63%	25.29%	-1.82%	-5.16%	-8.15%
Radiology	28.13%	26.42%	28.24%	-13.05%	-11.77%	-14.34%
Rehabilitation	-24.94%	-24.53%	-22.37%	-45.62%	-42.10%	-41.83%
Renal dialysis	2.16%	2.66%	2.67%	6.28%	5.25%	5.24%
A&E and Ambulance	20.56%	14.68%	15.88%	-0.37%	-1.66%	-3.43%
Emergency Departments	27.69%	21.66%	23.53%	0.86%	0.81%	-1.93%
Other A&E services	41.67%	40.55%	44.81%	-0.93%	-0.62%	-4.01%
Ambulance Services	2.65%	-0.63%	-0.63%	-2.19%	-5.25%	-5.25%
Chemotherapy, Radiotherapy, High Cost Drugs and Devices	20.03%	22.66%	23.18%	8.94%	20.14%	13.99%
Chemotherapy	15.11%	5.92%	6.97%	12.53%	10.57%	-0.34%
Radiotherapy	3.94%	9.43%	9.38%	-12.50%	-2.66%	-11.91%
High Cost Drugs	32.29%	40.15%	40.15%	22.62%	35.82%	32.94%
High Cost Devices	33.79%	41.58%	42.30%	-21.78%	3.06%	2.67%
Specialist Services	9.80%	6.97%	8.10%	-0.27%	-2.38%	-3.82%
Critical Care	6.51%	6.37%	7.39%	-4.88%	-2.69%	-4.25%
Specialist Palliative Care	8.24%	9.76%	13.54%	-4.26%	-10.64%	-8.41%
Cancer Multi-Disciplinary Team Meetings	14.58%	14.45%	15.40%	7.61%	7.93%	5.71%
Other NHS activity	20.00%	21.68%	23.30%	-15.33%	-17.08%	-19.41%
Regular Day & Night Attenders	11.21%	9.99%	12.37%	-19.24%	-22.42%	-20.26%
Audiological services	20.24%	25.33%	26.55%	-14.60%	-13.23%	-18.22%
Day Care Facilities	55.29%	58.25%	58.22%	-25.29%	-29.52%	-29.52%
Total NHS output measured by NCC		**13.89%**	**15.65%**		**-2.51%**	**-5.17%**
Total NHS output measured by NCC, excluding Outpatient		**10.46%**	**11.91%**		**-1.35%**	**-4.12%**

Notes: Laspeyres growth rates are adjusted for working / total days. For the A&E and Ambulance setting, 'Calls' are excluded from the growth rates calculation. For Chemotherapy, Radiotherapy, High Cost Drugs and Devices setting, the growth rates are derived after excluding the new drug.

Outpatient activity

Outpatient activity, as measured in the NCC database, is classified into three major groups: consultant-led activity, non-consultant-led activity, and procedures. Consultant- and non-consultant-led activity represent broadly the same set of outpatient specific HRG-style codes (currency codes beginning with WF). Outpatient procedure codes represent procedure-related HRGs which may appear in other hospital settings. The shares of outpatient activity by the three major groups described above have slightly changed in 2021/22, with consultant-led activity representing 66% of overall outpatient activity as compared to 63% and 60% in 2020/21 and 2019/20 respectively. The share of non-consultant-led activity went down to 18% from about 25% in the two previous years, and outpatient procedures went up to 16% from the 12% in 2020/21, and is more similar to the 2019/20 share (15%). For the 2020/21-2021/22 link, raw volume growth was substantial and the adjusted Laspeyres growth rate was as high as 23.21%. When comparing activity with the pre-pandemic levels, i.e. with financial year 2019/20, despite very similar activity volumes the adjusted Laspeyres growth rate was negative, at -7.31%. This may reflect a change in activity composition across face-to-face and non-face-to-face activity. In particular, more costly face-to-face services will have decreased in volume while less costly remote service provision increased in 2021/22 compared to 2019/20.

A&E and ambulance services

A&E services are provided in both Emergency Departments (EDs) and 'Other A&E' departments.[41] In 2019/20 and 2020/21 attendances at A&E departments were classified into three groups: those where patients are subsequently admitted (AD) to an inpatient ward, those where patients are not admitted (NAD), and those with an unknown outcome (Unknown). However, in 2021/22 this classification was removed, and only the total number of activities within each department type was recorded. For comparability, we aggregate the activity for 2019/20 and 2020/21 and use the total figures by department type for the three consecutive years.

Between 2020/21 and 2021/22, emergency department attendances (raw volume) increased by 27.69%. This volume growth was substantial enough to show a slight recovery to pre-pandemic levels (0.86%). However, the Laspeyres volume growth corrected for the number of Trusts was slightly negative (-1.93%) between 2019/20 and 2021/22.

We note a substantial increase in the raw volume growth of 'Other A&E services' (41.67%) between 2020/21 and 2021/22. However, when we compare 'Other A&E services' activity in

[41] 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 the spreadsheet "9. Attendance Location" of the file "ECDS Enhanced Technical Output Specification (ETOS) v3.1.1." available at NHS Digital website "ECDS guidance and documents" (last accessed 7/11/2022).

2021/22 to that of 2019/20, both the raw volume growth rate and the Laspeyres volume growth corrected for the number of Trusts are moderately negative at -0.93% and a -4.01%, respectively.

As regards Ambulance services, the most substantial increase[42] in activity volume was captured for the 'Hear and treat/refer' category – 56% between 2020/21 and 2021/22, and 30% between 2019/20 and 2021/22. 'See and treat/refer' activity in 2021/22 decreased when compared to the pandemic year, while 'See and treat & convey' slightly increased, both being lower in volume than in 2019/20. Since the latter two activity types are much larger in volume and higher in cost than the 'Hear and treat/refer' services, the overall Laspeyres growth for both links was negative: -0.63% and -5.25% for the 2020/21-2021/22 and 2019/20-2021/22 links respectively.

Chemotherapy, Radiotherapy, High Cost Drugs and Devices

A large positive growth between 2020/21 and 2021/22 was recorded for the Chemotherapy, Radiotherapy, High Cost Drugs and Devices setting, mostly driven by High Cost Drugs and High Cost Devices , for which an increase in unit costs was recorded in 2021/22, contrary to the general tendency observed for all other healthcare activity. Table 22 reports the contribution to the 2021/22 growth rate of this NHS setting of each of three sub-settings. A substantial growth rate of 40.15% for High Cost Drugs was counterbalanced by a more moderate 6.97% growth in Chemotherapy, while the other two sub-settings contributed to a combined growth rate of 23.18%.

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

NHS Sub-setting	Laspeyres Growth rate	Setting specific growth index	Value of Activity in 2020/21	Share of overall spend	Contribution to overall growth rate
Chemotherapy	6.97%	106.97%	£2,030,873,635	41.31%	44.18%
Radiotherapy	9.38%	109.38%	£545,578,204	11.10%	12.14%
High Cost Drugs	40.15%	140.15%	£1,997,688,711	40.63%	56.94%
High Cost Devices	42.30%	142.30%	£342,613,786	6.97%	9.92%
Total/overall growth rate			**£4,916,754,336**		**23.18%**

Note: Individual Laspeyres growth rates are adjusted for working days and the number of Trusts. High Cost Drugs sub-setting excludes the new drug.

We find a substantial positive growth in this NHS setting when comparing activity in 2021/22 with 2019/20, equal to 8.94% when considering raw volumes. This increases to 20.14% when we calculate the Laspeyres growth rate, without adjusting for the number of providers. The large difference between these growth rates indicates that more expensive activity types have seen a larger volume growth in 2021/22 compared to 2019/20. Looking at the different components of this setting, High Cost Drugs and Devices are the main drivers of this result: for example, for Highs Cost Devices, we found that the large negative growth in raw volumes (-21.78%) becomes positive (3.06%) when cost-weighting was applied for the 2019/20-

[42] Note that a massive growth in the 'Other' category is due to a change in recording and hence the 'Other' activity is excluded from our analysis.

2021/22 link. When adjusted for the number of Trusts, the Laspeyres growth index for the setting becomes 13.99% - more than 6 percentage points lower than the uncorrected one, suggesting that Trusts not included in the 2019/20 National Cost Collection were contributing a large share of this setting's output growth.

Community care

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

Between 2020/21 and 2021/22, community care activity increased slightly in their raw volumes, 1.31%. However, the Laspeyres output growth rate, when not corrected for missing NHS Trusts activity, was -1.51% indicating that the positive growth was more substantial in community care services with lower unit costs. When correcting for the number of Trusts, however, the Laspeyres output growth rate becomes positive again (1.73%). This is an indication that less costly Community care activity is more likely to have been delivered by excluded Trusts.

The modest growth in activity, both in the raw volume and in cost-weighted measures, recorded in 2021/22 was not sufficient to reach pre-pandemic activity levels. Compared to 2019/20, in fact, community care activity in 2021/22 decreased by 3.67% in terms of raw volume, and by -8.71% when the Laspeyres cost-weighted growth is computed. The latter larger negative growth is due to larger negative differences occurring among more costly activity types Finally, when correcting for the number of Trusts, the Laspeyres growth rate becomes even more negative at -11.62%.

Diagnostic tests, pathology, and radiology

Following a large drop in activity volumes due to the pandemic, diagnostic and screening activities increased significantly in raw volumes in 2021/22, with a Laspeyres volume growth rate corrected for the number of Trusts of about 28% for both Diagnostic Tests and Radiology settings. However, when comparing the output of these two settings with that for 2019/20, a different dynamic is detected. The volume of activity of Diagnostic Tests almost reached pre-pandemic levels, having recorded a mere -1.97% growth in raw volumes. However, the Laspeyres growth was lower at -6.77%, due to lower volumes of more expensive activity types in 2021/22 compared to 2019/20. The negative growth becomes even bigger, at -9.81%, when correcting for the number of Trusts. For the radiology setting, post-pandemic recovery is still lagging behind, with a raw volume growth of -13.05% and a Laspeyres growth rate of -14.34%, when correcting for the number of providers.

Rehabilitation and Renal Dialysis

Renal Dialysis continues to be a setting least affected by the general trends, as is to be expected given that it is care that is life-saving. Continuing the previous trend, it recorded a positive 2.67% Laspeyres volume growth rate adjusted for the number of Trusts between 2020/21 and 2021/22. This growth is even higher, at 5.24% when compared to 2019/20. Rehabilitation services exhibit a different dynamic, but in a negative way. Instead of a post-pandemic recovery, we observe a negative adjusted Laspeyres volume growth rate of -22.37% when comparing 2021/22 with 2020/21. When comparing rehabilitation services delivered in 2021/22 to the pre-pandemic year, 2019/20, we get an even more substantial negative growth of -41.83%. We suspect that this rapidly falling trend may be due to some of the rehabilitation services being delivered, and therefore recorded, in other settings, and it is not an indication of lower rehabilitation care being provided by the NHS.

