Medical Education, Training and Research: The Cost to Teaching Hospitals

Fergal Lynch
November 1993
Medical Education, Training and Research: The Cost to Teaching Hospitals

Fergal Lynch
November 1993
# Table of Contents

## Summary and Conclusions

### Introduction
- Background to Study
- The Type of Costs Involved
- Methodology
- Data Sources
- Assumptions
- Format of Report

### Defining a Teaching Hospital
- Introduction
- NCHD Staffing Levels
- Formal Arrangements with Medical Schools
- Conclusions on Defining a Teaching Hospital

### Analysing In-Patient Costs
- Introduction
- Treatment and Care Costs
- Adjustment for Case Complexity
- Adjusted Costs
- Teaching Intensity and Costs per Case
- Teaching Intensity and Average Length of Stay
- Estimating Medical Education Costs
- Conclusion

### Main Cost Centres
- Introduction
- Costs per Case

### Conclusions
- Introduction
- Summary and Conclusions
- Validating the Results
- International Approaches to Estimates Teaching Costs
- Future Directions of the Model
Appendices

A  Analysis of Hospital Costs: A Schematic Summary
B  In-Patient Costs per Case, 1991
C  Casemix Index by Hospital
D  Adjusted In-patient Costs per Case, 1991
E  DRGs, Average Length of Stay and Teaching Intensity
F  Adjusting Main Cost Centres for Casemix
G  International Approaches to Estimating Teaching Costs
Summary and Conclusions

Background

The study was requested by the Department of Health to estimate the approximate costs incurred by teaching hospitals from their medical education, training and research functions. While it was clear that the bulk of undergraduate costs fell on the universities, there was a growing recognition that teaching hospitals incurred additional expenses as both undergraduates and non consultant hospital doctors (NCHDs) received hospital-based training.

The costs incurred by teaching hospitals might include the time taken for formal and informal teaching and ward rounds; additional tests and consultations that arise in the teaching environment; more intensive or sophisticated treatments offered to patients; any consequent increase in length of stay; and certain research costs.

Approach to Study

The study analysed hospital costs using data from the Department of Health’s Specialty Costings System and its Casemix Project to identify possible sources of additional training/education-related costs incurred by teaching hospitals. It covered in-patient costs only, accounting for over 70 per cent of total costs in the hospitals examined. There were three main stages to the analysis:

- Defining what constituted a teaching hospital for the purposes of the study;
- Examining overall in-patient costs in teaching and non teaching hospitals; and
- Analysing selected main cost centres as likely sources of teaching-related costs.

Defining a Teaching Hospital

There is no universal definition of what constitutes a teaching hospital for the purposes of medical training and education. This study judged the teaching status of hospitals by reference to NCHD staffing levels and the extent of formal arrangements between hospitals and medical schools. On this basis, six hospitals in Dublin and one each in Cork and Galway were treated as teaching ones; all others examined were classified as non teaching.
Overall In-Patient Costs

The study examined 1991 data for fifteen selected hospitals, comparing the average cost of treating an in-patient in a teaching hospital with that of a non teaching hospital. A distinction was made between the direct costs of treating a patient (such as medical pay, diagnostic facilities, drugs and supplies) and the associated costs of care (including catering and maintenance). Both treatment and care costs per case were significantly higher in teaching hospitals than in non teaching ones. However, it is important to take account of the substantial differences that can arise in the complexity of cases before any valid conclusions can be drawn.

When an appropriate Casemix Index (CMI) was used for this purpose, the difference between average treatment costs per case in teaching and non teaching hospitals narrowed considerably and the difference in care costs was almost completely removed. Thus the great bulk of any additional costs to teaching hospitals, including those from their medical education/training functions, was concentrated in the costs of treating as opposed to caring for patients.

The study then examined in more detail the Main Cost Centres (MCCs) that comprise treatment costs. After adjustment for casemix using the CMI, the main differences between average costs of teaching and non teaching hospitals arose in the MCCs covering diagnostic areas (medical support and laboratories), drugs and supplies. There was little difference in medical pay costs per case, indicating that the costs of medical education/training were associated with what doctors do (in terms of tests and procedures) rather than what they are paid.

Conclusions

The main conclusions of the study are that:

- The extra costs to teaching hospitals from their medical education/training functions are in the order of 10 to 15 per cent of in-patient costs, ie between £17m and £25m in 1991.

- These additional costs arise in the treatment rather than care element of hospitals' work, and are concentrated in diagnostic facilities, drugs and supplies rather than medical pay.

Other findings of the study are that:

- There is a relatively strong relationship between the relative 'intensity' of medical education/training in each hospital and its treatment costs per case, but no such link exists between teaching intensity and care costs.

- Contrary to what might be expected, there appears to be no evidence of a link between teaching intensity and longer average length of stay.
Introduction

Background to Study

In September, 1992 the Department of Health prepared a paper on *Managing the Health Services for Performance and Value*. It reviewed existing initiatives in this area and identified a range of further steps that could be taken, particularly in relation to performance measurement and efficiency and effectiveness in the use of resources in clinical practice. The paper proposed two policy reviews in areas regarded as critical to the achievement of better value for money. One of these related to medical education and training.

The document argued that:

There is a significant on-cost in teaching hospitals, which is not quantified or identified separately at present. These extra costs occur at undergraduate and postgraduate levels. They would include the additional time taken on ward rounds, the time taken for formal and informal teaching, the infrastructural costs, the additional consultations, tests and procedures which would not occur in a non-teaching environment, the more intensive and sophisticated treatments which are offered to patients .... the consequent increases in length of stay, and the secondary costs of research.

The Type of Costs Involved

While the bulk of undergraduate costs are met by the Education vote, it was clear that teaching hospitals incur substantial additional resources to the medical training/education process, particularly at postgraduate level. The type of costs involved include the following examples:

**Undergraduate level**

- a range of clinical courses and practical instruction in hospitals affiliated to the medical schools. In the academic year 1991/2 over 1,300 undergraduate medical students in the third, fourth and fifth years (out of a total of 2,900 in all years) were involved in these courses;

- attendance at a general hospital as a Junior Clerk for nine months and as a Senior Clerk for four months prior to final medical examination.

**Intern level**

- proportion of consultants' and registrars' time devoted to practical oral training of interns;
any additional tests and examinations carried out for teaching purposes.

Upper Postgraduate level

study and examination leave for courses in general professional training (which generally takes about three years after completion of the intern year) and higher specialist training in selected specialties (usually a further three to five years);

cost of Coordinators of Training in teaching hospitals;

educational materials in hospitals, including books and equipment; and

other less quantifiable elements outlined above, including extra costs from ward rounds, tests and procedures and research expenses.

Methodology

It was clear from the outset that many of the costs outlined above would be difficult to quantify. A number arise in the course of normal clinical activity and could not easily be separated from work that would have been done irrespective of the hospital's teaching responsibilities. The aim, therefore, was to estimate teaching-related costs indirectly from existing data sources produced by the Department of Health and selected hospitals.

