

Measuring the economic output of COVID-19 testing, tracing and vaccinations: April 2020 to June 2021

An overview of our approach to measuring coronavirus (COVID-19) testing, tracing and vaccination services in government output.

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1 . Introduction

Background

The coronavirus (COVID-19) pandemic has resulted in the establishment of new publicly-funded services for COVID-19 testing, contact tracing and vaccinations. This article presents our revised methodology, introduced to better measure the output of these services in gross domestic product (GDP). These methods only concern government services and do not affect privately operated services, such as private testing for international flights, which are captured as household expenditure.

In nominal terms, the output of these services is captured through a "[sum of costs](#)" approach. As such, our estimates of current price output include spending on these services and no change in approach is required.

In volume terms, our approach is now to measure output directly using cost-weighted activity data, which is [the preferred approach for measuring non-market output \(PDF, 1.1MB\)](#) within the UK National Accounts. This method replaces the existing preliminary volume estimates for the COVID-19 testing, tracing and vaccination programmes.

These earlier estimates were informed by the number of tests registered and vaccines administered, in-year spending data for the NHS Test and Trace service and estimated costs to secure and manufacture COVID-19 vaccines for the UK and the deployment of vaccines in England. This change of method has resulted in mostly minor revisions to volumes, with our new volume estimates reaffirming the level of our early estimates. Further information on revisions is available in [Section 5](#).

Methodological framework for measuring non-market output

The measurement of non-market output presents a considerable challenge [across public services](#). In the absence of market prices, [the volume of non-market output is estimated using a cost-weighted activity index](#). In these indices, the growth rates of individual types of activity are weighted by their respective shares of expenditure. As a consequence, growth in treatments that are more numerous and more expensive have a greater effect on overall output growth than treatments that are less frequent or low cost.

This approach is mathematically equivalent to estimating the volume output measure through a [Laspeyres index](#), in which the unit cost for the previous year is used to weight activity for both the current and previous years, removing the impact of inflation in costs from output. Changes in output are consequently driven by changes in the number of activities performed, rather than by changes in costs.

The standard Laspeyres approach works best for ongoing or continuous activities – where each activity has a defined level and cost in each period. However, introducing new products into the Laspeyres index we use in the UK National Accounts presents a challenge, particularly so in this case because of the speed of the ramp-up in testing, tracing and vaccination. This has required us to adapt our approach, with this outlined in [Section 4](#).

2 . Measurement of COVID-19 testing, tracing and vaccination services prior to the April to June 2021 quarterly national accounts

Our initial quarterly volume estimates for testing and tracing services were informed by the relationship between expenditure in current price terms and volume for other health services. For vaccination volumes the estimates were based on the number of vaccines and the available estimated cost to secure and manufacture vaccines for the UK and [deploy vaccines in England \(PDF, 367KB\)](#).

A range of additional data sources were used to help inform the rate of growth in volumes from quarter to quarter, including publicly available activity data regarding the total number of coronavirus (COVID-19) tests registered and the total number of vaccines administered. While the growth from these data sources did not disaggregate by types of activity to enable activities of different costs to be weighted differently, these data helped to ensure volumes followed the high-level trends of testing, tracing and vaccination activity.

3 . New methodology for COVID-19 testing, tracing and vaccination output

This section outlines our methods for including the coronavirus (COVID-19) testing, tracing and vaccination programmes in gross domestic product (GDP) in volume terms. The impact of each programme on GDP is determined through a cost-weighted activity index.

The data collected to estimate volumes cover England, as UK-level data are not available for all three services. However, the impact of these services is scaled to account for UK-level volumes. More information on this scaling process can be found in [Section 4](#).

Testing

The COVID-19 testing programme was designed to monitor and reduce the spread of the coronavirus through the UK population. Initially, tests were offered to individuals who showed symptoms of COVID-19, with results processed by laboratories. [A large "at home" testing programme was subsequently launched](#) to provide easy access to testing - initially aimed at school students and key workers, but subsequently made available to all households.

