Public service productivity estimates: healthcare QMI

Quality and Methodology Information for Public service productivity: healthcare, detailing the strengths and limitations of the data, methods used, and data uses and users.

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1 . Output information

National Statistic	
Data collection	Administrative data
Frequency	Annual
How compiled	Output and input indices produced using a range of data sources, including from the UK National Accounts, NHS Digital, Department of Health and Social Care and the devolved administrations
Geographic coverage	UK and England separately available
Related publications	Public service productivity: healthcare
Last revised	2 February 2021

2 . About this Quality and Methodology Information report

This quality and methodology report contains information on the quality characteristics of the data (including the European Statistical System five dimensions of quality) as well as the methods used to create it.

The information in this report will help you to:

- understand the strengths and limitations of the data

- learn about existing uses and users of the data

- understand the methods used to create the data

- help you to decide suitable uses for the data

- reduce the risk of misusing data

3 . Important points

- The estimate for public service productivity is displayed as an index, showing the change over time of the amount of output provided for each unit of input.

- Public service output and inputs are measured in quantity terms (also referred to as volume terms), as opposed to expenditure terms, to remove the effect of price changes over time.

- Public service healthcare output is also adjusted for changes in the quality of healthcare, as recommended by the Atkinson Review.

- Productivity estimates included in this article are multi-factor productivity estimates, i.e. they include goods and services and capital inputs as well as labour input, as opposed to labour productivity estimates, and so are not comparable to ONS measures of whole-economy labour productivity.

- These estimates are produced to measure the productivity of public service healthcare, but do not measure value for money or the wider performance of public healthcare services.

4 . Quality summary

Overview

Public service healthcare productivity is estimated by comparing growth in the total quantity of healthcare output provided (adjusted for quality where possible) with growth in the total quantity of inputs used. If the growth rate of output exceeds the growth rate of inputs, productivity increases, meaning that more output is being produced for each unit of input. Conversely, if the growth rate of inputs exceeds the growth rate of output, then productivity will fall, indicating that less output is being produced for each unit of input.

Productivity estimates included in this article are multi-factor productivity estimates as opposed to labour productivity estimates, and so are not comparable with ONS measures of whole-economy labour productivity. This is because the inputs for public service productivity include goods and services and capital inputs, in addition to labour input. The public service productivity measures included in this article are also not directly comparable with the ONS whole economy multi-factor productivity estimates due to differences in the methodology used.

These estimates are produced to measure the productivity of public service healthcare. They do not measure value for money or the wider performance of public healthcare services. They do not indicate, for example, whether the inputs have been purchased at the lowest possible cost, or whether the desired outcomes are achieved through the output provided.

The methodology for calculating these statistics is based on the recommendations of the Atkinson Review on the measurement of government output and productivity for the National Accounts.

The headline measures included in Public service productivity: healthcare, England cover healthcare productivity in England and on a financial year basis, enabling users to more easily analyse the data in relation to other data available for the healthcare sector in England. Public service healthcare productivity is also calculated for the UK and on a calendar year basis, with extensive reference tables providing an equivalent level of data to that produced for England. The UK measures also form part of total public service productivity. Most data used in the measure is obtained and processed on a financial year basis and the UK calendar year figure is created by combining the financial year data for the four nations and then converting it into a calendar year basis by using a 'cubic spline' function.

The UK output statistics are also used as part of the measure of government output in the national accounts. However, there are a number of differences between the current measures:

- the national accounts do not include the quality adjustment, to comply with the [European System of National and Regional Accounts 2010](#)

- the national accounts also do not include the adjustment for the number of working days and total days

- the national accounts do not incorporate the developments to primary care output detailed in [Methodological developments to public service productivity: healthcare, 2021 update](#) at the time of writing, although these developments will be considered for inclusion in the national accounts when the availability to make changes allows

More information on the methodology can be found in [Sources and Methods Public Service Productivity Estimates: Healthcare](#).

Uses and users

Our productivity releases have a range of users including:

- The Department of Health and Social Care

- NHS England and NHS Improvement

- HM Treasury

- Office for Budget Responsibility

- National Audit Office

- health and other spending departments in the devolved administrations

- academics and researchers

- think tanks

- overseas statistical agencies

The statistics have two main uses - measuring changes over time in the productivity performance of the health service and supporting the estimation of potential future cost savings that can be made from future productivity gains.