The first step was to identify the hospitals that could be classified as having significant teaching functions for the purposes of the study, since virtually all hospitals would have at least some teaching-related costs. The average costs of treating in-patients in teaching as opposed to non teaching hospitals were examined, followed by a more detailed analysis of the main costs centres most likely to have teaching/training related expenses.

Data Sources

Three main sources of data, all related to 1991, are used in the analysis:

(a) the Department of Health's personnel census and selected hospital activity data;

(b) specialty costings data from the Department of Health covering the main cost centres (such as theatres, laboratories and medical pay) of participating hospitals, and

(c) information from the casemix project being carried out by the Department of Health. (The project is aimed at devising a system of determining the annual allocations to hospitals on the basis of the type and complexity of cases treated, using Diagnosis Related Groups). The casemix project uses data from the hospital in-patient enquiry (HIPE), the principal source of information on diagnoses and procedures in Irish hospitals.
Assumptions

Two key assumptions regarding the data used in this study underlie the analysis. These are that:

- the HIPE data supplied by hospitals in respect of 1991 is accurate and fully representative of their total workload; and
- costs under the specialty costings system have been classified correctly and consistently under each heading by all hospitals.

Some concern was expressed about these points during discussions in the course of this study. However, a key aim of the analysis in this report is to help develop a model for identifying the additional costs associated with medical teaching/training; the quality of estimates produced by this model will improve as the methods of recording activity and classifying costs becomes more refined. This should become more apparent when data for 1992 become available.

Format of Report

Chapter one deals with the definition of a teaching hospital for the purposes of the study. Chapter two analyses overall in-patient costs in teaching and non teaching hospitals with a view to identifying the main sources of teaching-related costs. Chapter three then examines selected main costs centres (MCCs) in both types of hospital to identify the origin of teaching costs in more detail. Chapter four draws together the report’s conclusions and suggests a number of approaches to validating the results further.
1 Defining a Teaching Hospital

1.1 Introduction

There is no single definition of what constitutes a teaching hospital for the purposes of medical training and education. Most non consultant hospital doctors (NCHDs) are deemed to be in training posts - other than some cases where posts are independently funded (eg by research bodies or pharmaceutical companies) - but it is clear that some hospitals have substantially greater teaching responsibilities than others.

Since this study is concerned with identifying the additional costs incurred by some hospitals because of their education/training functions, it was necessary to define a set of indicators which would clearly distinguish these teaching hospitals from all others. Two main indicators were used to estimate the presence of a significant teaching element:

- the extent of NCHD staffing at intern, house officer and registrar level; and
- the extent of formal arrangements with medical schools through joint academic/clinical posts.

Twenty-one hospitals participating in the Department of Health’s specialty costings study were examined under these headings. They included all of the larger acute hospitals and other selected hospitals throughout the country.

1.2 NCHD Staffing Levels

The most basic indicator of a significant teaching function in hospitals is likely to be the extent of NCHD staffing, ie numbers of interns, house officers and registrars. One would expect a higher incidence of NCHDs in hospitals with substantial teaching responsibilities. With this in mind, each hospital was categorised in table 1 below by reference to its number of NCHDs per 1,000 discharges. (The twenty-one hospitals examined accounted for two-thirds of all NCHDs in 1991, including 88 per cent of interns and around 60 per cent of house officers and registrars).

The average number of NCHDs per 1,000 discharges in the observed hospitals was 4.65. Eight hospitals exceeded this average, including the six major Dublin hospitals (Beaumont, St. Vincent’s, Meath, St. James’s, Mater and Blanchardstown) as well as UCH Galway and the Adelaide. Cork Regional and Limerick Regional were marginally below the average.
Table 1: NCHDs per 1,000 Discharges by Grade, 1991

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Intern</th>
<th>House Officer</th>
<th>Registrar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaufont</td>
<td>2.40</td>
<td>3.50</td>
<td>2.76</td>
<td>8.66</td>
</tr>
<tr>
<td>St. Vincent's</td>
<td>2.16</td>
<td>2.61</td>
<td>2.96</td>
<td>7.73</td>
</tr>
<tr>
<td>Meath</td>
<td>1.82</td>
<td>2.61</td>
<td>3.07</td>
<td>7.50</td>
</tr>
<tr>
<td>Blanchardstown</td>
<td>1.36</td>
<td>3.95</td>
<td>2.04</td>
<td>7.35</td>
</tr>
<tr>
<td>St. James's</td>
<td>1.54</td>
<td>3.03</td>
<td>2.51</td>
<td>7.08</td>
</tr>
<tr>
<td>Mater</td>
<td>1.34</td>
<td>2.58</td>
<td>1.80</td>
<td>5.72</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>1.22</td>
<td>2.78</td>
<td>1.65</td>
<td>5.65</td>
</tr>
<tr>
<td>Adelaide</td>
<td>2.48</td>
<td>1.03</td>
<td>2.07</td>
<td>5.60</td>
</tr>
<tr>
<td><strong>Overall Average</strong></td>
<td><strong>0.97</strong></td>
<td><strong>2.29</strong></td>
<td><strong>1.39</strong></td>
<td><strong>4.65</strong></td>
</tr>
<tr>
<td>Cork Regional</td>
<td>0.92</td>
<td>2.08</td>
<td>1.54</td>
<td>4.54</td>
</tr>
<tr>
<td>Limerick Regional</td>
<td>1.14</td>
<td>2.22</td>
<td>1.14</td>
<td>4.50</td>
</tr>
<tr>
<td>Loughlinstown</td>
<td>0.00</td>
<td>2.68</td>
<td>1.34</td>
<td>4.00</td>
</tr>
<tr>
<td>Sligo General</td>
<td>0.21</td>
<td>2.47</td>
<td>1.16</td>
<td>3.84</td>
</tr>
<tr>
<td>Lourdes</td>
<td>0.85</td>
<td>1.92</td>
<td>0.71</td>
<td>3.48</td>
</tr>
<tr>
<td>Cavan</td>
<td>0.28</td>
<td>2.49</td>
<td>0.56</td>
<td>3.32</td>
</tr>
<tr>
<td>Portiuncula</td>
<td>0.62</td>
<td>1.92</td>
<td>0.71</td>
<td>3.25</td>
</tr>
<tr>
<td>Tullamore</td>
<td>0.00</td>
<td>2.14</td>
<td>0.66</td>
<td>2.80</td>
</tr>
<tr>
<td>Waterford</td>
<td>0.12</td>
<td>1.62</td>
<td>1.02</td>
<td>2.76</td>
</tr>
<tr>
<td>Portlaoise</td>
<td>0.29</td>
<td>2.02</td>
<td>0.29</td>
<td>2.59</td>
</tr>
<tr>
<td>Mercy, Cork</td>
<td>0.93</td>
<td>1.32</td>
<td>0.31</td>
<td>2.56</td>
</tr>
<tr>
<td>Castlebar</td>
<td>0.39</td>
<td>1.65</td>
<td>0.39</td>
<td>2.44</td>
</tr>
<tr>
<td>Letterkenny</td>
<td>0.30</td>
<td>1.51</td>
<td>0.52</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Source: Derived from Personnel Census and Hospital Activity Data, Department of Health

1.3 Formal Arrangements with Medical Schools

A second indicator of teaching responsibilities is the extent to which certain hospitals have formal arrangements with one of the five medical schools through joint consultant academic/clinical appointments.