To measure the volume of output for the COVID-19 testing programme, we separately account for the output generated by each type of testing technology. The main COVID-19 testing technologies are:

- PCR (polymerase chain reaction) tests, which are typically used to test individuals that have COVID-19 symptoms; the results of PCR tests are processed in laboratories to determine whether the virus is present in the sample
- LFD (lateral flow devices), which are aimed at testing individuals not exhibiting COVID-19 symptoms; the lack of laboratory processing means these tests are cheaper and provide quicker diagnosis than PCR tests but are less accurate
- other less common testing technologies include loop-mediated isothermal amplification (LAMP) and LAMP with nanopore sequencing (LAMPORE); these account for a very small proportion of total tests relative to PCR and LFD

These test technologies are deployed through four testing "[pillars](#)".

Pillars 1 and 2 relate to large scale testing programmes, mainly used to control the spread of the virus. These pillars cover NHS swab testing for those with a clinical need (Pillar 1) and swab tests within the wider population (Pillar 2) and include a large majority of COVID-19 testing.

Pillars 3 and 4 relate to blood and swab tests primarily collected for research purposes and wider epidemiological surveillance and account for a relatively small proportion of overall tests conducted, standing at around 4% as of mid-September 2021.

Our measure of output growth in testing is based on the number of tests conducted under Pillars 1 and 2 of the testing strategy only, as unit costs are not readily available for Pillars 3 and 4.

To capture testing activity, we use [publicly available testing data](#) to record the number of tests carried out under Pillar 1. The Department of Health and Social Care (DHSC) provide data on testing activity for Pillar 2 tests, disaggregated by technology type. We use these data to measure all types of activity except LFDs. Of these non-LFD tests, we exclude those that have not been processed in laboratories and those which have not had their results registered. We also remove privately funded tests, which are considered market output, such as those taken in private healthcare, by international passengers and provided by employers. Finally, we also remove void tests, which are those that do not produce a positive or a negative result and cannot be considered the delivery of a service.

To measure LFD testing activity under Pillar 2 of the strategy we use management information from DHSC relating to the number of dispatched tests. As with the other test technology types, privately funded LFD tests are excluded. However, for LFD tests we include tests that have been dispatched but not yet registered. This is consistent with the treatment of products in the UK National Accounts under the concept of final use, where the consumption of goods and services comes at the time of the final transaction, and not necessarily the time of use.

Consequently, our activity measure for LFDs is greater than the number of tests registered, which is publicly available on [the GOV.UK dashboard](#). This approach is a revision to our initial method for measuring LFD tests, which only captured registered tests from the publicly available data. Further information on the [differences between the number of tests registered and dispatched](#) is published by DHSC.

Using data on tests dispatched ensures that all tests are included, and that none are double counted. As a result, our measure of LFD activity includes:

- tests that have been delivered to individuals and used (registered or not)
- tests that have been delivered to individuals but have not yet been used
- tests that have been ordered by individuals but are still in transit

We weight LFD tests by an LFD-specific unit cost, with all other types of activity weighted by a PCR unit cost. This accounts for the higher costs of tests requiring laboratory processing. Comprehensive unit costs for PCR and LFD tests were provided by the DHSC¹, comprising associated direct, indirect and overhead costs for the financial year ending 2021 (April 2020 to March 2021). Direct costs include the procurement of test kits and the processing of results, while indirect costs include distribution and storage costs. Overhead costs include programme management costs and facilities management costs.

Contact tracing

Individuals who test positive for COVID-19 after a PCR test, or in some circumstances other types of test, are subsequently [contacted by the tracing service](#). The tracing service providers seek contact information for people who have been in close proximity with the confirmed case and notify these individuals, asking them to self-isolate.

To measure the volume of output produced by the contact tracing programme, we use the number of people called and asked to self-isolate. This is based on published [weekly statistics](#) on "the number of people reached and asked to provide details of recent close contacts", and "close contacts reached and asked to self-isolate".

The costs information for this service is provided by DHSC. Unit costs for call hours and the total number of call hours are used to estimate a unit cost per call for the financial year ending 2021. This estimate of implied expenditure is then divided by the total number of people called and asked to self-isolate over the same period to derive the unit cost used for this activity. We do not include the underlying cost of the smartphone notification application within our measure of tracing output, as this is an intellectual property product [within the national accounts framework \(PDF, 1.33MB\)](#) and therefore does not form part of the unit cost.

Vaccinations

The UK's first approved COVID-19 vaccination was administered as part of the mass vaccination program on 8 December 2020, using the Pfizer/BioNTech vaccine. Oxford/AstraZeneca vaccines then became available to the public from 4 January 2021 onwards. The Moderna vaccine was subsequently introduced from 7 April 2021.