We work with stakeholders, including those involved in healthcare analysis and policymaking, working responsively to target development work to fit user needs. We very much welcome feedback from all interested parties, and if you would like to get in contact regarding the measurement of healthcare productivity, or other areas of public service productivity and efficiency, please contact public.servicesanalysis@ons.gov.uk.

Strengths and limitations

Strengths of the estimates include:

- estimates are produced according to the methodology established by the Atkinson Review, and adopted for other service sectors for other publications in the public service productivity estimates series

- the data are available both on an England and financial year basis, a comparable basis with other data available for the NHS in England and on a UK and calendar year basis, comparable with other service sectors included in public service productivity

- the measures undergo continuous improvement with an open revisions policy to ensure they meet user needs and are not constrained by the procedures of the UK National Accounts

Limitations of the estimates include:

- data gaps across the UK prevent the measurement of productivity for some services, including non-NHS provided services, where due to lack of data it is assumed that outputs equals inputs

- data gaps in some nations of the UK must be addressed through estimation using data from other UK nations; in particular, the absence of data on goods and services inputs in Northern Ireland mean growth in this element is estimated based on goods and services inputs for the rest of the UK, while the quality adjustment is produced using data for England only but is also applied to all three devolved administrations, where comparable data are unavailable

- due to the range of data used in the measure, the statistics are not released until around two years after the end of the reference period

- productivity is just one aspect of efficiency and cannot inform our understanding of all aspects of the performance of healthcare services; for example, whether the inputs have been purchased at the lowest possible cost, or whether funding is allocated to the most efficient or appropriate forms of care provision

Recent improvements

Recent improvements, include:

- The introduction of a "number of days adjustment" to output to account for the effects of leap years and year-to-year changes in the number of working days

- The introduction of a new set of deflators for intermediate goods and services consumption

- The incorporation of expenditure on NHS bank staff into labour inputs in England

- Changes to the measurement of capital consumption affecting all service areas in public service productivity

- An improved method for measuring primary care output, incorporating new data sources for GP output in England

These improvements are detailed in Methodological developments to public service productivity: healthcare, 2020 update and 2021 update and information about their effect on inputs, output and productivity can be found in the revisions sections of the relevant editions of Public service productivity: healthcare, England.

5 . Quality characteristics of public service healthcare productivity

This section provides a range of information that describes the quality and characteristics of the public service healthcare productivity measure and identifies issues that should be noted when using the output.

Relevance

The UK Centre for the Measurement of Government Activity (UKCeMGA) was launched in 2005 to take forward the recommendations from the Atkinson Review (PDF, 1.07MB) to improve the measure of government output and productivity, and to report on it.

In the years since the publication of the Atkinson Review (PDF, 1.07MB), we have developed estimates of healthcare output, inputs and productivity with data covering the four health administrations of the UK, to provide an aggregated level of analysis of productivity. These estimates are updated, and any methods changes explained in annual articles, published on our website.

There are three different statistical outputs published in Public service productivity: healthcare:

- a chain-linked volume index of healthcare output, adjusted for quality

- a chain-linked volume index of healthcare inputs

- a derived estimate for healthcare productivity (output per unit of input)

The estimates of the volume of healthcare output vary from the series presented in the UK National Accounts as general government final consumption expenditure (GGFCE) on healthcare. In line with the recommendations of the Atkinson Review (PDF, 1.07MB), the healthcare output measure has a quality adjustment, which is based on a series of outcomes relating to primary and secondary care and patient experience. This differs from the UK National Accounts, which follow the European System of Accounts 2010 guidelines where quality-adjustment methods are not permitted because of the potential lack of international comparability of these methods. The national accounts also lack the adjustment for year-to-year changes in the number of working days and total days incorporated in the measure of output used from the release, Public service productivity: healthcare, 2017 onwards and do not necessarily incorporate the latest developments made in the public service productivity series.

Data used to measure healthcare output and inputs predominantly come from data sources used and understood by the four health departments of the UK. Output and labour inputs are measured using administrative data, while goods and services inputs are measured using financial data adjusted using suitable deflators to account for changes in input costs faced by the health service. Capital consumption estimates and the weights used to aggregate inputs from labour, goods and services and capital data come from the national accounts, in line with the preferred methodology used across public service productivity estimates.

Accuracy and reliability

Both output and inputs series are constructed using a variety of administrative and national accounts data. The accuracy of the derived series therefore depends on the accuracy of the source data. Other than substantial methodological changes, the main source of revisions to the healthcare productivity estimates will be because of changes in source data and expenditure weights.

