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# Measuring NHS Output Growth

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## Abstract

We report estimates of output growth for the National Health Service in England over the period 2003/4 to 2006/7. Our output index is virtually comprehensive, capturing as far as possible all the activities undertaken for NHS patients by both NHS and non-NHS providers across all care settings.
We assess the quality of output by measuring the waiting times and survival status of every single patient treated in hospital, and we allow for improved disease management in primary care.

We propose and apply a method that avoids the traditional requirement for consistent definition of output categories over time in construction of output indices. Use of our approach is critical: it would be not otherwise be possible to calculate output growth for the NHS over the years we consider in any meaningful way.

After correcting for significant improvements in data collection in the early period, output growth for the NHS between 2003/4 to 2006/7 averages 5.1% per year, of which 1% is due to improvements in the quality of care.

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## Notation

| Notation | Interpretation |
|---|---|
| $x_{jt}$ | quantity (volume) of output *j* at time *t* |
| $v_{jt}$ | marginal social value of output *j* at time *t* |
| $c_{jt}$ | unit (average) cost of output *j* at time *t* |
| $I^{Lc}$ | Laspeyres cost weighted output index |
| $I^{Pc}$ | Paasche cost weighted output index |
| $I^{Fc}$ | Fisher cost weighted output index |
| $I^{Lcq}$ | Laspeyres quality-adjusted cost weighted output index |
| $a$ | In-hospital or 30-day post discharge survival rate |
| $k$ | Ration of health status before and after treatment |
| $L$ | life expectancy with treatment |
| $w$ | 80th percentile or mean waiting time |
| $r_w, r_L$ | Discount rates on the wait for treatment, QALYs |
| $\gamma$ | Inflation rate |
| $\mathrm{A}$ | Assumed life expectancy following outpatient attendance |

## Executive summary

There are three major challenges in measuring growth in the output of the health care system:

- It is necessary to quantify the **volume** of health care accurately. This requires classifying patients into reasonably homogenous 'output' groupings.
- In order to aggregate these output groups into a single index, some means of assessing their **relative value** is required.
- **Quality** is likely to be an important source of output growth, and it is necessary both to define quality and measure changes in the quality of health care output over time.

We address these challenges in measuring output growth over the period 2003/4 to 2006/7 for the NHS. We provide detailed consideration of output growth in broadly-defined health care settings: hospitals, outpatient departments, community settings, mental health care, primary care, and other settings. We assess the nature of the data provided by organisations working in each setting, and report setting-specific measures of output growth.

Two aspects of our output estimates distinguish them from standard practice in other sectors and internationally. First, our output index is virtually comprehensive, capturing as far as possible all the activities undertaken for NHS patients by both NHS and non-NHS providers. We analyse information about every patient treated in hospitals and outpatient departments and about every prescription dispensed in primary care. Significant improvements to data collection have allowed us to measure primary and community care more accurately and comprehensively over time. This contrasts with most indices that are based on a 'basket' of activities that are deemed to be representative of the whole.

Second, we assess the quality of output by measuring the waiting times and survival status of every single patient treated in hospital each year. This ensures precise measurement of these important aspects of quality. This is preferable to reliance on information from surveys, which may be unrepresentative, administered infrequently, measured inconsistently over time, and impossible to link to any specific activity (Atkinson, 2005). We also allow for improved disease management in primary care (Derbyshire et al., 2007).

We address a major practical challenge that arises in the NHS because of periodic wholesale revisions to the classification systems used to describe output categories. Traditional methods to calculate output growth require output categories to be consistent across adjacent time periods (Eurostat/Commission of the European Communities et al., 1993). But recently this requirement has not been met in the NHS. Between 2005/6 and 2006/7 the Reference Cost categories used to describe outputs in settings other than hospitals and primary care were completed re-defined. In 2007/8 there is to be a complete revision of the way that hospital output is defined, with the move from version 3.5 to version 4 HRGs. If we relied on traditional methods, output growth between 2005/6 and 2006/7 would be based solely on hospital and primary care activity. In contrast, output growth between 2006/7 and 2007/8 would be based solely on non-hospital activity. Clearly, comparisons of output growth over the full period would be rendered virtually meaningless, with only primary care activity being included throughout.

We propose a method that avoids the requirement for consistent definition of output categories over time. Instead we impute costs for the relevant outputs for the period in which the information is unavailable. Use of our approach is critical: it would not otherwise be possible to calculate output growth for the NHS over the years we consider in any meaningful way.

We use the Hospital Episode Statistics to quantify the amount of activity undertaken in **hospitals** and to assess the quality of this activity. A unit of activity is defined as a continuous inpatient spell which allows patients to be tracked when transferred between hospitals as part of their care pathway. We implement improvements to how continuous inpatient spells are calculated by identifying the order of same-day transfers, over-riding incorrect coding of discharge fields and linking records across successive years.

Hospital activity, survival rates and waiting times have all improved over time, all of which contribute positively to growth. Over the same period the NHS has been extending treatment to older patients . If the age profile of NHS patients increases more rapidly than the improvements in population life expectancy this will lead to a dampening of output growth. Output growth depends, then, on the net effect of these various conflicting influences.

The cost weighted output index for the hospital sector is positive throughout the period, averaging 3.62% per year. This is slightly lower than the percentage change in pure volume over the period, the reason being that, unsurprisingly, volume growth has been more rapid for less complex (ie less costly) activities than it has for more costly activities.

Improvements in 30-day survival post-discharge reflect positively on growth, adding around 0.25% to output growth in the hospital sector annually. The positive health effects enjoyed by those who survive hospital treatment capture both changes in health status and the changes in life expectancy. These improved health benefits add between 1.4% and 2.6% annually. Improvements in waiting times add between 0.1% and 0.3% to annual output growth.

We compare two sources of data about **outpatient activity**, namely the Outpatient Minimum Dataset (OMD) and the Reference Cost returns. We recommend using the latter for the purposes of calculating output growth, the grounds being that there is a high level of agreement between the two data sources, costs are matched to output groups in the Reference Cost data and the Reference Cost data are available earlier than the OMD.

There is a substantial increase in growth in outpatient activity between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. There was a shift toward less costly procedures thereafter which became pronounced between 2005/6 and 2006/7, to the extent that cost weighted output fell by 6.86%, despite overall activity having increased slightly. Nevertheless output growth across the whole period averages 4.39% per annum. Allowing for the improvement in outpatient waiting times has a positive effect on the growth rate, adding 0.09% in the early period to 0.04% more recently.

For **mental health care**, we use HES data to assess activity in the hospital sector and Reference Cost data for all other activities. There has been a reduction in hospital activity over time, with an increase in activity in other settings, these changes perhaps indicative of some substitution as a result of efforts to prevent hospital admission.

There is a substantial increase in growth between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. Later activity increases have been concentrated among less costly activities, which has depressed the rate of growth. Even so, the average across the whole period is still 8.59%. Quality adjustment of inpatient activity has an inconsistent impact on the index. Initially, quality adjustment contributes positively to growth, but between 2004/5-2005/6 the adjustment is negative though small (-0.8%). This is driven mainly by the large increase in the waiting time between these two years, but also by the slight fall in life expectancy as progressively the mean age of patients receiving treatment increases. Quality adjustment was neutral between 2005/6 and 2006/7.

There have been substantial changes over time in the way that **community health care services** are categorised and an expansion of data collection, particularly in 2004/5 which is reflected in the appearance of a substantial growth rate between 2003/4 and 2004/5. The growth rate is slightly negative between 2005/6 and 2006/7.

We use community care to explore the implications of applying the conventional method and our approach to dealing with categorisation changes. We also provide details of activity growth in community care by organisational type (hospitals, Primary Care Trust, PMS pilots and independent providers).

The growth rate in the **primary care sector** is calculated for consultations conducted in general practice and also when prescribing is included. Growth in consultations averaged 2.71% over the full period. Allowing for the improvements in the management of blood pressure for patients suffering from chronic heart disease, stroke and hypertension adds 0.5% to the average annual growth rate. Growth has been stronger for prescriptions than for consultations, mainly because volume has increased at a faster rate. When prescribing is taken into account, the average annual growth rate in the primary care sector, again allowing for quality improvements, amounts to 5.45%.

The growth rate for all **other NHS activities** is somewhat erratic over time, and is probably more a reflection of the way that data collection has changed across periods than it is of pure activity growth. The growth between 2003/4 and 2004/5 is driven mainly by the expanded provision of data by PCTs in 2004/5, while the growth between 2005/6 and 2006/7 is mainly due to the expansion in the number of categories, which meant that previously uncounted activity was included for the first time in 2006/7.

**Table 1 Cost weighted output index, Laspeyres index**

| **Setting** | **2003/4-2004/05** | **2004/5-2005/6** | **2005/6-2006/7** | **Average** |
|---|---|---|---|---|
| Hospital activity | 2.56% | 5.48% | 2.80% | 3.62% |
| Outpatient activity | 10.14% | 9.87% | -6.86% | 4.39% |
| Mental Health care services | 11.44% | 9.50% | 4.83% | 8.59% |
| Community care services | 315.53% | 10.25% | -0.65% | 108.38% |
| Primary care consultations | -0.21% | 5.63% | 2.70% | 2.71% |
| Primary care consultations & prescribing | 4.33% | 6.99% | 4.47% | 5.26% |
| All other NHS activity | 17.13% | 3.14% | 22.07% | 14.11% |
| Total NHS | 27.88% | 6.48% | 5.84% | 13.40% |
| Total NHS excluding prescribing | 31.79% | 6.22% | 5.82% | 14.61% |
| Hospital, outpatient, mental health and primary care consultations | 5.10% | 6.49% | 0.74% | 4.11% |

Table 1 reports the Laspeyres cost weighted output index by setting, for each pair of years, and the annual average across the whole period. Average growth between 2003/4 and 2005/6 amounted to 13.4%. Output growth is slightly higher if prescribing is excluded because, although the volume of prescriptions increased, this was at a slower rate than for the NHS as a whole.

Much of the growth in the early period is driven by better recording of activity, particularly in the community care sector and for “all other NHS activity”, so it is probably better to consider the later years in the series as more representative of actual output growth for the NHS as a whole. Other sectors are much less affected by changes in data collection procedures, so the estimates for these sectors are more likely to represent actual changes in output. The final row in Table 1 shows growth rates for those sectors where there has been greater temporal consistency in data collection. For activity in hospitals, outpatient departments, in mental health and in primary care the average growth rate was 4.11%. Growth between 2005/6-2006/7 was 0.74%, pulled down by the reduction in outpatient activity.

**Table 2 Quality-adjusted cost weighted output index, Laspeyres index**

| **Setting** | **2003/4-2004/05** | **2004/5-2005/6** | **2005/6-2006/7** | **Average** |
|---|---|---|---|---|
| Hospital activity | 5.66% | 7.48% | 4.88% | 6.01% |
| Outpatient activity | 10.23% | 9.96% | -6.81% | 4.46% |
| Mental Health care services | 11.83% | 9.42% | 4.82% | 8.69% |
| Community care services | 315.53% | 10.25% | -0.65% | 108.38% |
| Primary care consultations | 0.34% | 6.06% | 3.21% | 3.21% |
| Primary care consultations & prescribing | 4.51% | 7.16% | 4.67% | 5.45% |
| All other NHS activity | 17.13% | 3.14% | 22.07% | 14.11% |
| Total NHS | 28.82% | 7.11% | 6.08% | 14.00% |
| Total NHS excluding prescribing | 32.89% | 6.96% | 6.11% | 15.32% |
| Hospital, outpatient, mental health and primary care consultations | 6.76% | 7.48% | 1.08% | 5.10% |

Table 2 reports output growth when improvements in quality have been allowed for. These improvements apply to hospital activity, outpatient activity, mental health care services and primary care only. Quality adds an average of 0.6% annually to total NHS output growth.

# 1. Conceptual overview

## 1.1 Introduction

In this section, we provide a brief overview of the issues involved in measuring output growth in the health care sector and describe indices that have been developed for this purpose. We then address a particular practical problem, this being the periodic wholesale revision in categorisation systems used to describe health care output. Application of conventional accounting procedures would mean that substantial amounts of output would be excluded from the growth index for the years in which the revisions took place. We propose a method that ensures these outputs are included and demonstrate its importance by way of an illustrative example.

## 1.2 Specifying indices of output growth

Eurostat defines health care output as “the quantity of health care received by patients, adjusted to allow for the qualities of services provided, for each type of health care. The quantity of health care received by patients should be measured in terms of complete treatments” (Eurostat, 2001).

There are three major challenges in meeting this definition for the purposes of constructing an index of output growth:

- It is necessary to quantify the **volume** of health care accurately. Quantifying the number of patients who have completed their treatment is extremely challenging. Patients have very varied health care requirements and receive very different packages of care. To account for this, some means of classifying patients into reasonably homogenous ‘output’ groupings is necessary.
- In order to aggregate these output groups into a single index, some means of assessing their **relative value** is required.
- Output growth should reflect both the quantity and quality of output. This involves assessing changes in the **quality** of health care output over time.

We shall address these issues for the NHS in England. We shall consider sections of the health system separately, reflecting differences in the activities performed in broadly-defined health care settings – such as hospitals, outpatient departments, mental health care, community settings, and primary care. We shall assess the nature of the data provided by organisations working in each setting.

Quantifying the **volume** of health care output in terms of ‘completed treatments’ is difficult for two main reasons. First, many patients receive a range of interventions from different providers, in a variety of settings. Most countries, including England, lack the informational capability to track patients across different settings. Consequently we cannot capture accurately the full treatment pathway. Second, it is not always straightforward to determine when treatment has been completed. Indeed, for patients with chronic or terminal conditions who require care over a long period of time, treatment may not be considered ‘complete’ until the patient has died. Rather than quantifying ‘complete treatments’, it is common practice to define output in the health sector by counting the amount of each type of activity that is undertaken in each health care setting. An activity might be a consultation with a general practictioner (GP), an angioplasty involving a stay in hospital or a visit to the outpatient department. We define $x_j$ as the number of patients who have activity type *j*, where *j*=1…*J*.

The way that these activity categories are defined need not stay constant over time. One reason for this is that new technologies appear, as they do in all sectors of the economy. But of more consequence in the health sector is that the classification systems used to describe activity categories are often subject to substantial revision. This makes it difficult to make direct comparisons of activity from one period to the next and, therefore, to calculate growth rates. In section 1.3 we discuss this issue at greater length and propose a solution.

Of course, the health sector performs many different activities at any point in time. It is necessary to attach a **relative value** to each type of activity ($v_j$) in order to construct a measure of total output. In

Laspeyres form, where activities are valued in the base period (time *t*), an index of total output can be specified as:

$$I^{Lv} = \frac{(\text{number\_of\_activities}_{t+1})\times(\text{value\_per\_activity}_{t})}{(\text{number\_of\_activities}_{t})\times(\text{value\_per\_activity}_{t})} = \frac{\sum_{j=1}^{J} x_{jt+1}v_{jt}}{\sum_{j=1}^{J} x_{jt}v_{jt}} \qquad (1)$$

Where $x_j$ is the volume of activity in activity category *j*, with *j*=1…*J*, and *t* indexing time; and where $v_j$ is the value weight for activity category *j*. The problem in calculating this index is in finding relative values for each type of activity. For goods and services which are publicly subsidised there are no market prices to indicate the consumer's marginal willingness to pay for them. Instead, the convention in the national accounts has been to use cost to reflect the value of non-market outputs. A cost weighted output index (CWOI) in Laspeyres form is specified as:

$$I^{Lc} = \frac{(\text{number\_of\_activities}_{t+1})\times(\text{cost\_per\_activity}_{t})}{(\text{number\_of\_activities}_{t})\times(\text{cost\_per\_activity}_{t})} = \frac{\sum_{j=1}^{J} x_{jt+1}c_{jt}}{\sum_{j=1}^{J} x_{jt}c_{jt}} \qquad (2)$$

Where $c_j$ is the cost weight of activity category *j*. Using costs to weight activities implies that costs reflect the marginal value that society places on each of these activities. This holds only under certain assumptions, particularly that health care resources are allocated in line with societal preferences (ie the health system is allocatively efficient). Although this condition is unlikely to be met, at least cost-weights have the advantage that they are reasonably easy to obtain

Output growth indices can be calculated in various ways, with the Paasche and Fisher indices being other common forms. The Paasche index uses costs in the current period (*t*+1) to weight activity, and takes the following form:

$$I^{Pc} = \frac{\sum_{j=1}^{J} x_{jt+1}c_{jt+1}}{\sum_{j=1}^{J} x_{jt}c_{jt+1}} \qquad (3)$$

The Fisher index is calculated as the geometric mean of the Laspeyres and Paasche indices:

$$I^{Fc} = \sqrt{I^{Lc}\times I^{Pc}} \qquad (4)$$

We shall calculate all three of these forms of the output index.

Incorporating measures of **quality** in an output index is hampered primarily by a lack of consensus about how to define quality and, hence, how to measure it (Smith and Street, 2007). In our earlier work we proposed a quality-adjusted index that incorporates measures of quality that can be derived from data collected for patients treated in hospital. Our preferred index adjusts activity to reflect how long patients have to wait before being admitted to the hospital and the health outcomes associated with each type of activity (Dawson et al., 2005, Castelli et al., 2007a). The quality adjusted CWOI takes the following form:

$$I^{Lcq} = \frac{\sum_j x_{jt+1} c_{jt} \left( \frac{a_{jt+1} - k_{jt+1}}{a_{jt} - k_{jt}} \right) \frac{\left[ \frac{\left(1 - e^{-r_L L_{jt+1}}\right)}{r_L} - \frac{\left(e^{r_w w_{jt+1}} - 1\right)}{r_w} \right]}{\left[ \frac{\left(1 - e^{-r_L L_{jt}}\right)}{r_L} - \frac{\left(e^{r_w w_{jt}} - 1\right)}{r_w} \right]}}{\sum_j x_{jt} c_{jt}} \quad (5)$$

This index captures improvements in survival following hospital treatment, measured by 30-day survival rates for each treatment ($a_j$). Allowance is also made for the improved quality of life experienced by patients who survive treatment, measured as the ratio of average health status before and after treatment ($k_j$). As we shall see in section 2.2.2 limited availability of health status data means that, in calculating this index, it is not possible to specify a value for *k* for every type of activity. Nor is there any information with which to judge changes in the ratio over time, hence in practice we are forced to assume that $k_{jt} = k_{jt+1} = k_j$.

The age structure of patients treated in hospital may change over time, in which case younger (older) patients will have more (less) time to enjoy the benefits of increased health subsequent to treatment. This is captured by calculating life expectancy for each treatment type ($L_j$) by considering the age and gender profiles of patients having each treatment at each time period. $r_L$ is the discount rate applied to future life years.

The time that patients have to wait before receiving treatment ($w_j$) may have adverse health effects. The index allows for this possibility by capturing the welfare loss associated with not being treated immediately, assuming that the marginal disutility of waiting increases as the delay extends. This is akin to charging interest on the cost of waiting, captured by the discount rate $r_w$. The expected waiting time is measured at the $80^{th}$ percentile of the waiting time distribution for each type of treatment, in recognition that reductions in these relatively long waiting times confer benefits on all patients by reducing the risk of having to face a very long wait.

The quality adjusted CWOI is calculated for activities conducted in the hospital sector, where patient-level data are available to populate the various elements of the index. We are also able to incorporate information on outpatient waiting times in index of growth in outpatient activity and adopt a procedure developed by the Department of Health to capture improvements in the control of cholesterol and high blood pressure in primary care (Derbyshire et al., 2007). For other sectors, we calculate CWOIs that do not incorporate quality adjustments.

## 1.3 Changes in output categories

Traditional methods to calculate output growth require output categories to be consistent across adjacent time periods (Eurostat/Commission of the European Communities et al., 1993). However, categorisation of health service activity (output groups) often changes from year to year. Changes happen, though somewhat infrequently, in market sectors, particularly as new products are launched (eg iPods). It happens more frequently in non-market sectors, where direct volume measurement has only recently been adopted for the national accounts, and where output descriptions are still being developed and are subject to regular revision. Examples in the NHS include counting of previously unmeasured activities (eg many types of community care) and, most importantly, re-categorisation of previously quantified activity. In particular, between 2005/6 and 2006/7 the Reference Cost categories used to define outputs in settings other than hospitals and primary care were completed revised. In 2007/8 there is to be a complete revision of the way that hospital output is defined, with the move from version 3.5 to version 4 Healthcare Resource Groups (HRGs). If we relied on traditional methods, output growth between 2005/6 and 2006/7 would be based solely on hospital and primary care activity. In contrast, output growth between 2006/7 and 2007/8 would be based solely on non-hospital activity.

Consequently comparisons of output growth over the full period would be rendered virtually meaningless, with only primary care activity being included throughout. In this section we explain the nature of the problem and provide a solution that ensures that all outputs are included in the index.

Categorisation changes can be summarised as taking two forms:

- Introduction of new categories
- Retirement of old categories

An output series is designed to measure growth in output over time, measured by aggregating change for each specific output type. This calculation requires two pieces of information:

- A measure of the amount of activity for each specific activity type ( $x_j$ )
- A measure of the relative value of each output type, which is given by its cost ( $c_j$ )

In Laspeyres form, aggregate output growth is given by

$$I^{Lc} = \frac{\sum_{j=1}^{J} x_{jt+1} c_{jt}}{\sum_{j=1}^{J} x_{jt} c_{jt}} \qquad (6)=(3)$$

The fundamental problem in calculating this index is that when a new output category ( $x_j^N$ ) is introduced in *t+1*, there is no value for cost in the previous (base) year $c_{jt}$ .

The Paasche index uses cost weights in the year *t+1*, with aggregate output growth given by

$$I^{Pc} = \frac{\sum_{j=1}^{J} x_{jt+1} c_{jt+1}}{\sum_{j=1}^{J} x_{jt} c_{jt+1}} \qquad (7)=(4)$$

Calculating the Paasche index is problematic when output categories are "retired", because there is no value for $c_{jt+1}$ .