We use publicly available activity data to estimate [the overall number of vaccines administered](#), combining the number of first and second doses of vaccines received by individuals. We disaggregate vaccine activity further for our output measure using data on vaccine type (Pfizer, AstraZeneca and Moderna) and delivery setting (hospital hubs, vaccination centres and local sites), to give nine different types of activity. The data for these more granular activity types are supplied by the NHS.

Unit costs for these different types of activity are derived from data on deployment costs for vaccine delivery settings, obtained from the DHSC, and purchase costs for the different types of vaccines from the Department for Business, Energy and Industrial Strategy (BEIS).

Notes for: New methodology for COVID-19 testing, tracing and vaccination output

1. Unit costs are commercially sensitive but provided as part of the statistical compilation process. As such, unit costs cannot be disclosed.

4 . Integration of COVID-19 testing, tracing and vaccine services into healthcare volumes

Summary of approach

Healthcare volumes, as measured in gross domestic product (GDP), are based on the growth in cost-weighted activity for a variety of timely healthcare-related indicators. These cover a range of day-to-day healthcare services, such as elective and non-elective treatments in hospitals, outpatient consultations and primary care activities. However, timely quarterly activity data are not available for all healthcare activity and so the quarterly indicators used account for only a portion of healthcare output. In the short term, we assume that the changes in these timely indicators reflect changes in the level of healthcare output more broadly.

In the longer term, these timely estimates are benchmarked against a more comprehensive measure of healthcare output once more detailed annual data become available. The benchmark includes a much more granular and complete assessment of healthcare activities across the whole UK, for example, activities relating to mental healthcare and community health services, as well as greater granularity in the types of elective and non-elective inpatient services measured in each UK nation. From this series an output growth index is produced that can be used to derive volumes.

Because, by necessity, the indicators used to produce quarterly healthcare output cover a smaller proportion of healthcare than the annual index, simply introducing the volumes of coronavirus (COVID-19) testing, tracing and vaccines as additional indicators into this measure would result in the impact of growth in the new services being overestimated relative to the rest of healthcare. This would present a problem as there has been a notable difference between the growth of these new COVID-19 healthcare activities and existing healthcare services.

Therefore, as an alternative, we produce two separate cost-weighted activity indices: one for regular healthcare services and the other for the new COVID-19 testing, tracing and vaccination services. These two output indices are then combined using appropriate quarterly expenditure weights for each component. Quarterly weights are used because of the large quarterly changes in both the existing and new COVID-19-related healthcare services, which, if the weights were held constant over the year, would lead to bias in the growth rates.

Expenditure weights

We use implied expenditure (produced by multiplying activity levels by their respective unit cost) as the means of weighting together the growth indices for existing healthcare services and the new COVID-19 testing, tracing and vaccination services.

For the existing healthcare services, we use implied expenditure for the comprehensive measure of healthcare output, while for the new services we use implied expenditure based on the activity and unit cost data described in earlier sections. This ensures that the expenditure weights are representative of the services measured in each output growth index. To ensure both expenditure weights are representative of the same geographical coverage, we use the England component of the comprehensive measure of healthcare output within the weighting¹.

However, a number of adjustments are needed to ensure consistency between these weights. Firstly, the weight for the existing services, being based on implied expenditure from the comprehensive measure of healthcare, is only available on an annual basis. To obtain quarterly expenditure weights, the implied expenditure derived from the quarterly indicators is scaled to the level of the comprehensive measure of healthcare output. The scaling factor used to obtain these weights represents the difference between implied expenditure for a year in the comprehensive measure of healthcare output and the corresponding year in the quarterly series. These factors are used to scale all four quarters of that year.

Secondly, there is a time lag in the production of the comprehensive measure of healthcare output to which the quarterly series is scaled, resulting in implied expenditure for existing healthcare services being presented in the prices of an earlier year. For example, if the comprehensive measure ended in 2018, the quarterly series for 2019 to the present quarter would be scaled based on the difference between the quarterly and comprehensive measure for 2018. We therefore need a further adjustment to the expenditure weights to ensure the existing healthcare services and the new COVID-19 testing, tracing and vaccination services are presented in the same year's prices, avoiding the risk of inflation resulting in bias in the weights.