The five medical schools had a total of 2,905 undergraduate students in the academic year 1991/2, of which 1,352 were in their third, fourth and fifth year clinical training in affiliated and other hospitals. A total of 451 students were in their final undergraduate year. Details by medical school are set out in table 2.
Table 2: Undergraduate Medical Students by Medical School, 1991/2

<table>
<thead>
<tr>
<th>Medical School</th>
<th>In Clinical Training</th>
<th>Final Year Students</th>
<th>All Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal College of Surgeons</td>
<td>416</td>
<td>129</td>
<td>931</td>
</tr>
<tr>
<td>Trinity College, Dublin</td>
<td>214</td>
<td>73</td>
<td>438</td>
</tr>
<tr>
<td>University College, Cork</td>
<td>199</td>
<td>74</td>
<td>445</td>
</tr>
<tr>
<td>University College, Dublin</td>
<td>229</td>
<td>104</td>
<td>693</td>
</tr>
<tr>
<td>University College, Galway</td>
<td>294</td>
<td>71</td>
<td>398</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1,352</strong></td>
<td><strong>451</strong></td>
<td><strong>2,905</strong></td>
</tr>
</tbody>
</table>

Note: Not all clinical training is confined to the hospitals with joint academic/clinical appointments. Other general and special hospitals are also used by the medical schools for this purpose.

Source: Each Medical School

The joint academic/clinical appointments which may be taken to indicate substantial responsibilities are as follows:

<table>
<thead>
<tr>
<th>Medical School</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal College of Surgeons</td>
<td>Beaumont</td>
</tr>
<tr>
<td>Trinity College, Dublin</td>
<td>St. James's</td>
</tr>
<tr>
<td></td>
<td>Adelaide</td>
</tr>
<tr>
<td></td>
<td>Meath</td>
</tr>
<tr>
<td>University College, Cork</td>
<td>Cork Regional</td>
</tr>
<tr>
<td>University College, Dublin</td>
<td>Mater</td>
</tr>
<tr>
<td></td>
<td>St. Vincent's</td>
</tr>
<tr>
<td>University College, Galway</td>
<td>UCH Galway</td>
</tr>
</tbody>
</table>

A number of other hospitals are recognised for the purposes of higher training for NCHDs but this would cover a much wider number of hospitals than those with joint appointments. They were not seen as a useful means, for the purposes of this study, of identifying hospitals with substantial teaching responsibilities.

1.4 Conclusions on Defining a Teaching Hospital

Table 3 summarises the results for hospitals under the two main indicators above. In the case of the first seven hospitals, the indicators point clearly to the presence of a significant teaching function at both undergraduate and postgraduate level. The first three of these, Beaumont, the Meath and St. Vincent's, were well above the average for NCHDs per 1,000 discharges and are also connected to a medical school. The next four, St. James's, Adelaide, the Mater and University College Hospital, Galway also had an above-average rate of NCHDs and have joint appointments with a medical school. All seven could therefore be regarded as teaching hospitals for the purposes of this study.
Table 3: Summary of Main Indicators of Teaching Functions

<table>
<thead>
<tr>
<th>Hospital</th>
<th>NCHDs Per 1,000 Discharges</th>
<th>Medical School Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaumont</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>Meath</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>St. Vincent’s</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>St. James’s</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>Adelaide</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>Mater</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>Blanchardstown</td>
<td>■ ■</td>
<td>X</td>
</tr>
<tr>
<td>Cork Regional</td>
<td>■ ■</td>
<td>✓</td>
</tr>
<tr>
<td>Limerick Regional</td>
<td>■ ■</td>
<td>X</td>
</tr>
<tr>
<td>All other hospitals examined</td>
<td>O ■ ■</td>
<td>X</td>
</tr>
</tbody>
</table>

Key: NCHDs per 1,000 discharges: ■ ■ = 9.00 - 7.50; ■ ■ = 7.49 - 5.00; ■ = 4.99 - 4.60 (average) O = 4.59 and under. ✓ = Joint appointments with medical school; X = No joint appointments.

Source: Derived from Table 2 and information from Comhairte na nOspideal.

Cork Regional Hospital, while just at the average in terms of NCHDs per 1,000 discharges, is attached to a medical school and is treated as a teaching hospital in this study.

The question of whether any other hospital should be classified as teaching arose primarily in the case of Blanchardstown and Limerick Regional. While Blanchardstown had significantly more than the average number of NCHDs per 1,000 discharges (7.35 versus an average in observed hospitals of 4.65), it had no joint academic/clinical posts with any medical school. On balance it was decided to classify Blanchardstown as a non teaching hospital for the purposes of this study. Limerick Regional had just under the average number of NCHDs per 1,000 discharges and was not attached to a medical school. It was also treated as a non teaching hospital.

All other hospitals examined were below the average for NCHDs per 1,000 discharges and had no joint consultant appointments with a medical school. They were classified as non teaching hospitals for the purposes of this study. However, for reasons of comparability (which are discussed in chapter two below), it was decided to focus all further analysis on the fourteen hospitals involved in the Department of Health’s casemix project, as well as one other hospital (Beaumont).
The division between teaching and non teaching hospitals selected for further study was therefore as follows:

**Teaching Hospitals**

- St. Vincent's
- Cork Regional
- Mater
- Beaumont
- St. James's
- UCH Galway
- Meath

**Non Teaching Hospitals**

- Blanchardstown
- Limerick
- Mercy
- Waterford
- Lourdes
- Castlebar
- Tullamore
- Sligo
2 Analysing In-Patient Costs

2.1 Introduction

The first objective of the analysis was to compare the average cost of treating an in-patient in a teaching hospital with that of a non teaching hospital. After adjusting for differences in the complexity of cases between hospitals, the gap between average costs in the two types of hospital would serve as a useful initial indicator of the additional costs incurred by teaching hospitals as a result of their training/education functions. Of course some of the gap could be due to a number of other factors, such as differing medical practices, relative efficiency between hospitals, availability of more expensive equipment and the quality of care given, but these comparisons of cost were a useful first step.

The comparisons relate to in-patient costs only ie excluding out-patients, day cases, long-stay care and obstetrics. This represented 71 per cent of the fifteen hospitals' total costs in 1991, or £284m out of total expenditure of £400m. This chapter examines these costs at a hospital-wide level; the next chapter examines selected areas of hospital costs - main cost centres - in further detail.

2.2 Treatment and Care Costs

The Department of Health's specialty costings system distinguishes between the direct costs of treating a patient and the associated costs of care. Treatment comprises the costs of theatres, laboratories, medical pay, medicines, blood, medical gases, medical/surgical supplies and medical support departments. Care costs include nurses' pay, general administration, medical and nursing administration, non medical support, patient and staff catering, and maintenance. Of the £284m under examination, treatment costs accounted for £139m and care costs for £145m.