### *1.3.1 Possible solutions to categorisation changes*

There are three ways to deal with the problem of categorisation changes.

Method A is the *traditional* approach, and entails inclusion of output categories only if information is available in two successive years. Obviously, this leads to loss of information.

Method B involves *mapping* of new and retiring activities. This is the strategy we adopted in the original York/NIESR project to deal with the change from v3.1 to v3.5 HRGs (Dawson et al., 2005). Mapping requires that new and retiring categories are somehow related and judgements to be made about the nature of their relationship. If there are new categories that are capturing previously uncounted outputs, the mapping strategy cannot be adopted.

Method C involves *imputing* values where cost data are missing for any particular time period. In the case of the Laspeyres index, the best available alternative value for $c_{jt}$ is $c_{jt+1}$ . The use of $c_{jt+1}$ necessitates an assumption about how costs vary over time for the specific output type $(\gamma_j)$ , so that

$c_{jt} = \gamma_j c_{jt+1}$ can be calculated. It may be reasonable to assume that costs increase at the same rate for all output types, with $\gamma_1 = \gamma_2 = ... = \gamma_J$ , so we have $c_t = \gamma c_{t+1}$. In this case $\gamma$ captures inflation, and can be calculated by comparing the price index (PI) in one period to that in the previous period, $\gamma = PI_{t+1} / PI_t$ . In the health sector, two candidate price indices are the Health Services Cost Index and the Pay Cost Index.

For a Paasche index, a value for $c_{jt+1}$ is required. This can be imputed in an analogous fashion, with $c_{jt+1} = \frac{1}{\gamma} c_{jt}$ .

### *1.3.2 Illustrative comparison of methods*

To illustrate the implications of adopting one method or another we consider ten output categories that are subject to different volumes over time. In order to assess the pure volume effect of the alternative methods, we assume a common set of cost weights (ie each unit of activity is of equal value) and no inflation.

**Table 1-1 Illustrative sample of categories**

| **Categories** | **$t_0$** | | **$t_1$** | | **$t_2$** | | **$t_3$** | |
|---|---|---|---|---|---|---|---|---|
| | *activity* | *cost* | *activity* | *cost* | *activity* | *cost* | *activity* | *cost* |
| **A** | 750 | 1 | 820 | 1 | 700 | 1 | 650 | 1 |
| **B** | 1000 | 1 | 1500 | 1 | 2200 | 1 | 3500 | 1 |
| **C** | 0 | 0 | 3000 | 1 | 4200 | 1 | 0 | 0 |
| **D** | 20 | 1 | 0 | 0 | 0 | 0 | 4500 | 1 |
| **E (=F+G)** | 1500 | 1 | 1700 | 1 | 0 | 0 | 0 | 0 |
| **F** | 0 | 0 | 0 | 0 | 900 | 1 | 1800 | 1 |
| **G** | 0 | 0 | 0 | 0 | 1200 | 1 | 2400 | 1 |
| **H** | 250 | 1 | 620 | 1 | 0 | 0 | 0 | 0 |
| **I** | 3000 | 1 | 3250 | 1 | 0 | 0 | 0 | 0 |
| **J(=H+I)** | 0 | 0 | 0 | 0 | 4000 | 1 | 2000 | 1 |
| **Total activity** | 6520 | | 10890 | | 13200 | | 14850 | |
| **Actual growth** | - | | 67.02% | | 21.21% | | 12.50% | |

Table 1-1 provides illustrative data for ten output categories covering the spectrum of cases that present themselves when dealing with the construction of output growth indices, these being:

- Categories subject to no categorisation changes, which present no problems. Categories A and B are examples of categories that are recorded throughout the whole time period.
- Introduction of a new category and subsequent retirement. Category C is introduced at time $t_1$ and retired at $t_3$.
- Retirement and subsequent re-introduction of an original category. Category D is retired in $t_1$, and then re-introduced at $t_3$.
- Subsequent disaggregation of an original category. The activities recorded under category E at $t_0$ and $t_1$ are disaggregated at time $t_2$ to form two categories F and G.
- Subsequent aggregation of originally separate categories. Activity in categories H and I was itemised separately until $t_1$ but was amalgamated into the single Category J at time $t_2$.

The three methods use different amounts of activity data to construct the index of output growth. Table 1-1-2 shows how much of the data is used under each method.

- The top row (actual) shows the raw count of activity available in each year.

- The second row shows that a large proportion of data is lost by the requirement that activity categories are constant over two successive years, as is necessary if Method A is implemented. For instance, when comparing growth between $t_0$-$t_1$, 20 units of activity relating to category J are lost in $t_0$ and 3000 units relating to category C are lost in $t_1$. Categorisation changes mean that almost half of the volume of activity is lost at times $t_1$ and $t_2$.
- Data loss is less severe under Method B, shown in row 3. This is because mapping of activity categories (E=F+G; J=H+I) allows data for these categories to be preserved. Nevertheless activity relating to categories C and D, where mapping is ruled out, is omitted.
- Finally, as shown in the final row, no activity data are lost under Method C.

**Table 1-2 Data used in the output index under each method**

| Total Activity count | $t_0$ - $t_1$ | | $t_1$ - $t_2$ | | $t_2$ - $t_3$ | |
|---|---|---|---|---|---|---|
| | $t_0$ | $t_1$ | $t_1$ | $t_2$ | $t_2$ | $t_3$ |
| Actual | 6520 | 10890 | 10890 | 13200 | 13200 | 14850 |
| Method A | 6500 | 7890 | 5320 | 7100 | 9000 | 10350 |
| Method B | 6500 | 7890 | 10890 | 13200 | 9000 | 10350 |
| Method C | 6520 | 10890 | 10890 | 13200 | 13200 | 14850 |

Table 1-3 shows the estimates of output growth derived from applying each method. The actual growth rate is shown in the top row. Remember that this captures a pure volume effect, because costs are constant across output categories and over time.

The estimates of output growth under both Methods A and B are markedly different to the actual growth rate. This is entirely due to their selective use of data. In contrast, output growth under Method C is identical to actual growth.

**Table 1-3 Output growth, Laspeyres index**

| Index | $t_0$ - $t_1$ | $t_1$ - $t_2$ | $t_2$ - $t_3$ |
|---|---|---|---|
| Actual growth | 67.02% | 21.21% | 12.50% |
| Method A growth | 21.38% | 33.46% | 15.00% |
| Method B growth | 21.38% | 21.21% | 15.00% |
| Method C growth | 67.02% | 21.21% | 12.50% |

### *1.3.3 Conclusion*

Re-categorisation of output groups creates problems when measuring output growth over time. The standard approaches are either to include output categories only if they are measured in two successive years or to map new categorise back to those that they replace. Both approaches imply loss of activity data, resulting in biased estimates of output growth. While the mapping approach preserves more data, it requires (sometimes strong) assumptions to be made about the relationship between output categories.

The fundamental problem is that relevant cost weights are unavailable. However, if these cost weights can be imputed from an alternative source, accurate estimates of output growth can be obtained.

We suggest that, in calculating a Laspeyres index, the best alternative (base) cost weight for a category introduced at $t_1$ is the cost in $t_1$ deflated back to $t_0$.

In calculating a Paasche index, the best alternative (current) cost weight for a category retired after $t_0$ is the cost in $t_0$ inflated to $t_1$.

New (retiring) categories also suffer an absence of data on quality in the previous (subsequent) period. For instance, waiting times are used to adjust the volume of outpatient activity. While a current waiting time might be available for a new category of outpatient activity, the waiting time in the previous period will be unknown. To overcome this problem, we adopt an analogous procedure to that used to impute costs in order to impute waiting times when these are missing. This involves applying a waiting time deflator that reflects the general trend in waiting times between the two periods of interest.

The imputation approach can be applied to calculation of output indices only. Different assumptions (about activity levels) are required if the purpose is to calculate price indices.

# 2. Hospital activity

The hospital episode statistics (HES) are the prime source for identifying activity growth in the provision of inpatient and day case services to NHS patients. In this section we first describe the nature of the HES data and then detail how these data are manipulated in order to make them suitable for inclusion in the output index. This manipulation involves the following:

- Identifying and eliminating duplicate records
- Linking records relating to the same individual in order to provide an indication of the treatment pathway relating to the episode of care within the hospital sector
- Calculating the costs of this treatment pathway
- Attaching measures of quality to the treatment pathway

## 2.1 Hospital episode statistics

Hospital Episode Statistics provide information on admitted patient care delivered by NHS hospitals in England from 1989 to the present time. HES covers all medical and surgical specialities and includes private patients treated in NHS hospitals. In addition, the HES captures admitted patient care funded by the NHS but provided by the independent sector – although the quality of data from some independent sector providers is poor (Healthcare Commission, 2007, Mason et al., 2009).

HES now comprises over 15 million patient records each year. Records are stored according to the financial year (1st April to 31st March) in which the period of care finished. Each patient record includes a number of data fields, containing demographic data (e.g. age, gender), clinical information (e.g. diagnoses, procedures performed) and details of the hospital and specialty where the patient received treatment. We are also able to link HES data to death registry records, so deaths following discharge can be measured.

### *2.1.1 Identifying duplicate records*

HES is constructed from records submitted by hospitals on a quarterly basis to a central national clearing-house. Hospitals differ in how they submit data, with some providing a full upload of all data from the start of the financial year to quarter-end, and others uploading only the new records pertaining to the previous quarter. Sometimes hospitals resubmit records if data for some fields were previously missing or inaccurate. Although there are processes of verification and validation, it is possible for duplicate records to be submitted and included in HES. Obviously duplication entails double counting of activity.

We build on the method described by Lakhani *et al* to identify and eliminate duplicate records from HES (Lakhani et al., 2005) and to ensure that results can be replicated:

- We drop records with invalid information in the HESID, EPISTART and EPIKEY fields. Such records amount to around 0.01% of the total (see Table 2-1).
- Under the Lakhani *et al* method all episodes are first sorted by the HESID, EPISTART, EPIORDER and EPIEND fields. However, this does not produce a *unique ranking* because some (around 5,000) patients have two transfers between hospitals on the same day. This might be because a patient is transferred from hospital to another setting, perhaps to have diagnostic tests or chemotherapy, and then transferred back to the original hospital or on to another hospital. The original sorting does not allow for instances such as these. We create a variable TRANSIT that allows the sequence of same-day transfers to be identified, and use this to arrive at a unique sorting of HES records. The coding procedure is provided in Figure 2-1 below. Producing a unique rank of the HES records is important since it affects the attribution of a sequence of episodes to each patient. The type and amount of activity identified depends on the way the HES records are sorted.
- In our earlier study (Dawson et al., 2005), we defined a record as a duplicate if two or more consecutive episodes contained identical values in the fields listed in Table 2-2 below. The row labelled 'standard duplicates cleaning' in Table 2-1 reports the number of duplicates identified under this procedure. In instances of duplication, the record with a valid value in the ELECDUR field is retained. If more than one record has a valid ELECDUR, then the record with the most

non-empty fields is selected. If this fails to discriminate between records, then the first occurrence of the duplicated episode is retained.

- In this study, we adopt a more stringent basis for identifying duplicates. A duplicate is identified if successive records have corresponding values across the fields used for ranking, namely HESID, EPISTART, EPIORDER, EPIEND and TRANSIT. The number of additional cases dropped as a result of applying this procedure is reported in the 'duplicates in the ranking variables' row in Table 2-1. In these instances of duplication, the record with the most complete fields is retained. If these are identical, the record with the most recent submission date is retained. If these dates are the same, the record with the highest value of EPIKEY is retained.

```
gen transit = 0
replace transit = 1 if ((admisorc<51 | admisorc>53) & admimeth!=81) &
(disdest>=51 & disdest<=53)
replace transit = 3 if ((admisorc>=51 & admisorc<=53) | admimeth==81)
& (disdest<51 | disdest>53)
replace transit = 2 if ((admisorc>=51 & admisorc<=53) | admimeth==81)
& (disdest>=51 & disdest<=53)

* transit = 1 if the patient was admitted to the provider through any
route other than as a transfer and was then transferred elsewhere
* transit = 3 if the patient was transferred from another provider
and was then discharged (but not transferred to another provider)
* transit = 2 if the patient was transferred from another hospital
and was then transferred to another provider
```

**Figure 2-1 Coding for TRANSIT variable**

**Table 2-1 Consequences of elimination of invalid and duplicate HES records**

| | 2003/4 | % | 2004/5 | % | 2005/6 | % | 2006/7 | % |
|---|---|---|---|---|---|---|---|---|
| starting population of FCEs | 14,008,253 | | 14,458,833 | | 15,294,851 | | 15,777,369 | |
| invalid obs | -1,588 | -0.011 | -1,003 | -0.007 | -1,779 | -0.012 | -1,634 | -0.010 |
| standard duplicates cleaning | -15,103 | -0.108 | -24,496 | -0.169 | -13,231 | -0.087 | -37,837 | -0.240 |
| duplicates in the ranking variables | -21,611 | -0.154 | -25,686 | -0.178 | -23,861 | -0.156 | -34,382 | -0.218 |
| Final population of FCEs | 13,969,951 | 99.727 | 14,407,648 | 99.646 | 15,255,980 | 99.746 | 15,703,516 | 99.532 |

**Table 2-2 Fields used to identify duplicate HES records**

| | | | |
|---|---|---|---|
| ADMIDATE | ADMIMETH | ADMISORC | CLASSPAT |
| DIAG_1-14 | DISDATE | DISDEST | DISMETH |
| EPIEND | EPIORDER | EPISTART | EPISTAT |
| EPITYPE | HESID | MAINSPEF | OP_DTE_1-12 |
| OPER_1-12 | RESHA | RESLADST | STARTAGE |
| TRETSPEF | | | |

### 2.1.2 Defining a unit of hospital activity

Three definitions of a unit of hospital activity can be derived from HES:

- Consultant Episodes
- Provider Spells
- Continuous Inpatient Spells

In most countries a "unit" of patient care in hospital encompasses the time between a patient being admitted to and discharged from a single provider. HES is unusual in that each patient record corresponds to a period of care within a particular consultant specialty at a single hospital provider – termed a *Consultant Episode*.

About 8% of patients are transferred from the care of one consultant to another during their time in hospital. In such cases, a new HES record is generated. These records can be linked together for each individual patient, to create what is termed a *Provider Spell*. This measure corresponds most closely to the conventional measure of a unit of hospital activity used in other countries

Some patients are also transferred to a different provider during their treatment episode. It is possible to link records so patients are tracked when they are transferred between hospitals as part of their care pathway. The resulting measure of activity is termed a *Continuous Inpatient Spell* (CIPS) (Lakhani et al., 2005). CIPS might comprise multiple episodes, including the transfer from one hospital to another as well as the move from one consultant to another within a given hospital. There will therefore be more than one record in the HES database for such patients. The patient identifier (HESID) and admission details can be used to link continuous periods of treatment.

**Table 2-3 HES records for four patients**

| hesid | admidate | disdate | dismeth | epistart | epiorder | epiend | transit | hrgla~35 | procode |
|---|---|---|---|---|---|---|---|---|---|
| 2262507 | 8092005 | 8092005 | 1 | 8092005 | 1 | 8092005 | 0 | Q06 | RVV01 |
| 8203182 | 27022005 | . | 8 | 27022005 | 1 | 7032005 | 0 | E11 | RTP00 |
| 8203182 | 27022005 | 22042005 | 1 | 7032005 | 2 | 22042005 | 0 | E11 | RTP00 |
| 1299814 | 13012006 | 20012006 | 1 | 13012006 | 1 | 20012006 | 1 | G24 | RTE00 |
| 1299814 | 20012006 | 28012006 | 4 | 20012006 | 1 | 28012006 | 3 | G24 | 5KY00 |
| 69008325 | 26102005 | 26102005 | 1 | 26102005 | 1 | 26102005 | 1 | E12 | RFSDA |
| 69008325 | 26102005 | 26102005 | 1 | 26102005 | 1 | 26102005 | 2 | E15 | RHQNG |
| 69008325 | 26102005 | 31102005 | 1 | 26102005 | 1 | 31102005 | 3 | E12 | RFSDA |

To make these distinctions more concrete, let us consider some actual HES records. Table 2-3 provides data for four patients chosen because they illustrate the differences between FCEs, provider spells and CIPS:

- Patient HESID=2262507 is a straightforward example of a patient who is under the care of a single consultant throughout their hospital treatment for a vascular condition (HRG Q06). This patient did not stay overnight, and was not transferred elsewhere. For this patient FCE=provider spell=CIPS. More than 90% of HES records are of this type.
- Patient HESID=8203182 was in hospital for almost two months, admitted on 27/02/2005 and discharged on 22/04/2005. On 7/03/2005, the patient was transferred from the care of one consultant to another, triggering a second FCE. Despite this internal transfer, the patient was categorised to the same HRG (E11=acute myocardial infarction with complications) for both FCEs. This patient had two FCEs but a single provider spell and single CIPS.
- Patient HESID=1299814 suffered chronic pancreatic disease (HRG G24) and was admitted to provider RTE00 on 13/01/2006. On 20/01/2006 this patient was transferred to provider 5KY00 but died on 28/01/2006 (Dismeth=4). This patient had two FCEs and two provider spells but a single CIPS.
- Patient HESID=69008325 was admitted to RFSDA suffering an acute myocardial infaction (E12) on 26/10/2005, and then to RHQNG on the same day for a percutaneous coronary intervention (E15), before being transferred back later in the day to the hospital where the

patient was originally admitted. Our TRANSIT code allows us to order these same-day transfers. This patient had three FCEs and three provider spells, but a single CIPS.

Identifying which FCEs are part of the same CIPS is not straightforward, even after the HES data have been ordered. If we consider the four patients in Table 2-3 we need to be able to ascertain that the first row of data belongs to one patient (2262507), the next two rows relate to another (8203182), the fourth and fifth rows to another (1299814), and the final rows to another (69008325), and so on for 15 million records each year! As visual inspection is clearly impractical, we first order the HES data and then we determine whether two consecutive records are delivered to the same patient.

HES records are ordered sequentially as follows. First, records are ordered using HESID. Then, for a patient with more than one record, EPISTART is used to order the records commencing on different days, EPIORDER orders two records that start on the same day and EPIEND orders those records that involve a transfer from one provider to another. These standard conditions do not produce a unique ranking for the small number of patients who have two transfers on the same day. This can effect the replicability of our results – a different number of CIPS may be obtained if the HES records are sorted without taking same-day transfers into account. Our TRANSIT variable is used to sort these records into the correct sequence.

After HES records have been ordered we assess whether consecutive records are part of the same CIPS by applying the matching rules given in Figure 2-2.

| Two consecutive FCE, $FCE_i$ and $FCE_{i-1}$, belong to the same patient CIPS if: | Identifying criteria |
|---|---|
| They are part of the same hospital spell | $Hesid_i = hesid_{i-1}$ & $epiorder_i \neq 1$ & patient is not discharged in $FCE_{i-1}$ |
| They involve transfers between hospitals as part of the treatment pathway | $Hesid_i = hesid_{i-1}$ & $epiorder_i = 1$ & patient was transferred to a different hospital in $FCE_{i-1}$ & the difference between the admission date in $FCE_i$ and the discharge date in $FCE_{i-1}$ is less than two days. The variable TRANSIT allows us to attribute up to three hospital transfers occurring to the same patient on the same day to the correct CIPS (e.g. a patient has an FCE in hospital H1 in the morning, then he is transferred to the hospital H2 where a new FCE is recorded, then he is transferred to hospital H3 later in the day where another FCE is recorded). |
| Discharge date and discharge method have been added incorrectly to the FCE | $Hesid_i = hesid_{i-1}$ & admission date in the $FCE_i$ is the same as in the $FCE_{i-1}$ & the difference between the admission date in $FCE_i$ and the discharge date in $FCE_{i-1}$ is negative. |

**Figure 2-2 Matching rules for consecutive HES records**

The matching condition in the final row is in addition to that proposed by Lakhani *et al* (Lakhani et al., 2005) and to that currently included in DH guidance on construction of CIPS[1]. This condition corrects for potential data error in the discharge date and discharge method of the patients, which seems to be 'over-coded', appearing in some records even though these do not constitute the final FCE.

An example is provided in Table 2-4. Patient 33225 was admitted on 18/12/2005 with ischaemic heart disease (E23) and discharged the following day. However, the patient suffered a gastrointestinal bleed requiring a diagnostic endoscopic or intermediate procedure (F63), and was transferred to another consultant, who subsequently transferred the patient back to the original consultant.

[1] http://www.performance.doh.gov.uk/nhsperformanceindicators/2002/construct_cip.doc accessed 11/07/08

For this patient, the three FCEs should amount to a single CIPS. However, because a discharge date and discharge method has been entered for all three FCEs (shaded cells), the Lakhani *et al* code identifies each FCE as a completed CIPS (Lakhani et al., 2005). Our condition overrides any entry for discharge method when the discharge date occurs later than the admission date for the subsequent FCE. Consequently these three FCEs are correctly identified as part of the same CIPS.

**Table 2-4 Example of miscoded discharge data and discharge method fields**

| hesid | admidate | disdate | dismeth | epistart | epiorder | epiend | transit | hrgla~35 | procode |
|---|---|---|---|---|---|---|---|---|---|
| 33225 | 18122005 | 19122005 | 1 | 18122005 | 1 | 19122005 | 0 | E23 | RD700 |
| 33225 | 18122005 | 19122005 | 1 | 19122005 | 2 | 19122005 | 0 | F63 | RD700 |
| 33225 | 18122005 | 19122005 | 1 | 19122005 | 3 | 19122005 | 0 | E23 | RD700 |

If we do not include this final part in the algorithm, we will overestimate the number of CIPS in the HES system. As a consequence our algorithm provides a more accurate indication of the amount of activity being conducted because it reduces the likelihood of overcounting CIPS. The number of provider spells and (in-year) CIPS using the former (Lakhani *et al*) code and our revised procedure are presented in Table 2-5 below. The difference between the number shows that a significant number of records (c 50,000-90,000 per annum) are miscoded in this way.