Specialist services

The setting Specialist services, as defined in this report, comprises the following services: Critical care,[43] Specialist palliative care, and Cancer Multi-Disciplinary Team Meetings. Up to 2018/19, cystic fibrosis services were reported in the NCC data as a separate activity and included in the Specialist services setting. In the 2019/20 NCC schedule, this activity was recorded under different NHS settings and the volumes were no longer comparable. In the 2020/21 NCC dataset cystic fibrosis activity was reported again in a new format, in a separate schedule, while in the 2021/22 collection it is reported in the supplementary materials, rather than in the core schedule, indicating potential data issues. We therefore decided to exclude this sub-setting from the calculations of the Laspeyres output growth rate for the Specialist services setting.

Critical care services, the largest contributor to the setting, decreased during the pandemic, however not as substantially as for many other service types, since taking care of hospitalised COVID-19 patients was within the remit of these services. In 2021/22, critical care activity increased by 7.39% if the Laspeyres volume growth rate, adjusted for the number of Trusts, is considered. Within critical care services, growth in adult critical care activity almost increased, the volumes of activity in 2021/22 are still lower than in 2019/20 by about 10% and 6% respectively. The Laspeyres volume growth rate for critical care services, adjusted for the number of Trusts, was negative at -4.25% between 2019/20 and 2021/22.

Specialist palliative care recorded a positive growth post-pandemic, with a 13.54% Laspeyres growth rate, when corrected for the number of Trusts. However, in comparison with 2019/20, the growth was still negative, both in terms of raw volume, -4.26%, and in terms of the adjusted Laspeyres volume growth measure, -8.41%. This suggests that a larger negative growth was observed in more expensive types of care.

An exception in the Specialist services setting were Cancer Multi-Disciplinary Team Meetings, which not only increased substantially between 2020/21 and 2021/22, but also exceeded the

[43] Up to 2017/18, CHE NHS productivity updates referred to Critical Care under the 'Adult critical care' label.

pre-pandemic activity levels, having recorded a 5.71% adjusted Laspeyres volume growth rate between 2019/20 and 2021/22.

Other NHS activity

Between 2020/21 and 2021/22, all three service groups included in the 'Other NHS activity' settings increased considerably both in terms of the raw volume and the Laspeyres growth rates, an indication of a good recovery compared the pandemic. However, when comparing activity with pre-pandemic levels, 2019/20, we find that activity was still quite below pre-pandemic levels, resulting in large negative volume growth rates. Day care facilities activity had a 58.22% Laspeyres volume growth rate, when adjusted for the number of providers, between 2020/21 and 2021/22, but the growth rate between 2019/20 and 2021/22 was -29.52% for the same measure.

As regardsRegular Day and Night Attenders, we found that he Laspeyres cost-weighted growth rate, adjusted for the number of Trusts, increased by 12.37% between 2021/22 and 2020/21, showing a good recovery from the pandemic year. However, it has not reached pre-pandemic levels, with a negative growth of -20.26% between 2019/20 and 2021/22.

Finally, Audiological Services recorded a 26.55% Laspeyres growth rate between 2020/21 and 2021/22, albeit still a negative growth rate of -18.22% when compared to 2019/20.

6.5. Dentistry and ophthalmology

- **Between 2020/21 and 2021/22, the cost-weighted and working days adjusted Laspeyres output growth measure for**
  - **Ophthalmology was 38.26%;**
  - **Dentistry was 140.71%.**
- **Combining the two activities yielded growth of 112.92%.[44]**

Information about dentistry[45] (activity and costs) is published by NHS Digital (now NHS England). Up to 2019/20, Ophthalmology[46] (activity only) data were published by NHS Digital, but this series has been discontinued. Since 2020/21, the figures have been provided to us directly by NHS England. Table 23 shows the volume of activity and average costs for both types of outputs, with dental activity differentiated into dental bands for the last three financial years. Unit cost data for Ophthalmological services were provided by the Association of Optometrists up until 2019/20, and since 2020/21 have been taken from the NHS Business Services Authority website.[47]

[44] Between 2019/20 and 2021/22, the cost-weighted and working days adjusted Laspeyres output growth for Ophthalmology was -4.38%, for Dentistry was -27.70%, and for the two activities combined was -23.81%.
[45] NHS Dental Statistics (last accessed 01/02/2024).
[46] Ophthalmic services activity (last accessed 01/02/2024).
[47] NHS Business Authority Cost of NHS Treatment (last accessed 01/02/2024).

Table 23: Ophthalmology and Dentistry

Output		2019/20		2020/21		2021/22	
		Volume of activity	Average cost (£)	Volume of activity	Average cost (£)	Volume of activity	Average cost (£)
Ophthalmology		13,355,060	21	9,199,829	22	12,719,843	22
Dentistry	**Band 1**	23,009,601	23	4,890,432	24	13,774,346	24
	Band 2	9,777,565	62	2,953,317	65	7,328,280	65
	Band 3	1,833,103	269	497,917	283	1,391,912	283
	Urgent	3,637,713	23	3,580,057	24	3,782,854	24
	Other	123,192	23	62,929	24	85,368	24
	Total	**38,381,173**	**45**	**11,984,652**	**45**	**26,362,760**	**49**

The raw volume of ophthalmic services increased in 2021/22 by 38.26%, with average costs remaining unchanged. This substantial growth was not sufficient to reach the pre-pandemic activity levels: activity volumes in 2021/22 were 4.76% lower than in 2019/20.

Dental activity recorded a substantial raw volume growth of 119.97% in 2021/22, with the largest increases observed for Bands 1 and 3 (respectively, 181.66% and 179.55%). While these increases appear very large, they are due to exceptionally low numbers observed in the previous year, which was heavily affected by the pandemic. When comparing activity volumes with 2019/20, it is clear that dental activity is still far behind, with total volumes in 2021/22 being 31.31% lower than in 2019/20. The growth rate for dental services has been negative for a while, and the pandemic has exacerbated systemic issues, with significant number of NHS dentists having moved away from providing NHS treatments,[48] and this trend is likely to continue as in addition to those leaving, a large proportion of NHS dentists might further reduce their commitment with the NHS.[49]

Average costs of each type of dental activity remained unchanged, but due to a huge increase in the most costly treatment type (Band 3) and lower than in 2020/21 and 2019/20 proportion of Band 1 treatments, the average unit cost of dental services increased to £49.

Combining activity for dental services and ophthalmology, the cost-weighted and working days adjusted Laspeyres output growth measure was 112.92% between 2020/21 and 2021/22. The analogous measure between 2019/20 and 2021/22 was -24.37%.

6.6. Primary care activity

- **The Laspeyres cost-weighted, quality and working days output growth measure for primary care activity was 19.89% between 2020/21 and 2021/22.[50]**

Since 2018/19, NHS England (formerly NHS Digital) has been releasing the General Practice (GP) appointments dataset, which is used to calculate the output growth of primary care

[48] Campbell D. 'Dental deserts' form in England as dentists quit NHS, experts warn: The Guardian; 2022 (last accessed 01/02/2024).
[49] According to a survey run by the British Dental Association (last accessed 01/02/2024).
[50] Between 2019/20 and 2021/22, the cost-weighted, quality and working days adjusted Laspeyres output growth of primary care activity was 16.89%.

activity (Arabadzhyan et al., 2021).[51,52] NHS England releases three separate datasets: (1) a monthly summary of GP appointments data at the national level, (2) a monthly dataset at the CCG level with NHS geographies up to regional local office included, and (3) a CCG-level dataset reporting daily appointment counts in general practices. The monthly and daily appointment datasets at CCG level allow for the grouping of GP appointment modes by appointment status and waiting time.

Each monthly data release covers the most recent 30 months, with updated information on the current month and the previous 17 months (18 months in total). The data include activity recorded within the appointment systems for the great majority of General Practices across England, with average patient coverage of about 99.7% during 2021/22.[53] For the purpose of our NHS productivity calculations, we use the monthly CCG-level dataset to obtain monthly appointment data, with a breakdown by appointment status and waiting time within each appointment mode. We use the national-level dataset for the monthly estimates of patient coverage. Since December 2020, the data on COVID-19 vaccinations carried out by GP practices and Primary Care Networks has also been recorded and are included in our analysis.[54]

In this report, we follow the methodology outlined in the previous productivity update (Arabadzhyan et al., 2023). In addition to our analysis of activity and its growth between the latest two financial years, i.e. 2020/21 and 2021/22, we also provide an overview of how GP appointments compare with pre-pandemic volumes and growth rates, i.e. 2019/20. Note that COVID-19 vaccinations are not adjusted for waiting times since we do not have information on how long patients had to wait for their vaccination appointments.

In the remainder of this section, we outline the impact of the COVID-19 pandemic on the delivery of primary care services and the quality of the data recorded; provide information on assigning the unit costs to different appointment modes; report the cost-weighted, quality- and working days adjusted output growth rates of the primary care setting for 2020/21-2021/22 and 2019/20-2021/22 links. Finally, we perform a sensitivity analysis using unit cost weights specific for different GP appointment modes, as per methodology followed in the previous NHS productivity growth update (Arabadzhyan et al., 2023).

6.6.1. GP services and the COVID-19 pandemic and beyond

The COVID-19 pandemic has provoked a structural shift in both patients' healthcare seeking behaviours (the demand side) and the way care has been provided (the supply side). While patients were avoiding using primary care services either out of fear of contracting the virus or putting pressure on the NHS,[55] GP practices were faced with the task of reorganising service provision to contain the spread of SARS-COV-2. Guidelines issued by NHS England and NHS

[51] Up to 2017/18, the output growth measure of the primary care setting was calculated using GP Patient Survey data (Castelli et al., 2020, Castelli et al., 2019).
[52] NHS Digital GP appointments data (last accessed 07/05/2023). For the analysis presented in this section, we used the January 2023 publication.
[53] Calculated based on the January 2023 Appointments in General Practice publication.
[54] These data are published separately from the main GP appointments data, in the National Immunisation Management Service (NIMS) dataset. NIMS is the System of Record for the NHS COVID-19 vaccination programme in England.
[55] Fear of contacting GPs during Covid outbreak 'fuelling missed diagnoses' – The Guardian (last accessed 08/05/2023).