Figure 1 compares the average treatment and care costs per case between teaching and non teaching hospitals. Both types of cost are substantially higher in teaching hospitals. This is not surprising, since teaching hospitals generally deal with more complex cases, help to train medical and nursing staff and are the sites of most hospital-based research.

A striking feature of the comparisons is the considerable variation in costs between individual hospitals, as shown in figure 2 below. The average treatment cost per case in teaching hospitals is almost twice that for non teaching hospitals and care.
costs per case are also noticeably higher in teaching institutions. Figure 2 also shows that there are noticeable variations in average costs within both types of hospital. (The detailed data for figure 2 are in appendix B).

**Figure 2: Cost per Case by Hospital**

Treatment Costs per Case

Care Costs per Case

### 2.3 Adjustment for Case Complexity

Few conclusions can be drawn from the information above because no account has been taken of the relative complexity of cases between hospitals. Teaching hospitals are generally the largest and most sophisticated hospitals in the system and deal with the most complex and difficult cases. National and regional specialties are also located in some of the teaching hospitals. In order to address the issue of case complexity, a *Casemix Index (CMI)* is used. It is taken from the Department of Health's casemix project and uses techniques adopted for similar allocation systems internationally.

The CMI is a measure of the relative costliness and complexity of a hospital's total inpatient workload as compared to the average costliness and complexity for all hospitals in the sample(in this case the fourteen hospitals in the casemix project). Thus, hospitals with a CMI of greater than 1.0 treat cases that are more costly/complex than the overall average, while the opposite applies for those with a CMI of less than 1.0. (The CMI of the fifteenth hospital examined here - Beaumont - was estimated using regression techniques).

The Department of Health supplied separate CMIs for the *treatment* and *care* elements of each hospital’s costs, as shown in appendix C. (For technical reasons it was not possible to calculate a separate CMI for treatment and care costs in respect of Beaumont and Blanchardstown; their overall CMI was used instead). When the relevant CMI is applied to in-patient costs it gives a clearer picture of the *real* differences in average costs per case, i.e. after variations in complexity of cases have been taken into account. Again it must be emphasised that not all of the difference in average costs between teaching and non teaching hospitals will be due to teaching costs, but adjusting for case complexity is an important first step.
Before using the CMI, it is important to note the argument that it may not be the ideal means of adjustment for case complexity. Firstly, its calculation is based partly on data from the specialty costings system, the approach to which was being refined during 1991 and subsequently. Secondly, it is not clear that the CMI can accurately distinguish between the costs associated with investigating the same condition in a teaching as opposed to a non teaching hospital. This difficulty might arise, for example, where a teaching hospital engages in more extensive (and costlier) investigations than those carried out in a non teaching hospital for the same condition.

However, it must be emphasised that the CMI is by far the most useful tool currently available for estimating case complexity and that few conclusions about relative costs in teaching and non teaching hospitals could have been drawn in this study without its application.

2.4 Adjusted Costs

An important result occurs after adjustment for case complexity. Figure 3 illustrates that when the relevant CMIs are applied, the difference between average treatment costs per case between teaching and non teaching hospitals narrows considerably, while the difference in average care costs is almost completely removed.

This suggests that, after variations in case complexity are taken into account, the differences in the costs per case are concentrated almost entirely in the costs of treating as opposed to caring for patients. Treatment costs per case are about 35 per cent higher in teaching hospitals, while care costs are just 7 per cent greater.

Therefore, the bulk of any additional costs to teaching hospitals from their medical education/training function and related research work arises in the area of treatment rather than care. This narrows the focus of examination to treatment costs; apart from the considerably greater gap in treatment costs between teaching and non teaching hospitals, most of the care costs cover elements in which teaching-related expenses are much less likely to arise (eg administration, catering and maintenance).

In more detail, figure 4 illustrates for each hospital the trend that emerged from figure 3. It is notable that the ratio of treatment to care costs varies between teaching and
non teaching hospitals. In the majority of teaching hospitals, treatment costs represent over half of all costs per case (the average is 51 per cent), while most non teaching hospitals had treatment costs of much less than half their total costs per case (with an average of 45 per cent). There may be a number of reasons for this: as noted in the introduction, the validity of the data depends on an accurate and consistent classification of costs by all hospitals. It is also possible, for example, that some of the administration costs of health board hospitals (ie Cork Regional, UCH Galway, Limerick, Waterford, Castlebar, Tullamore and Sligo) are included in the boards' own budgets rather than those of the hospitals, thus reducing their estimated care costs. However, the accuracy of the distinction between treatment and care costs should improve as methods of assigning costs are refined.

2.5 Teaching Intensity and Costs per Case

Having identified the treatment area as the primary source of potential teaching-related costs, the next step was to examine whether the relative 'intensity' of medical education/training in each hospital would affect its treatment or care costs per case. One indicator of teaching intensity is the number of NCHDs per 1,000 discharges. (As would be expected, there is generally a higher rate of NCHDs per case in teaching hospitals than in non teaching ones). While it may be argued that the presence of NCHDs in larger numbers does not automatically imply additional training-related costs, it might be seen as a reasonable indicator of a teaching function, particularly when combined with the other characteristics of a teaching hospital as discussed in chapter one.

The examination revealed a relatively close link between the number of NCHDs and treatment costs per case, but no such link with care costs per case. A useful statistical measure of this relationship is the coefficient of determination \( r^2 \) which measures how accurately one variable (such as costs per case) can be predicted from another variable (eg number of NCHDs). In the case of treatment costs the \( r^2 \) was 0.68 (where 1.0 represents perfect correlation) but for care costs it was just 0.34. Ideally the analysis would have excluded NCHDs not assigned to in-patient cases (such as those in out-patient
departments) but there were insufficient data to do this.

The Department of Health estimates that there are about 170 additional NCHDs in the hospitals included in this study who are not officially in training posts. These include doctors funded independently by other agencies such as research bodies or pharmaceutical companies. When they are taken into account the \( r^2 \) for treatment costs increases to 0.76 but remains relatively low for care costs at 0.35.

Figure 5 illustrates on scatterplots the relationship between the number of NCHDs per 1,000 discharges and the treatment and care costs per case in each of the fifteen hospitals under examination. They underline the relatively close link of treatment costs with NCHDs per 1,000 discharges and the absence of any significant such link with care costs.

In summary, therefore, the analysis suggests that treatment costs are significantly influenced by the extent of training/education in a hospital, whereas care costs are not. This develops the earlier conclusion that the great majority of any additional costs to teaching hospitals from their medical education functions are concentrated in treatment rather than care.

**Figure 5:**

<table>
<thead>
<tr>
<th>NCHDs by Treatment Cost per Case</th>
<th>NCHDs by Care Cost per Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Graph" /></td>
<td><img src="image2.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

2.6 Teaching Intensity and Average Length of Stay

One of the results of more intensive training in teaching hospitals might be longer average lengths of stay (ALOS). Longer ALOS might result, for example, from such factors as the time taken for formal and informal teaching and ward rounds; any extra examinations carried out by NCHDs; and perhaps any research into the medical efficacy of alternative treatments. All of these factors could lead to a longer ALOS than would be the case if there was no significant medical education/training function in the hospital.
A detailed examination was carried out in the course of this study, but no obvious link could be found between ALOS and the type of hospital involved, ie teaching or non teaching. This analysis was carried out at the level of individual diagnosis related groups (DRGs). Under the DRG system, patient cases are classified into homogenous groups which receive similar treatment processes and use similar levels of resources. There are almost 500 different DRGs into which patients may be classified under the system currently in use.