**Table 2-5 Counts of activity completed within the year of analysis**

| | FCEs | Spells | CIPS (A and B type) | Single episode spells |
|---|---|---|---|---|
| **2003/4** | | | | |
| former cips code | 13,969,951 | 12,625,489 | 12,398,683 | 11,283,408 |
| new cips code | 13,969,951 | 12,570,888 | 12,345,418 | 11,191,117 |
| **2004/5** | | | | |
| former cips code | 14,407,648 | 12,964,184 | 12,724,566 | 11,539,744 |
| new cips code | 14,407,648 | 12,900,566 | 12,662,394 | 11,431,889 |
| **2005/6** | | | | |
| former cips code | 15,255,980 | 13,683,727 | 13,438,191 | 12,165,073 |
| new cips code | 15,255,980 | 13,610,022 | 13,366,433 | 12,041,195 |
| **2006/7** | | | | |
| former cips code | 15,703,516 | 14,077,709 | 13,836,703 | 12,537,467 |
| new cips code | 15,703,516 | 13,995,789 | 13,756,489 | 12,398,312 |

### *2.1.3 Counting CIPS across HES years*

The existing Lakhani *et al* and DH procedures do not link records for the same patient across years. This is restrictive because a number of patients with multiple FCEs will be in hospital when the HES year ends (ie they will still be in hospital overnight on March 31). If an FCE had been completed for such patients prior to the year-end date, two CIPS are counted using the Lakhani *et al* procedure, one attributed to the year of admission, the second to the year of discharge. This constitutes double counting, as only a single CIPS has been delivered.

We have extended the methodology to ensure that such patients are counted appropriately. This involves identifying patients with CIPS that overlap the end of the HES (financial) year, and linking their records across the two (or, occasionally, three) years.

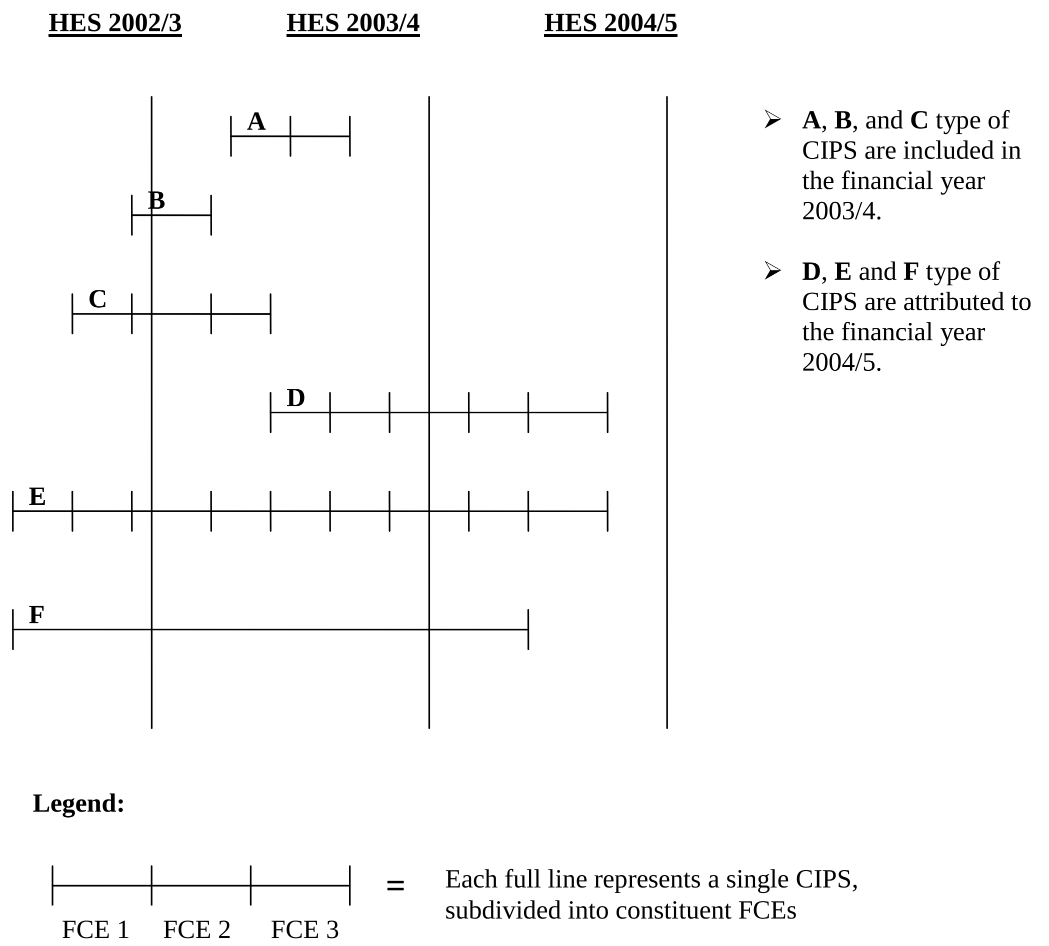


**Figure 2-3 Examples where treatment spans HES years**

Figure 2-3 provides examples of the most common cases:

- Patient A has two FCEs as part of the provider spell, and is admitted and discharged during 2003/4. This case is unproblematic.
- Patient B was admitted at the end of the HES year 2002/3 and discharged in HES year 2003/4 and comprises a single FCE. The record appears in the HES 2003/4 data, and again is unproblematic.
- Problems start to arise when considering patient C, who was admitted during 2002/3 and was transferred to the care of another consultant and was still under the care of this consultant on 31 March when the HES year ends. The patient then was transferred to another consultant in 2003/4. The Lakhani *et al* method would count two CIPS, one corresponding to the first FCE and attributed to 2002/3, the second comprising the final two FCEs and attributed to 2003/4. However these three separate FCEs should be counted as a single CIPS, with activity being attributed to 2003/4 when the CIPS ended. Our linkage method across years allows us to identify these separate records as part of the same CIPS.
- Patients D, E and F are more complex variations of the problem. Of these, patient F is the simplest (though somewhat unrealistic) case. Despite being in hospital for a very long time, this patient remains in a single specialty (under the care of a single consultant) throughout and would appear in the HES returns for 2004/5 as a Finished Consultant Episode when finally discharged.
- FCEs for patient E appear in HES data for each of the three years as responsibility for care is transferred from one consultant to another over time. The Lakhani *et al* procedure would identify three (multi-FCE) CIPS having been completed in each year whereas only a single

CIPS should be counted. The situation is similar for patient D, though only two years are involved. Patients of this type are a fairly common occurrence.

To ascertain whether CIPS in one (*previous*) HES year continue to the next (*current*) HES year we apply the following method.

1. Identify 'unfinished CIPS' for the *previous* HES year:
   - Either the patient is not discharged in the last FCE recorded for this patient in the *previous* HES year
   - Or the patient is transferred to another provider in the last FCE recorded for this patient in the *previous* HES year
2. Add these 'unfinished CIPS' to the HES data for the *current* HES year.
3. Re-run the algorithm described in Figure 2-2 to link consecutive FCEs.
   - If there is a match, the records are considered part of a CIPS and attributed to the *current* HES year
   - If any of the 'unfinished CIPS' fail to match with any FCE in the *current* HES year, they are attributed to the *previous* HES year.

Table 2-6 shows the number of FCEs, Spells and CIPS that are completed within each relevant HES year.

**Table 2-6 Counts of FCEs, Spells and CIPS completed within HES year**

| | FCEs | Spells | CIPS (A, B, C type) | One epis Spells |
|---|---|---|---|---|
| **2003/4** | | | | |
| new cips code | 13,953,201 | 12,546,542 | 12,310,818 | 11,151,629 |
| **2004/5** | | | | |
| New cips code | 14,406,831 | 12,877,464 | 12,628,042 | 11,384,985 |
| **2005/6** | | | | |
| new cips code | 15,256,933 | 13,588,848 | 13,332,851 | 11,995,177 |

Table 2-7 reports the number of CIPS that were unfinished in the previous year (C type) and the number unfinished at the end of the current year (D, E and F type). A very small number of patients are in hospital for more than a year (E and F type), most of whom suffer mental health conditions.

**Table 2-7 Counts of CIPS that span HES years**

| | coming from previous year (C type of CIPS) | going to following year (D, E and F type of CIPS) | coming from previous year ar going to the following (E and F type of CIPS) |
|---|---|---|---|
| **2003/4** | | | |
| CIPS | 24,645 | 34,789 | 265 |
| FCEs | 43,879 | 60,610 | 542 |
| **2004/5** | | | |
| CIPS | 34,789 | 34,529 | 252 |
| FCEs | 60,610 | 61,366 | 600 |
| **2005/6** | | | |
| CIPS | 34,529 | 33,750 | 283 |
| FCEs | 61,366 | 60,413 | 632 |

## 2.2 Constructing the hospital output index

All the preceding discussion has focussed on deriving accurate counts of activity ( $x_j$ ), defined as the volume of CIPS (*x*) for each HRG (*j*). Identifying CIPS correctly is important not only in order to have a more accurate estimate of the amount of activity being conducted. It is also necessary so that we can apportion activity to the appropriate time period, assess the nature and quality of activity, and calculate costs. This is because, as mentioned in section 1.2, our preferred form of the output index for the hospital sector takes the following form:

$$I^{Lcq} = \frac{\sum_j x_{jt+1} c_{jt} \left( \frac{a_{jt+1} - k_j}{a_{jt} - k_j} \right) \frac{\left[ \frac{\left(1 - e^{-r_L L_{jt+1}}\right)}{r_L} - \frac{\left(e^{r_w w_{jt+1}} - 1\right)}{r_w} \right]}{\left[ \frac{\left(1 - e^{-r_L L_{jt}}\right)}{r_L} - \frac{\left(e^{r_w w_{jt}} - 1\right)}{r_w} \right]}}{\sum_j x_{jt} c_{jt}} \qquad (8)=(5)$$

To be able to calculate this index, we need information from variables recorded in each of the various FCEs that constitute the CIPS – no single FCE contains all the requisite information except in the case where FCE=CIPS. Table 2-8 shows which FCEs contain the requisite information for a patient with multiple (*n*) FCEs as part of their CIPS.

**Table 2-8 FCEs containing requisite data for construction of the output index**

| $FCE_1$ | $FCE_2$ | … | $FCE_n$ |
|---|---|---|---|
| Activity group ($HRG_1$) | | | |
| Waiting time | | | |
| Age, gender | | | |
| Reference cost $HRG_1$ | Reference cost $HRG_2$ | + | Reference cost $HRG_n$ |
| | | | Discharge year |
| | | | Discharge method |

In summary:

- Hospital activity is attributed to the period (*t*) in which the patient was discharged. This information is contained in the final FCE in the CIPS.
- The type of activity *j* is defined on the basis of the reason for admission. The HRG to which the patient is attributed is identified according to the first FCE in the CIPS.
- The average cost of each HRG ( $c_j$ ) is based on all the HRGs to which the patient is allocated during their CIPS. The procedure used to make this calculation is described below in section 2.2.1.
- Death following surgery is derived from the discharge method variable which is recorded in the final FCE in the CIPS. This is used to calculate hospital survival rate for each HRG ( $a_j$ ).
- Life expectancy ( $L_j$ ) for each HRG depends on the age and gender composition of patients in that HRG. This is derived from the first FCE in the CIPS.
- The 80% percentile waiting time ( $w_j$ ) for each HRG is recorded in the first FCE in CIPS.

### *2.2.1 Assigning costs to CIPS*

The Reference Cost database reports average costs across England by HRG and admission type[2]. However, these average costs are reported for FCEs not CIPS. This raises the question of how to take into account the cost of care for patients with multiple FCEs as part of their CIPS. In the final report of our original project we outlined three alternative methods (Dawson et al., 2005). A slight variation of one of these has been adopted following the Willmer review (Willmer and Little, 2007). This method involves the following steps:

First allocate every patient *i* to the HRG recorded in the first FCE, designated HRG *j*. For each patient, calculate the cost of their CIPS ( $c_i^{CIPS-HRG}$ ) by summing the HRG costs across all the FCEs to which the patient is assigned.

[2] www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_082746 accessed 11/07/08

$$c_i^{CIPS-HRG_j} = c_i^{FCE-HRG_j} + \sum_{k \neq j}^{n} c_{kt}^{FCE-HRG_k} \qquad \forall i \qquad (9)$$

The total cost of all CIPS allocated to HRG *j* is given by summing CIPS costs for all patients assigned to HRG *j*, *i*=1…*x*:

$$C_j^{CIPS-HRG_j} = \sum_{i}^{x} c_i^{FCE-HRG_j} \qquad (10)$$

The total volume of CIPS activity (ie the number of patients) assigned to HRG$_j$ is designated $x_j^{CIPS-HRG_j}$. The average CIPS cost for HRG *j* is calculated by dividing the total CIPS cost for this HRG by the number of CIPS assigned to HRG *j*.

$$c_j^{CIPS-HRG_j} = \frac{C_j^{CIPS-HRG_j}}{x_j^{CIPS-HRG_j}} \qquad (11)$$

Reference costs are missing for mental health activities (T chapter) and unclassified activity (U codes). It is important to attach a cost weight to unclassified activities, so that improvements in the classification of activity over time will be captured by the index. For both mental health care activities and unclassified activity we use the median cost across FCEs as is consistent with our earlier report (Dawson et al., 2005).

### *2.2.2 Health outcomes*

The health outcomes associated with each treatment are not observed directly, so we adopt the formulation recommended in our earlier work (Dawson et al., 2005). This involves piecing together (i) short-term survival from treatment (ii) post-treatment health status and (iii) healthy life expectancy.

- Short term survival for each HRG ($a_j$) is derived from HES, and measured as survival thirty day after discharge. Records in the HES include a link to the ONS mortality data – the HES 'Date of Death' field. This means that the death of a patient can be determined over the short and longer term, whether or not the death occurs in hospital. Summary statistics for mean in-hospital and 30-day post-discharge survival rates are shown in Table 2-9. This reveals a consistent improving trend in survival over time.
- The ratio of pre- and post-treatment health status conditional on short term survival ($k_j$) is not routinely available for all HRGs. For thirty elective HRGs we have inferred a value from published data (Castelli et al., 2007b). For elective HRGs where the value is unknown, we have applied the mean value from these thirty HRGs. For emergency HRGs, we have applied a value of half the mean, in recognition that the pre-treatment health status of emergency patients is likely to be worse than that of elective patients, even though their post-treatment health status might be similar. This means that, subject to their short-term survival, the health gains from treatment are greater for emergency than elective patients. As a consequence if the health sector treats a greater proportion of emergency patients output will be higher.
- Healthy life expectancy ($L_j$) is derived from life tables[3] and the 1996 Health Survey for England (Prescott-Clarke and Primatesta, 1998) and estimated according to the gender mix and average age of patients in each HRG. The mean age of elective patients has been gradually increasing over time, as shown in the first two columns of Table 2-10. All else equal, this would imply a gradual decline in average life expectancy, as the final columns of Table 2-10 show to be the case. This would serve to dampen output growth, reflecting the likelihood that the marginal benefit of treatment decreases with the age of the patient.
- We discount healthy life years occurring in the future, at rate $r_L$.

[3] Period expectation of life, 1981-2056 - Principal projection – England available from http://www.gad.gov.uk/Demography_Data/Life_Tables/Eoltable06.asp accessed 12/05/08

**Table 2-9 In-hospital and 30-day post discharge survival rates**

| Year | Mean in-hospital survival rate | | Mean 30 day post discharge survival rate | |
|---|---|---|---|---|
| | *Elective and day cases* | *Emergencies* | *Elective and day cases* | *Emergencies* |
| **2003/04** | 0.9972 | 0.9581 | 0.9936 | 0.9492 |
| **2004/05** | 0.9974 | 0.9607 | 0.9938 | 0.9516 |
| **2005/06** | 0.9977 | 0.9631 | 0.9947 | 0.9549 |
| **2006/07** | 0.9979 | 0.9647 | 0.9951 | 0.9565 |

**Table 2-10 Mean age and life expectancy for elective and non-elective patients**

| Year | Mean age | | Mean life expectancy | |
|---|---|---|---|---|
| | *Elective and day cases* | *Emergencies* | *Elective and day cases* | *Emergencies* |
| **2003/04** | 53.2 | 41.4 | 23.54 | 33.82 |
| **2004/05** | 53.6 | 41.6 | 23.75 | 34.11 |
| **2005/06** | 53.9 | 41.6 | 23.65 | 34.25 |
| **2006/07** | 54.4 | 41.6 | 23.59 | 34.58 |

### *2.2.3 Waiting times*

In our earlier work we considered the negative welfare effects of having to wait for hospital treatment (Dawson et al., 2005). Any reduction in waiting times is welfare enhancing and, therefore, can be considered as contributing to output growth. We discussed a number of ways that these effects might be incorporated in the output index and recommended the following:

- Waiting time should be measured as the time between being placed on the inpatient waiting list and being admitted.
- For groups of patients in each output category (HRG), the waiting time they face should be measured as the 'certainty equivalent wait'. This reflects the possibility that the disutility of being on a waiting list depends not just on the average wait but also the risk of a longer than average wait. We measure the certainty equivalent wait as the waiting time for patients at the 80th percentile of the waiting time distribution for each elective HRG. Reductions in these relatively high waiting times deliver benefits to all patients on the waiting list by reducing the risk of facing an excessive wait. This appears as $w_j$ in equation (8).
- Waiting times are introduced as a scaling factor, in which waiting time captures a charge for waiting which represents the welfare loss as a result of not having been treated immediately. This is an offset against the benefit of the treatment which applies for the residual life span. Interest is charged on the cost of waiting and the marginal disutility of waiting increases with the length of the wait. We refer to this as 'discounting to date of treatment with charge for waiting', defined as $r_w$.

Waiting times fell year-on-year over the period, both on average and for those at the upper end of the distribution (Table 2-11).

**Table 2-11 Waiting times for hospital admission**

| Year | Waiting time | |
|---|---|---|
| | *Mean* | *80th percentile* |
| **2003/04** | 77.8 | 118.8 |
| **2004/05** | 70.5 | 104.0 |
| **2005/06** | 66.5 | 94.7 |
| **2006/07** | 65.1 | 88.8 |

## 2.3 Growth in elective and non-elective hospital output

Elective and non-elective activity has increased over time, as shown in Table 2-12. Activity weighted costs for elective activity increased for the first three years at a progressively slower rate, and fell slightly in 2006/7 (see Table 2-12). A progressively slowing increase in costs is evident for emergency activity throughout the period. Costs are very similar in 2005/6 and 2006/7, because there was little or no change to the tariff used under Payment by Results.

**Table 2-12 Elective and non-elective activity**

| Year | Volume of Activity | | Volume of Activity | | Volume of Activity | |
|---|---|---|---|---|---|---|
| | *Elective and day cases* | *% change* | *Non-electives* | *% change* | *All* | *% change* |
| **2003/04** | 6,401,519 | | 5,723,817 | | 12,125,336 | |
| **2004/05** | 6,433,933 | 0.51% | 6,009,802 | 5.00% | 12,443,735 | 2.63% |
| **2005/06** | 6,864,612 | 6.69% | 6,291,117 | 4.68% | 13,155,729 | 5.72% |
| **2006/07** | 7,194,697 | 4.81% | 6,363,388 | 1.15% | 13,558,085 | 3.06% |

**Table 2-13 Costs of hospital activity**

| Year | Activity weighted average unit cost | |
|---|---|---|
| | *Elective and day cases* | *Emergencies* |
| **2003/04** | 937 | 1126 |
| **2004/05** | 1031 | 1210 |
| **2005/06** | 1041 | 1241 |
| **2006/07** | 1036 | 1244 |

Activity, survival rates and waiting times have all improved over time, all of which contribute positively to growth. Over the same period the NHS has been extending treatment to older patients . If the age profile of NHS patients increases more rapidly than the improvements in population life expectancy this will lead to a dampening of output growth.. Output growth depends, then, on the net effect of these various conflicting influences.

Table 2-14 reports output growth for each pair of adjacent years applying the Laspeyres, Paasche and Fisher formulations of the output index. The first column shows output growth without any form of quality adjustment, thereby capturing the effect of the increase in volume, weighted by cost. As we would expect given the data in Table 2-12, the CWOI is positive throughout the period. However the growth rate between each pair of years is slightly lower that the percentage changes in volume as reported in the final column of Table 2-12. The reason is that the mix of activities has changed over time as well, with changes in the mix being captured by the cost weights. The implication is that volume growth has been more rapid for less complex (ie less costly) activities than it has for more costly activities, as would be expected.

Column 2 (survival adjustment) shows the impact of allowing for improvements in 30-day survival post-discharge. These improvements reflect positively on growth, adding around 0.25% to output growth annually.

Column 3 (health effects) then allows for the positive health effects enjoyed by those who survive hospital treatment, incorporating both the change in health status ($k$) and the change in life expectancy ($L$). These improved health benefits contribute positively to growth, adding between 1.4% and 2.6% annually. The final column (quality adjustment) allows for improvements in waiting times, which add between 0.1% and 0.3% to annual output growth.