Improvement led to the adoption of a total triage system by GP practices across the country, with only a few patients asked to attend a GP practice in person to see a GP, nurse or other healthcare professional. This implied that starting from March 2020, GP practices increasingly changed the way they would see patients. A higher proportion of appointments were offered as either a telephone or video/online consultation. Importantly, the changes introduced were accompanied by the reassurance that GP practices would continue to receive the same income as they would have in the business-as-usual scenario.

As England started moving out of the pandemic, and a substantial fraction of the population was immunised, GP practices were advised to adapt their mode of operation accordingly, in particular by ensuring that face-to-face appointments were offered to patients, and that patients' preferences for face-to-face consultations were respected.[56] Activity restoration measures also included additional funding to increase practice capacity.[57]

The pandemic has also affected the GP appointments data collection and its quality. As noted in the GP appointments data publication,[58] the differences in appointment management systems among practices were exacerbated during the pandemic, negatively affecting the quality of the data recorded. As many appointments are pre-booked, a fraction of face-to-face appointments booked before lockdown restrictions were introduced may have been delivered via either a telephone call or video/online tool. This may be due to a number of reasons: patients presenting with COVID-19 symptoms; patients or healthcare professionals seeking to limit any unnecessary face-to-face contacts. Consequently, the number of face-to-face consultations recorded in the NHS Digital GP appointments dataset is likely to be an overestimate. By contrast, telephone appointment numbers might be underestimated to a larger extent than before the pandemic. Underestimates of phone consultations arise partly from block appointment bookings[59] (when several patients are contacted, while only one notional appointment is recorded). This practice may have increased and so exacerbated the issue of undercounting during the pandemic.

These considerations must be taken into account when making inference about the growth rates of primary care activity.

6.6.2. Assigning unit costs to primary care consultations

Unit costs for primary care consultations are taken from the PSSRU 'Unit Costs of Health and Social Care' reports (Curtis and Burns, 2020, Jones and Burns, 2021, Jones et al., 2022).[60] In order to calculate the primary care cost-weighted output growth measures, we need to use appropriate unit costs for the different types of primary care activity. As it is not possible to fully distinguish between types of healthcare professionals delivering primary care services, we use the cost of patient contact per minute of GP's time as our primary unit. [61,62] The per-

[56] See updated guidance for practices from 13/05/2021 (last accessed 08/05/2023).
[57] See GP access improvement plan from 14/10/2021 (last accessed 08/05/2023).
[58] Appointments in general practice: supporting information - NHS Digital (last accessed 08/05/2023).
[59] Ibid.
[60] The unit costs are taken from the PSSRU "Unit Costs of Health and Social Care" 2020 (p. 126), 2021 (p. 111) and 2022 (p. 66) (last accessed 08/05/2023).
[61] GP appointment data distinguish only between GPs, nurses and 'other' healthcare professionals.
[62] A fuller explanation for this decision can be found in Arabadzhyan et al. (2021).

minute cost of GP contact reported for 2019/20 and 2020/21 was equal to £4.30, while for 2021/22 it rose to £4.51. This increase does not impact the current update, as we calculate a Laspeyres volume growth index, which uses cost weights of the base year, in our case 2020/21.

Finally, in order to calculate the unit costs for different types of appointments, we need to know the average duration of each consultation type. It should be noted that changes in the way primary care services were delivered during the pandemic could have affected the total duration of a consultation. The GP appointments data collection started recording consultation duration from December 2021. However, these data are not available by mode of appointment. Also, data quality remains a concern, with about a quarter of observations having unknown consultation duration. In the absence of more recent empirical evidence, we are using the baseline estimates of consultation duration for each consultation type reported in the 2018/19 NHS productivity update (Arabadzhyan et al., 2021) and the cost per-minute of GP time, to obtain the unit costs for each appointment mode reported in Table 24.

However, the COVID-19 pandemic had profound impacts on the way primary care services were delivered, with some of the changes in work practices becoming the "new normal". Therefore, we treat face-to-face, telephone and other remote appointments as being of the same value, assigning the unit cost of a GP face-to-face appointment also to the other two types of GP appointments (see Arabadzhyan et al. (2023) for a detailed analysis of the pandemic-driven changes to both demand for and supply of primary care activity).

In Table 24, we report the total volume of GP appointments by mode of appointment for the years 2019/20, 2020/21 and 2021/22, and their respective unit costs, with the same unit costs for face-to-face, telephone and video/online consultations.

Table 24: Volume of GP activity and unit costs (£)

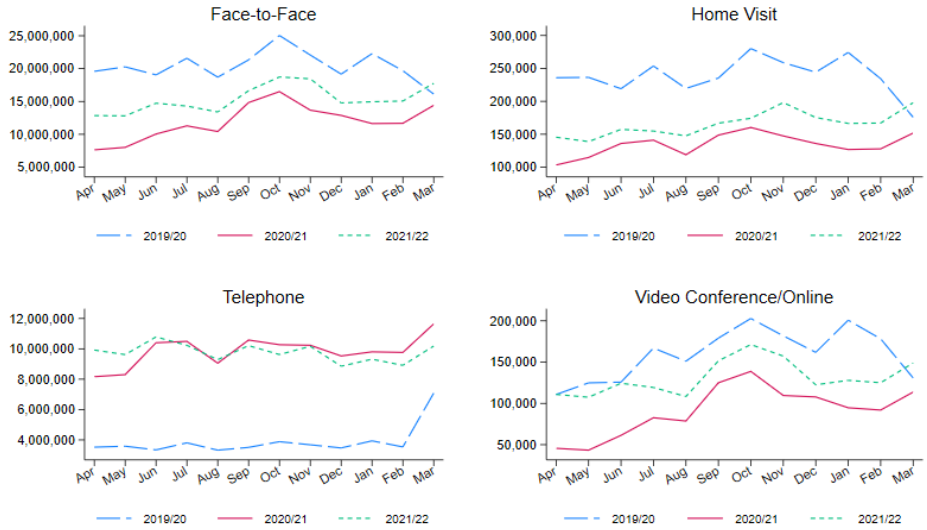
Appointment mode	2019/20	2020/21	2021/22	2019/20 & 2020/21	2021/22
	Volume of activity	Volume of activity	Volume of activity	Average cost (£)	Average cost (£)
Face-to-Face	244,918,881	143,040,299	184,508,264	39.65	41.58
Home Visit	2,868,106	1,612,794	1,990,396	121.68	126.59
Telephone	46 678,238	118,225,447	117,123,929	39.65	41.58
Video/Online	1,914,916	1,092,986	1,574,982	39.65	41.58
COVID-19 vaccinations	-	19,846,183	41,375,339	39.65	41.58
Total GP appointments	**296,380,141**	**283,817,710**	**283,817,710**	-	-

Overall, between 2020/21 and 2021/22 primary care output increased by 22.11%, when considering its raw volume growth. Even in comparison with the pre-pandemic 2019/20, the number of consultations was 16.94% higher. This increase was driven by telephone appointments, which rose by more than 2.5 times between 2019/20 and 2020/21 and remained on a similar level in 2021/22. Face-to-face consultations (including vaccinations),

home visits and video/online appointments also increased in 2021/22, but did not reach the pre-pandemic levels recorded in 2019/20.

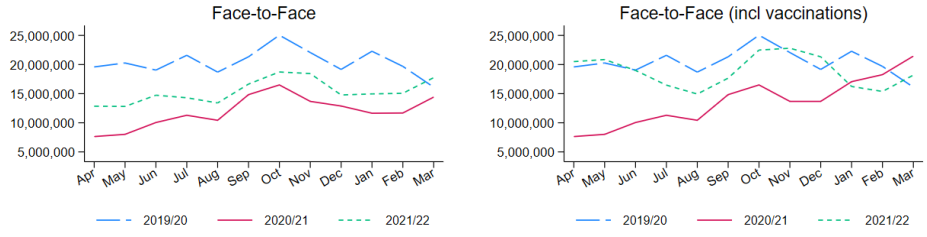
Further, we analyse the dynamics of appointment counts on a more disaggregated (monthly) level, to understand how the composition of attended appointments changed over time. Figure 12 shows that the substantial increase in the number of telephone appointments, already observed in March 2020, was present throughout 2020/21 and persisted in 2021/22. For other appointment modes, a similar picture appears: while seasonal variation is very similar across years, the number of GP appointments in 2021/22 did not reach the same volume observed in 2019/20 (with the exception of the already noted telephone appointments). In particular, the volume of home visit in 2021/22 is much more similar to 2020/21 levels than to the 2019/20 ones.

Figure 12: Monthly trends of appointment counts by mode of appointment (2019/20, 2020/21, 2021/22)



Yearly seasonality patterns were similar across years, with more variation between March (at the onset of the pandemic) and August. Figure 13 provides a comparison of monthly trends in face-to-face appointments without (left panel) and with (right panel) vaccination appointments included.

Figure 13: Face-to-face appointment counts with and without vaccinations (2019/20, 2020/21, 2021/22)



We note that vaccination appointments contributed considerably to the total volume of face-to-face activity, which now exhibits a rising trend from December 2020 to May 2021. The 2021/22 appointment counts are much closer to the 2019/20 levels when vaccinations are accounted for.

6.6.3. Quality adjustments

We normally include two quality adjustments for primary care activity: (1) improvement in disease management (blood pressure management) for three conditions: coronary heart disease, history of transient ischaemic attack or stroke, and hypertension;[63] (2) waiting times.

However, in 2019/20, the data to measure improvement in disease management, which are taken from the Quality and Outcomes framework (QOF) indicators set, were not comparable with previous years because of a change in the definition of these indicators.[64] In 2021, to alleviate primary care workload, the majority of QOF indicators were income protected, which meant that practices received funding independently from their performance.[65] NHS Digital therefore omitted the achievement data from the official publication, as comparison across years would have been misleading.[66] In 2021/22, achievement indicators were reintroduced in the official publication, but we are not yet able to incorporate QOF quality adjustment into the current update due to lack of data for 2020/21.

We do, however, include a waiting time adjustment, which is presented in further detail in the next section, as part of the baseline primary care Laspeyres growth estimate.

6.6.4. Waiting times quality adjustment

Information on the time between the date an appointment is booked and the date of the actual appointment, (waiting time (WT)), are collected. In particular, the GP appointment dataset includes information on the number of appointments by time intervals, e.g. same day, 1 day, 2 to 7 days, etc, for each appointment mode.[67]

Similarly to hospital inpatient and outpatient activity, we use the 80th percentile waiting time as our quality indicator. Further, we assume a uniform distribution of appointments within each of the above waiting time intervals and apply the formula below to determine the 80th percentile waiting time for each appointment mode:

$$Wait_{80} = L_{80} + h_{80}\frac{80\% - Cumul_{80-1}}{freq_{80}} \quad \text{(E9)}$$

where L_{80} is the lower bound of the 80th percentile interval, h_{80} is the length of the 80th percentile interval, $Cumul_{80-1}$ is the cumulative relative frequency of the interval preceding the 80th percentile interval, and $freq_{80}$ is the relative frequency of the 80th percentile interval.