The study examined the ALOS of two sets of DRGs:

1. selected DRGs which, based on their complexity (or relative value under the casemix project), are a possible indicator of teaching intensity. Certain DRGs with a high relative value and others with a low relative value were examined, and
2. the top 20 DRGs by number of discharges, which accounted for nearly one-quarter of all in-patients treated.

In the first set of DRGs there was no noticeable link between teaching intensity (as indicated by the more highly complex DRGs through their relative value) and average length of stay, irrespective of the hospital’s teaching/non teaching status. In some DRGs the ALOS was higher in teaching hospitals, while in others it was significantly higher in non teaching ones, irrespective of whether the DRG was complex or relatively simple.

Similarly, in the case of the top 20 DRGs, there was no consistent trend linking lengths of stay with teaching status. In many DRGs there was virtually no difference between the ALOS in teaching and non teaching hospitals. Where a difference did arise, there was no discernible pattern; in some cases the teaching hospitals had a longer ALOS while in others the ALOS was longer in non teaching institutions.

Based on the analysis of these two sets of DRGs, it can be concluded that, contrary to what might be expected, there is no obvious link between ALOS and teaching intensity in Irish teaching hospitals. Fuller details of the analysis are contained in appendix E.

2.7 Estimating Medical Education Costs

It is now possible to make broad estimates of medical education/training expenses in teaching hospitals. These are based on the difference between the (casemix-adjusted) average treatment costs of teaching and non teaching hospitals. As a first step, table 4 below estimates the 'add-on' factor incurred by teaching hospitals in their costs per case as a result of their medical education/training functions and any other sources of extra cost, such as differing medical practices or relative efficiency between hospitals.

The 'excess' cost per case in teaching hospitals - column [A] - is taken to be the amount by which their average treatment costs exceed the average treatment cost in non teaching hospitals (ie the amount above £497.47). This 'excess' cost (the average of which was £178.86 per case) is multiplied by the number of discharges - column [B] - to give an estimated total 'excess' cost per teaching hospital. This gives a total of £22.5 million.
In column [E] the 'excess' cost per hospital is expressed as a percentage of each hospital's adjusted in-patient costs (£167.7 million) - column [C] as a proportion of column [D]. The table indicates, therefore, that the addition to teaching hospitals' in-patient costs, after differences in casemix have been taken into account, is in the order of 13 per cent, ie around £23 million.

**Table 4: Estimated Medical Teaching Costs in Teaching Hospitals, 1991**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Excess Cost £ per Case</th>
<th>Discharges</th>
<th>Total Excess (£m)</th>
<th>In-Patient Costs Adjusted (£m)</th>
<th>Add-On Factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Vincent's</td>
<td>250.99</td>
<td>15,431</td>
<td>3.9</td>
<td>22.4</td>
<td>17.3</td>
</tr>
<tr>
<td>Cork Regional</td>
<td>33.90</td>
<td>27,258</td>
<td>0.9</td>
<td>26.9</td>
<td>3.4</td>
</tr>
<tr>
<td>Mater</td>
<td>152.01</td>
<td>18,231</td>
<td>2.8</td>
<td>24.6</td>
<td>11.3</td>
</tr>
<tr>
<td>St. James's</td>
<td>332.78</td>
<td>19,068</td>
<td>6.3</td>
<td>30.5</td>
<td>20.8</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>89.48</td>
<td>17,747</td>
<td>1.6</td>
<td>20.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Meath</td>
<td>181.39</td>
<td>8,863</td>
<td>1.6</td>
<td>12.4</td>
<td>12.9</td>
</tr>
<tr>
<td>Beaumont</td>
<td>281.04</td>
<td>19,154</td>
<td>5.4</td>
<td>30.9</td>
<td>17.4</td>
</tr>
<tr>
<td><strong>Average/Total</strong></td>
<td><strong>178.86</strong></td>
<td><strong>125,752</strong></td>
<td><strong>22.5</strong></td>
<td><strong>167.7</strong></td>
<td><strong>13.4</strong></td>
</tr>
</tbody>
</table>

[A] = Treatment cost per case minus £497.47 (basic price for non teaching hospitals)
[C] = 'Excess Cost' by hospital, ie [A] x [B]
[D] = In-Patient Costs adjusted by the casemix index (CMI)
[E] = 'Add-on' percentage from training costs etc, ie [C]/[D]

Having made this basic estimate, the most difficult question to answer next is what proportion of these add-on costs is attributable to teaching hospitals' medical education/training functions. As previously noted, it is very likely that factors other than teaching account for at least some of the 'add-on' costs identified, which would lead to an over-estimate of teaching costs. These factors could include:

1. differing medical practices;
2. the quality of care given;
3. differences in relative efficiency between hospitals;
4. availability of more sophisticated and expensive equipment in some teaching hospitals (which may encourage more intensive investigation irrespective of teaching functions); and
the role of teaching hospitals as tertiary referral centres in high-population areas. Unlike most of their non teaching counterparts, these hospitals experience a demand for service cover from a wider population which could increase their costs in any event.

However, there are also balancing factors which could lead to an underestimate of training costs. The first concerns the nature of the CMI used to adjust in-patient costs for case complexity. The CMI is built up using data which include the training/education costs that this study aims to identify. Use of the CMI may therefore standardise too much for the costs being estimated.

Secondly, some of the factors identified above as leading to possible over-estimates of teaching costs might equally result in under-estimates. This would occur, for example, if teaching hospitals as a whole were more efficient than non teaching ones, or if differing medical practices lead to overall savings rather than additional costs in teaching hospitals.

Thirdly, while it is clear that the great majority of teaching-related costs are concentrated in the treatment element, the analysis suggests slightly higher care costs per case in teaching hospitals, some of which could be attributed to teaching/training.

If any of these considerations apply, the estimated 'add-on' factor of 13 per cent could be an understatement. Obviously the real extra cost of medical training would depend on the relative strength in either direction of the factors above.

Finally, the importance of ensuring that hospitals classify their costs accurately and consistently between treatment and care elements must again be noted. Any problems in this regard would affect the findings of the study.

2.8 Conclusion

Bearing these factors in mind, the indications are that the additional costs incurred by teaching hospitals as a result of their medical education/training functions are in the order of 10 to 15 per cent of adjusted in-patient costs in teaching hospitals, or between £17m and £25m.

Since this study has focused on acute in-patient spending, the estimates exclude some of the costs arising in areas not covered by the present Casemix Project, eg Out-Patients, Accident & Emergency, Psychiatry, long-term Geriatric Care and Obstetrics.