**Table 2-14 Output growth in the hospital sector**

| | Hospital activity - CWOI | Hospital activity - survival adjustment | Hospital activity - health effects | Hospital activity - quality adjustment |
|---|---|---|---|---|
| **Laspeyres** | | | | |
| 2003-04 - 2004/05 | 2.56% | 2.83% | 5.38% | 5.66% |
| 2004-05 - 2005/06 | 5.48% | 5.92% | 7.34% | 7.48% |
| 2005/06 - 2006/07 | 2.80% | 3.05% | 4.79% | 4.88% |
| **Paasche** | | | | |
| 2003-04 - 2004/05 | 2.49% | 2.75% | 5.28% | 5.56% |
| 2004-05 - 2005/06 | 5.36% | 5.79% | 7.20% | 7.35% |
| 2005/06 - 2006/07 | 2.80% | 3.05% | 4.79% | 4.88% |
| **Fisher** | | | | |
| 2003-04 - 2004/05 | 2.53% | 2.79% | 5.33% | 5.61% |
| 2004-05 - 2005/06 | 5.42% | 5.85% | 7.27% | 7.41% |
| 2005/06 - 2006/07 | 2.80% | 3.05% | 4.79% | 4.88% |

# 3. Outpatient activity

## 3.1 Introduction

A large volume of patients are seen in outpatient settings. Some are referred by their GP so that a consultant can make a more detailed assessment of their condition. These visits are classified as first appointments. A large proportion of patients visit the outpatient department on more than one occasion, perhaps to be informed about the results of diagnostic tests undertaken during the first appointment or so that the patient's doctor can monitor recovery following hospital treatment. Subsequent outpatient visits of this type are termed follow-up appointments.

There are two main sources of data about the amount and type of outpatient activity conducted in England, namely the Reference Cost database and the outpatient minimum dataset (OMD). In this section we evaluate and compare these two data sources, before constructing a CWOI for the outpatient sector. We start with the OMD.

## 3.2 The outpatient minimum dataset (OMD)

The OMD was first compiled in 2003/4 and contains details of outpatient appointments delivered by NHS hospitals in England. Table 3-1 reports the total number of outpatient appointments for the three years from 2003/4, with appointments sub-divided into first and follow-up appointments, and those with an unknown status. In 2005/6 there is a substantial increase in the number of appointments recorded in the OMD. This is probably partly due to improved data collection, one sign of which is the reduction in the number of 'unknown' appointments. But much of the change may be real, with the Reference Cost data recording a similar rate of increase as we shall see in section 3.3.

**Table 3-1 Outpatient appointments**

| | 2003/4 | | 2004/5 | | 2005/6 | |
|---|---|---|---|---|---|---|
| First appointments | 14,045,098 | 27.4% | 14,051,069 | 27.9% | 17,274,655 | 28.5% |
| Follow-up appointments | 35,517,283 | 69.3% | 36,087,658 | 71.6% | 43,149,964 | 71.2% |
| Unknown | 1,675,863 | 3.3% | 282,086 | 0.6% | 183,784 | 0.3% |
| **Total appointments** | **51,238,244** | **100.0%** | **50,420,813** | **100.0%** | **60,608,403** | **100.0%** |

Outpatient appointments are not always fulfilled. Either patients or providers may cancel the appointment beforehand, and patients may simply fail to attend on the day, without giving prior warning. A breakdown of appointments by attendance status is provided in Table3-2. Many providers have been attempting to reduce 'did not attend' (DNA) rates because the lack of warning makes it difficult to reallocate resources to more productive activities. There has been a reduction in DNAs since 2003/4, but these still account for 7% of first appointments and almost 9% of follow-up appointments.

**Table3-2 Attendances and non-attendances**

| | | | | | | |
|---|---|---|---|---|---|---|
| **First appointments** | | | | | | |
| Attended | 12,355,063 | 88.0% | 12,169,563 | 86.6% | 14,918,796 | 86.4% |
| Did not attend | 1,103,350 | 7.9% | 957,298 | 6.8% | 1,198,659 | 6.9% |
| Patient cancelled | 321,859 | 2.3% | 509,355 | 3.6% | 622,738 | 3.6% |
| Hospital cancelled | 212,559 | 1.5% | 364,981 | 2.6% | 436,379 | 2.5% |
| Unknown | 52,267 | 0.4% | 49,872 | 0.4% | 98,083 | 0.6% |
| **Follow-up appointments** | | | | | | |
| Attended | 29,826,569 | 84.0% | 29,180,113 | 80.9% | 35,039,342 | 81.2% |
| Did not attend | 3,333,723 | 9.4% | 3,177,282 | 8.8% | 3,818,089 | 8.8% |
| Patient cancelled | 1,059,117 | 3.0% | 1,590,178 | 4.4% | 1,806,853 | 4.2% |
| Hospital cancelled | 1,175,244 | 3.3% | 2,035,371 | 5.6% | 2,294,473 | 5.3% |
| Unknown | 122,630 | 0.3% | 104,714 | 0.3% | 191,207 | 0.4% |

Table3-3 provides an indication of the quality of coding in OMD and how this has changed over time. The main specialty or treatment specialty was not recorded for some 3% of appointments in 2003/4, the proportion falling to 2.4% in 2005/6. Coding of the type of staff caring for the patient has also improved over time (the definition of staff type was changed in 2005/6). Waiting times have also been recorded for an ever-increasing proportion of patients, defined as the "period in days between the date of the appointment date and either the referral request received date or the DNA date" (The Information Centre, 2006).

The outcome of an outpatient attendance indicates whether the patient was discharged from consultant care, if another appointment was given, or if an appointment was to be made at a future date. Again, coding has improved over time, but this may be related to the reduction in DNA rates.

The diagnosis field is supposed to contain information about the patient's illness or condition, coded using ICD-10 codes. Almost all patients are assigned the code R69X6, indicating an unknown diagnosis (The Information Centre, 2005). In contrast, age and gender are very well coded.

**Table3-3 Missing data for selected variables**

| | 2003/4 | | 2004/5 | | 2005/6 | |
|---|---|---|---|---|---|---|
| Specialty | 1,571,305 | 3.1% | 1,143,034 | 2.3% | 1,430,941 | 2.4% |
| Staff type | 26,586,279 | 51.9% | 24,820,452 | 49.2% | 28,142,715 | 46.4% |
| Waiting time | 9,345,390 | 18.2% | 8,142,947 | 16.1% | 9,304,283 | 15.4% |
| Outcome | 5,418,192 | 10.6% | 4,357,748 | 8.6% | 5,733,090 | 9.5% |
| Diagnosis | 49,968,823 | 97.5% | 49,009,772 | 97.2% | 58,884,243 | 97.2% |
| Age | 51,136 | 0.1% | 113,229 | 0.2% | 56,692 | 0.1% |
| Gender | 84,104 | 0.2% | 65,141 | 0.1% | 95,674 | 0.2% |

Table 3-4 reports the location of outpatient attendances, coding of which has evolved over time to distinguish activity undertaken in Foundation Trusts, the first of which were established in 2003/4, and to identify work performed by independent sector providers. As would be expected, the vast majority of outpatient activity is undertaken in the hospital sector. There are no obvious shifts in the location of care over time.

**Table 3-4 Attendances by type of provider**

| | 2003/4 | | 2004/5 | | 2005/6 | |
|---|---|---|---|---|---|---|
| **First appointments** | | | | | | |
| NHS Trust | 13,715,337 | 97.7% | 11,530,563 | 82.1% | 13,655,198 | 79.0% |
| Foundation Trust | | | 2,105,989 | 15.0% | 3,144,648 | 18.2% |
| PCT | 307,848 | 2.2% | 374,347 | 2.7% | 393,537 | 2.3% |
| Independent Sector provider | | | 17,047 | 0.1% | 38,669 | 0.2% |
| Other providers | 21,222 | 0.2% | 23,123 | 0.2% | 42,603 | 0.2% |
| **Follow-up appointments** | | | | | | |
| NHS Trust | 34,620,177 | 97.5% | 29,311,822 | 81.2% | 34,188,320 | 79.2% |
| Foundation Trust | | | 5,629,232 | 15.6% | 7,737,942 | 17.9% |
| PCT | 811,399 | 2.3% | 1,051,832 | 2.9% | 1,040,258 | 2.4% |
| Independent Sector provider | | | | | 14,236 | 0.0% |
| Other providers | 76,213 | 0.2% | 94,772 | 0.3% | 169,208 | 0.4% |

Mean and 80$^{th}$ percentile waiting times are reported in Table 3-5. The mean waiting time for a first outpatient appointment is around seven weeks, with 80% of patients being seen within three months. There has been a reduction in first appointment waiting times over time, particularly for those facing long waits. Waiting times for follow-up attendances are considerably longer. This is probably because the 'referral request date' applies to the first in a sequence of appointments, rather than being specific to each follow-up appointment.

**Table 3-5 Outpatient waiting time (days)**

| | 2003/4 | 2004/5 | 2005/6 |
|---|---|---|---|
| **First appointments** | | | |
| Mean | 54 | 52 | 50 |
| 80th percentile | 89 | 85 | 79 |
| **Follow-up appointments** | | | |
| Mean | 319 | 325 | 320 |
| 80th percentile | 521 | 530 | 518 |

## 3.3 Reference Costs data

There has been an evolution in the way that outpatient attendances have been recorded in the Reference Cost data, with an increase in the number of categories over time, and a major overhaul of the categorisation architecture for the 2006/7 collection exercise.

Table 3-6 reports how data collection has evolved in NHS Trusts (in which the majority of outpatient activity is concentrated) from 2003/4 to 2005/6. The main feature was the separate recording of activity delivered to children and adults for some specialties introduced in 2004/5, and the substantial expansion of activity categories introduced in 2005/6.

**Table 3-6 Outpatient activity in NHS Trusts, 2003/4 – 2005/6**

| | 2003/4 | | 2004/5 | | 2005/6 | |
|---|---|---|---|---|---|---|
| | Cat | contacts | Cat | Contacts | cat | contacts |
| First attendances by specialty | 79 | 13,405,618 | 44 | 2,430,624 | 70 | 2,793,284 |
| First attendances by specialty - children | | | 40 | 1,035,772 | 64 | 1,142,072 |
| First attendances by specialty - adults | | | 44 | 10,124,285 | 71 | 11,139,453 |
| Follow-up attendances by specialty | 79 | 29,382,105 | 45 | 6,145,618 | 78 | 6,726,700 |
| Follow-up attendances by specialty - children | | | 41 | 2,158,907 | 67 | 2,329,385 |
| Follow-up attendances by specialty - adults | | | 44 | 23,266,944 | 76 | 26,386,781 |
| Maternity first attendances | 8 | 720,908 | 8 | 750,020 | 8 | 877,210 |
| Maternity follow-up attendances | 8 | 1,953,345 | 8 | 2,371,265 | 8 | 2,712,510 |
| Outpatient procedures | | | 14 | 252,839 | 16 | 423,760 |
| **Total** | | **45,461,976** | | **48,536,274** | | **54,531,155** |

In 2006/7 the classification system was subject to a major overhaul, with data recorded according to whether or not the attendance was consultant led and whether or not it involved face-to-face contact. Table 3-7 provides a breakdown of the major classification headings, with details of the number of activity categories and the volume of activity recorded under each heading. Obviously this major overhaul would make it impossible to make year-on-year comparisons, unless the recommendations made in section 0 are accepted.

**Table 3-7 Outpatient activity in NHS Trusts, 2006/7**

| | 2006/7 | |
|---|---|---|
| | **Categories** | **Contacts** |
| Consultant Led First Attendance Multiprofessional Face to Face | 95 | 291,249 |
| Consultant Led First Attendance Multiprofessional Non Face to Face | 1 | 3,338 |
| Consultant Led First Attendance Outpatient Face to Face | 128 | 12,883,981 |
| Consultant Led First Attendance Outpatient Non Face to Face | 30 | 62,193 |
| Consultant Led Follow up Attendance Multiprofessional Face to Face | 100 | 703,654 |
| Consultant Led Follow up Attendance Multiprofessional Non Face to Face | 1 | 42 |
| Consultant Led Follow up Attendance Outpatient Face to Face | 131 | 28,486,692 |
| Consultant Led Follow up Attendance Outpatient Non Face to Face | 43 | 115,539 |
| Not Consultant Led First Attendance Multiprofessional Face to Face | 40 | 80,595 |
| Not Consultant Led First Attendance Multiprofessional Non Face to Face | 5 | 513 |
| Not Consultant Led First Attendance Outpatient Face to Face | 112 | 2,725,741 |
| Not Consultant Led First Attendance Outpatient Non Face to Face | 33 | 38,444 |
| Not Consultant Led Follow up Attendance Multiprofessional Face to Face | 50 | 200,060 |
| Not Consultant Led Follow up Attendance Multiprofessional Non Face to Face | 4 | 22,920 |
| Not Consultant Led Follow up Attendance Outpatient Face to Face | 119 | 7,975,732 |
| Not Consultant Led Follow up Attendance Outpatient Non Face to Face | 47 | 225,111 |
| Outpatient Procedures | 304 | 1,522,434 |
| **Total** | **1243** | **55,338,238** |

## 3.4 Comparison of sources of activity data

In this section we compare counts of activity in the Reference Cost and Outpatient Minimum Dataset. We focus on data for 2005/6 where it was possible to map a high proportion of activity by specialty. We concentrate on comparing first appointments, and amalgamate data recorded separately for children and adults. Table 3-8 shows the amount of activity recorded in the two datasets, with 5% more activity being recorded in the Reference Costs. It was possible to map a high proportion of activity between the two datasets by specialty, though some 23% of activity recorded in the OMD does not have an equivalent specialty code in the RC data. The Reference Costs data suggest that 17% more activity is being conducted in the average specialty than is recorded in the OMD. However, this is mainly because the OMD includes a broad range of specialty codes, for which an equivalent in the RC data does not exist. In contrast, the RC data classifies activity to codes not available in the OMD, including maternity appointments, outpatient procedures, and other appointments relating to treatments such as bone marrow transplantation, family planning, anti-coagulation, spinal injuries and orthoptics.

**Table 3-8 Counts of first appointments for 2005/6 RC and OMD**

| **First Appointments** | | **RC** | **OMD** | **Difference** |
|---|---|---|---|---|
| Matched by specialty | | 15,945,564 | 13,301,838 | 17% |
| Unmatched RC data | Maternity | 759,456 | | |
| | Procedures | 262,383 | | |
| | Other | 1,193,697 | | |
| Unmatched OMD data | | | 3,972,817 | |
| **Total** | | **18,161,100** | **17,274,655** | **5%** |
| Percent matched | | 88% | 77% | |

Figures 3-1 to Figure 3-3 show comparisons of the counts of first appointments as recorded in the Reference Costs and OMD, for high volume (>100,000 RC contacts), medium volume (10,000<*x*<100,000 RC contacts) and low volume (<10,000 RC contacts) specialties. The graph on the right hand side reports the number of contacts recorded in the two data sets for each specialty while the graph on the left hand side shows the difference in counts as a percentage of the number of RC contacts. Bars above (below) the 0% line indicate that RC counts are higher (lower) than OMD counts. The figures show that RC counts are generally higher than OMD counts for high volume specialties, but that the opposite tends to hold for medium and low volume specialties.

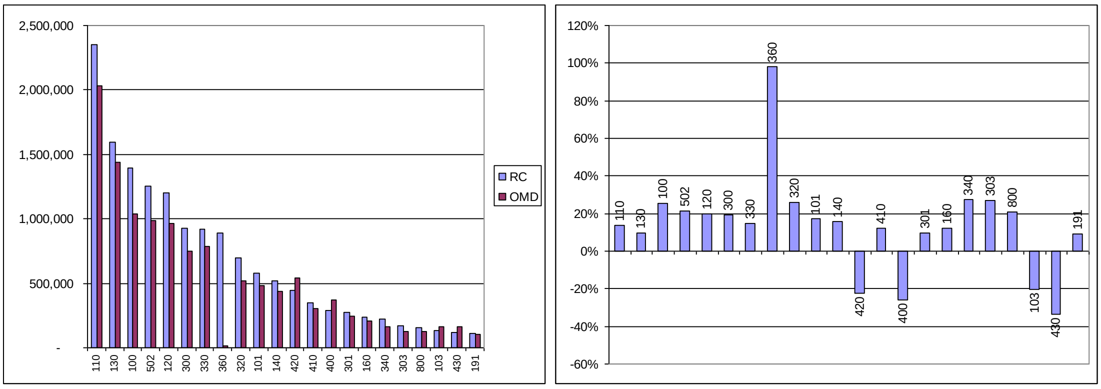


**Figure 3-1 Comparison of RC and OMD first appointments in 2005/6, high volume specialties**

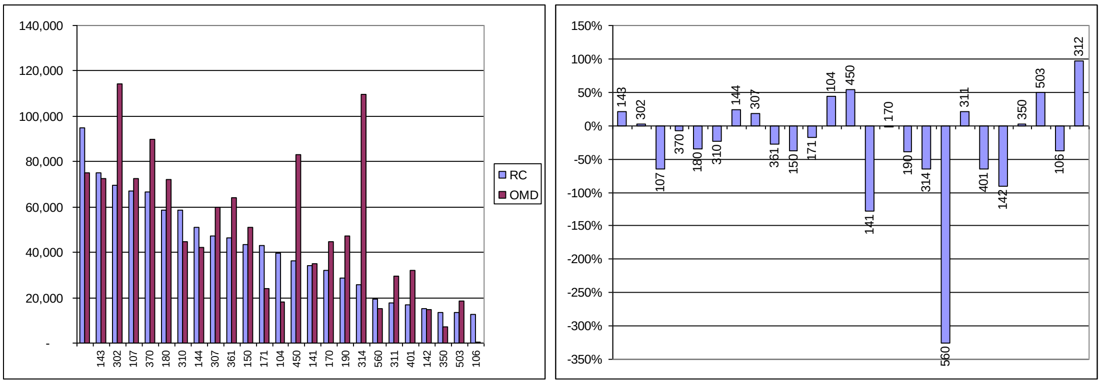


**Figure 3-2 Comparison of RC and OMD first appointments in 2005/6, medium volume specialties**

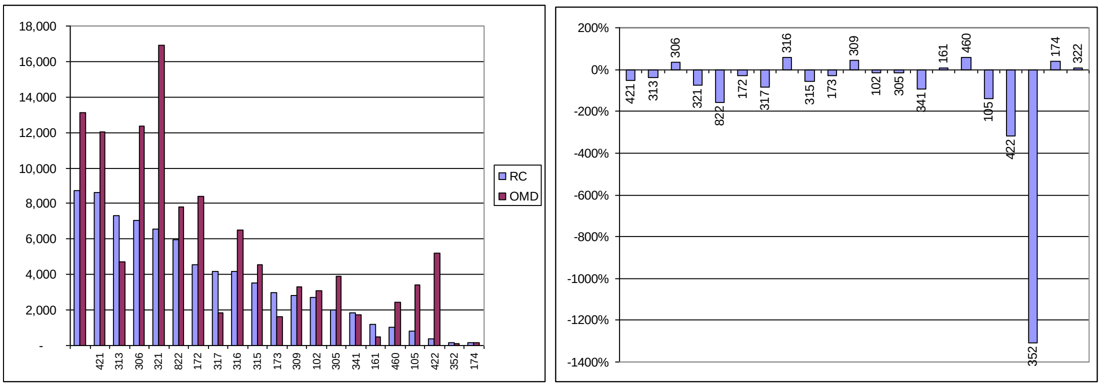


**Figure 3-3 Comparison of RC and OMD first appointments in 2005/6, low volume specialities**

For purposes of calculating activity growth in the outpatient sector we recommend use of the Reference Cost data. This recommendation is based on the following considerations.

- There is a high degree of agreement in the volume of first appointments recorded in the OMD and Reference Cost data for 2005/6, this being the only year when direct comparisons by specialty can be made. When there are discrepancies across specialties, the direction of bias cannot be established.
- Other than the volume and type of activity, the most crucial piece of information for the construction of the CWOI is the cost of each unit of activity. By design this information is linked to each type of outpatient activity in the Reference Cost data. However, because a fairly large proportion of OMD specialties (23%) categories cannot be mapped to RC specialties and because the RC categories are subject to continual revision, it is not straightforward to match cost data to records contained in the OMD.
- The comparative advantage of the OMD over the Reference Cost data is that waiting times are recorded for the majority of patients. This information can be used as a quality adjustment in the CWOI, in a similar fashion to its incorporation in measuring output growth in the hospital

sector. That said, outpatient waiting times can also be obtained from the quarterly QM08 returns, so use of the OMD is not imperative for this purpose.

- Outpatient data for 2006/7 as recorded in the OMD were not available at the time of writing.

On balance, therefore, we have decided to calculate growth rates in outpatient activity using Reference Cost data supplemented by waiting time information from the QM08 returns, which is reviewed in section 3.5.

## 3.5 Waiting times from quarterly returns

Outpatient waiting time data are submitted quarterly by NHS hospitals and summarised in the QM08 returns.[4] This quarterly return reports data for around seventy specialties. The data categorise patients into time-bands according to the length of wait from receipt of GP written referral request to first outpatient attendance. These time-bands have been revised over time.

We calculate the mean outpatient wait by specialty as the weighted average of the mid-points of each time-band, which are given in Table 3-9. We use 32.5 as the mid-point wait for those categorised as having waited more than 26 weeks in 2003/4, which is consistent with our original study (Dawson et al., 2005). For those years where the final categories were collapsed into a single time-band we apply the weighted average wait of those in the former time-bands in the previous year.

**Table 3-9 Assumptions about mid-point waits (weeks)**

| 2003/4 | | 2004/5 & 2005/6 | | 2006/7 | |
|---|---|---|---|---|---|
| Category | Midpoint wait | Category | midpoint wait | category | midpoint wait |
| 0 to <4 | 2 | 0 to <4 | 2 | 0 to <4 | 2 |
| 4 to <13 | 8.5 | 4 to <13 | 8.5 | 4 to <8 | 6 |
| 13 to <17 | 15 | 13 to <17 | 15 | 8 to <13 | 10.5 |
| 17 to <21 | 19 | 17 to <21 | 19 | 13 plus | 15 |
| 21 to <26 | 23.5 | 21 and over | 24.5 | | |
| 26 and over | 32.5 | | | | |

Mean outpatient waiting times overall and for high volume specialties are reported in Table 3-10. There has been a continual reduction in waiting times over the four years, falling from 8.4 weeks (59 days) in 2003/4 to 6 weeks (42 days) in 2006/7. These reductions are evident across all specialties.