The waiting time quality adjustment is then calculated in the same way as for the outpatient appointments:

[63] See Arabadzhyan et al. (2023) for further details on this quality adjustment.
[64] For further details on these changes, see the 2019/20 National Health Service productivity update (Arabadzhyan et al., 2022).
[65] COVID-19: toolkit for GPs and GP practices - BMA (last accessed 08/05/2023).
[66] Further details on Quality and Outcomes indicators, 2021, are available on the NHS Digital website (last accessed 08/05/2023).
[67] The full list of time intervals is as follows: same day, 1 day, 2 to 7 days, 8 to 14 days, 15 to 21 days, 22 to 28 days, more than 28 days, unknown (NHS Digital GP appointment data, last accessed 08/05/2023).

$$X_{(0,t)}^{cq\_PC} = \frac{\sum_j x_{jt} c_{j0} \frac{e^{-r_w W_{jt}}}{e^{-r_w W_{j0}}}}{\sum_j x_{j0} c_{j0}} \quad \text{(E10)}$$

where x_{jt} is the number of consultations of type *j*, c_{j0} is the unit cost of appointment type *j*, r_w is the discount factor equal to 0.015, W_{j0} and W_{jt} are the 80th percentile waiting times for appointment mode *j* in years *0* and *t* respectively.

Table 25 presents the 80th percentile waiting times for each appointment mode for the financial years 2019/20, 2020/21 and 2021/22. It is worth noting that the waiting times distribution is positively skewed: in 2021/22, about 46% of face-to-face appointments;[68] 72% of home visits; 68% of telephone consultations; and 50% of video/online appointments took place within 1 day from the booking date.

Compared to the previous financial year, the waiting times for face-to-face and video/online appointments increased, which is consistent with the trends observed in the total number of GP consultations for both face-to-face and video/online appointments (both types of consultations increased in 2021/22). The 80th percentile waiting time for telephone consultations increased substantially in 2021/22, although the volumes of telephone appointments were similar to those recorded in 2020/21. Finally, the waiting time for home visits decreased slightly in 2021/22 compared to the previous financial year.

We also note that the 2021/22 waiting times for all types of GP consultations are quite different from the ones recorded in 2019/20: face-to-face and video/online consultations waiting times are lower (consistent with lower volumes delivered), while home visits and telephone waiting times are higher. These changes might be due to a variety of reasons. An increase in telephone appointment waiting times could have been driven by both a change in the case-mix of patients presenting to GP practices, with less urgent patients who do not need immediate assistance starting to seek care again, and a change in workforce capacity. For example, an increase in the 80th percentile waiting time for telephone appointments might be due to the fact that staff working in GP practices are seeing a higher number of patients as face-to-face, limiting their ability to engage in telephone consultations. Finally, as regards home visits, the lifting of lockdown restrictions and the easing of safety protocols, as well as the need to provide vaccinations may have resulted in a timelier response to patients' home visits' requests.

Table 25: Waiting times (days) for GP appointments, 2019/20 – 2021/22

Appointment mode	80th percentile waiting time (days)		
	2019/20	2020/21	2021/22
Face-to-Face	14.00	10.95	12.05
Home Visit	1	4.46	4.31
Telephone	3.36	3.74	5.71
Video/Online	17.61	10.57	11.08

[68] Note that vaccinations appointments do not have information on waiting times, so they do not contribute to the calculation of the 80th percentile waits for the face-to-face appointments.

Finally, we also analyse the monthly dynamics of the 80th percentile waiting times by mode of appointment. Figure 14 shows that the 80th percentile waiting time for face-to-face and telephone appointments in 2021/22 showed a similar seasonality pattern to 2020/21, whereas for home visits and online appointments it appears to be more similar to 2019/20. Overall, in 2021/22 the 80th percentile waiting times for different appointment modes were fairly stable during the financial year, with the exception of video/online appointments, whose waiting times peaked in October 2021, similarly to what was observed in October 2020.

Figure 14: Monthly trends of 80th percentile waiting times by mode of appointment (2019/20, 2020/21, 2021/22)

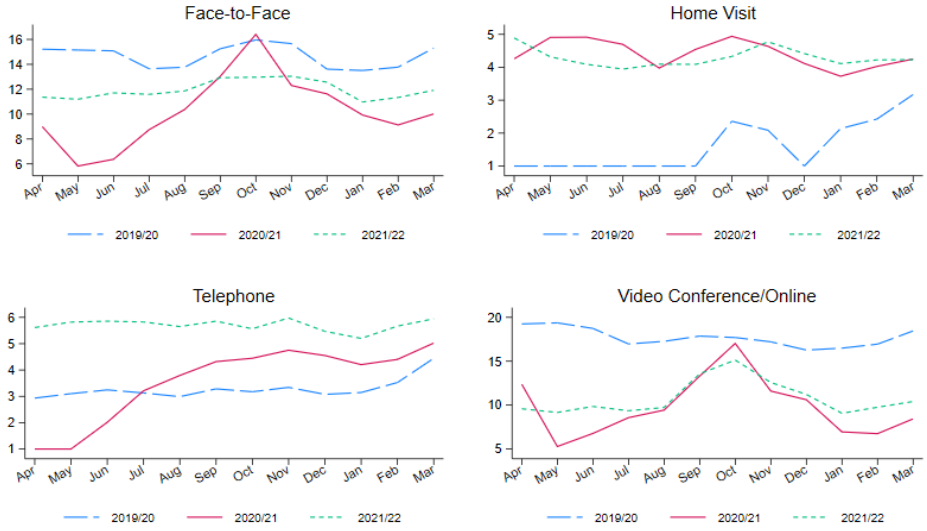


Table 26 reports the cost-weighted Laspeyres output growth rates for the primary care setting when adjusting for waiting time alone and correcting for the total number of working days (WD) for the last three financial years. We also report growth rates in primary care comparing volumes of activity in 2021/22 with pre-pandemic volumes in primary care activity in 2019/20. Focusing first on growth between 2020/21 and 2021/22, we find that the total number of appointments delivered increased substantially, with a 22.13% increase in the cost weighted Laspeyres growth rate. Adjusting for waiting times decreases the cost weighted Laspeyres growth rate to 19.89%. This is due to the increase in the volume of appointments partially off-set by an overall rise in waiting times. Comparing 2021/22 with 2019/20 yields a lower growth rate, which is, however, still substantial. The cost-weighted growth measure is 16%, whilst adjusting for waiting times increases it to 16.43%. Although telephone appointments, the main driver of the high growth rate, were affected by an increase in waiting times when compared to 2019/20, the waiting times improvement for face-to-face and video/online consultations more than compensated for it. Thus resulting in a higher overall growth rate. Correcting for the total number of working days[69] further increases the growth rate, yielding a 16.89% Laspeyres growth between 2019/20 and 2021/22.

[69] The number of working days in 2019/20 was 254 compared to 253 in 2020/21 and 2021/22. Working-days adjustment therefore does not change the 2020/21-2021/22 growth.

Table 26: Primary care output growth measures: comparisons

Primary Care Output growth rates	2019/20-2020/21	2020/21-2021/22	2019/20-2021/22
Raw consultations	-4.24%	22.11%	16.94%
Laspeyres Cost-weighted (CW)	-5.02%	22.13%	16.00%
Laspeyres CW and WT-adjusted	-3.06%	19.89%	16.43%
Laspeyres CW, WT and WD-adjusted	-2.68%	19.89%	16.89%

6.6.5. Sensitivity analysis

In this sub-section we perform a sensitivity analysis, assuming different unit costs for different types of primary care appointments, as in Arabadzhyan et al. (2022). This yields unit costs of £21.5 for telephone and video/online consultations, £39.65 for face-to-face appointments and £121.68 for home visits. Columns 'Sensitivity 1' and 'Sensitivity 2' of Table 27 report the results of this analysis for the 2020/21-2021/22 and 2019/20-2021/22 links, respectively.

Table 27: Primary care output growth measures: sensitivity to the choice of unit costs

Primary Care Output growth rates	2020/21-2021/22	Sensitivity 1	2019/20-2021/22	Sensitivity 2
Raw consultations	22.11%		16.94%	
Laspeyres Cost-weighted (CW)	22.13%	27.44%	16.00%	5.82%
Laspeyres CW and WT-adjusted	19.89%	25.35%	16.43%	6.92%
Laspeyres CW, WT and WD-adjusted	19.89%	25.35%	16.89%	7.34%

We find that assigning lower unit costs to telephone and video/online consultations yields an even higher growth rate of the primary care output between 2020/21 and 2021/22, due to a substantial increase in face-to-face appointments, which are now assigned relatively larger weights as compared to telephone appointments. The cost-weighted growth rises to 27.44%; about 5 percentage points higher than our baseline estimate. Adjusting for waiting times reduces the growth rate slightly, but the difference with our baseline estimate remains of the same magnitude. In contrast, when using 2019/20 as the baseline year, assigning lower unit costs to remote appointments yields a substantially lower growth rate. The cost-weighted Laspeyres measure is about 10 percentage points lower and equals 5.82%. Waiting times and working days adjustment brings it up to 7.34%. This difference in growth rates is again due to a relatively higher cost weight assigned to both face-to-face consultations and home visits, which were fewer in 2021/22 compared to 2019/20, while telephone appointments – the main driver of growth – were assigned a relatively lower weight.

6.7. Community prescribing

- **The Laspeyres cost-weighted and total days adjusted output growth measure for Community Prescribing was 4.66% between 2020/21 and 2021/22.**

In 2020, the NHS Business Services Authority (BSA) took over from NHS Digital in publishing Community Prescribing data as part of the Prescription Cost Analysis (PCA) publication. Information about the number and cost of prescriptions at drug level are published on a monthly basis. The data includes 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.

6.7.1. Methods

The community prescribing dataset includes information on total expenditure and total volume for each drug prescribed (PropGenLinkCode). We calculated drug unit costs as the ratio of expenditure and volume. A drug can retain the same PropGenLinkCode over time but be reported in different units. This change can occur in the middle of a financial year (most often from January). This sort of change impacts the calculated unit cost and critically prevents a like-for-like comparison. It is also possible for data entry error to lead to an artificial large change in volume or expenditure over time which might impact on overall results. To minimise both possibilities in a transparent and automated way, we employed two outlier detection methods.[70] In this way we excluded outliers which are unlikely to be comparable with similar data either within or between years, while retaining as much information as possible.