Given the conclusions above, it was decided to concentrate on the components of treatment costs when trying to estimate the additional costs incurred by teaching hospitals as a result of their medical education/training function. The next step, therefore, was to examine the main elements (or main cost centres) of treatment costs in more detail with a view to isolating the main sources and size of medical training costs. This issue is discussed in chapter three.
3 Main Cost Centres

3.1 Introduction

Having established that the main source of teaching-related costs was in the treatment rather than care element of hospitals' work, the next stage was to examine in more detail the main cost centres (MCCs) that comprise the £139m of treatment costs in the fifteen hospitals under analysis. Table 5 groups the MCCs under seven headings and details the expenditure each one.

Table 5: Main Cost Centres of Treatment Expenditure, 1991

<table>
<thead>
<tr>
<th>Main Cost Centre</th>
<th>Expenditure (£m)</th>
<th>Share of total Treatment Costs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Support Departments</td>
<td>30.3</td>
<td>21.8</td>
</tr>
<tr>
<td>Theatres</td>
<td>18.4</td>
<td>13.3</td>
</tr>
<tr>
<td>Laboratories</td>
<td>18.4</td>
<td>13.2</td>
</tr>
<tr>
<td>Medical Pay</td>
<td>32.3</td>
<td>23.2</td>
</tr>
<tr>
<td>Drugs &amp; Medicines</td>
<td>14.2</td>
<td>10.2</td>
</tr>
<tr>
<td>Bloods, Medical Gases and Supplies</td>
<td>22.1</td>
<td>15.9</td>
</tr>
<tr>
<td>Other Direct Charges</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Totals</td>
<td>139.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>


3.2 Costs per case

As in the case of overall hospital costs above, there is a substantial difference in the average cost per case in each MCC between teaching and non teaching hospitals. This is illustrated in figure 6 below. The most notable differences arise in the case of bloods, gases and supplies, medical support departments, drugs and medicines, and medical pay.

However, it is necessary to take differences in casemix into account before any useful conclusions can be drawn. As in the case of overall hospital costs, a casemix index (CMI) was required to adjust for differences in casemix.

The question of which CMI to use required some detailed examination because there was concern that it would not be valid to apply either a hospital's overall CMI or its treatment CMI (the latter became available as this report was being finalised) to adjust for casemix in the seven separate MCCs. There was no certainty, for example, that each MCC would necessarily use roughly the same combination of resources upon which calculation of the overall or treatment CMIs were based. As discussed in appendix F, the differences between the results produced by the alternative CMIs was marginal and

19
it is the overall CMI that is used below.

Figure 6 below shows the adjusted costs per case by main cost centre. The key result to note is that, after adjustment for casemix, there is little difference in the medical pay costs per case between teaching and non teaching hospitals. The main differences arise in bloods, gases and supplies; drugs and medicines; and diagnostic areas (medical support departments and laboratories). The main conclusion, therefore, is that the costs of medical education/training are associated not with what doctors are paid but what they do in terms of tests ordered, procedures carried out and research work. This conclusion is reached after adjustment for differences in complexity of cases treated.
4 Conclusions

4.1 Introduction

This chapter draws together the conclusions of the study, makes suggestions about possible means of verifying the findings of the report and other next steps and points briefly to the approach taken in other countries to estimating teaching-related costs.

4.2 Summary and Conclusions

The average costs per case in teaching and non teaching hospitals were examined by reference to total in-patient costs. These were divided between treatment-related and care-related elements and standardised for the substantial differences in complexity of cases across hospitals.

The main conclusions of the study are that:

- the most significant differences in average costs per case between the two types of hospital, after adjustment for case complexity, arise in the treatment rather than care element of hospitals' work;
- there is a relatively strong relationship between teaching intensity (as measured by NCHDs per 1,000 discharges) and treatment costs per case, but no such link is evident between teaching intensity and care costs;
- there appears to be no evidence of a link between teaching intensity and average length of stay. There is no consistent trend between teaching and non teaching hospitals in the ALOS for selected individual DRGs;
- the additional costs incurred by teaching hospitals as a result of their medical education/training functions are in the order of 10 to 15 per cent of total in-patient costs. This would amount to between £16m and £25m in 1991; and
- the main costs to teaching hospitals from their education/training functions are concentrated in diagnostic facilities, drugs and supplies. There is little difference in the (adjusted) medical pay costs per case between teaching and non teaching hospitals. This implies that medical education costs are much more closely associated with what doctors do (in terms of tests ordered, procedures carried out and research work) than with what they are paid.

4.3 Validating the Results

Having reached the conclusions outlined above, the next step was to examine the validity of the results. As might be expected, preliminary validation was possible through checks
on the internal consistency of the data. Discussions on a number of drafts of the report were then held, initially with the Department of Health and later with individual clinicians and hospital administrators. Their comments and suggestions for improvements have been incorporated in the final version of the study.

A number of approaches could now be taken towards validating further the findings of the report. The first might be a more detailed study at hospital level to test some of the conclusions more closely. This could include

- examination of selected hospitals' costs to establish whether teaching-related expenses can be identified at first hand;
- tracing the volume and type of tests/procedures at the level of selected individual DRGs, again to see whether teaching-related costs can be narrowed to specific areas of hospitals' work; and
- using a form of 'time and motion' study to observe the teaching-related commitments of doctors in a selected ward. (Clearly this would be a very time-consuming approach and would have to be very carefully planned if worthwhile results were to be achieved).

The second area of validation would involve further testing of the model as additional and more sophisticated data become available. The most obvious initial test would be to use the complete set of 1992 data as soon as they are to hand. All data used in this report relate to 1991 and, as noted earlier, both the specialty costing system and the casemix project worked to refine their methods further in respect of 1992.

The next test would be based on more refined methods of classifying patients according to DRG category. At present the Department of Health uses a DRG grouper known as the HCFA 9 (devised by the US Health Care Financing Administration) to assign patients to individual DRGs according to treatments and procedures. This creates 492 DRGs but contains no estimates of severity of illness.

The Department of Health has been testing the more sensitive APD (All Patient Grouper) system for possible use in Ireland. This grouper includes various grades of severity of illness and yields a considerably larger number of DRGs. In this way, the new system reduces the problem of wide variations in severity of illness within individual DRGs and should be more sensitive to teaching-related costs. Recent research on a further improvement of the system, the APRG (All Patient Refined Grouper) indicates that it may be even more sensitive to teaching costs.

If technically possible, it would be valuable to use the data produced by the two new DRG groupers to test the results of this report.

A third approach to validation would be a formal statistical test, devising a multi-variate model to estimate the explanatory power of the variables used. For example, treatment costs could be used as the dependent variable against three independent variables - teaching status, teaching intensity (eg number of NCHDs per 1,000 discharges) and CMI.
The analysis would estimate how much of the variations in treatment costs are explicable through variations in each of the other three variables.

4.4 International Approaches to Estimating Teaching Costs

Having presented a model for estimating teaching-related costs in Ireland, it is worthwhile considering a brief description of the approaches taken in other countries. The systems adopted in England and the USA are set out in appendix G. They may help illustrate that the difficulty of estimating such costs accurately is an international one and that the methods used elsewhere must, as in Ireland's case, be based on estimates drawn from existing data.