**Table 3-10 Outpatient waiting times (days) for selected specialties**

| Code | Specialty | 2003/4 | 2004/5 | 2005/6 | 2006/7 |
|---|---|---|---|---|---|
| 999 | All specialties | 59 | 52 | 46 | 43 |
| 100 | General surgery | 47 | 45 | 40 | 35 |
| 101 | Urology | 59 | 52 | 46 | 42 |
| 110 | Trauma and orthopaedics | 75 | 64 | 56 | 51 |
| 120 | Ear, Nose and Throat | 68 | 58 | 51 | 48 |
| 130 | Ophthalmology | 67 | 59 | 50 | 47 |
| 140 | Oral surgery | 63 | 58 | 51 | 52 |
| 300 | General medicine | 55 | 49 | 44 | 39 |
| 320 | Cardiology | 54 | 48 | 43 | 40 |
| 330 | Dermatology | 62 | 54 | 48 | 43 |
| 400 | Neurology | 77 | 63 | 55 | 53 |
| 410 | Rheumatology | 73 | 61 | 54 | 47 |
| 420 | Paediatrics | 46 | 45 | 42 | 39 |
| 502 | Gynaecology | 49 | 44 | 40 | 36 |

We link the mean waiting time for each specialty to the activity in the same specialty reported in the Reference Cost data. Classification changes in the Reference Cost collection has introduced ever more

[4] http://www.performance.doh.gov.uk/waitingtimes/index.htm accessed 26/7/08

categories that not specialty specific. All such categories are assigned the overall mean waiting time for their relevant year.

As noted in section 0, where new outpatient categories are introduced, we impute a value of waiting time for the previous period by inflating current waiting time by the general trend between the two periods (waiting times tend to have fallen over time). Similarly for retiring categories we impute waiting times in the subsequent period by deflating according to the general trend for the relevant time frame.

### 3.6 Growth of outpatient activity

The Reference Cost data are used to construct a CWOI, with the data from the quarterly waiting time returns used as a quality adjuster applied to the volume of activity. In Laspeyres form, the CWOI takes the standard form:

$$I^{Lc} = \frac{\sum_{j=1}^{J} x_{jt+1} c_{jt}}{\sum_{j=1}^{J} x_{jt} c_{jt}} \qquad (12)=(3)$$

The quality-adjusted CWOI is a simplified version of the output index ( $I^{Lcq}$ ) used to calculate the growth in hospital activity. The equivalent index for outpatient activity takes the form:

$$I^{Lcq\_out} = \frac{\sum_j x_{jt+1} c_{jt} \left[ \mathrm{A} - \frac{\left(e^{r_w w_{jt+1}} - 1\right)}{r_w} \Big/ \mathrm{A} - \frac{\left(e^{r_w w_{jt}} - 1\right)}{r_w} \right]}{\sum_j x_{jt} c_{jt}} \qquad (13)$$

Where the mean (rather than 80$^{th}$) percentile waiting time is used as a value for $w_j$ and where $\mathrm{A}$ is constant reflecting the assumption that outpatients have a remaining life expectancy of 26 years.

The main constituent data items (volume, cost and waiting times) are summarised in Table 3-11. The overall volume of activity has increased over time. However, the mix of this activity has also changed, as indicated by the average unit costs. Average unit costs increased between 2003/4 and 2004/5, implying that more complex (ie costly) activities were being undertaken in the 2004/5 compared to 2003/4. But subsequently average unit costs have been falling year-on-year, implying that less costly (ie complex) activities account for an increasing proportion of the total volume. If the growth in the volume of activity is concentrated among less costly activities at the expense of more costly activities, the cost-weighted output growth might be negative.

**Table 3-11 Outpatient activity, costs and waiting times**

| | **Volume of activity** | **Activity weighted average unit costs** | **Activity weighted average waiting times (weeks)** |
|---|---|---|---|
| **2003/04** | 50,205,073 | 98.10 | 8.32 |
| **2004/05** | 52,724,302 | 105.63 | 7.41 |
| **2005/06** | 60,541,477 | 102.63 | 6.53 |
| **2006/07** | 63,453,507 | 92.67 | 5.94 |

The final column of Table 3-11 reports the trend in mean outpatient waiting times, which have been decreasing consistently. This improvement in waiting times will be reflected in the quality adjusted CWOI having a higher value than the unadjusted CWOI.

**Table 3-12 Growth in outpatient activity**

| Outpatient - unadjusted CWOI | | Outpatient - quality adjusted CWOI | |
|---|---|---|---|
| **Laspeyres** | | **Laspeyres** | |
| 2003-04 - 2004/05 | 10.14% | 2003-04 - 2004/05 | 10.23% |
| 2004-05 - 2005/06 | 9.87% | 2004-05 - 2005/06 | 9.96% |
| 2005-06 - 2006/07 | -6.86% | 2005-06 - 2006/07 | -6.81% |
| **Paasche** | | **Paasche** | |
| 2003-04 - 2004/05 | 9.74% | 2003-04 - 2004/05 | 9.83% |
| 2004-05 - 2005/06 | 9.84% | 2004-05 - 2005/06 | 9.93% |
| 2005-06 - 2006/07 | -6.86% | 2005-06 - 2006/07 | -6.81% |
| **Fisher** | | **Fisher** | |
| 2003-04 - 2004/05 | 9.94% | 2003-04 - 2004/05 | 10.03% |
| 2004-05 - 2005/06 | 9.86% | 2004-05 - 2005/06 | 9.94% |
| 2005-06 - 2006/07 | -6.86% | 2005-06 - 2006/07 | -6.81% |

Growth in outpatient activity is reported in Table 3-12. Looking at the unadjusted CWOI first, this reveals a substantial increase in growth between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. The large increase in activity between 2004/5 and 2005/6 was more than enough to offset the slight shift toward less costly procedures. This shift became more pronounced between 2005/6 and 2006/7, to the extent that cost weighted output fell by 6.86%, despite overall activity having increased slightly.

As anticipated, allowing for the improvement in waiting times has a positive effect on the growth rate, adding 0.09% in the early period to 0.04% more recently.

# 4. Mental health care services

## 4.1 Introduction

Data on services provided to patients suffering mental health conditions is available from two sources. The Hospital Episode Statistics classify patients with mental health problems to HRGs in Chapter T. HES allows us to assess changes in waiting times and survival rates for these patients over time, and to incorporate this information into the output index as a quality adjustment taking the same form as that used for other activities performed in hospitals. The HES data for mental health patients are described in section 4.2. The Reference Cost database also captures services provided to patients with mental health problems, and the nature of this information is assessed in section 0, before growth rates are calculated.

## 4.2 Inpatient activity from HES

Table 4-1 reports the number of CIPS recorded in the mental health HRGs (T codes) in HES. The volume of elective activity has been falling over time, and there have also been decreases in the amount of emergency activity, although the trend has not been falling consistently over the period. These reductions in hospital activity might be a reflection of efforts to prevent hospital admission for these patients by providing more support in other settings.

**Table 4-1 Mental health activity recorded in HES**

| **Year** | **Volume of mental health activity** | |
|---|---|---|
| | *Elective and day cases* | *Emergencies* |
| **2003/04** | 47,384 | 120,789 |
| **2004/05** | 45,624 | 123,983 |
| **2005/06** | 41,439 | 120,203 |
| **2006/07** | 38,408 | 115,560 |

As mentioned in section 2.2.1, the average cost of treating an inpatient with a mental health condition is not reported in the Reference Costs, where inpatient activity is costed on the basis of occupied bed days. In the absence of patient cost data, we have assigned the median cost across all FCEs to mental health HRGs recorded in HES. These median costs are reported in Table 4-2.

An alternative source is the PSSRU's annual publications reporting Unit Costs of Health and Social Care[5] which provides costs estimates of acute and long stay NHS services for people with mental health problems. The drawback of these estimates, however, is that are based on surveys conducted in 1995/6 with costs inflated to the current period.

**Table 4-2 Costs applied to inpatient activity**

| **Year** | **Activity weighted average unit costs HES Mental Health** | |
|---|---|---|
| | *Elective and day cases* | *Emergencies* |
| **2003/04** | 676.32 | 936.88 |
| **2004/05** | 688.58 | 1,012.07 |
| **2005/06** | 673.01 | 1,012.17 |
| **2006/07** | 655.86 | 1,012.17 |

Survival rates for mental health patients are reported in Table 4-3. Survival rates have improved year-on-year for patients admitted as emergencies, and were also higher in 2006/7 than in 2003/4 for elective patients, though there is no consistent annual trend. Similar temporal patterns emerge when

[5] http://www.pssru.ac.uk/pdf/uc/uc2007/uc2007.pdf accessed 10/07/08

considering changes in life expectancy (Table 4-4), which are driven partly by the survival rates and partly by the age/gender mix of mental health patients in each particular period.

**Table 4-3 Survival rates for mental health patients**

| Year | Mean in-hospital survival rate | | Mean 30 day post discharge survival rate | |
|---|---|---|---|---|
| | *Elective and day cases* | *Emergencies* | *Elective and day cases* | *Emergencies* |
| **2003/04** | 0.9858 | 0.9797 | 0.9778 | 0.9674 |
| **2004/05** | 0.9850 | 0.9816 | 0.9772 | 0.9696 |
| **2005/06** | 0.9869 | 0.9825 | 0.9801 | 0.9722 |
| **2006/07** | 0.9883 | 0.9835 | 0.9815 | 0.9738 |

**Table 4-4 Life expectancy of mental health patients**

| Year | Average life expectancy | |
|---|---|---|
| | *Elective and day cases* | *Emergencies* |
| **2003/04** | 29.71 | 28.06 |
| **2004/05** | 30.09 | 28.74 |
| **2005/06** | 30.01 | 28.89 |
| **2006/07** | 30.60 | 29.03 |

Changes in waiting times are reported in Table 4-5. Although general trends in waiting times have been downward, waiting times have actually risen for patients suffering mental health conditions, most notably for those suffering senile dementia (T01) and mania without sectioning (T05). All else equal, this will translate into a reduction in output in the periods when waiting times increased.

**Table 4-5 Waiting times for mental health patients**

| Year | Elective Waiting Time | |
|---|---|---|
| | *Mean* | *80th Percentile* |
| **2003/04** | 67.24 | 159.88 |
| **2004/05** | 63.11 | 40.35 |
| **2005/06** | 181.18 | 264.80 |
| **2006/07** | 164.55 | 256.83 |

## 4.3 Activity in reference costs

The categorisation of data on mental health activity in Reference Costs has evolved over time. Table 4-6 gives an indication of this evolution for non-outpatient activities, according to the major classifications used (which appear as separate spreadsheets) in the excel files. Over time there have been various changes to the number of categories. In 2006/7, quantification of specialist services delivered in the community commenced, and activity by specialist teams was subdivided according to the age of the patients to whom services were delivered.

Inpatient data in the Reference Costs is recorded on the basis of occupied beddays, with the total number of beddays each year reported in Table 4-7. This shows a gradual reduction in the number of occupied beddays for most mental health patients treated as inpatients while there is no clear trend for care delivered to patients receiving specialist services. Beddays are not a good measure of activity, with the numbers of patients treated being a preferable measure. This is available from HES, as reported in section 4.2. Thus in our growth index for mental health we drop ‘activity’ recorded as “inpatient data” and “specialist services inpatient data” in favour of the number of inpatients patients recorded in HES.

**Table 4-6 Mental health activities (other than outpatients) in Reference Costs**

| | Unit of measurement | 2003/4 | 2004/5 | 2005/6 | 2006/7 |
|---|---|---|---|---|---|
| Inpatient Data | Occupied bed days | 5 | 5 | 5 | 5 |
| Domiciliary Visit Data | Visits | 2 | 2 | 2 | 2 |
| Secure Unit Data | Occupied bed days | 9 | 10 | 13 | 12 |
| Specialist Services Inpatient Data | Occupied bed days | 4 | 4 | 3 | 3 |
| Community : Specialist Services | Contacts | | | | 3 |
| Community : Specialist Services | Contacts | | | | 3 |
| Specialist Teams | Contacts | 1 | 9 | 12 | |
| Specialist Teams: adult | Contacts | | | | 10 |
| Specialist Teams: child | Contacts | | | | 6 |
| Specialist Teams: elderly | Contacts | | | | 5 |
| Day Care Facilities | Patient days | 1 | 1 | 3 | 3 |

**Table 4-7 Inpatient occupied bed days, Reference Costs**

| **Year** | **Occupied bed days** | |
|---|---|---|
| | *Inpatients* | *Specialist services* |
| **2003/04** | 9,754,781 | 101,935 |
| **2004/05** | 9,255,375 | 87,908 |
| **2005/06** | 8,454,683 | 108,803 |
| **2006/07** | 7,519,364 | 87,818 |

The greatest evolution in the coding of mental health activities in the Reference Cost data has been with respect to outpatient activity. The main features are reported in Table 4-8 and can be summarised as follows:

- A change in the unit of measurement from appointments in 2003/4 to attendances thereafter
- Quantification of community based outpatient activity from 2004/5 onwards
- Quantification of outpatient attendances for specialist services (eating disorders, mother and baby units, autistic spectrum disorder) from 2006/7
- Sub-division of outpatient activity according to whether or not there was a face-to-face contact from 2006/7

The volume of mental health activity recorded in Reference Costs, excluding the inpatient and specialist occupied bed days, is reported in Table 4-9 4-9.

**Table 4-8 Classification of outpatient mental health care activity**

| Mental health service - outpatients | | | | 2003/4 | 2004/5 | 2005/6 | 2006/7 |
|---|---|---|---|---|---|---|---|
| Booked Appointments | First | | Attendances* | 4 | 5 | 5 | |
| Outpatients | First | Face-to-face | Attendances | | | | 5 |
| Outpatients | First | Non face-to-face | Attendances | | | | 4 |
| Booked Appointments | Follow-up | | Attendances* | 4 | 5 | 5 | |
| Outpatients | Follow-up | Face-to-face | Attendances | | | | 4 |
| Outpatients | Follow-up | Non face-to-face | Attendances | | | | 2 |
| Booked Appointments: Community-based Services | First | | Attendances* | | 5 | 5 | |
| Community-based Services | First | Face-to-face | Contacts | | | | 5 |
| Community-based Services | First | Non face-to-face | Contacts | | | | 5 |
| Booked Appointments: Community-based Services | Follow-up | | Attendances* | | 5 | 5 | |
| Community-based Services | Follow-up | Face-to-face | Contacts | | | | 5 |
| Community-based Services | Follow-up | Non face-to-face | Contacts | | | | 5 |
| Outpatients : Specialist Services | First | Face-to-face | Attendances | | | | 4 |
| Outpatients : Specialist Services | First | Non face-to-face | Attendances | | | | 3 |
| Outpatients : Specialist Services | Follow-up | Face-to-face | Attendances | | | | 4 |
| Outpatients : Specialist Services | Follow-up | Non face-to-face | Attendances | | | | 2 |
| Specialist Services Booked Appointments | First | | Attendances* | 4 | 4 | 4 | |
| Specialist Services Booked Appointments: Community-based Services | First | | Attendances* | | 3 | 3 | |
| Community : Specialist Services | First | Face-to-face | Contacts | | | | 3 |
| Community : Specialist Services | First | Non face-to-face | Contacts | | | | 3 |
| Specialist Services Booked Appointments | Follow-up | | Attendances* | 4 | 4 | 4 | |
| Specialist Services Booked Appointments: Community-based Services | Follow-up | | Attendances* | | 3 | 3 | |

**Table 4-9 Volume of mental health activity recorded in Reference Costs, excluding inpatient activity**

| **Year** | **Mental Health - Reference Costs** | | |
|---|---|---|---|
| | *Categories* | *Activity* | *Mean unit cost* |
| **2003/04** | 31 | 15,168,410 | 151.39 |
| **2004/05** | 59 | 16,389,891 | 164.36 |
| **2005/06** | 64 | 17,738,894 | 169.55 |
| **2006/07** | 105 | 19,259,205 | 166.82 |

## 4.4 Growth of mental health care activity

We calculate output growth for mental health care activity using HES data to measure activity undertaken in the inpatient hospital setting and the Reference Cost data to quantify activity elsewhere.

Growth in mental health care activity is reported in Table 4-104-10. Looking at the unadjusted CWOI first, this reveals a substantial increase in growth between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. The large increase in activity between 2004/5 and 2005/6 was more than enough to offset the slight shift toward less costly procedures. This shift became more pronounced between 2005/6 and 2006/7, to the extent that cost weighted output fell by 4.83%, despite overall activity having increased slightly.

**Table 4-10 Growth in mental health care activity**

| Mental Health – unadjusted CWOI | | Mental Health - quality adjusted CWOI | |
|---|---|---|---|
| **Laspeyres** | | **Laspeyres** | |
| 2003-04 - 2004/05 | 11.44% | 2003-04 - 2004/05 | 11.83% |
| 2004-05 - 2005/06 | 9.50% | 2004-05 - 2005/06 | 9.42% |
| 2005-06 - 2006/07 | 4.83% | 2005-06 - 2006/07 | 4.82% |
| **Paasche** | | **Paasche** | |
| 2003-04 - 2004/05 | 11.07% | 2003-04 - 2004/05 | 11.46% |
| 2004-05 - 2005/06 | 7.92% | 2004-05 - 2005/06 | 7.85% |
| 2005-06 - 2006/07 | 4.17% | 2005-06 - 2006/07 | 4.17% |
| **Fisher** | | **Fisher** | |
| 2003-04 - 2004/05 | 11.25% | 2003-04 - 2004/05 | 11.64% |
| 2004-05 - 2005/06 | 8.70% | 2004-05 - 2005/06 | 8.63% |
| 2005-06 - 2006/07 | 4.50% | 2005-06 - 2006/07 | 4.49% |

Quality adjustment of inpatient activity has an inconsistent impact on the index. Initially, quality adjustment contributes positively to growth (+0.39%, 2003/4-2004/5, Laspeyres), but between 2004/5-2005/6 the adjustment is negative, though small (-0.8%). This is driven mainly by the large increase in the waiting time between these two years (Table 4-55), but also by the slight fall in life expectancy (Table 4-4). Quality adjustment had a neutral effect between 2005/6 and 2006/7.

# 5. Community services

## 5.1 Introduction

NHS community care services are those provided to NHS patients - whether by NHS or non-NHS providers – in the community setting. While this might sound a relatively straightforward definition, the type of services falling within the scope of this definition has changed over time. Most notably, the scope of services has changed following the replacement of previous Körner statistical returns with the Reference Cost data. We analyse how community activity has been measured over time in sections 5.2 and 5.3 before considering the way costs of community care are reported in the Reference Costs returns (section 5.4). In section 5.5 we calculate growth rates for community activity, and provide an analysis of growth by organisational type in section 5.6.

## 5.2 Körner statistical returns

For most of the 1990s, for the purposes of its statistical collection the Department of Health defined community care statistics as encompassing the following:

"Ambulance services, chiropody, clinical psychology, community mental health (psychiatric) nursing, contraceptive services, HIV/AIDS and sexually transmitted diseases, district nursing, health advice and support programmes, learning disability nursing, occupational therapy, physiotherapy, specialist care nursing, speech and language therapy, community and NHS maternity services."[6]

**Table 5-1 Korner data collections by activity category and year**

| Community Services categories | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 | 1996-97 | 1997-98 | 1998-99 | 1999-2000 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ambulance | | | | | | | | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ▓ | ▓ |
| Chiropody | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| Clinical pyschology | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | | |
| Community mental health nursing | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| District nursing | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| Health visiting | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| Community learning disability nursing | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| Occupational therapy | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ▓ | |
| Physiotherapy | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ▓ | |
| Speech and language therapy | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ▓ | |
| Family planning clinic data | | | | | | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |
| Specialist care nurses | | | | | | | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | ░ | | |

Table 5-1 shows the main service categories and the years for which activity data are available – a shaded cell indicates that data were compiled either by the Department of Health (light shading) or Information Centre (dark shading). Activity in each of these areas was reported under the medical statistics section of the Department of Health website which contains links to excel spreadsheets with activity data for each service area dating back to 1988/99. From 2004/5 data for ambulance services, OT, physiotherapy and speech and language therapy were compiled by the Information Centre.[7]

Activity by ambulance services is recorded in a variety of ways, including emergency calls, emergency incidents and ambulance journeys. The activities have since been classified under paramedic services and will be considered in 7.2. For the majority of community services "Initial contacts (new episodes of care)" are the usual basis for defining a unit of activity, though for some of the period "first contacts (different persons receiving care)" were also recorded. Figure 5-1 shows the total number of initial contacts across all service categories with the exception of ambulance services. The large increase in the volume of activity recorded from 1993/4 is clearly related to the inclusion of family planning clinic

[6] http://www.dh.gov.uk/en/Publicationsandstatistics/Statistics/StatisticalWorkAreas/Statisticalhealthcare/DH_4086490 accessed 23/01/08

[7] http://www.ic.nhs.uk/webfiles/publications/ accessed 23/1/08

data and of activity by specialist care nurses. The sharp fall in 2004/5 is due to the discontinuation of data collection.