Table 28 presents information about the number of drug-months and drugs dropped as a result of respectively the within year and between year outlier methods. Each pair of years was considered in turn. Drug-months and drugs were dropped for both years for a given comparison, even if an outlier was only identified in one of those two years. The table indicates 47 drug-months were dropped when comparing 2020/21 with 2021/22, a substantial reduction compared to the 332 cases flagged up as outliers when comparing 2019/20 with 2020/21. Similarly, 26 drugs were dropped compared to 130. The drugs dropped due to being outliers between years is the more critical element, as all months were dropped in these cases. Therefore, 130 drugs is equivalent to 1,560 (130x12) drug-months.

Table 28: Observations dropped as outliers for Community Prescribing

Years	Observations	
	Drug-months dropped (Within year outlier)	Drugs dropped (Between year outlier)
2019/20 – 2020/21	332	130
2020/21 – 2021/22	47	26

6.7.2. Activity and growth rates

Table 29 reports summary statistics for community prescribing. In 2021/22, 7,175 distinct drugs were observed. This increase, compared to 2020/21, primarily reflects the smaller number of drugs dropped in comparing 2020/21 with 2021/22, as shown in Table 28. The total number of prescriptions made out increased by 39 million (3.0%), overhauling the drop observed between 2019/20 and 2020/21. The total number of items and expenditure on community prescribing also both increased, by 3.7% and 3.0% respectively, continuing generally upward trends. The larger proportional increase in items prescribed is also reflected in the fall in the unit cost of items from 11p to 10p.

[70] Details on the two outlier detection methods can be found in Arabadzhyan et al. (2023).

The total number of prescriptions and expenditure in 2021/22 was similar but lower than equivalent information reported by the NHS Business Service Authority.[71] This aligns with excluding some drugs and drug-months to ensure a like-for-like comparison in calculating change over time.

Table 29: Community Prescribing, summary data 2019/20 – 2021/22

Year	Unique drug codes observed	Total Prescriptions	Total items prescribed	Total Spend	Activity weighted prescription unit cost (£)	Activity weighted prescribed item unit cost (£)
2019/20	7,589	1,129,503,664	88,499,683,355	£9,215,999,566	8.05	0.10
2020/21	7,137	1,106,274,762	89,217,616,708	£9,403,485,867	8.50	0.11
2021/22	7,175	1,139,254,272	92,514,172,928	£9,687,036,928	8.50	0.10

In 2021/22, 499 new drugs were observed, amounting to a total expenditure of £9.2 million in 2020/21 prices. 566 drugs prescribed in 2020/21 were not observed in 2021/22, representing £10.7 million of expenditure in 2021/22 prices. No data items appear incorrect, we therefore took the data at face value.

Volume and price indices for community prescribing are reported in Table 30. Between 2020/21 and 2021/22, the Paasche Price ratio indicates a reduction in price by 3.9%. This restores a consistently downward trend observed from 2004/05.[72] The Laspeyres volume index was positive between 2020/21 and 2021/22, at 4.66%.[73]

Table 30: Community Prescribing: price and volume indices 2019/20 – 2021/2022

Years	Paasche Price Ratio	Laspeyres Volume Ratio
2019/20 – 2020/21	1.0106	1.0300
2020/21 – 2021/22	0.9610	1.0466

From the base year of 2004/05, trends in the volume and prices of items prescribed are shown in Figure 15. This figure highlights that the increase in volume observed continued an upward trend of the most recent years, with volume in 2021/22 exceeding the previous peak of 2016/17. The observed fall in average price continued the generally downward trend of prices since 2004/05, though prices in recent years have been more flat or slightly increasing.

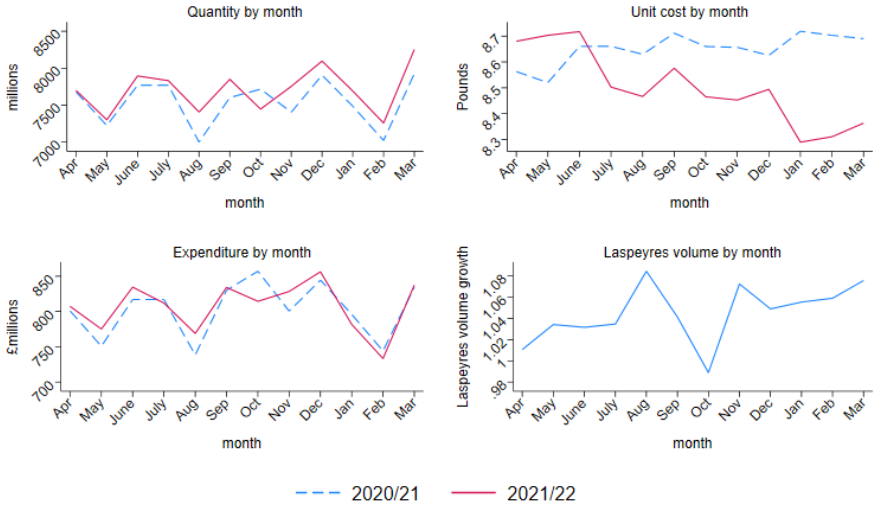
[71] NHS Business Services Authority publication (last accessed 16/06/2023).
[72] See Table A25 in the Online Appendix in Arabadzhyan et al. (2023) for earlier equivalent figures, beginning from 2004/05.
[73] Total day adjustment does not impact on growth rates between 2020/21 and 2021/22, due to there being the same number of days in both years.

Figure 15: Price and volume changes for community prescribed pharmaceuticals

6.7.3. Month by month comparisons

Figure 16 presents month by month comparisons of volume, expenditure, mean unit costs, and the Laspeyres volume index. Volume and expenditure followed similar paths over the last two financial years. The volume figure suggests a consistently higher volume throughout 2021/22 compared to 2020/21. Unit costs broadly declined over 2021/22, compared to a slight general increase in 2020/21. However, in both cases the degree of variation over time was modest. Laspeyres volume growth appears more volatile, with a peak of more than 8% in August compared to a slight fall in October. However, the overall range remained relatively narrow.

Figure 16: Activity, expenditure, unit cost and Laspeyres index by month for community prescribed pharmaceuticals 2020/21-2021/22



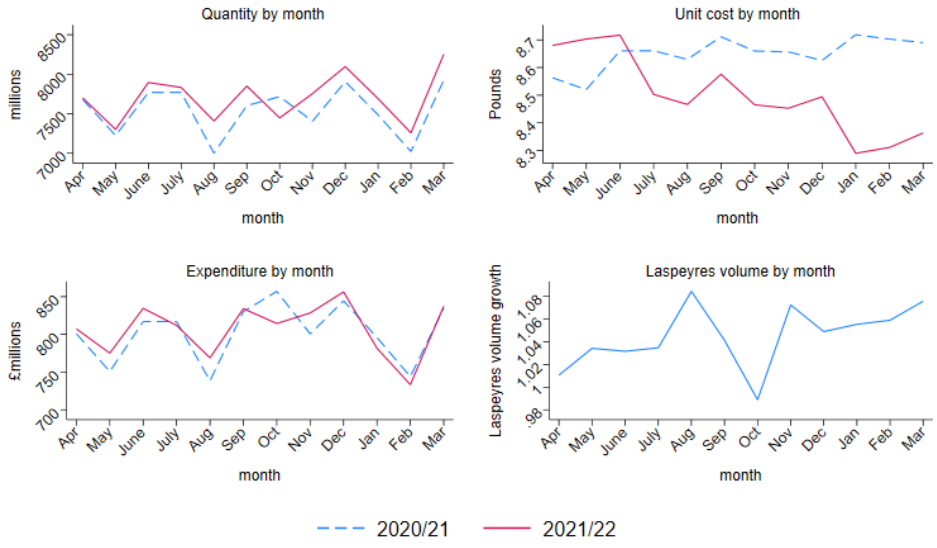
6.7.4. Comparison of 2019/20 with 2021/22

In the previous sections, we focused on changes between the years 2020/21 and 2021/22. A specific comparison of 2021/22 with 2019/20, the last year minimally impacted by the COVID-19 pandemic, is also valuable for understanding how NHS activity compared to a pre-pandemic period. The Laspeyres volume index comparing volumes in 2021/22 with volumes

in 2019/20 and using 2019/20 prices as weights, indicates a volume change of 6.59% before total day adjustment and 6.88% after total day adjustment. This is similar to the sum of Laspeyres growth between 2019/20-2020/21 and 2020/21-2021/22 shown in in Table 30.

Finally, Figure 17 presents month by month comparisons of 2019/20 and 2021/22 in terms of volume, expenditure, unit cost and Laspeyres index. Volume and expenditure in 2021/22 were generally higher than in equivalent months for 2019/20, but the pattern over time was less similar between these years as when comparing 2020/21 with 2021/22. Unit costs fell slightly over 2021/22, while they rose, especially in March 2020. The higher unit cost in March of 2020 is related to the early impacts of the COVID-19 pandemic. Laspeyres growth was generally higher but also more volatile when comparing 2021/22 with 2019/20 than when comparing 2021/22 with 2020/21, as shown in Figure 16. It is also noteworthy that the unit cost for the year 2021/22 given in Figure 16 are similar but do not exactly match those presented in Figure 17. This also holds, but is less visually striking, for volume and expenditure. This difference arises because drugs and drug-months which are outliers in either year considered are dropped from both years. When considering 2019/20 and 2021/22, 333 drug-months and 137 drugs were dropped due to being either within year or between year outliers respectively. This compares to 47 drug months and 26 drugs when comparing the years 2020/21 and 2021/22. Overall, these results indicate the impact of the COVID-19 pandemic and its aftermath on prescriptions has been more limited than in other care settings.

Figure 17: Activity, expenditure, unit cost and Laspeyres index by month for community prescribed pharmaceuticals 2019/20-2021/22



7. Growth in input categories

7.1. Direct labour growth measure

- **Between 2020/21 and 2021/22, the cost (salary)-weighted Laspeyres volume growth for NHS staff was 3.82%.**

The Electronic Staff Record (ESR) data, provided by NHS England, have been used to calculate direct labour growth since 2007/08.[74,75,76] 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. Due to precautions taken with the reporting of cells with small numbers, the aggregate figures we obtain will not match precisely with those published by NHS England using the same ESR data.[77,78]

National average staff earnings data cover the same staff groups and organisations as counts of staff at the occupation code or more disaggregated level, provided by NHS England. Basic pay is reported per head and per FTE, whilst non-basic pay is reported per head only. We construct total pay per FTE as the sum of basic pay per FTE and non-basic pay per head times the ratio 'basic pay per FTE/basic pay per head', as per recent reports (Arabadzhyan et al., 2021). This method of imputation relies on the assumption that for each occupation code, the ratio of 'basic pay per FTE/basic pay per head' is a good proxy for the ratio of 'non-basic pay per FTE/non-basic pay per head'.