It is also not possible to directly compare these public service productivity estimates with other productivity estimates we produce. Public service productivity estimates use an expenditure framework, that is, the government as a purchaser of services on behalf of citizens, rather than as a producer. The figures therefore give a measure of the productivity of the government's provision of services, whether produced by state-controlled organisations, or purchased from the private sector. Traditional methods of productivity estimation use a production or supply framework, and so are not directly comparable with these statistics for reasons of:

- coverage

- measurement of output differences

- quality adjustment

A more detailed explanation of the comparability of our public service productivity estimates is given in this methods paper.

It is difficult for us to provide a confidence interval around our estimates given the multiple sources of data on which the estimates are based. We hold regular quality assurance conversations with the devolved administrations who provide us with the inputs and output data relevant to their nations and quality assure the measure for England with other bodies that have expertise in measuring efficiency, including the Department of Health and Social Care, NHS England and NHS Improvement, and the Centre for Health Economics at the University of York.

Coherence and comparability

The estimates are included in two separate bases. The article Public service productivity: healthcare, England is produced on an England and financial year basis to provide users in England with a measure comparable with other data available on the health service in England. A UK calendar year measure is also published as part of Public service productivity: total public service, to provide the most comprehensive available coverage of the UK and for consistency with other service sectors.

The UK and England measures are not directly comparable due to differences in administrative data collection methodology, differences in data coverage and the statistical process used to convert financial year data into calendar years ('cubic splining'). Furthermore, some aspects of the England measure are estimated using UK data, such as capital consumption, while some aspects of the UK measure are estimated using data only for England, such as the quality adjustment. Finally, for the early years of the UK series, output and much of the inputs are calculated solely from data for England as data for Northern Ireland were not included in the measure until financial year ending (FYE) 2004 and data for Scotland and Wales not included until FYE 2005.

For these various reasons, it should be noted that the difference between UK and England measures cannot be assumed to be due to data from the devolved administrations. Further information on this issue is available in Public service productivity: healthcare, England.

A separate healthcare productivity measure is produced by the Centre for Health Economics (CHE) at the University of York. This takes the same broad approach to the ONS series of measuring inputs and output in volume terms, but uses different data sources for inputs and output, a different methodology and has some differences in service coverage.

The hospital procedures element of the quality adjustment is shared between the two series as CHE supplies ONS with the dataset used to produce this element. However, the published quality adjustment figure may differ between the CHE and ONS series as the hospital procedures quality adjustment is applied to output data from different data sources, and the ONS quality adjustment includes separate data for patient experience and primary care.

Despite the differences in data sources, methodology and coverage, long-term average growth rates for the CHE and ONS series are similar. The latest estimates of Productivity of the English NHS show productivity growth between FYE 2005 and FYE 2018 was 1.3% per year on average. Our estimates for productivity for England, the most comparable measure, between FYE 2005 and FYE 2018 are 1.4% per year on average. We have worked with CHE to understand the differences between our productivity measures, and more information on these differences are included in Public service productivity: healthcare, England.

Accessibility and clarity

Our recommended format for accessible content is a combination of HTML webpages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. We also offer users the option to download the narrative in PDF format. In some instances, other software may be used, or may be available on request. For further information please refer to the contact details at the beginning of this report.

For information regarding conditions of access to data, please refer to the following:

- terms and conditions (for data on the website)

- freedom of information

- accessibility

More details on related releases can be found on the GOV.UK release calendar. If there are any changes to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully.

A brief glossary of key terms is provided in Public service productivity: healthcare and information on changes to the methodology is published to update users, most recently in Methodological developments to public service productivity: healthcare, 2020 update and 2021 update.

Timeliness and punctuality

Public service productivity: healthcare, England, financial year ending 2019 includes measures of the productivity of healthcare from financial year ending (FYE) 1995 to FYE 2019. For the UK measure, data on a financial year basis are converted to be used on a calendar year basis using a splining process. This involves the imputation of quarterly data based on trends in data over multiple financial years and constructs an equivalent calendar year figure based on these imputed quarterly figures.

The full set of data required to produce the productivity measure is not usually available until around 19 months after the end of their financial year reference period - October or November of year t for data to the end of March year t-1. After allowing time for the production of the measures, the public service healthcare productivity articles are published in January with a lag of just over 21 months since the end of the reference period for the financial year England article and just over 24 months for the calendar year UK figures.