4.5 Future Directions of the Model

This study has attempted to estimate the additional costs to teaching hospitals that arise from their medical education/training and related research functions. The key aim was to formulate a model for estimating these costs in the future. Inevitably there are qualifications to the results because of the intangible nature of the costs being measured and the fact that the data systems used (the specialty costings system and casemix project) are relatively new. However, the quality of estimates produced by the model can be expected to improve as the methods for producing the data are refined and experience from the validation exercises suggested above are taken into account.

A valuable step would be to ensure that the model presented above is used each year to estimate teaching-related costs and refined as often as better data and methods become available. Only in this way can the estimates become more robust over time.

In addition, use and refinement of the model would be of value in the casemix project. At present the hospitals participating in the casemix system are banded into two groups by reference to estimated teaching/non teaching status. The model presented here could be used to test the validity of this banding.
Appendices
Appendix A
Analysis of Hospital Costs: A Schematic Summary

IN PATIENT COSTS (£284m)

TREATMENT COSTS (£139m)  CARE COSTS (£145m)

CMI ADJUSTMENT BY HOSPITAL

TEACHING VERSUS NON TEACHING HOSPITALS

ADJUSTED COST PER CASE (CPC)

Substantial differences in TREATMENT CPC

ADJUSTED COST PER CASE (CPC)

Little difference in CARE CPC

ANALYSIS OF MAIN COST CENTRES (MCCs) BY HOSPITAL

CMI ADJUSTMENT BY HOSPITAL

ADJUSTED CPC BY MCC

TEACHING VERSUS NON TEACHING HOSPITALS

MEDICAL PAY: THEATRES & OTHER DIRECT CHARGES MED SUPPORT LABS & SUPPLIES

Little difference in CPC Some difference in CPC Large difference in CPC
Appendix B: In-Patient Costs per Case, 1991

<table>
<thead>
<tr>
<th>Teaching Hospitals</th>
<th>Discharges</th>
<th>In-Patient Cost (£m)</th>
<th>Treatment Cost (£m)</th>
<th>Care Cost (£m)</th>
<th>In-Patient Cost per Case (£)</th>
<th>Treatment Cost per Case (£)</th>
<th>Care Cost per Case (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Vincent's</td>
<td>15,431</td>
<td>26.5</td>
<td>13.7</td>
<td>12.9</td>
<td>1,721</td>
<td>886</td>
<td>835</td>
</tr>
<tr>
<td>Cork Regional</td>
<td>27,258</td>
<td>29.2</td>
<td>16.2</td>
<td>13.0</td>
<td>1,073</td>
<td>595</td>
<td>478</td>
</tr>
<tr>
<td>Mater</td>
<td>18,231</td>
<td>31.6</td>
<td>16.6</td>
<td>15.0</td>
<td>1,733</td>
<td>911</td>
<td>822</td>
</tr>
<tr>
<td>St James's</td>
<td>19,068</td>
<td>33.1</td>
<td>17.7</td>
<td>15.4</td>
<td>1,736</td>
<td>931</td>
<td>805</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>17,747</td>
<td>19.7</td>
<td>10.4</td>
<td>9.3</td>
<td>1,111</td>
<td>585</td>
<td>526</td>
</tr>
<tr>
<td>Meath</td>
<td>8,863</td>
<td>13.9</td>
<td>6.7</td>
<td>7.2</td>
<td>1,564</td>
<td>756</td>
<td>808</td>
</tr>
<tr>
<td>Beaumont</td>
<td>19,154</td>
<td>41.9</td>
<td>20.2</td>
<td>21.7</td>
<td>2,189</td>
<td>1,057</td>
<td>1,132</td>
</tr>
<tr>
<td>Averages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,558</td>
<td>807</td>
<td>751</td>
</tr>
<tr>
<td>Non Teaching Hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blanchardstown</td>
<td>6,865</td>
<td>10.7</td>
<td>4.1</td>
<td>6.6</td>
<td>1,558</td>
<td>592</td>
<td>966</td>
</tr>
<tr>
<td>Limerick</td>
<td>17,045</td>
<td>14.0</td>
<td>6.9</td>
<td>7.1</td>
<td>819</td>
<td>402</td>
<td>417</td>
</tr>
<tr>
<td>Mercy</td>
<td>12,761</td>
<td>9.9</td>
<td>4.6</td>
<td>5.3</td>
<td>773</td>
<td>361</td>
<td>412</td>
</tr>
<tr>
<td>Waterford</td>
<td>12,436</td>
<td>13.7</td>
<td>5.3</td>
<td>8.4</td>
<td>1,101</td>
<td>423</td>
<td>678</td>
</tr>
<tr>
<td>Lourdes</td>
<td>11,841</td>
<td>10.4</td>
<td>4.1</td>
<td>6.3</td>
<td>878</td>
<td>347</td>
<td>531</td>
</tr>
<tr>
<td>Castlebar</td>
<td>10,814</td>
<td>8.8</td>
<td>3.6</td>
<td>5.2</td>
<td>811</td>
<td>330</td>
<td>481</td>
</tr>
<tr>
<td>Tullamore</td>
<td>7,497</td>
<td>7.3</td>
<td>3.3</td>
<td>4.0</td>
<td>974</td>
<td>437</td>
<td>537</td>
</tr>
<tr>
<td>Sligo</td>
<td>12,959</td>
<td>13.3</td>
<td>5.7</td>
<td>7.6</td>
<td>1,027</td>
<td>438</td>
<td>589</td>
</tr>
<tr>
<td>Averages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>954</td>
<td>406</td>
<td>548</td>
</tr>
</tbody>
</table>

Source: Derived from Department of Health specialty costings data.
Appendix C: Casemix Index by Hospital

There was some concern that it would not be valid to apply a hospital's overall CMI separately to the *treatment* and *care* elements of hospital costs. This is because the CMI is built up using service weights for certain costs, daily costs for others and a combination of service weights and daily costs for a third category. There was no guarantee that the treatment and care costs, when studied separately, would contain a similar proportion of these three categories as did the total in-patient costs on which the CMI was calculated initially. Accordingly, the Department of Health supplied separate CMIs applicable to the *treatment* and *care* elements of hospital costs, as shown below. The overall CMI for each hospital is also included.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Treatment CMI</th>
<th>Care CMI</th>
<th>Overall CMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Vincent's</td>
<td>1.183</td>
<td>1.182</td>
<td>1.183</td>
</tr>
<tr>
<td>Cork Regional</td>
<td>1.119</td>
<td>1.061</td>
<td>1.090</td>
</tr>
<tr>
<td>Mater</td>
<td>1.402</td>
<td>1.185</td>
<td>1.293</td>
</tr>
<tr>
<td>St. James's</td>
<td>1.121</td>
<td>1.054</td>
<td>1.087</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>0.996</td>
<td>0.992</td>
<td>0.994</td>
</tr>
<tr>
<td>Meath</td>
<td>1.114</td>
<td>1.117</td>
<td>1.115</td>
</tr>
<tr>
<td>Beaumont</td>
<td>N/A</td>
<td>N/A</td>
<td>1.358</td>
</tr>
<tr>
<td>Blanchardstown</td>
<td>N/A</td>
<td>N/A</td>
<td>1.105</td>
</tr>
<tr>
<td>Limerick</td>
<td>0.787</td>
<td>0.892</td>
<td>0.840</td>
</tr>
<tr>
<td>Mercy, Cork</td>
<td>0.851</td>
<td>0.876</td>
<td>0.864</td>
</tr>
<tr>
<td>Waterford</td>
<td>0.776</td>
<td>0.877</td>
<td>0.827</td>
</tr>
<tr>
<td>Lourdes</td>
<td>0.794</td>
<td>0.880</td>
<td>0.837</td>
</tr>
<tr>
<td>Castletown</td>
<td>0.755</td>
<td>0.890</td>
<td>0.823</td>
</tr>
<tr>
<td>Tullamore</td>
<td>0.962</td>
<td>0.966</td>
<td>0.964</td>
</tr>
<tr>
<td>Sligo</td>
<td>0.712</td>
<td>0.813</td>
<td>0.763</td>
</tr>
</tbody>
</table>