From 2016, separate information has been provided for FTE count and earnings of staff working at 'core' and 'wider' services.[79] We take an FTE weighted average of wages of staff working in 'core' and 'wider' services, and apply this calculated wage to all staff within the occupation code. In this way, a value by type of work is identified, rather than one also influenced by the type of provider worked for. If wage information is missing for either 'core' or 'wider' service providers for a specific occupation code, we assume the observed wage also reflects the average for equivalent staff in the other organisation group.

For the year 2021/22, FTE and salary information was reported at a more disaggregated level than occupation code for a small number of occupation codes. For example, FTEs are reported for the same occupation code but a different care setting within the same provider. In order to retain comparability of input type, an FTE weighted average of salaries of staff within the same occupation code was calculated. If wage information is missing for some instances of an occupation code but not others, the FTE weighted mean of observed salaries was taken as the proxy of wages for all staff within that occupation code.

[74] Before 2007/08, the number of staff was extracted from the Workforce Census.
[75] More precisely, NHS England shares the ESR and NHS combined Payroll data with us, but these can be accessed from the NHS iView database (last accessed 28/02/2024), which is constructed from the ESR and NHS combined Payroll and Human Resources System.
[76] 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).
[77] If a provider-staff group cell contains fewer than 5 staff, the provider reports 0 or 5 at random.
[78] NHS workforce statistics (last accessed 28/02/2024).
[79] Core services are made up of hospital Trusts and commissioning bodies. Wider services are made up of central support services such as NHS England and NHS Improvement.

Productivity growth between 2020/21 and 2021/22 was calculated using the software STATA 18, instead of SAS 9.2. As part of this change, analyses were performed using the years 2020/21 and 2021/22 only. As a result, imputation of wages draws on information only from these two years, instead of all previous years, as was the case previously. This approach brings methodology in line with output care settings. Analysis for growth between 2019/20 and 2020/21 was also done as a replication exercise. Any cases where it was not possible to exactly duplicate results presented in Arabadzhyan et al. (2023) are noted within impacted tables.

Table 31 shows the number of organisations reporting FTE counts information by organisation type.[80] Due to mergers, both Clinical Commissioning Groups (CCGs) and Trusts' figures have broadly decreased over time. The number of Commissioning Support Units (CSUs) remains the same between 2020/21 and 2021/22. Table 31 also reports total expenditure on staff by organisation type. Expenditure is calculated as the summed products of FTE staff employed in each occupation code in the provider type and the national average total earnings for that occupation code. Differences in expenditure between 2020/21 and 2021/22 broadly reflect a continuation of existing trends.[81] The total expenditure for CCGs increased due to higher expenditure/CCG. Proportional increases in expenditure are larger but overall expenditure substantially smaller for categories with small numbers of organisations (NHS England, CSUs and non-geographic staff). The increase in expenditure among Trusts is smaller but still substantial from 2020/21 to 2021/22 (7.1%) than between 2019/20 and 2020/21 (8.4%). See Table A26 in the Online Appendix for historic trends in expenditure by provider type from 2010/11 to 2021/22.

Table 31: Number of reporting organisations and expenditure by type 2019/20 – 2021/22

Organisation type	2019/20		2020/21		2021/22	
	Orgs	Exp (£m)	Orgs	Exp (£m)	Exp (£m)	Exp (£m)
CCGs	191	949	121	969	94	1,018
CSUs	4	182	4	198	4	224
NHS England	1	321	1	362	1	451
Non-geographical staff	1	76	1	78	1	111
NHS Trusts	226	42,132	220	45,673*	215	48,899

* This number differs to the one previously reported, due to imputation of costs when missing being taken from only the years 2019/20 and 2020/21, as part of translation of analysis code to STATA 18. In Arabadzhyan et al. (2023), this figure was 45,786.

Table 32 reports the number of FTE staff employed by Trusts and other NHS organisations (hereafter non-Trusts) by broad categories for each year from 2019/20 to 2021/22.[82] These figures show that the majority of staff are employed by hospital Trusts and the largest employee group is that of 'Nursing, midwifery and health visiting staff and learners'. FTE staff in Trusts has grown in each of the last three years for all categories except for 'Unknown and

[80] For conciseness, this table includes only the main organisation types, which account for about 97% of FTEs and 98% of total expenditure. The main analysis includes all categories. A time series of equivalent information from 2010/11 is presented in Table A26 in the Online Appendix.

[81] A time series of equivalent information from 2010/11 onwards is presented in Table A27 in the Online Appendix.

[82] Table A28 in the Online Appendix provides a longer time series of staff employed within Trusts from 2007/08 to 2021/22.

Non-funded staff'. The FTEs in non-Trusts have also generally grown over time. The ratios of different staff categories have been stable over the past three years.

Table 32: Count of FTE staff employed by category

NHS Staff type	2019/20		2020/21		2021/22	
	Trust	Non-Trust	Trust	Non-Trust	Trust	Non-Trust
Medical staff	115,084	1,446	122,009	1,354	126,212	1,662
Ambulance staff	33,165	3	35,837	4	36,983	5
Administration and estates staff	236,469	42,652	246,786	44,283	257,331	48,870
Health care assistants and other support staff	142,077	433	148,158	431	150,882	444
Nursing, midwifery and health visiting staff and learners	374,532	4,430	394,876	4,673	403,301	4,937
Scientific, therapeutic and technical staff and health care scientists	190,177	5,083	201,425	5,170	212,477	5,536
Unknown and Non-funded staff	2,619	109	1,352	101	662	108
Total	**1,094,123**	**54,156**	**1,150,443**	**56,016**	**1,187,848**	**61,562**

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

Figure 18 and Figure 19 present growth in FTE by staff category among staff employed by Trusts and by other organisations respectively. These figures highlight some findings from the previous table. First, that all known staff categories employed by Trusts have increased between both 2019/20-2020/21 and 2020/21-2021/22. Unknown staff employed by Trusts fell substantially within both comparisons. This suggests a general improvement in the coding of staff. Among staff employed at non-Trust organisations, the falls observed between 2019/20 and 2020/21 in the Medical and Healthcare assistants is comfortably overturned by growth between 2020/21 and 2021/22.

Figure 18: Growth in Trust FTE staff by group 2019/20 to 2021/22

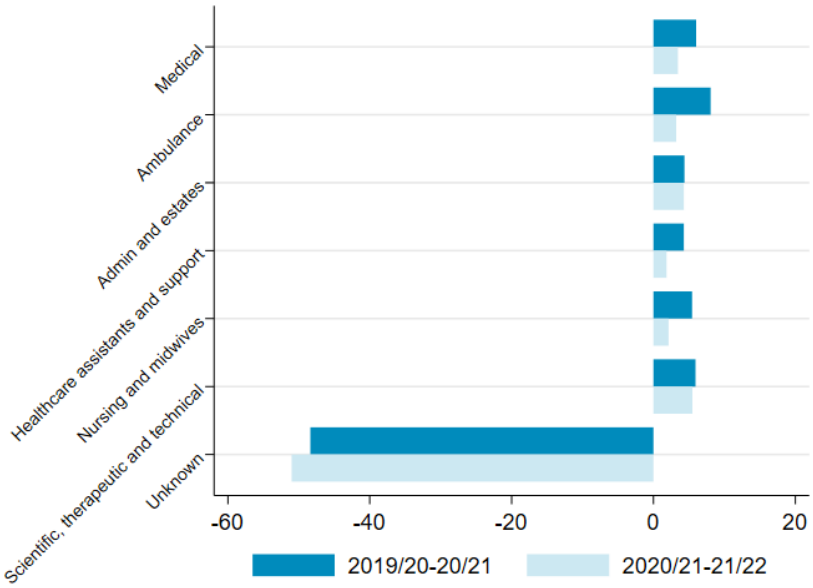


Figure 19: Growth in Non-Trust FTE staff 2019/20 to 2021/22

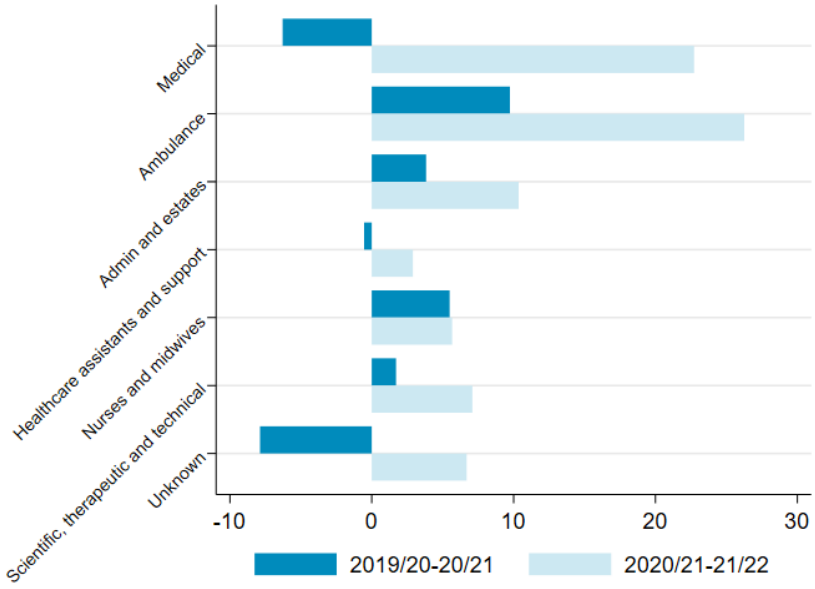


Table 33 presents nominal expenditure growth and Laspeyres volume growth in labour for the NHS overall and for Trusts alone from 2019/20 to 2021/22.[83] Laspeyres volume indices indicate growth of 3.82% overall and 3.47% for the group of Trusts between 2020/21 and 2021/22. These growth rates are smaller than those recorded between 2019/20 and 2020/21. Nominal expenditure growth is also smaller between 2020/21 and 2021/22 than between 2019/20 and 2020/21. For both nominal and Laspeyres growth, this difference is around one percentage point overall and 1.5 percentage points for Trusts. These results indicate the increased staffing levels observed during the COVID-19 pandemic have been retained.