The annual public service productivity statistics are usually published as part of the January Office for National Statistics productivity theme day. Provisional dates are published on the GOV.UK statistical release calendar. Actual publication dates are finalised at least one month ahead of publication. Good practice is to provide 12 months advance notice of release dates. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the Code of Practice for Statistics.

Concepts and definitions (including list of changes to definitions)

Our analysis is at the international forefront of measuring productivity in the public services and follows the principles for public service productivity measurement established in the [Atkinson Review (PDF, 1.07MB)](). Measurement of quantity output also follows the guidelines of the [System of National Accounts (SNA) 1993]() and subsequent [SNA 2008](), as well as the [European System of Accounts 1995]() and subsequently the [European System of Accounts 2010]().

Why you can trust our data

We are the UK's largest independent producer of statistics and its national statistics institute. Our [data and security policies]() detail how data are collected, secured and used in the publication of statistics. We treat the data that we hold with respect, keeping it secure and confidential, and we use statistical methods that are professional, ethical and transparent.

The public service productivity estimates have [National Statistics]() status, designated by the [UK Statistics Authority]() in accordance with the [Statistics and Registration Service Act 2007](). This designation signifies compliance with the Code of Practice for Statistics, which has recently been updated and focuses on trustworthiness of data in greater depth.

6 . Methods used to produce public service healthcare productivity

A summary of sources of data and statistical methods used to compile the output are documented in [Sources and Methods for Public Service Productivity Estimates: Healthcare (PDF, 328KB)]().

As stated previously in this QMI, there are three different statistical outputs published in Public service productivity: healthcare:

- a chain-linked volume index of healthcare output, adjusted for quality

- a chain-linked volume index of healthcare inputs

- a derived estimate for healthcare productivity (output per unit of input)

Quantity output

In the public service healthcare productivity measures, healthcare output is disaggregated into four components:

- hospital and community health services (HCHS) - includes hospital services, community care, mental health and ambulance services

- primary care services - includes general practice, publicly-funded dental treatment and sight tests

- GP prescribing - includes prescription drugs dispensed in the community

- non-NHS provision - includes healthcare funded by the government but provided by the private or third sector

Of these components, HCHS, primary care and GP-prescribing output are all measured using data on the number of activities undertaken and their unit costs by service type in a cost-weighted activity index (CWAI). The CWAI calculates the change in the number of activities undertaken, weighting each activity by its cost such that an increase of one unit of activity for a high-cost activity has a greater effect on the output than an increase of one unit of activity for a low-cost activity.

Output growth is calculated between each pair of consecutive years in the series (for instance, 2016 and 2017) and an output index constructed by chain-linking the growth rates together. The output index does not have a monetary value, but instead compares the relative volume or quantity of healthcare provided across time.

The CWAI for healthcare output is produced using the Laspeyres approach, where the unit costs used for weighting different activity types are those taken from the first year of each activity pair and follows the formula:

$$I^t = I^{t-1} \cdot \frac{\sum_i (a_i^t \cdot u_i^{t-1})}{\sum_i (a_i^{t-1} \cdot u_i^{t-1})}$$

where:
I = index value
a = activity count
u = unit cost
t = year
i = activity type

From the article Public service productivity: healthcare, 2017 onwards, HCHS and primary care activity data used in the output calculations are adjusted to account for the fluctuations caused by year-to-year changes in the number of working days and total days.

The data for quantity output come from administrative data sources from the health service, some of which are published, such as the NHS reference costs, and some are provided directly to the Office for National Statistics (ONS) for use in the national accounts.

In contrast to HCHS, primary care and GP-prescribing, the fourth component of healthcare output, non-NHS provision is calculated using the same deflated expenditure data as are used to calculate inputs. As a result, non-NHS provision is considered an "output-equals-inputs" component and does not drive changes in the productivity measure. The CWAI produced for GP-prescribing is also used in the inputs on an "output-equals-inputs" basis, and so GP-prescribing also does not drive changes in the productivity measure.

Due to data gaps, the output of primary care is not measured for Wales and non-NHS provision is not measured for Northern Ireland.

Output: quality adjustment

A quality adjustment factor is applied to the volume of activity index to generate estimates of healthcare output. A positive quality adjustment indicates that the quality of healthcare services provided, as defined by the selection of indicators used in the quality adjustment, has improved. It should be noted that while the quality adjustment aims to cover a range of relevant aspects of healthcare quality, it cannot be taken as a comprehensive indicator of the quality or outcomes of all NHS services.