We adjust implied expenditure for the new services, which are presented in contemporary prices, by deflating testing, tracing and vaccination expenditure back to the same period of the comprehensive measure of existing healthcare services. The [average weekly earnings for public sector healthcare workers](#) are used to deflate the expenditure, as labour costs represent a substantial share of the costs of providing the new services and healthcare services more generally.

Combining growth indices for new and existing healthcare services

Having produced expenditure weights for both the existing healthcare services and the new COVID-19 testing, tracing and vaccination services, the respective growth indices are then combined using an approach that reflects the Laspeyres method normally used in measuring public sector output.

Given that the index representing COVID-19 testing, tracing and vaccination output is quarterly and that the time series is short, it is weighted by implied expenditure from the previous quarter, rather than the previous year. This has the important impact of avoiding distortion as a result of fixed base period effects, whereby a series that experiences falls and increases in different quarters of the same year leads to overstated growth rates when weights are fixed annually.

Quarter 2 (April to June) 2020 represents the first period for which we have activity data for the new set of services. As there is no expenditure weight to use for the previous quarter, we are unable to calculate a combined index for Quarter 2 2020 using the conventional Laspeyres index approach. Instead, growth in the overall index is adjusted such that it matches the combined volume growth of existing and new healthcare services.

The weight of the existing healthcare output series and its (negative) contribution in monetary terms to growth in the overall healthcare output index, decreases by the difference between the output of the existing healthcare series and the new testing, tracing and vaccination series. Thus, the effect of the contribution of these new services in monetary terms is integrated into the combined index.

Notes for: Integration of COVID-19 testing, tracing and vaccine services into healthcare volumes

1. While using England-level weights to get the appropriate relative shares of each index, the growth indices are combined at a UK-level.

5 . Impact on volumes

Our approach to estimating output for coronavirus (COVID-19) testing, tracing and vaccinations is incorporated within the chained volume measurement (CVM) of gross domestic product (GDP) and consequent breakdowns by sector and industry. CVMs present goods and services with the effect of price changes removed.

We introduce our new method of estimating COVID-19 testing, tracing and vaccination volumes in the Quarter 2 (April to June) 2021 [quarterly national accounts](#). This replaces the previous method, which was used to estimate volumes up to the [first quarterly estimate](#) of GDP for Quarter 2 2021.

Figure 1 shows the impact of incorporating COVID-19 testing, tracing and vaccination activities into the measurement of volumes of government healthcare services. The impact of the COVID-19-related services on growth in healthcare volumes is greatest in Quarter 1 (January to March) 2021, when mass testing and the COVID-19 vaccination programmes both ramped up.

The figure also shows the revision to our measurement of COVID-19 testing, tracing and vaccination volumes resulting from the implementation of a volumetric measurement approach.