Table 33 also presents equivalent information when comparing the year 2019/20 with 2021/22. This comparison provides information about staff employed in the most recent year, compared to just before the COVID-19 pandemic. The direct 2019/20 to 2021/22 comparison is broadly in line with the sum of growth of the other two comparisons noted. The difference between this sum and direct comparison is larger for nominal growth partly because the higher percentage increases in each year mean compounding of growth over time plays a larger role. Overall, the 2019/20-2021/22 comparison reinforces the finding that staff volumes increased during both the main pandemic year (2020/21) and in the next year, unlike most output categories.

[83] See Table A29 in the Online Appendix for the equivalent series from 2007/08 to 2021/22.

Table 33: Growth in direct labour 2019/20 – 2021/22

Years	Nominal expenditure growth		Laspeyres volume growth	
	All*	Trusts	All*	Trusts
2019/20 – 2020/21**	8.52%	8.60%	4.81%	4.95%
2020/21 – 2021/22	7.38%	7.06%	3.82%	3.47%
2019/20 – 2021/22	16.53%	16.28%	8.79%	8.57%

* All NHS organisations. ** Figures for 2019/20-2020/21 have been updated following the translation of analysis from SAS 9.2 to STATA 18. The changes primarily reflect the use of two years (2019/20 and 2020/21) to impute missing values of salary from any one year, instead of all previous years back to 2010/11. In Arabadzhyan et al. (2023), nominal expenditure growth between 2019/20 and 2020/21 was 8.59% overall and 8.68% for Trusts. Laspeyres volume growth over the same period was 4.93% overall and 5.06% for Trusts.

7.1.1. Month by month comparisons

Over the year 2020/21, a range of major policy initiatives were introduced temporarily in response to the COVID-19 pandemic. In this section we consider if these policies had an impact on staff volumes and expenditure over the year, by applying month by month comparisons.

Figure 20 presents month by month comparisons of FTEs, expenditure, mean salary/wages, and the Laspeyres Volume index between 2020/21 and 2021/22. The total number of FTEs employed in each month, mean salaries and overall expenditure are all higher in 2021/22 than in 2020/21. The year by year difference is substantially larger than changes within each year, though FTE volume and expenditure also indicate a general increase over time. Laspeyres volume growth in direct labour varies by around one percentage point over the year when comparing equivalent months. It is highest in April and over the autumn-winter period, while lowest in March and early summer. The higher growth rate when comparing autumn and winter months might reflect greater need for staff in this period of 2021/22 due to more social mixing and therefore spread of all forms of infectious disease in that year compared to 2020/21.

Figure 20: Monthly trends in count of staff FTEs, expenditure, average salary/wages and Laspeyres volume index for direct labour between 2020/21 and 2021/22

Figure 21 presents equivalent information to Figure 20, for the comparison of 2019/20 with 2021/22. This plot shows FTE volume, mean salary and total expenditure on staff are all higher in 2021/22 than in 2019/20. Also, that the difference between these levels between years is substantially larger than variation within each year. The Laspeyres volume growth measure indicates variation between months of just under one percentage point. Overall, growth trends downwards over the year. The comparison indicates highest growth in June and lowest growth in March.

Figure 21: Monthly trends in count of staff FTEs, expenditure, average salary/wages and Laspeyres volume index for direct labour between 2019/20 and 2021/22

7.2. Indirect NHS input growth measures

- **Between 2020/21 and 2021/22, the indirect growth rate for NHS inputs was 3.55% and the mixed NHS input growth rate was 4.49%.[84]**

7.2.1. Expenditure data sources

Expenditure on inputs by the NHS England Group[85] and NHS Trusts are taken from published financial accounts. Items of expenditure from each account are aggregated to the broad categories of Labour, Materials, and Capital. Labour covers expenditure on staff wages and other payments for work. Materials consist of assets which are expected to be consumed within the financial year they are purchased. Capital consists of expenditure on assets which are expected to be retained and used in multiple years. By using these broad categories, we can 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.

[84] Comparing NHS inputs in 2021/22 to 2019/20, we find that growth is equal to 13.58% for the mixed approach and 12.48% for the indirect approach.

[85] NHS England Group includes CCGs and NHS England and NHS Improvement.

Expenditure of the NHS England Group is reported in the annual reports and accounts of the Department of Health and Social Care (DHSC).[86] The items of expenditure used to calculate Labour, Materials, and Capital in the 2020/21 – 2021/22 accounts are presented in Table 34.

Table 34: Categorisation of operating expenditure items

Organisation	Labour	Materials	Capital
NHS Foundation Trusts and Non-Foundation Trusts Source: TAC	• Staff and executive directors' costs • Non-executive directors	• Purchase of services • Supplies and services – clinical • Supplies and services – clinical: utilisation of consumables donated from DHSC group bodies for COVID response • Supplies and services – general • Supplies and services – general: notional cost of equipment donated from DHSC for COVID response below capitalisation threshold • 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) • Inventories written down (consumables donated from DHSC group bodies for COVID response) • Provisions arising/released in year
NHS England Group Source: DHSC Annual Report and Accounts	• Staff costs	• Consultancy services • Transport • Clinical negligence costs • Establishment • Education, training & conferences • Supplies and services – general • Inventories consumed • Research & development expenditure • Other	• Premises • Impairment of receivables • Rentals under operating leases • Depreciation • Amortisation • Impairments & reversals • Interest charges

Note: Items of expenditure for Foundation Trusts and Non-Foundation Trusts are taken from accounts of 2021/22. The items used in previous years can be found in Table A30 in the Online Appendix.

[86] See DHSC annual reports and accounts 2021-2022 (last accessed 07/02/2024).

For the NHS England Group accounts, it was not possible to separate the resources allocated for the COVID-19 response, hence it is not possible for us to estimate the extra (financial) resources raised specifically for the pandemic effort.

We also use Trust level accounts for all NHS Trusts (non-FT) and Foundation Trusts (FT). Each FT and Non-FT publishes accounts annually, with a specified set of items of expenditure in TACs. Table 35 reports the sources of expenditure data used. Similarly to 2020/21, in 2021/22 NHS Trust and Foundation Trust accounts include extra items of expenditure related explicitly to COVID-19. Specifically, two expenditure items under Materials and one under Capital (see Table 34). However, these represent a very small fraction of total expenditures on either Materials or Capital (0.94% and 0.05% respectively). It is not possible to fully disentangle the COVID-19 response resources in other items. Therefore, the true impact of COVID-19 on input expenditure cannot be evaluated.

Table 35: Sources of expenditure information 2013/14 – 2021/22

Years	Foundation Trusts	Non-Foundation Trusts	NHS England Group
2013/14 – 2016/17	Consolidated NHS Financial Trusts Accounts	Financial monitoring and accounts	DHSC Annual Reports and Accounts
2017/18 – 2021/22	Trust accounts consolidation		

Finally, we obtain expenditure on agency and bank staff directly from the DHSC.

7.2.2. Expenditure on inputs

This section describes nominal expenditure on inputs, which is converted to real terms using appropriate deflators. We use the NHS Cost Inflation Index when considering Materials and Capital and the CHE ESR deflator for NHS Staff. For further details on the deflators used see section 9.1 in the Appendix.

Table 36 presents current expenditure on Labour, Materials, and Capital of the NHS England Group from 2019/20 to 2021/22. Expenditure on Labour grew by 12.28%, Materials fell slightly by 0.71%, and Capital reduced by 7.91%, with total expenditure growing by 3.33% between 2020/21 and 2021/22. These figures contrast with changes between 2019/20 and 2020/21, when in response to the pandemic, Labour grew by 6.78%, Materials by 64.02% and Capital by 14.88%, yielding a massive 33.21% growth for expenditure overall over the pandemic link.

Table 36: Current expenditure by NHS England Group (£000)

Year	Labour	Materials*	Capital*
2019/20	2,126,458	2,009,981	540,893
2020/21	2,270,582	3,296,681	621,361
2021/22	2,549,296	3,273,357	572,190

* Interest payments are moved from Material to Capital expenditure, to align with the practice followed with NHS Trusts.

Expenditure on Labour, Materials, and Capital among NHS Foundation and non-Foundation Trusts is reported in Table 37. It should be noted that expenditure on Labour inputs reported by NHS Trusts in 2019/20 includes additional pension costs, which accrued because of an

increase in the NHS employer contribution rate from 14.38% to 20.68%, from 1st April 2019.[87] This additional expenditure, equal to over £2.3 billion, was detracted from total Labour expenditure before calculating the NHS labour input growth rate, as it would otherwise artificially impact its growth rate.

Expenditure on both labour and Material input categories continued to increase, whilst capital expenditure decreased substantially in 2021/22. The nominal increase in Labour expenditure was 6.00% in 2021/22, which is a substantial decrease from the 12.59% recorded in 2020/21. Materials nominal expenditure continued to increase by 18.75%, a higher percentage increase than that recorded in 2020/21. This may be an indication of the inflationary pressures[88] experienced by the economy as a whole. Only nominal capital expenditure fell significantly, with a negative growth rate of 22.69%, which almost off-sets the growth (26.33%) recorded between 2019/20 and 2020/21.

Table 37: Current expenditure by NHS Trusts (£000)

Year	Labour	Materials	Capital
2019/20	59,601,842*	25,041,698	8,769,510
2020/21	67,106,390	28,504,921	11,078,757
2021/22	71,134,250	33,850,830	8,565,085

NHS expenditure on all input items from 2019/20 to 2021/22 is summarised in Table 38. The table includes the sum of Labour (NHS Staff and bank staff), Materials and Capital across NHS Trusts and NHS England Group. Expenditure on Primary Care and Community Prescribing (Prescribing) are also included. Details about the source of information of Community Prescribing are given in section 6.7. Expenditure on NHS staff constitutes the largest proportion of total input expenditure and saw an increase of 5.66% in 2021/22. Materials nominal expenditure increased by 16.74%, whilst capital nominal expenditure decreased by 21.90%. Finally, nominal expenditure on primary care increased by 7.36% between 2020/21 and 2021/22.

Table 38: Total NHS current expenditure 2019/20 – 2021/22 (£000)

Year	NHS Staff	Material	Capital	Prescribing	Primary Care
2019/20	59,348,146	27,051,717	9,333,550	9,281,577	14,751,852
2020/21	66,935,079	31,801,635	11,700,085	9,403,486	16,176,029
2021/22	70,723,546	37,124,187	9,137,275	9,687,037	17,367,209

[87] For further information on additional pension costs derived from an increase of the NHS Pension Scheme employer contribution rate, please see NHS BSA (last accessed 14/03/2022).
[88] Consumer price inflation, UK: March 2022 (last accessed 02/04/2024).