The quality adjustment incorporates:

- short-term post-operative survival rates (derived from Hospital Episodes Statistics (HES))

- estimates of health benefit from procedures (derived from research studies, ONS Life Tables and Patient Reported Outcome Measures)

- waiting times (from HES)

- aggregate data on clinical measures recorded on GP practice computers (from the Quality and Outcomes Framework)

- patient experience surveys (from NHS England)

The first three bullets in this list constitute the hospital procedures quality adjustment and are applied to output using a dataset provided by the Centre for Health Economics at the University of York.

With reference to the four output components listed in 'quantity output', Hospital and Community Health Services (HCHS) and primary care services are quality adjusted, but no quality adjustment is applied to GP-prescribing or non-NHS provided services. Quality adjustment of public service health output: current method provides a more detailed description of the quality adjustment methodology.

Inputs

As with output, inputs are also calculated on a volume basis and are presented in index form. Inputs consist of three components: labour, goods and services and capital consumption.

Labour inputs are mainly measured through a Laspeyres cost-weighted labour index (CWLI), which uses administrative data on the health service's workforce to measure growth in full-time equivalent staff numbers weighted by their cost, in a similar manner to the cost-weighted activity index used for quantity output. However, NHS bank staff inputs in England, which are introduced to the measure from FYE 2017, are measured using deflated expenditure data.

The intermediate consumption of goods and services used in the provision of healthcare is also calculated using expenditure data deflated by relevant deflators to account for the cost inflation faced by the health service. From the articles published in January 2020 onwards, many of the deflators used are taken from the NHS Cost Inflation Index (NHSCII), which is produced by the Department of Health and Social Care. This includes the overall NHSCII, sector-specific components of the NHSCII and a version specific to NHS providers' intermediate consumption produced by the ONS.

While expenditure data are available for England, Scotland and Wales, they are currently unavailable for Northern Ireland and so growth in goods and services for Northern Ireland is implicitly assumed to equal goods and services growth for the rest of the UK.

The consumption of fixed capital covers the cost of depreciation of capital goods (items that are anticipated to be in use over several years, such as buildings and vehicles) over time. Data used for this element are estimated in the UK National Accounts using the perpetual inventory method.

The total inputs index is created by weighting the three components of healthcare input together according to their share of total healthcare expenditure recorded in the UK National Accounts.

Productivity

Productivity change in publicly funded healthcare is calculated by dividing the change in the volume of output by changes in the volume of inputs.

How we quality assure and validate the data

Data are quality assured at a detailed level to ensure there are no changes to the data collection methodology. This is done through regular conversations with data suppliers in the devolved administrations for data received from their jurisdictions and with reference to information published by NHS Digital and other published data sources on changes to the data collection for England, which enables us to understand changes we observe in the data.

The chain-linking methodology used to construct the output and inputs indices means that the indices are constructed from a series of growth rates between consecutive pairs of years. As, a result, where there are changes in how some of the data are reported, these do not result in step-changes in the level of inputs or output. More information on chain-linking is available from this methodological note (PDF, 58KB).

The statistics and methodological developments we make are quality assured internally and by healthcare productivity experts in the Department of Health and Social Care, NHS England and NHS Improvement and the Centre for Health Economics at the University of York.

How we disseminate the data

Public service healthcare productivity estimates are published annually in Public service productivity: healthcare, England. Estimates for the UK are also included in Public service productivity: total, UK.

7 . Other information

Methodological developments to public service productivity: healthcare, 2020 update explains the introduction of the working and total day adjustment, the NHS Cost Inflation Index, NHS bank staff and improved capital consumption inputs to public service healthcare productivity.

Methodological developments to public service productivity: healthcare, 2021 update describes the new methodology for measuring primary care output.

Sources and Methods Public Service Productivity Estimates: Healthcare provides a guide to how estimates of productivity in publicly funded healthcare are calculated.

Quality adjustment of public service health output: current method describes the methodology used for quality adjusting healthcare output.

Public service productivity: healthcare, England, financial year ending 2019 analyses public service healthcare productivity for England only on a financial year basis for improved comparability with other data available for the health service in England.

Public service productivity: total, UK, 2017 is a regular publication providing information and analysis of productivity across all public services in the UK, including healthcare.