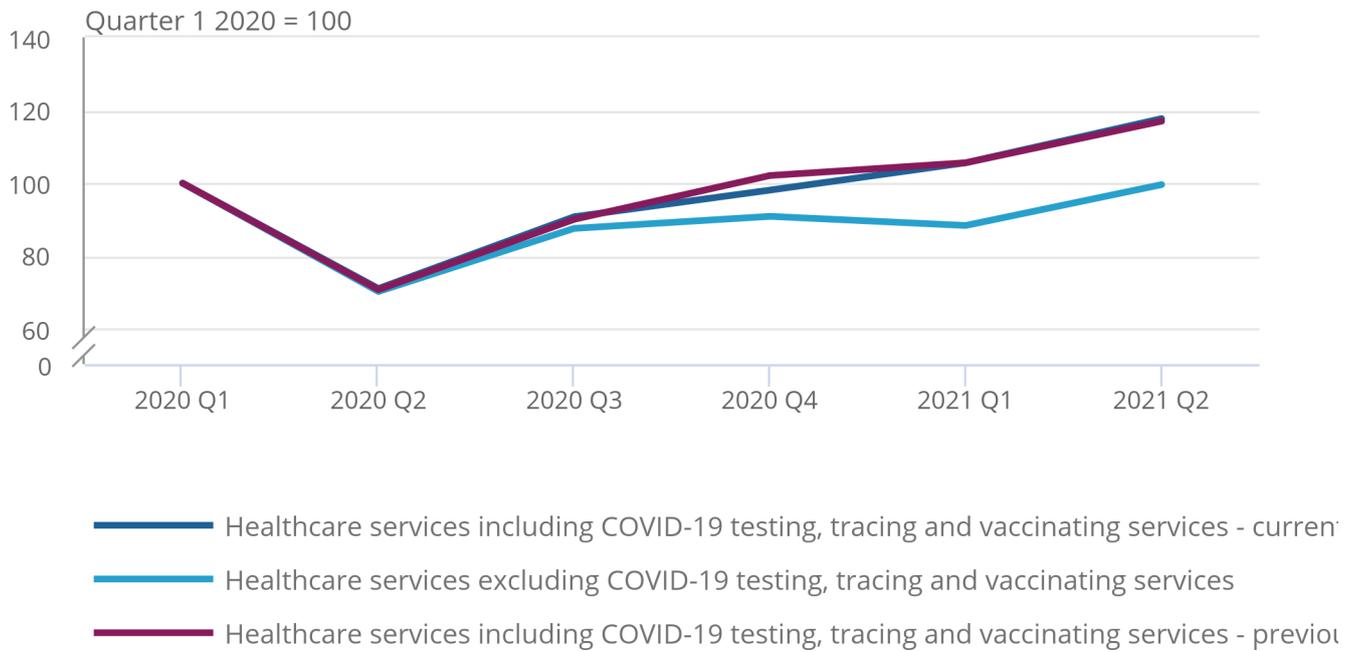
Generally, estimates from the original method were reaffirmed by the new method and revisions were small between the Quarter 2 2021 first quarterly estimate (FQE) and Quarter 2 2021 quarterly national accounts (QNA). The largest revision to GDP from the new method was to Quarter 4 (October to December) 2020, where the estimates from the new method revised down growth in COVID-19 testing, tracing and vaccination output. This leads to GDP growth that is 0.4 percentage points lower in Quarter 4 2020. As the revisions to COVID-19 testing, tracing and vaccination volumes were smaller for Quarters 1 and 2 of 2021, this downward revision in Quarter 4 2020 is reversed, with upward revisions to GDP growth of 0.3 and 0.1 percentage points for Quarter 1 and Quarter 2 2021 respectively.

Figure 1: Growth in healthcare output is greater with the adjustment, particularly in Quarter 1 2021

General government human health services: output volume index, UK

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General government human health services: output volume index, UK



Source: Office for National Statistics

Notes:

Data correspond to general government final consumption expenditure for Standard Industrial Classification section 86: human health.

The overall volume estimate for COVID-19 testing, tracing and vaccination services is in the region of £4.5 billion for the calendar year 2020. Volume estimates for the first two quarters of 2021 are much larger at around £14.2 billion, partly because of the ramp-up of testing and partly because of the operation of the vaccination programme.

Table 1: Testing, tracing and vaccination volumes (£ millions)

	2021 Q2 QNA estimates			2021 Q2 FQE estimates		Revision
(£ millions)	Testing	Tracing	Vaccines	Total	Total	Total
2020 Q2	300	0	0	300	200	100
2020 Q3	1,300	0	0	1,300	1,000	300
2020 Q4	2,600	200	100	2,900	4,500	-1,600
2021 Q1	4,800	200	1,900	6,900	6,900	0
2021 Q2	4,900	100	2,300	7,300	7,000	300

Source: Office for National Statistics

Notes

1. Values are rounded to the nearest £100 million.
2. Values for tracing in Quarter 2 2020 and Quarter 3 2020 are estimated at between £0 and £50 million.
3. Some of the variation between the previous testing, tracing and vaccination services adjustment and the current adjustment will be because of the change of reference year between the two data vintages.

Table 1 also provides a breakdown of volumes for the three components individually. Testing represents the largest of the three newly-incorporated services in each quarter, with the vaccination programme also representing a sizeable share of volumes in 2021. Tracing is a much smaller component in scale, which is also reflected in [analyses of expenditure data](#).

While the revisions to the volume estimates of COVID-19 testing, tracing and vaccination services are relatively small, the new measurement approach represents a methodological improvement and an alignment with the methodology used for other government healthcare services. This is one part of a wider package of revisions to volumes for government healthcare services, which include the incorporation of revised quarterly activity data.

The new methodology will be used for future quarterly estimates and will inform our less timely comprehensive measure of healthcare output along with our measures of [public service productivity](#). We will continue to monitor developments in delivery of these services and work with data suppliers to ensure that the volume output measure continues to reflect the ongoing management of the pandemic.