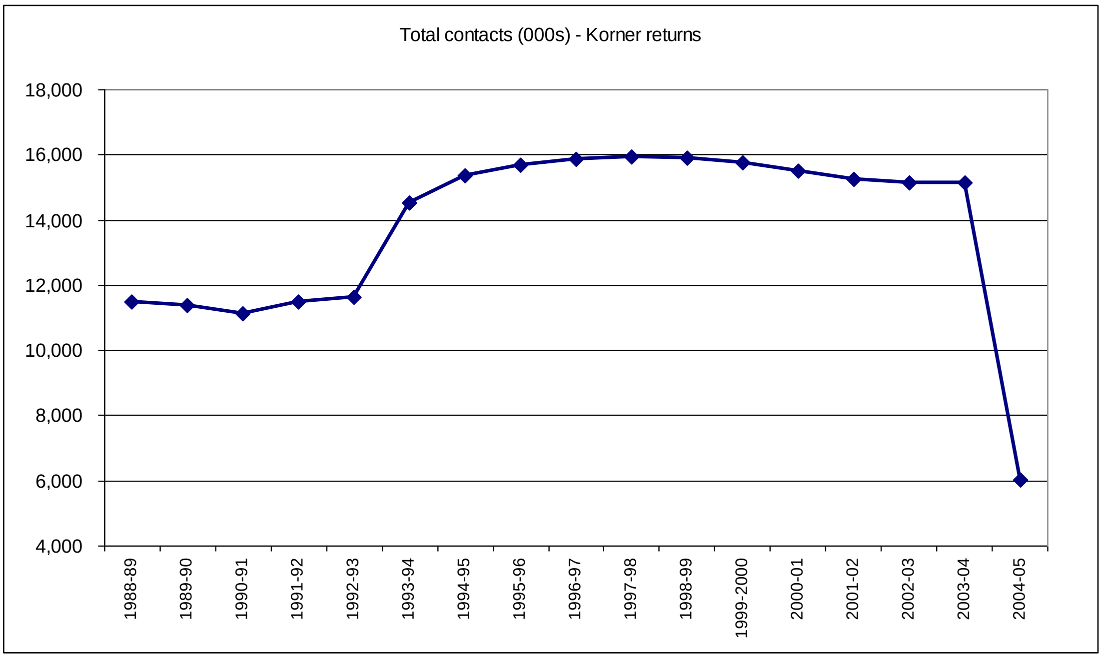


**Figure 5-1 Total community care contacts by year, Korner collections**

## 5.3 Activity recorded in the Reference Costs returns

Since 1999/2000, the Reference Cost data progressively replaced the Korner statistical returns. The Reference Cost returns differ from the Korner returns in the following key respects:

- The activity categories differ.
- Average costs are reported for each type of activity in Reference Costs. No cost data appear in the Korner returns.
- Data in the Reference Costs are reported separately for four groups of provider, these being NHS Trusts, PCTs, PMS pilots and non-NHS providers. The Korner returns summarise provider returns by region.

Activity and cost data for community care services were first included in the Reference Costs for 1999/2000, when data for Physiotherapy, Occupational Therapy and Speech Therapy Services were reported for NHS Trusts. Since then, coverage has changed with activity categories being added, removed or redefined. Activity and cost data for patients treated by non-NHS providers were introduced in 2003/04.

Table 5-2 provides an indication of how data collection has evolved over time, reporting the number of activity/cost categories under broad headings. The increase in the number of categories is driven both by the addition of new categories as data collection is extended and by disaggregation of existing categories into more refined groupings. These constant changes in the architecture of the classification system pose problems in ensuring that an output growth index is an accurate reflection of growth in the community sector. As we discussed in section 1.3, including categories only if they appear in successive years (Method A) or mapping of categories (Method B) would create significant biases in growth estimates in this sector.

**Table 5-2 Reference Cost data collections by broad activity category and organisational type**

| Year | Type of Provider / Activity category | Community Nursing Services Data | Community /Outreach Nursing Services Data | Community Midwifery Services HRG-based Data | Community Midwifery Visit Data | Community Medical Services Vaccinations Data | Community Medical Services Data | Community Therapy Services | Direct Access Therapy Services | Community Services Other Attendances Data | Physio, Occupational and Speech Therapy | Community Services Needle Exchange Scheme | Community Rehabilitation Teams | Total by Organisation | Total by year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1999/00** | **NHS Trusts** | | | | | | | | | 14 | 6 | | | **20** | **20** |
| **2000/01** | **NHS Trusts** | 3 | 14 | | | | | | | 3 | 21 | 1 | | **42** | **104** |
| | **PCTs** | 3 | 8 | | | | | | | 3 | 21 | 1 | | **36** | |
| | **PMS + pilots** | 3 | 6 | | | | | | | 3 | 14 | | | **26** | |
| **2001/02** | **NHS Trusts** | 3 | 14 | 15 | 3 | | | 3 | 3 | 3 | | | | **44** | **90** |
| | **PCTs** | 3 | 14 | 2 | 2 | | | 3 | 3 | 3 | | | | **30** | |
| | **PMS + pilots** | 3 | 5 | | 1 | | | 3 | 1 | 3 | | | | **16** | |
| **2002/03** | **NHS Trusts** | 8 | 26 | 21 | 2 | 1 | 1 | 12 | 12 | 3 | | | | **86** | **174** |
| | **PCTs** | 8 | 29 | 3 | 2 | 2 | 1 | 12 | 12 | 3 | | | | **72** | |
| | **PMS + pilots** | 6 | 3 | | | | 1 | | 4 | 2 | | | | **16** | |
| **2003/04** | **NHS Trusts** | 10 | 54 | 11 | 2 | 1 | 1 | 6 | 6 | 5 | | | | **96** | **201** |
| | **PCTs** | 11 | 46 | 2 | 2 | 1 | 1 | 6 | 6 | 5 | | | | **80** | |
| | **PMS + pilots** | 9 | 3 | | | 1 | 1 | 2 | 2 | 3 | | | | **21** | |
| | **non-NHS providers** | | | | | | | | 4 | | | | | **4** | |
| **2004/05** | **NHS Trusts** | 13 | 66 | 10 | 2 | 1 | 1 | 6 | 6 | 5 | | | | **110** | **242** |
| | **PCTs** | 11 | 62 | 3 | 2 | 1 | 1 | 6 | | 5 | | | | **91** | |
| | **PMS + pilots** | 9 | 2 | | | 1 | 1 | 2 | | 3 | | | | **18** | |
| | **non-NHS providers** | 1 | 5 | 3 | | | 1 | 6 | 3 | 4 | | | | **23** | |
| **2005/06** | **NHS Trusts** | 11 | 69 | 8 | 2 | 1 | | 12 | | 5 | | | | **108** | **267** |
| | **PCTs** | 13 | 65 | 6 | 2 | 1 | | 12 | | 5 | | | | **104** | |
| | **PMS + pilots** | 10 | 5 | 1 | | | | 2 | | 3 | | | | **21** | |
| | **non-NHS providers** | 10 | 9 | 5 | | | | 6 | | 4 | | | | **34** | |
| **2006/07** | **NHS Trusts** | 13 | 67 | 10 | 2 | 1 | 4 | 12 | | 6 | | | 1 | **116** | **272** |
| | **PCTs** | 13 | 61 | 4 | 2 | 1 | 4 | 12 | | 8 | | | 1 | **106** | |
| | **PMS + pilots** | 10 | 5 | | | | 1 | 2 | | 3 | | | | **21** | |
| | **non-NHS providers** | 7 | 6 | 4 | | | 1 | 7 | | 4 | | | | **29** | |

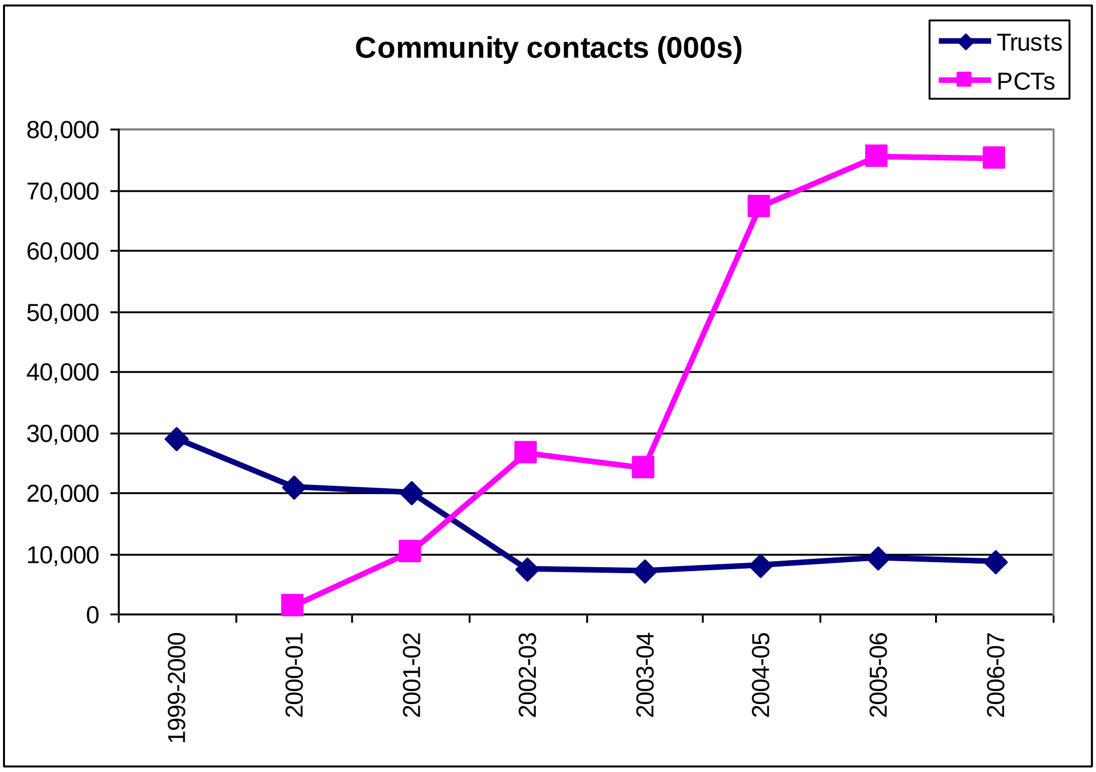


**Figure 5-2 Community care contacts in Trusts and PCTs**

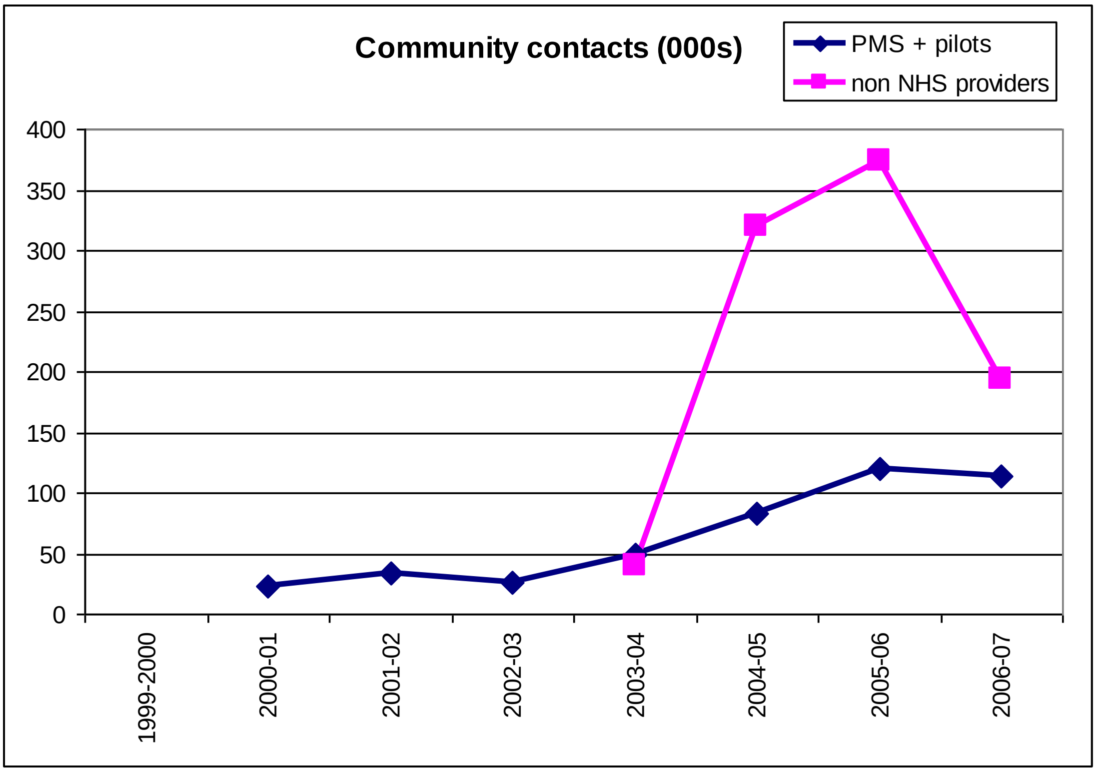


**Figure 5-3 Community care contacts in PMS pilots and non-NHS providers**

Figure 5-2 and Figure 5-3 show the volume of community care contacts recorded over time for the four types of provider. There are three features of these series of particular note:

- NHS Trusts reported successively lower amounts of community care activity between 1998/9 and 2002/3. This may indicate that community care activities that were previously organised by NHS hospital trusts are now managed by community care providers or PCTs.

- Data collection was expanded significantly in 2004/5, when the requirements to provide Reference Cost returns was strengthened and rolled out to more providers. This expansion of coverage will drive a large increase in output "growth" between 2003/4 and 2004/5. It will be important to attribute this change correctly to expansion of data collection, rather than inferring that a major change in underlying work practices has taken place.
- There is a small reduction in contacts in 2006/7 compared to the previous year. This is likely to result in a reduction in the output growth rate in these years.

## 5.4 Cost data from the Reference Costs

For each type of activity, the Reference Cost database reports both the volume of activity and the average national cost, calculated from information provided by all providers of the particular activity.

There are concerns about the quality and accuracy of these Reference Cost data, with inaccuracies arising for a number of reasons (Information Centre, personal communication). The most obvious source of inaccuracy is lack of familiarity with the costing procedures, which afflicts initial costing returns but is likely to become less problematic over time. A second source of error arises from changes in the classification of activities or in definitional changes. An example, taken from the collection of outpatient activity, was the change from "outpatient appointments" to "booked outpatient appointments" which led to a reduction in reporting and an increase in unit cost. Finally, the Reference Cost returns might engender behavioural change, perhaps in unintended ways. For example, if a provider finds itself with very high reference costs one year, it may take steps to include as much activity as possible in subsequent years. This problem is exacerbated by the fact that the definitions are open to interpretation.

If the reporting inaccuracy means that a specific activity has a higher cost in any particular year than it should, this will have two types of impact on the overall growth rate for the sector under consideration:

- The weight assigned to the activity will be higher relative to other activities, meaning that it is given excessive influence in the output index.
- The weight assigned to the activity in one year may differ substantially to that in another year. This will create volatility in the output index across time periods.

For many community care activities, there is high volatility in average costs in different years. The cost for many activities can be twice that reported in an adjacent year. Whether this is inaccurate is difficult to judge. For many community care activities both the cost and the volume of activity is quite low (in 2006/7 for NHS Trusts, mean unweighted cost was £122 and there were fewer than 1000 patients in 29/116 categories). Given that much costing involves the allocation of overheads, volatility is to be expected.

That said, we identified concerns with one particular activity, this being Intensive Care Nursing: Adult: Face to Face Total Contacts. Only 2 or 3 NHS Trusts report activity of this type, but the data reported are highly volatile both in terms of the amount of activity reported from one year to the next and in the unit costs. The data for this activity are reported in Table 5-3.

**Table 5-3 Example of volatile Reference Cost data**

CN206AF Band 6 - Intensive Care Nursing : Adult : Face to Face Total Contacts

| | No. of Total Contacts in Financial Year | National Average Unit Cost £ | Interquartile Range of Unit Costs 2 Lower Quartile £ | Upper Quartile £ | No. of Data Submissions |
|---|---|---|---|---|---|
| 2006/7 | 12 | 1,687 | 1,687 | 1,687 | 1 |
| 2005/6 | 632 | 259 | 676 | 1,566 | 2 |
| 2004/5 | 17 | 40,538 | 25,405 | 72,181 | 2 |
| 2003/4 | 1,222 | 485 | 944 | 21,028 | 3 |
| 2002/3 | 1,218 | 448 | 801 | 68,739 | 3 |

## 5.5 Growth in community care activity

These average costs are transformed into a set of cost weights which are common across the community sector as a whole. These weights are derived from the sum of activity-weighted costs reported across all providers (NHS Trusts, PCTs and PMS pilots and non-NHS providers).

Given the extensive changes in how community care activities have been defined over time we compare CWOI estimates calculated according to two methods outlined in section 1.3.1, namely.

- Method B, which involves *mapping* new categories to those they replace;
- Method C, which involves *imputing* a value for the cost weight where data are missing.

Method B entails omission of data when activity categories cannot be mapped. This is most likely to occur when previously unrecorded activity is included in the Reference Cost data collection exercise. As Table 5-4 shows there is fairly significant amount of activity that is newly recorded each year. For instance, in 2003/4 a total of 157,212 contacts are lost because they were recorded in activity categories that were dropped in the subsequent year while 603,251 contacts are omitted from 2004/5 data because there was no equivalent activity category in the previous year. Consequently, a CWOI based on Method B will omit 760,463 contacts from the calculation of output growth between 2003/4 and 2004/5. A full list of these “retiring” categories appears in the top half of Table 5-5 while “new” categories are listed in the lower half of the table for these two periods.

**Table 5-4 Number of contacts available and included if Method B used to calculate CWOI**

| | 2003/04 | 2004/05 | 2004/05 | 2005/06 | 2005/06 | 2006/07 |
|---|---|---|---|---|---|---|
| **Activity included in CWOI calculations** | 31,185,224 | 75,070,541 | 75,271,132 | 84,667,653 | 85,077,434 | 82,589,290 |
| **Total activity recorded in every year** | 31,342,436 | 75,673,792 | 75,673,792 | 85,092,838 | 85,092,838 | 83,895,139 |
| **Difference** | **-157,212** | **-603,251** | **-402,660** | **-425,185** | **-15,404** | **-1,305,849** |
| **Percentage of activity included over total activity** | **-0.50%** | **0.80%** | **0.53%** | **0.50%** | **0.02%** | **1.56%** |

**Table 5-5 Retiring and new categories**

| | | |
|---|---|---|
| **Retiring activity categories** | | |
| ***Activities included in 2003/4 but not in 2004/5*** | | **Contacts** |
| N65A | Direct Access Occupational Therapy Services : Adult | 108,796 |
| N65C | Direct Access Occupational Therapy Services : Child | 16,756 |
| N75A | Direct Access Speech Therapy Services : Adult | 31,601 |
| CMM05 | Upper Genital Tract Minor Procedures | 5 |
| CMM09 | Threatened or Spontaneous Abortion | 5 |
| CMN10 | Caesarean Section w cc | 5 |
| CMN11 | Caesarean Section w/o cc | 43 |
| | **Total** | **157,211** |
| **New activity categories** | | |
| ***Activities included in 2004/5 but not in 2003/4*** | | |
| CMJ44 | Minor Dermatological Conditions or Benign Tumours | 1 |
| CML39 | Penis Minor Open Procedure <70 w/o cc | 725 |
| CMM10 | Surgical Termination of Pregnancy | 378 |
| CMN04 | Neonates with Multiple Major Diagnoses | 1 |
| CMN05 | Neonates with one Major Diagnosis | 4 |
| CMP20 | Other Congenital Conditions | 1 |
| CN206AN | Band 6 - Intensive Care Nursing : Adult : Non-Face to Face Total Contacts | 11 |
| CN207BAF | Band 7B - Tuberculosis Specialist Nursing : Adult : Face to Face Total Contacts | 39,091 |
| CN207BAN | Band 7B - Tuberculosis Specialist Nursing : Adult : Non-Face to Face Total Conta | 2,199 |
| CN207BCF | Band 7B - Tuberculosis Specialist Nursing : Child : Face to Face Total Contacts | 7,396 |
| CN207BCN | Band 7B - Tuberculosis Specialist Nursing : Child : Non-Face to Face Total Conta | 729 |
| CN210AN | Band 10 - Haemophilia Nursing Services : Adult : Non-Face to Face Total Contacts | 1,200 |
| CN210CN | Band 10 - Haemophilia Nursing Services : Child : Non-Face to Face Total Contacts | 1,160 |
| CN211AN | Band 11 - Transplantation Patients Nursing Services : Adult : Non-Face to Face T | 846 |
| CN214AF | Band 14 - Tissue Viability Nursing / Liaison : Adult : Face to Face Total Contac | 197,767 |
| CN214AN | Band 14 - Tissue Viability Nursing / Liaison : Adult : Non-Face to Face Total Co | 17,766 |
| CN214CF | Band 14 - Tissue Viability Nursing / Liaison : Child : Face to Face Total Contac | 1,572 |
| CN214CN | Band 14 - Tissue Viability Nursing / Liaison : Child : Non-Face to Face Total Co | 285 |
| CN215AF | Band 15 - Treatment Room Nursing Services [GP practice-based] : Adult : Face to | 284,741 |
| CN215AN | Band 15 - Treatment Room Nursing Services [GP practice-based] : Adult : Non-Face | 23,687 |
| CN215CF | Band 15 - Treatment Room Nursing Services [GP practice-based] : Child : Face to | 21,897 |
| CN215CN | Band 15 - Treatment Room Nursing Services [GP practice-based] : Child : Non-Face | 1,794 |
| | **Total** | **603,251** |

Method C requires imputation of cost weights in the years when activity (and, hence, costs) are not reported. The Hospital Services Cost Index[8,9] (HSCI), as modified by ONS, is used to inflate (deflate) current average costs to impute values for retiring (new) categories respectively. This allows all available activity to be included in the calculation.

The CWOI is calculated from 2003/04 to 2006/07 under Method B in Table 5-6 and under Method C in Table 5-7.