8. Concluding remarks

We find that overall NHS output, when adjusted for quality, increased by 19.26%, between 2020/21 and 2021/22. This is in line with the objectives set out by NHS England to recover care for patients awaiting elective and cancer care. However, the quality of care, as included in our measure, dampens the growth in NHS output, as the simple cost-weighted NHS output growth rate is marginally higher at 19.45%.

NHS inputs grew by 3.55% when measured using an entirely indirect approach (our preferred measure), between 2020/21 and 2021/22.[89]

Given the positive and large growth in NHS outputs, and the more modest growth in NHS inputs between 2020/21 and 2021/22, it is not surprising that NHS productivity shows positive growth at 15.18%, between 2020/21 and 2021/22.

Our findings show that NHS outputs and productivity in 2021/22 increased considerably compared to the previous year, and support the governments, Department of Health and Social Care, and NHS England's aim to set the NHS on a path of recovery. However, this is a comparison with a baseline year, 2020/21, affected by major disruptions to healthcare delivery in both elective and emergency care. We therefore also compared productivity in 2021/22 with the pre-pandemic year of 2019/20, to more directly investigate the extent of NHS recovery. Similarly to Arabadzhyan et al. (2023), test and trace services were not included as an output, as we did not have access to the full information. So far as these services were delivered by NHS staff as part of their NHS role, the costs of these services would be included in our measure of NHS inputs, but they are not in our measure of NHS outputs. This means that our NHS output and productivity growth measures are likely to slightly underestimate the true output and productivity growth between 2020/21 and 2021/22.

We find that compared to the pre-pandemic year of 2019/20, NHS cost-weighted output growth in 2021/22 is still sluggish, at -1.45%. Adjusting for the quality of care provided decreases growth to -1.53%, an indication that compared to the pre-pandemic year, the quality of care is lower in 2021/22. In contrast, NHS inputs grew at 13.58% (mixed approach), thus yielding negative productivity growth of -13.30%.[91]

Comparing total factor productivity in the NHS with growth of the UK economy as a whole, as measured by the Gross Value Added per Hour (labour productivity, LP), we find NHS productivity has substantially recovered from 2020/21, but remains below productivity of the UK economy. This is despite NHS productivity being higher than the overall economy in 2019/20 and a slowing down of UK economy growth, as the measures introduced to support workers were gradually discontinued (Office for National Statistics, 2020).

[89] Our preferred measure for the 2021/22 NHS productivity update is based on the indirect approach. This is because financial accounts appear to correctly reflect the expenditure on NHS staff, as the Department of Health and Social Care noted delays in updating the staff and pay-roll systems by NHS Trusts during the pandemic. However, our preferred NHS productivity growth measure, including the one between 2019/20 and 2021/22, is based on the mixed approach.

Taking the comparison of 2021/22 with both 2020/21 and 2019/20 together, it can be seen that the NHS has recovered substantially from the initial shock of the COVID-19 pandemic. However, output has yet to reach the level of 2019/20 overall, leaving a productivity gap compared to both the pre-pandemic level and the UK economy as a whole.

Finally, taking a longer-term view (from 2004/05 to 2021/22), we calculate the average annual growth rate for NHS outputs, inputs and productivity. Please note that up to 2018/19-2019/20 the mixed approach is used to calculate both NHS inputs and productivity growth rates, whilst the indirect approach is used for the 2019/20-2020/21 and 2020/21-2021/22 links. We find growth in NHS quality adjusted outputs has averaged 3.1% per annum and growth in NHS inputs has averaged 3.11%, with NHS productivity growth averaging -0.02%.

These are still below the average annual growth rates achieved by the NHS before the pandemic, i.e. up to 2018/19, when average NHS quality adjusted output growth per annum was 3.75% per annum, average NHS input growth was 2.63%, and average NHS productivity was 1.09%.

9. Appendix

9.1. Deflators

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

We employed specific deflators for four categories of expenditure (Materials and Capital are considered as a homogenous category) until 2015/16. From 2016/17 and limited to Community Prescribing, we use the direct Laspeyres output growth, instead of deflating its expenditure.[90] In 2018/19 we incorporated a specific deflator for agency staff. The various categories of expenditure and deflators used from 2013/14 onwards are summarised in Table A 1.

Table A 1: Sources of deflator data

<table>
<tr><th>Years</th><th>Labour</th><th>Materials & Capital</th><th>Primary Care</th><th>Prescribing</th></tr>
<tr><td>2013/14 – 2014/15</td><td rowspan="3">ESR deflator</td><td rowspan="2">Hospital and Community Health Services (HCHS) deflator</td><td rowspan="2">Pay and Price deflator
0.1 + 0.4*ESR deflator + 0.4*HCHS deflator</td><td rowspan="2">PCA / NHS BSA</td></tr>
<tr><td>2014/15 – 2015/16</td></tr>
<tr><td>2015/16 – 2016/17</td><td rowspan="2">NHS Cost Inflation Index: Provider Non-Pay Index (NHSCII-PNPI)</td><td rowspan="2">NHS Cost Inflation Index: General Practice Index (NHSCII-GPI)</td><td rowspan="3"></td></tr>
<tr><td>2016/17 – 2017/18</td><td rowspan="2">ESR deflator and Agency deflator (from NHSCII)</td></tr>
<tr><td>2017/18 – 2021/22</td></tr>
</table>

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

The Hospital and Community Health Services deflator and Pay and Price deflator were provided by DHSC. In 2016/17, the Pay and Price deflator was discontinued and we replaced it with a combination of ESR and HCHS deflators. In 2017/18, the DHSC created a set of new deflators – known as the NHS Cost Inflation Index[91] – from which we use specific deflators for Materials and Capital, and Primary Care. We use the Provider Non-Pay Index to deflate expenditure on Materials and Capital, and the General Practice Index to deflate expenditure on primary care. The Provider Non-Pay index (PNPI) is calculated by weighting several sub-components – various expenditure categories in the providers accounts. Each of them is deflated using the most appropriate available deflator: components of Producer Price Index

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

91 Details on the methodology behind the index can be found in NHS Cost Inflation Index (last accessed 12/03/2024). For a comparison of HCSC and NHSCII see p.154 Unit Costs of Health and Social Care 2019 (last accessed 12/03/2024).

(PPI), Services Producer Price Index (SPPI),[92] Consumer Price Index (CPI), etc. and their combinations are used to construct item-specific deflators. As regards the General Practice Index, it is computed as a weighted average of the staff and non-staff subcomponents. The former is calculated using GP and other staff earnings data provided by NHS Digital, whereas intermediate consumption is deflated using the Consumer Price Index, including the owner occupiers' housing costs (CPIH) published by ONS.

In addition, starting from 2018/19, a separate deflator for agency staff was produced within the NHSCI index. For the financial years 2020/21 and 2021/22 the agency deflator is calculated using data from the Crown Commercial Services/London procurement partnership. This data does not provide full coverage of Agency Expenditure, it is only data on agency supply through the NHS Workforce Alliance framework agreements, and they estimate that this accounts for around 40% of the total market. In previous years, the agency deflator was calculated using data collected by NHS England and NHS Improvement from all NHS Trusts, cover NHS Trusts' agency staff spending and the number of shifts worked, which allowed one to calculate the change in the cost of an agency staff shift, based on the assumption that the length of an agency staff shift was constant, which was deemed to be a reasonable assumption.[93] As agency expenditure normally accounts for a large share of expenditure, it is important to understand more closely how agency staff costs vary over time and reflect this back into our measures of NHS input and NHS productivity growth. This is particularly important when agency staff costs have different growth rates than NHS provider staff costs, as shown in Table A 2.

Table A 2 shows deflation figures for each category of expenditure from 2018/19 – 2019/20 to 2020/21 – 2021/22. These figures indicate that between 2020/21 and 2021/22 all input categories were subject to an increase in costs, with the exception of prescribing and agency expenditures.

Table A 2: Deflator values 2018/19 – 2021/22

Years	Labour	Materials and Capital	Primary Care	Prescribing
2018/19 – 2019/20	2.73% (-1.30%)	1.44%	3.18%	-0.08%
2019/20 – 2020/21	3.49%	0.78%	6.04%	1.06%
2020/21 – 2021/22	3.43%	1.70%	4.48%	-3.90%

Note: agency deflator in brackets; the agency deflator for 2019/20 and 2020/21 have been suppressed as it is based on management information from NHSEI.

[92] ONS have introduced some changes to the construction of the PPI and SPPI indices, because of these some of the components of the indices used for the NHSCII are not produced anymore. As a consequence, alternative indices were used and the NHSCII back series were updated accordingly. This change does not affect our productivity series.
[93] As highlighted by ONS (last accessed 12/03/2024), discussions with the NHS experts suggest agency staff shift lengths have been stable in recent years.

9.2. NHS Trust-only productivity measures

While the main body of our research concerns the calculation of productivity growth for the whole NHS, we also produced an NHS Trusts-only productivity growth measure.

Table A 3 reports NHS output, input and productivity growth rates for NHS Trusts only. The NHS output growth measure for the 2020/21 – 2021/22 link, adjusted for both quality, and working and total days, where appropriate (see section 2.4 for further details on working and total days adjustment) increased to 20.09% from the -19.37% growth recorded between 2019/20 and 2020/21. This is a slightly larger output growth than for the NHS as a whole. However, when comparing 2019/20 with 2021/22, the Trust-only output growth is more negative than the -1.53% overall NHS growth, which was driven by substantial positive growth rates for Community Prescribing and Primary Care.

Trust specific input growth was quite similar to that of the NHS as a whole: 4.84% using the mixed method and 3.72% using the indirect method for the 2020/21 – 2021/22 link, and slightly higher than the overall NHS ones for the 2019/20 – 2021/22 link (14.38% and 13.14% for the mixed and indirect measures respectively). As a result, between 2020/21 and 2021/22 Trust-only productivity growth was slightly higher than that of the NHS as a whole (by 0.4-0.6 percentage points), while when comparing 2021/22 with the pre-pandemic year 2019/20, Trust-specific productivity growth was more negative than the overall NHS one by about 3.5 percentage points (see Table A 3 for full details).

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

Years	Quality and working days adjusted Output growth	Input growth		Productivity growth rate	
		Mixed	Indirect	Mixed	Indirect
2019/20 – 2020/21	-19.73%	9.75%	11.38%	-26.54%	-27.61%
2020/21 – 2021/22	20.09%	4.84%	3.72%	14.55%	15.79%
2019/20 – 2021/22	-5.09%	14.38%	13.14%	-17.02%	-16.11%

9.3. Working and Total Days

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

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

Year	Total days	Working days
2019/20	366	254
2020/21	365	253
2021/22	365	253

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