**Table 5-6 CWOI for community services using method B**

| Index | Laspeyres | Paasche | Fisher |
|---|---|---|---|
| **2003/04 - 2004/05** | 350.25% | 136.90% | 226.59% |
| **2004/05 - 2005/06** | 10.71% | 10.13% | 10.42% |
| **2005/06 - 2006/07** | -3.19% | -3.97% | -3.58% |
| **Average** | **119.25%** | **47.69%** | **77.81%** |

**Table 5-7 CWOI for community services using method C**

| Index | Laspeyres | Paasche | Fisher |
|---|---|---|---|
| **2003/04 - 2004/05** | 315.53% | 93.82% | 183.79% |
| **2004/05 - 2005/06** | 10.25% | 9.76% | 10.00% |
| **2005/06 - 2006/07** | -0.65% | -1.43% | -1.04% |
| **Average** | **108.38%** | **34.05%** | **64.25%** |

There are some notable features of these data:

- The expansion of data collection in 2004/5 is reflected in the appearance of a substantial growth rate between 2003/4 and 2004/5, irrespective of how CWOI is calculated.
- The growth rate falls between 2005/6 and 2006/7, as would be anticipated by observing Figure 5-2 and figure 5-3.
- The growth rates calculated using Method C are lower (less extreme) than those for Method B. There is no reason why this would hold generally, as it depends on the specific nature of the data that are omitted from the index under Method B (ie how representative these data are of the full dataset).

## 5.6 Comparison by organisational type

Finally we consider the total number of contacts by type of provider, with crude counts of activity presented in Table 5-8.

[8] Results are not sensitive to using the GDP deflator or PCI deflator.

[9] Hospital Services Cost and Pay Cost Indices, as modified by ONS, were kindly provided by the Department of Health. The data provided covered the period from 1994/95 to 2005/06 and we have assumed that the value for 2006/7 is the same as that for the previous year.

**Table 5-8 Total number of contacts by organisational type**

| Setting | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2003/04 | | 2004/05 | | 2005/06 | | 2006/07 | |
| | Nr | % | Nr | % | Nr | % | Nr | % |
| **NHS Trusts** | 7,202,470 | 22.98 | 8,070,654 | 10.67 | 9,088,842 | 10.68 | 8,635,426 | 10.29 |
| **PCTs** | 24,049,910 | 76.73 | 67,199,753 | 88.80 | 75,511,266 | 88.74 | 74,951,786 | 89.34 |
| **PMS Pilots** | 49,514 | 0.16 | 82,682 | 0.11 | 119,441 | 0.14 | 113,488 | 0.14 |
| **Non NHS Providers** | 40,542 | 0.13 | 320,703 | 0.42 | 373,289 | 0.44 | 194,439 | 0.23 |
| **Total** | 31,342,436 | 100 | 75,673,792 | 100.00 | 85,092,838 | 100.00 | 83,895,139 | 100.00 |

Table 5-9 shows the growth rates in CWOI calculated under out preferred method by provider type, for the Laspeyres index only. This demonstrates that much of the growth in the early period is due to increased recording of activity by PCTs and non-NHS providers.

**Table 5-9 Laspeyres CWOI by organisational type using method C**

| Setting | Year | | |
|---|---|---|---|
| | 2003/04 to 2004/05 | 2004/05 to 2005/06 | 2005/06 to 2006/07 |
| NHS Trusts | 44.72% | 15.32% | -3.13% |
| Primary Care Trusts | 363.33% | 9.68% | 0.07% |
| PMS + Pilots | 69.15% | 38.40% | -7.65% |
| non-NHS providers | 388.44% | 10.67% | -48.86% |

# 6. Primary care consultations and prescribing

## 6.1 Introduction

In this section we assess output growth in the primary care sector where two broad types of activity are considered: consultations in general practice settings and prescribing. Data on consultations are not collected routinely so have to be extrapolated from survey information. In stark contrast detailed data are collected about every prescription dispensed in England. But whether prescribing ought to be considered an output is a matter of controversy, so output growth is estimated with and without this component.

## 6.2 Primary care consultations

Estimates of the national volume of consultations are based on data collected as part of the QRESEARCH project. This data source replaces previous estimates of primary care activity derived from the General Household Survey, which is known to be deficit in measuring changes in consultation rates from year to year (Atkinson, 2004).

QRESEARCH is a large consolidated database derived from the anonymised health records of over 9 million patients.[10] The data currently come from 554 general practices in the UK using a common clinical computer system. These data are used to derive estimates of primary care activity for England as a whole (Fenty et al., 2006). Table 6-1 reports these estimates of activity by type of consultation.[11]

**Table 6-1 Activity (000 contacts) and costs in primary care**

| | | 2003/4 | | 2004/5 | | 2005/6 | | 2006/7 | |
|---|---|---|---|---|---|---|---|---|---|
| | | **activity** | **cost** | **activity** | **cost** | **activity** | **cost** | **activity** | **cost** |
| GP | Home Visit | 6,600 | £65 | 5,800 | £69 | 6,000 | £69 | 5,900 | £55 |
| GP | Telephone | 11,800 | £24 | 12,500 | £30 | 14,000 | £27 | 15,100 | £21 |
| GP | Surgery | 149,600 | £21 | 148,300 | £24 | 153,900 | £25 | 156,600 | £34 |
| GP | Other | 3,800 | £21 | 4,200 | £24 | 4,800 | £25 | 5,000 | £34 |
| Practice Nurse | | 80,800 | £9 | 84,600 | £10 | 93,700 | £10 | 99,000 | £9 |
| Other Clinicians | | 9,500 | £14 | 10,200 | £15 | 10,700 | £14 | 11,400 | £14 |
| **Total** | | **262,000** | | **265,600** | | **283,200** | | **293,000** | |

The cost of each of these activities is taken from the PSSRU's annual publications reporting Unit Costs of Health and Social Care.[12] Costs for consultations provided by GPs are taken from Table 9.8b in each publication, and include direct care staff costs. These unit costs vary (sometimes quite markedly) from one year to the next. These changes are driven primarily by assumptions about how long each type of contact lasts, estimates of which are derived each year from the UK General Practice Workload Survey.[13] Thus, if unit costs fall over time, this is mainly because the survey indicates that the length of each consultation is becoming shorter.

## 6.3 Allowing for quality change in primary care

In 2007, the Department of Health proposed a means of allowing for changes in the quality of care provided by NHS general practice (Derbyshire et al., 2007). The approach utilises data captured as part of the Quality and Outcomes Framework (QOF),[14] under which GPs are rewarded for achieving a range of diverse targets. Three QOF indicators were selected as providing information about improvements in disease management, namely:

[10] http://www.qresearch.org/Public/WhatIs.aspx accessed 10/07/08
[11] http://www.ic.nhs.uk/webfiles/publications/Consultations%20Report%2015%20financial%20year%20April2008.xls accessed 13/10/08
[12] http://www.pssru.ac.uk/pdf/uc/uc2007/uc2007.pdf accessed 10/07/08
[13] http://www.ic.nhs.uk/pubs/gpworkload accessed 10/07/08
[14] http://www.dh.gov.uk/en/Healthcare/Primarycare/Primarycarecontracting/QOF/DH_4125653 accessed 13/10/08

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

If disease management in primary care is improving over time, the supposition is that this will be reflected in reduced blood pressure for an increasing proportion of patients with CHD, stroke and hypertension. Hence, primary care consultations are deemed to be more valuable if a blood pressure reading below the target of 150/90 is recorded.

To incorporate these aspects of quality into an output index for primary care four pieces of information are required for each time period:

- The number of consultations for patients with CHD, stroke and hypertension with a blood pressure reading of 150/90 or less, defined as $x_{1t}$ ;
- The number of consultations for patients suffering from CHD, stroke and hypertension with blood pressure of more than 150/90, defined as $x_{2t}$ ;
- The number of consultations for conditions other than CHD, stroke and hypertension, defined as $x_{3t}$ .
- The value of a consultation where a blood pressure reading of 150/90 or less is taken ( $v_1$ ) relative to a consultation where the reading is above this threshold ( $v_2$ ) and to other consultations ( $v_3$ ).

Quality adjustment involves assessing the proportion of consultations that fall into each of the three broad categories and weighting these proportions by the relative value of each type of consultation. Thus the adjustment (*A*) takes the following form:

$$A = \frac{v_1 \frac{x_{1t+1}}{x_{t+1}} + v_2 \frac{x_{2t+1}}{x_{t+1}} + v_3 \frac{x_{3t+1}}{x_{t+1}}}{v_1 \frac{x_{1t}}{x_t} + v_2 \frac{x_{2t}}{x_t} + v_3 \frac{x_{3t}}{x_t}}$$

Where the total number of consultations *x* at time *t* is $x_t = x_{1t} + x_{2t} + x_{3t}$ . The Department of Health calculated wo versions of this index, allowing for different values to be attached to a consultations where blood pressure of the desired level is recorded. In the first version, the relative values of $v_1 : v_2 : v_3$ are 1.3:1:1. In the second version, the relative values are 1.5:1:1. These values are constant over time. If there is an increase in the proportion of consultations for patients with CHD, stroke and hypertension with a blood pressure reading of 150/90 or less, *A*>1.

The Laspeyres cost weighted activity index for primary care consultations for any pair of time periods *t* and *t*+1 is calculated as:

$$I^{Lc} = \frac{x_{t+1} c_t}{x_t c_t}$$

This assumes that the cost of a consultation is the same irrespective of the patient’s condition and of the blood pressure reading. The quality adjusted index, then, is calculated as:

$$I^{Lcq} = I^{Lc} \times A$$

This is equivalent to the following formulation:

$$I^{Lcq} = \frac{v_1 x_{1t+1} c_t + v_2 x_{2t+1} c_t + v_3 x_{3t+1} c_t}{v_1 x_{1t} c_t + v_2 x_{2t} c_t + v_3 x_{3t} c_t}$$

Information on the prevalence and QOF achievement prior to 2006/7 is aggregated from the quarterly provided in a single file by the Information Centre,[15] while prevalence data[16] and QOF achievement data for 2006/7[17] are taken from other files. Data on prevalence and QOF achievement for each year are provided in Table 6-2

**Table 6-2 Prevalence and QOF achievement, patients with CHD, stroke and hypertension**

| **Year** | **Prevalence** | | | **Proportion with low blood pressure** | | |
|---|---|---|---|---|---|---|
| | *CHD* | *Stroke* | *Hypertension* | *CHD* | *Stroke* | *Hypertension* |
| 2003/04 | 3.54% | 1.59% | 10.41% | 70.17% | 63.18% | 55.11% |
| 2004/05 | 3.57% | 1.63% | 11.06% | 78.60% | 73.13% | 64.33% |
| 2005/06 | 3.57% | 1.66% | 11.48% | 84.44% | 81.22% | 71.05% |
| 2006/07 | 3.54% | 1.61% | 12.49% | 88.86% | 86.92% | 77.62% |

Recall that a consultation where low blood pressure is recorded is considered to be either 1.3 or 1.5 times as valuable as any other consultation. In effect, then, a positive quality adjustment operates by inflating the number of consultations. So a proportionate increase in these more valuable consultations will be reflected in there being more 'quality adjusted' consultations than actual consultations. The number of quality consultations for the two values of $v_1$ are reported in Table 6-3.

**Table 6-3 Quality adjusted volume of consultations (000s)**

| | **Quality adjustment = 1.3** | | | | **Quality adjustment = 1.5** | | | |
|---|---|---|---|---|---|---|---|---|
| | 2003/4 **activity** | 2004/5 **activity** | 2005/6 **activity** | 2006/7 **activity** | 2003/4 **activity** | 2004/5 **activity** | 2005/6 **activity** | 2006/7 **activity** |
| GP Home Visit | 6,783 | 5,993 | 6,225 | 6,152 | 6,904 | 6,122 | 6,376 | 6,320 |
| GP Telephone | 12,126 | 12,917 | 14,526 | 15,745 | 12,344 | 13,195 | 14,877 | 16,175 |
| GP Surgery | 153,737 | 153,246 | 159,683 | 163,288 | 156,495 | 156,543 | 163,538 | 167,747 |
| GP Other | 3,905 | 4,340 | 4,980 | 5,214 | 3,975 | 4,433 | 5,101 | 5,356 |
| Practice Nurse | 83,034 | 87,421 | 97,221 | 103,228 | 84,524 | 89,302 | 99,568 | 106,047 |
| Other Clinicians | 9,763 | 10,540 | 11,102 | 11,887 | 9,938 | 10,767 | 11,370 | 12,211 |
| **Total** | **269,348** | **274,458** | **293,738** | **305,514** | **274,180** | **280,363** | **300,830** | **313,856** |

## 6.4 Primary care prescribing

Current DH practice is to consider prescriptions issued in primary care as activities and, therefore, to include them as health care outputs. Technically, however, prescriptions should be treated as an input into the production of health. This is how drugs delivered in the hospital sector are dealt with. For hospital based activity, drugs provided only enter the output index as an element in the cost weight (Reference Cost) attached to each treatment: they are not counted as activities in their own right.

The justification for including drugs prescribed in the primary care setting is that (i) GPs add value through prescribing - otherwise all licensed drugs would be available over the counter and (ii) the value GPs add to health care output is not reflected in the assumption that the wage rate approximates the marginal product of GPs.

[15] http://www.ic.nhs.uk/webfiles/QOF/2006-07/QResearch%202006-70%20QOF/Times%20Series%20Analysis%20for%20Selected%20Clinical%20Indicators%20from%20QOF%202001-2006%20-%20Tables%20%28v1-0%29.xls accessed 13/10/08
[16] http://www.ic.nhs.uk/webfiles/QOF/2006-07/National%20QOF%20tables%202006-07%20-%20prevalence.xls accessed 13/10/08
[17] http://www.ic.nhs.uk/webfiles/QOF/2006-07/National%20QOF%20tables%202006-07%20-%20clinical.xls accessed 13/10/08

There would be no need to appeal to this justification if the unit of health care output is measured as the number of patients treated weighted by their health gain (Dawson et al., 2005). Pharmaceuticals would then be counted consistently as an input. If prescribing more expensive drugs turned out to be cost effective in improving health outcomes, this would appear as a productivity increase provided that changes in health status are measured accurately and routinely. However, this preferred form of the output index cannot be calculated because measures of health outcomes are not available for the majority of treatments.

The volume of primary care prescribing is derived from Prescription Pricing Authority (PPA) data. The PPA data are collected in order to remunerate pharmacists (and dispensing GPs). It is therefore a reliable and comprehensive measure of the volume of prescriptions dispensed, which can be disaggregated to product type (item). Price per item is also recorded in the PPA data, which can be used to weight prescribing activity. The volume of prescriptions dispensed in the primary care sector has increased over time, as shown in Table 6-4.

**Table 6-4 Volume of primary care prescriptions, PPA data**

| | Categories | volume of prescriptions |
|---|---|---|
| 2003/4 | 186 | 649,233,969 |
| 2004/5 | 186 | 681,532,170 |
| 2005/6 | 196 | 722,411,747 |
| 2006/7 | 196 | 752,503,399 |
| 2007/8 | 199 | 793,115,668 |

Current practice in compiling the national accounts is to use prices to weight the volume of prescriptions. This is imperfect because drug prices are higher for branded than generic items. When drugs come off patent the NHS is able to secure better value for money by substituting from branded products to generic alternatives. But because price weights are used, this shift would imply a decrease in output when, in fact, it is a pure price effect. To wash out this price effect from the output index it would be necessary to link branded and generic drugs and to apply a common cost weight to them. The Office of National Statistics is currently exploring the feasibility of adopting such an approach (Office for National Statistics, 2008).

## 6.5 Growth in primary care activity

The growth rates in primary care consultations, calculated first as a straightforward cost-weighted output index and then allowing for quality adjustment, are reported in Table 6-5. The CWOI shows a negative growth between 2003/4-2004/5, driven by a reduction in the volume of home visits and consultations in the surgery. As these are both relatively costly, reductions in these activities was not offset by the increase in the other types of consultation. Once the substantial improvements in the number of patients recorded as having low pressure are taken into account, however, the growth rate in this period is positive. Thereafter high rates of growth in primary care are found, driven both by volume increases and by increasing achievement of the QOF targets. When we calculate quality-adjusted growth rates for the NHS as a whole, we apply the more conservative estimate of 1.3 as the value for a consultation where low blood pressure is recorded.

Table 6-6 reports growth rates in the primary care sector when prescribing is also taken into account. Unsurprisingly given the year-on-year increases in the volume of prescriptions, their inclusion adds positively to growth in all periods.

**Table 6-5 Growth in primary care consultations**

| | CWOI | CWOI QA=1.3 | CWOI QA=1.5 |
|---|---|---|---|
| **Laspeyres** | | | |
| 2003-04 - 2004/05 | -0.21% | 0.34% | 0.69% |
| 2004-05 - 2005/06 | 5.63% | 6.06% | 6.34% |
| 2005-06 - 2006/07 | 2.70% | 3.21% | 3.53% |
| **Paasche** | | | |
| 2003-04 - 2004/05 | -0.13% | 0.42% | 0.77% |
| 2004-05 - 2005/06 | 5.55% | 5.98% | 6.25% |
| 2005-06 - 2006/07 | 2.48% | 2.98% | 3.30% |
| **Fisher** | | | |
| 2003-04 - 2004/05 | -0.17% | 0.38% | 0.73% |
| 2004-05 - 2005/06 | 5.59% | 6.02% | 6.29% |
| 2005-06 - 2006/07 | 2.59% | 3.10% | 3.42% |

**Table 6-6 Growth in primary care consultations and prescribing**

| | CWOI | CWOI QA=1.3 | CWOI QA=1.5 |
|---|---|---|---|
| **Laspeyres** | | | |
| 2003-04 - 2004/05 | 4.33% | 4.51% | 4.63% |
| 2004-05 - 2005/06 | 6.99% | 7.16% | 7.27% |
| 2005-06 - 2006/07 | 4.47% | 4.67% | 4.81% |
| **Paasche** | | | |
| 2003-04 - 2004/05 | 3.71% | 3.92% | 4.05% |
| 2004-05 - 2005/06 | 6.65% | 6.83% | 6.95% |
| 2005-06 - 2006/07 | 4.03% | 4.26% | 4.40% |
| **Fisher** | | | |
| 2003-04 - 2004/05 | 4.02% | 4.21% | 4.34% |
| 2004-05 - 2005/06 | 6.82% | 7.00% | 7.11% |
| 2005-06 - 2006/07 | 4.25% | 4.46% | 4.61% |

# 7. Other health care activities

## 7.1 Introduction

This section considers all other categories of activity reported (primarily) in the Reference Costs which have not been considered elsewhere. It is not particularly helpful to aggregate these activities into a single 'residual' category because of the various ways in which a unit of activity is described. For this reason, we report how these activities are described under several broad headings.

## 7.2 Descriptive analysis of the nature and volume of activity

Activity in Accident & Emergency is counted by the number of attendances, which have been categorised ever more precisely over time, with the number of A&E categories increasing from 515 in 2003/4 to 2,170 in 2006/7. There has been a steady growth in A&E attendances, as documented in the first two columns of Table 7-1. The amount of incidents attended by the paramedic services has also been increasing, as reported in the final two columns.

**Table 7-1 A&E activity**

| **Year** | **A&E activity** | | **Paramedic services** | |
|---|---|---|---|---|
| | *Categories* | *Attendances* | *Categories* | *Incidents* |
| **2003/04** | 515 | 14,875,689 | 138 | 5,464,831 |
| **2004/05** | 548 | 16,964,603 | 184 | 5,717,025 |
| **2005/06** | 569 | 18,748,725 | 174 | 5,703,663 |
| **2006/07** | 2,170 | 19,597,216 | 186 | 6,822,587 |

The Reference Costs record the number of clinical measurement, pathology and radiology tests performed. Radiology tests were defined much more precisely in 2006/7, with interventional radiology also being included. An increasing volume of all types of test performed is shown in Table 7-2.

**Table 7-2 Tests performed**

| **Year** | **Clinical measurement tests** | | **Pathology tests** | | **Radiology** | |
|---|---|---|---|---|---|---|
| | *Categories* | *Number of tests* | *Categories* | *Number of tests* | *Categories* | *Number of tests* |
| **2003/04** | 8 | 290,244 | 11 | 153,292,529 | 23 | 5,313,814 |
| **2004/05** | 10 | 369,988 | 9 | 180,676,234 | 23 | 5,152,720 |
| **2005/06** | 14 | 465,622 | 9 | 221,966,384 | 25 | 5,784,605 |
| **2006/07** | 14 | 735,569 | 9 | 236,269,050 | 193 | 23,918,500 |

Details about chemotherapy attendances for solid and non solid tumours, radiotherapy sessions and bone marrow transplantations are reported in Table . Again volume appears to have increased over time. A blank entry indicates no activity as being recorded for the year in question, although the activity probably appears within a different Reference Cost category.

**Table 7-3 Chemotherapy, radiotherapy and bone marrow transplantation**

| Year | Chemotherapy | | Radiotherapy | | Bone marrow transplantation | |
|---|---|---|---|---|---|---|
| | *Categories* | *Attendances* | *Categories* | *Patient treatments* | *Categories* | *Episodes* |
| **2003/04** | - | - | 36 | 131,010 | 14 | 2,008 |
| **2004/05** | 15 | 777,312 | 22 | 1,622,278 | 12 | 1,855 |
| **2005/06** | 15 | 763,806 | 22 | 1,634,156 | 13 | 1,929 |
| **2006/07** | 45 | 1,642,444 | 57 | 1,743,490 | - | - |

The number of sessions of renal dialysis and the number of kidney transplantation (measured as episodes) recorded in the Reference Costs data have fallen over time, as shown in Table 7-4 Details of activity provided to those suffering from spinal injuries was not included in the 2006/7 Reference Cost collection – at least not in the same format as previously.

**Table 7-4 Renal dialysis, kidney transplantation and spinal injuries**

| Year | Renal dialysis & kidney transplantation | | Specialist spinal injuries | |
|---|---|---|---|---|
| | *Categories* | *Sessions/episodes* | *Categories* | *Sessions/episodes* |
| **2003/04** | 9 | 7,678,300 | 2 | 110,859 |
| **2004/05** | 9 | 8,234,650 | 2 | 112,149 |
| **2005/06** | 15 | 6,821,656 | 2 | 109,292 |
| **2006/07** | 8 | 4,200,298 | - | - |

Audiological services include the number of hearing aids, number of attendances, number of hearing aid repairs, and number of neonates screened. Critical care services were counted by the number of occupied bed days and number of retrieval services until 2006/7 when a new classification was introduced. Cystic fibrosis services are quantified on the basis of episodes and occupied bed days (for most severe patients – band 5). Details for all these services are provided in Table 7-5.

**Table 7-5 Audiological, critical care and cystic fibrosis services**

| Year | Audiological services | | Critical care services | | Cystic fibrosis services | |
|---|---|---|---|---|---|---|
| | *Categories* | *Activity* | *Categories* | *Bed days* | *Categories* | *Episodes/bed days* |
| **2003/04** | 8 | 2,109,260 | 15 | 2,093,947 | 8 | 19,801 |
| **2004/05** | 8 | 1,902,390 | 34 | 2,184,333 | 8 | 16,317 |
| **2005/06** | 8 | 1,692,721 | 29 | 2,197,135 | 8 | 13,704 |
| **2006/07** | 9 | 2,905,175 | 58 | 2,468,777 | 8 | 13,944 |

Details about the number of regular day or night admissions and of the number of ward attenders, measured by the number of attendances, is shown in Table 7-6. This latter type of activity was re-classified to other headings after 2004/5, but the category was re-introduced for the 2006/7 collection. Day care captures regular attendances mainly for stroke and elderly patients. Activity under this heading has been falling over time.

**Table 7-6 Regular admission, ward attenders and day care**

| Year | Regular admissions | Ward attenders | Day care |
|---|---|---|---|

| | Categories | Admissions | Categories | Attendances | Categories | Attendances |
|---|---|---|---|---|---|---|
| **2003/04** | 272 | 97,744 | 66 | 929,826 | 3 | 798,197 |
| **2004/05** | 297 | 122,447 | 76 | 846,342 | 3 | 735,070 |
| **2005/06** | 313 | 177,131 | - | - | 3 | 649,963 |
| **2006/07** | 540 | 179,927 | 104 | 694,667 | 3 | 439,932 |

The hospital at home scheme is measured by the number of contacts. Rehabilitation activity is measured in terms of bed days and contacts for community rehabilitation. Neither service shows any clear pattern in the volume of activity over time (Table 7-7).

**Table 7-7 Hospital at Home and rehabilitation**

| **Year** | **Hospital at Home** | | **Rehabilitation** | |
|---|---|---|---|---|
| | *Categories* | *Contacts* | *Categories* | *Bed days/contacts* |
| **2003/04** | 1 | 46,072 | 8 | 3,365,991 |
| **2004/05** | 1 | 434,698 | 8 | 4,095,087 |
| **2005/06** | 1 | 593,586 | 9 | 4,509,489 |
| **2006/07** | 1 | 470,737 | 23 | 3,028,598 |

A number of services appear in the Reference Costs for one year only, the main reason being that they were included in the 2006/7 collection for the first time. These services are detailed in Table 7-8.

**Table 7-8 Other services**

| *Year* | *Service* | *Categories* | *Activity* | *Form of measurement* |
|---|---|---|---|---|
| **2004/05** | **Dietetics** | 1 | 151,191 | Attendances |
| **2006/07** | **Specialist palliative care** | 13 | 93,880 | Attendances |
| **2006/07** | **Patient transport services** | 3 | 6,421,047 | Services provided |
| **2006/07** | **Hospital travel cost scheme** | 3 | 275,478 | Services provided |
| **2006/07** | **High cost drugs** | 128 | 26,277,491 | Procurements |

Finally, we also include information about activity in Walk-in-Centres and NHS Direct, the former being included elsewhere in the Reference Cost collection in 2006/7. Information on the volume of sight tests and on courses of dental treatment was derived from the Information Centre (The Information Centre, 2007a, The Information Centre, 2007b). Activity in each of these areas has increased over time (Table 7-9).

**Table 7-9 Walk-in-Centres, NHS Direct and ophthalmic and dental services**

| Year | *Walk in Centres* | *NHS Direct* | *Ophthalmic* | *Dentist* |
|---|---|---|---|---|
| **2003/04** | 1,613,183 | 12,946,688 | 9,846,000 | 32,347,793 |
| **2004/05** | 1,838,569 | 15,915,078 | 10,150,000 | 32,829,731 |
| **2005/06** | 2,507,479 | - | 10,355,000 | 33,248,551 |
| **2006/07** | - | - | 10,485,000 | 35,051,081 |

## 7.3 Growth in all other activities

Table 7-10 reports the growth rate in all these activities, weighted according to their costs. As can be seen, the growth rate is somewhat erratic over time, and is probably more a reflection of the way that data collection has changed across periods than it is of pure activity growth. The growth between 2003/4 and 2004/5 is driven mainly by the expanded provision of data by PCTs in 2004/5, while the growth between 2005/6 and 2006/7 is mainly due to the expansion in the number of categories, which meant that previously uncounted activity was included for the first time in 2006/7.

**Table 7-10 Growth in all other activities**

| | **Other NHS activity - CWOI** |
|---|---|
| **Laspeyres** | |
| 2003-04 - 2004/05 | 17.13% |
| 2004-05 - 2005/06 | 3.14% |
| 2005-06 - 2006/07 | 22.07% |
| **Paasche** | |
| 2003-04 - 2004/05 | 10.49% |
| 2004-05 - 2005/06 | 2.80% |
| 2005-06 - 2006/07 | 22.15% |
| **Fisher** | |
| 2003-04 - 2004/05 | 13.76% |
| 2004-05 - 2005/06 | 2.97% |
| 2005-06 - 2006/07 | 22.11% |

## 8. Overall output growth

In Table 8-1 we report output growth for the whole NHS, including growth in prescribing activity, for the three types of output index. The Laspeyres index, which is commonly used in the UK accounts, suggests higher rates of growth than the Paasche index.

Output growth is particularly high between 2003/4 and 2004/5. This is driven primarily by the substantial increase in reporting of Reference Cost data by Primary Care Trusts, most of which relates to community care activities and our category capturing "all other" NHS activity. While it is, of course, desirable to capture ever more data on what the NHS is doing, it is very difficult to distinguish between improvements in data collection and pure activity growth. This difficulty is more challenging still in the context of wholesale revisions to the way that activity categories are defined. The figures for output growth in the later period are more likely to reflect actual output growth.

**Table 8-1 Output growth for the NHS, including prescribing**

| | NHS unadjusted | NHS survival adjustment only | NHS quality adjusted |
|---|---|---|---|
| **Laspeyres** | | | |
| 2003/04 - 2004/05 | 27.88% | 27.96% | 28.82% |
| 2004/05 - 2005/06 | 6.48% | 6.61% | 7.11% |
| 2005/06 - 2006/07 | 5.84% | 5.91% | 6.08% |
| **Average** | **13.40%** | **13.49%** | **14.00%** |
| **Paasche** | | | |
| 2003/04 - 2004/05 | 10.17% | 10.25% | 11.22% |
| 2004/05 - 2005/06 | 6.11% | 6.24% | 6.74% |
| 2005/06 - 2006/07 | 5.65% | 5.72% | 5.90% |
| **Average** | **7.31%** | **7.40%** | **7.95%** |
| **Fisher** | | | |
| 2003/04 - 2004/05 | 18.69% | 18.78% | 19.69% |
| 2004/05 - 2005/06 | 6.29% | 6.42% | 6.92% |
| 2005/06 - 2006/07 | 5.74% | 5.82% | 5.99% |
| **Average** | **10.24%** | **10.34%** | **10.87%** |

The quality of NHS output has also improved over time. The indices for hospital and mental health care activity capture improvements in 30-day post-discharge survival, and these improvements add about 0.1% to annual output growth. Our quality adjustment supplements improvements in survival with changes in health status and the changes in life expectancy as well as improvements in waiting times and disease management in primary care. Improvements in these aspects of quality add some 0.5% to annual output growth for the NHS as a whole.

Current Department of Health practice is to consider prescriptions issued in primary care as activities and, therefore, to include them as health care outputs. Technically, however, prescriptions should be treated as an input into the production of health. This is how drugs delivered in the hospital sector are dealt with. Whether prescriptions dispensed outside the hospital sector ought to be considered an output is a matter of controversy, so we present estimates of output growth without this component in Table 8-2. This shows that NHS output growth is higher if prescribing is excluded because, although the volume of prescriptions increased, this was at a slower rate than for the NHS as a whole.

**Table 8-2 Output growth for the NHS, excluding prescribing**

| | NHS unadjusted | NHS survival adjustment only | NHS quality adjusted |
|---|---|---|---|
| **Laspeyres** | | | |
| 2003/04 - 2004/05 | 31.79% | 31.89% | 32.89% |
| 2004/05 - 2005/06 | 6.37% | 6.37% | 6.96% |
| 2005/06 - 2006/07 | 5.91% | 5.91% | 6.11% |
| **Average** | **14.69%** | **14.72%** | **15.32%** |
| **Paasche** | | | |
| 2003/04 - 2004/05 | 10.79% | 10.89% | 12.03% |
| 2004/05 - 2005/06 | 5.88% | 6.03% | 6.61% |
| 2005/06 - 2006/07 | 5.66% | 5.91% | 6.11% |
| **Average** | **7.44%** | **7.61%** | **8.25%** |
| **Fisher** | | | |
| 2003/04 - 2004/05 | 20.84% | 20.94% | 22.02% |
| 2004/05 - 2005/06 | 6.05% | 6.20% | 6.78% |
| 2005/06 - 2006/07 | 5.74% | 5.91% | 6.11% |
| **Average** | **10.87%** | **11.01%** | **11.64%** |

## 9. Conclusion

There are three major challenges in measuring growth in the output of the health care system:

- It is necessary to quantify the **volume** of health care accurately. This requires classifying patients into reasonably homogenous 'output' groupings.
- In order to aggregate these output groups into a single index, some means of assessing their **relative value** is required.
- **Quality** is likely to be an important source of output growth, and it is necessary both to define quality and measure changes in the quality of health care output over time.

Two aspects of our output estimates distinguish them from standard practice in other sectors and internationally. First, our output index is virtually comprehensive, capturing as far as possible all the activities undertaken for NHS patients by both NHS and non-NHS providers. We analyse information about every patient treated in hospitals and outpatient departments and about every prescription dispensed in primary care. Significant improvements to data collection have allowed us to measure primary and community care more accurately and comprehensively over time. This contrasts with most indices that are based on a 'basket' of activities that are deemed to be representative of the whole.

Second, we assess the quality of output by measuring the waiting times and survival status of every single patient treated in hospital each year. This ensures precise measurement of these important aspects of quality. This is preferable to reliance on information from surveys, which may be unrepresentative, administered infrequently, measured inconsistently over time, and impossible to link to any specific activity (Atkinson, 2005). We also allow for improved disease management in primary care (Derbyshire et al., 2007).

We address a major practical challenge that arises in the NHS because of periodic wholesale revisions to the classification systems used to describe output categories. Traditional methods to calculate output growth require output categories to be consistent across adjacent time periods (Eurostat/Commission of the European Communities et al., 1993). But recently this requirement has not been met in the NHS. Between 2005/6 and 2006/7 the Reference Cost categories used to describe outputs in settings other than hospitals and primary care were completed re-defined. In 2007/8 there is to be a complete revision of the way that hospital output is defined, with the move from version 3.5 to version 4 HRGs. If we relied on traditional methods, output growth between 2005/6 and 2006/7 would be based solely on hospital and primary care activity. In contrast, output growth between 2006/7 and 2007/8 would be based solely on non-hospital activity. Clearly, comparisons of output growth over the full period would be rendered virtually meaningless, with only primary care activity being included throughout.

We propose a method that avoids the requirement for consistent definition of output categories over time. Instead we impute costs for the relevant outputs for the period in which the information is unavailable. Use of our approach is critical: it would be not otherwise be possible to calculate output growth for the NHS over the years we consider in any meaningful way.

We use the Hospital Episode Statistics to quantify the amount of activity undertaken in **hospitals** and to assess the quality of this activity. A unit of activity is defined as a continuous inpatient spell which allows patients to be tracked when transferred between hospitals as part of their care pathway. We implement improvements to how continuous inpatient spells are calculated by identifying the order of same-day transfers, over-riding incorrect coding of discharge fields and linking records across successive years.

Hospital activity, survival rates and waiting times have all improved over time, all of which contribute positively to growth. Over the same period the NHS has been extending treatment to older patients. If the age profile of NHS patients increases more rapidly than the improvements in population life expectancy this will lead to a dampening of output growth. Output growth depends, then, on the net effect of these various conflicting influences.

The cost weighted output index for the hospital sector is positive throughout the period, averaging 3.62% per year. This is slightly lower than the percentage change in pure volume over the period, the reason being that, unsurprisingly, volume growth has been more rapid for less complex (ie less costly) activities than it has for more costly activities.

Improvements in 30-day survival post-discharge reflect positively on growth, adding around 0.25% to output growth annually in the hospital sector. The positive health effects enjoyed by those who survive hospital treatment capture both changes in health status and the changes in life expectancy. These improved health benefits add between 1.4% and 2.6% annually. Improvements in waiting times add between 0.1% and 0.3% to annual output growth. Overall, then, output growth for the hospital sector, allowing for quality, averages 6.01% per annum.

We compare two sources of data about **outpatient activity**, namely the Outpatient Minimum Dataset (OMD) and the Reference Cost returns. We recommend using the latter for the purposes of calculating output growth, the grounds being that there is a high level of agreement between the two data sources, costs are matched to output groups in the Reference Cost data and the Reference Cost data are available earlier than the OMD.

There is a substantial increase in growth in outpatient activity between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. There was a shift toward less costly procedures thereafter which became pronounced between 2005/6 and 2006/7, to the extent that cost weighted output fell by 6.86%, despite overall activity having increased slightly. Nevertheless output growth across the whole period averages 4.39% per year. Allowing for the improvement in outpatient waiting times has a positive effect on the growth rate, adding 0.09% in the early period to 0.04% more recently.

For **mental health care**, we use HES data to assess activity in the hospital sector and Reference Cost data for all other activities. There has been a reduction in hospital activity over time, with an increase in activity in other settings, these changes perhaps indicative of some substitution as a result of efforts to prevent hospital admission.

There is an increase in output growth of 11.44% between 2003/4 and 2004/5, which appears to be driven largely by a shift toward more costly types of activity. Later activity increases have been concentrated among less costly activities, which has depressed the rate of growth, although the average across the whole period is still 8.59%. Quality adjustment of inpatient activity has an inconsistent impact on the index. Initially, quality adjustment contributes positively to growth, but between 2004/5-2005/6 the adjustment is negative, though small (-0.8%). This is driven mainly by the large increase in the waiting time between these two years, but also by the slight fall in life expectancy. Quality adjustment was neutral between 2005/6 and 2006/7.

There have been substantial changes over time in the way that **community health care services** are categorised and an expansion of data collection, particularly in 2004/5 which is reflected in the appearance of a substantial growth rate between 2003/4 and 2004/5. The growth rate is slightly negative between 2005/6 and 2006/7.

We use community care to explore the implications of applying the conventional method and our approach to dealing with categorisation changes. We also provide details of activity growth in community care by organisational type (hospitals, Primary Care Trust, PMS pilots and independent providers).

The growth rate in the **primary care sector** is calculated for consultations conducted in general practice and also when prescribing is included. Growth in consultations averaged 2.71% over the full period. Allowing for the improvements in the management of blood pressure for patients suffering from chronic heart disease, stroke and hypertension adds 0.5% to the average annual growth rate. Growth has been stronger for prescriptions than for consultations, mainly because volume has increased at a faster rate. When prescribing is taken into account, the average annual growth rate in the primary care sector, again allowing for quality improvements, amounts to 5.45%.

The growth rate for all **other NHS activities** is somewhat erratic over time, and is probably more a reflection of the way that data collection has changed across periods than it is of pure activity growth. The growth between 2003/4 and 2004/5 is driven mainly by the expanded provision of data by PCTs in 2004/5, while the growth between 2005/6 and 2006/7 is mainly due to the expansion in the number of categories, which meant that previously uncounted activity was included for the first time in 2006/7.

Table 9-1 reports the Laspeyres cost weighted output index by setting, allowing for improvements in quality. Growth rates are presented for each pair of years and the annual average across the whole period.

Much of the total NHS growth in the early period is driven by better recording of activity, particularly in the community care sector and in the residual category (all other NHS activity), so it is probably better to consider the later years in the series as more representative of actual output growth for the NHS as a whole. Other sectors are much less affected by changes in data collection procedures, so the estimates over time for these sectors are more likely to represent actual changes in output. The final row in Table 1 shows growth rates for those sectors where there has been greater temporal consistency in data collection. For activity in hospitals, outpatient departments, in mental health and in primary care the average growth rate was 5.10%. Growth between 2005/6-2006/7 was 1.08%, pulled down by the reduction in outpatient activity.

**Table 9-1 Quality-adjusted cost weighted output index, Laspeyres index**

| Sector | 2003/4 - 2004/05 | 2004/5 - 2005/6 | 2005/6 - 2006/7 | Average |
|---|---|---|---|---|
| **Hospital activity** | 5.66% | 7.48% | 4.88% | 6.01% |
| **Outpatient activity** | 10.23% | 9.96% | -6.81% | 4.46% |
| **Mental Health care services** | 11.83% | 9.42% | 4.82% | 8.69% |
| **Community care services** | 315.53% | 10.25% | -0.65% | 108.38% |
| **Primary care consultations** | 0.34% | 6.06% | 3.21% | 3.21% |
| **Primary care consultations & prescribing** | 4.51% | 7.16% | 4.67% | 5.45% |
| **All other NHS activity** | 17.13% | 3.14% | 22.07% | 14.11% |
| **Total NHS** | 28.82% | 7.11% | 6.08% | 14.00% |
| **Total NHS excluding prescribing** | 32.89% | 6.96% | 6.11% | 15.32% |
| **Hospital, outpatient, mental health and primary care consultations** | 6.76% | 7.48% | 1.08% | 5.10% |

Quality improvements apply to hospital activity, outpatient activity, mental health care services and primary care consultations only. We apply the more conservative estimate of 1.3 as the value for a consultation where low blood pressure is recorded. Quality adds an average of 0.6% annually to total NHS output growth. Output growth is higher if prescribing is excluded because, although the volume of prescriptions increased, this was at a slower rate than for the NHS as a whole.

## 10. References

Atkinson, T. (2004) *Atkinson Review: Interim Report,* London, The Stationary Office.

Atkinson, T. (2005) *Atkinson Review: Final Report. Measurement Of Government Output And Productivity For The National Accounts,* Basingstoke, Palgrave Macmillan.

Castelli, A., Dawson, D., Gravelle, H., Jacobs, R., Kind, P., Loveridge, P., Martin, S., O'mahony, M.,

Stevens, P., Stokes, L., Street, A. & Weale, M. (2007a) A New Approach To Measuring Health System Output And Productivity. *National Institute Economic Review,* 200**,** 105-117.

Castelli, A., Dawson, D., Gravelle, H. & Street, A. (2007b) Improving The Measurement Of Health System Output Growth. *Health Economics,* 16**,** 1091-1107.

Dawson, D., Gravelle, H., O'mahony, M., Street, A., Weale, M., Castelli, A., Jacobs, R., Kind, P., Loveridge, P., Martin, S., Stevens, P. & Stokes, L. (2005) *Developing New Approaches To Measuring Nhs Outputs And Productivity, Final Report,* York, Centre For Health Economic Research Paper 6.

Derbyshire, K., Zerdevas, P., Unsworth, R. & Haslam, M. (2007) *Further Developments In Measuring Quality Adjusted Healthcare Output,* Leeds, Department Of Health.

Eurostat (2001) *Handbook On Price And Volume Measures In National Accounts*, Luxembourg: Office For Official Publications Of The European Communities.

Eurostat/Commission Of The European Communities, International Monetary Fund, Organisation For Economic Co-Operation And Development, United Nations & Bank, W. (1993) *System Of National Accounts 1993*, European Communities/Eurostat, Imf, Oecd, United Nations And World Bank.

Fenty, J., Coupland, C., Hippisley-Cox, J. & Gravelle, H. (2006) *Determinants Of Consultation Rates Over Time: Implications For Estimating The National Volume Of Consultations. ,* Nottingham, Qresearch University Of Nottingham.

Healthcare Commission (2007) *Independent Sector Treatment Centres: A Review Of The Quality Of Care,* London, Commission For Healthcare Audit And Inspection.

Lakhani, A., Coles, J., Eayres, D., Spence, C. & Rachet, B. (2005) Creative Use Of Existing Clinical And Health Outcomes Data To Assess Nhs Performance In England: Part 1-Performance Indicators Closely Linked To Clinical Care. *British Medical Journal,* 330**,** 1426-1431.

Mason, A., Miraldo, M., Siciliani, L., Sivery, P. & Street, A. (2009) *Establishing A Fair Playing Field For Payment By Results,* York, Centre For Health Economic Research Paper 39.

Office For National Statistics (2008) *Sources And Methods For Public Service Productivity: Health,* London, Office For National Statistics.

Prescott-Clarke, P. & Primatesta, P. (Eds.) (1998) *Health Survey For England 1996,* London, The Stationary Office.

Smith, P. C. & Street, A. (2007) Measurement Of Non-Market Output In Education And Health. *Economic And Labour Market Review,* 1**,** 46-52.

The Information Centre (2005) *Hospital Episode Statistics: How Hes Is Processed: 2004-5 Data Year,* Leeds, The Information Centre.

The Information Centre (2006) *Hospital Episode Statistics: Outpatient Data Dictionary,* Leeds, The Information Centre.

The Information Centre (2007a) *General Ophthalmic Services: Activity Statistics For England And Wales,* Leeds, The Information Centre.

The Information Centre (2007b) *Nhs Dental Activity And Workforce Report England: 31 March 2006,* Leeds, The Information Centre.

Willmer, R. & Little, C. (2007) *Review Of Data Sources And Methodology For The Calculation Of Hospital Output In The Nhs,* London, Department Of Health.