Note: Separate Treatment and Care CMIs for Beaumont and Blanchardstown could not be calculated for technical reasons. The overall CMI for Beaumont was estimated using regression techniques.

Source: Department of Health
## Appendix D: Adjusted In-Patient Costs per Case, 1991

<table>
<thead>
<tr>
<th>Teaching Hospitals</th>
<th>Discharges</th>
<th>In-Patient Cost (£m)</th>
<th>Treatment Cost (£m)</th>
<th>Care Cost (£m)</th>
<th>In-Patient Cost per Case (£)</th>
<th>Treatment Cost per Case (£)</th>
<th>Care Cost per Case (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Vincent's</td>
<td>15,431</td>
<td>22.4</td>
<td>11.5</td>
<td>10.9</td>
<td>1,455</td>
<td>748</td>
<td>707</td>
</tr>
<tr>
<td>Cork Regional</td>
<td>27,258</td>
<td>26.7</td>
<td>14.5</td>
<td>12.3</td>
<td>981</td>
<td>531</td>
<td>450</td>
</tr>
<tr>
<td>Mater</td>
<td>18,231</td>
<td>24.5</td>
<td>11.8</td>
<td>12.7</td>
<td>1,344</td>
<td>650</td>
<td>694</td>
</tr>
<tr>
<td>St James’s</td>
<td>19,068</td>
<td>30.4</td>
<td>15.8</td>
<td>14.6</td>
<td>1,594</td>
<td>830</td>
<td>764</td>
</tr>
<tr>
<td>UCH Galway</td>
<td>17,747</td>
<td>19.8</td>
<td>10.4</td>
<td>9.4</td>
<td>1,118</td>
<td>587</td>
<td>531</td>
</tr>
<tr>
<td>Meath</td>
<td>8,863</td>
<td>12.4</td>
<td>6.0</td>
<td>6.4</td>
<td>1,402</td>
<td>679</td>
<td>723</td>
</tr>
<tr>
<td>Beaumont</td>
<td>19,154</td>
<td>30.9</td>
<td>14.9</td>
<td>16.0</td>
<td>1,612</td>
<td>779</td>
<td>834</td>
</tr>
<tr>
<td><strong>Averages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,330</td>
<td>676</td>
<td>654</td>
</tr>
<tr>
<td>Non Teaching Hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blanchardstown</td>
<td>6,865</td>
<td>9.7</td>
<td>3.7</td>
<td>6.0</td>
<td>1,410</td>
<td>536</td>
<td>874</td>
</tr>
<tr>
<td>Limerick</td>
<td>17,045</td>
<td>16.7</td>
<td>8.8</td>
<td>7.9</td>
<td>979</td>
<td>512</td>
<td>467</td>
</tr>
<tr>
<td>Mercy</td>
<td>12,761</td>
<td>11.4</td>
<td>5.4</td>
<td>6.0</td>
<td>895</td>
<td>424</td>
<td>471</td>
</tr>
<tr>
<td>Waterford</td>
<td>12,436</td>
<td>16.4</td>
<td>6.8</td>
<td>9.6</td>
<td>1,318</td>
<td>546</td>
<td>772</td>
</tr>
<tr>
<td>Lourdes</td>
<td>11,841</td>
<td>12.3</td>
<td>5.2</td>
<td>7.1</td>
<td>1,041</td>
<td>437</td>
<td>604</td>
</tr>
<tr>
<td>Castlebar</td>
<td>10,814</td>
<td>10.6</td>
<td>4.7</td>
<td>5.9</td>
<td>977</td>
<td>437</td>
<td>540</td>
</tr>
<tr>
<td>Tullamore</td>
<td>7,497</td>
<td>7.6</td>
<td>3.5</td>
<td>4.1</td>
<td>1,010</td>
<td>455</td>
<td>555</td>
</tr>
<tr>
<td>Sligo</td>
<td>12,959</td>
<td>17.5</td>
<td>8.1</td>
<td>9.4</td>
<td>1,339</td>
<td>615</td>
<td>724</td>
</tr>
<tr>
<td><strong>Averages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,106</td>
<td>497</td>
<td>609</td>
</tr>
</tbody>
</table>

Note: Adjusted costs are obtained by dividing the hospital's treatment or care CMI (Appendix C) into actual costs (Appendix B).

Source: Derived from data supplied by the Department of Health's specialty costings system and casenix project.
Appendix E: DRGs, Average Length of Stay and Teaching Intensity

Chapter two referred briefly to an examination of selected DRGs to establish whether there was a link between average length of stay (ALOS) and the extent of a hospital's teaching functions. This appendix describes the analysis in more detail.

The ALOS by hospital of two sets of DRGs were examined:

(a) certain DRGs with a high relative value (or RV as described below) and others with a low RV using RV as a possible indicator of teaching intensity, and

(b) the top 20 DRGs by number of discharges, which accounted for nearly one-quarter of all in-patients treated.

High and Low Value RVs

Relative Values (RVs) are a measure of the resource use of an individual DRG relative to a national average. The RV for each DRG is calculated by dividing the average cost per patient of that DRG by the average cost per patient for all DRGs. Thus a DRG costing £1000 where the average cost of all DRGs is £2000 would have an RV of 0.5. The standard RV is 1.0, indicating that the DRG in this example is half as costly/complex as the average of all DRGs.

Figure A

ALOS of High Rank DRGs (RV = > 1.1)

Key: (RVs in Brackets)
14 Cerebrovascular Disorders (2.4766)
122 Circulatory Disorders (1.6379)
127 Heart Failure & Shock (1.3833)
395 Red Blood Cell Disorders (1.1562)
359 Uterine & Adnexa Procedures (1.1167)
88 Chronic Obstructive Pulmonary Disease (1.1163)

Using high RVs as an indicator of case complexity and of possible teaching intensity, the ALOS of those DRGs from the national top 50 (by number of discharges) which had a relatively high RV (greater than 1.1) were examined. So too were those from the top 50 with a relatively low RV (less than 0.5). Figures A and B illustrate the ALOS
of these DRGs by teaching hospital, non teaching hospital and all hospitals in the sample.

Figure B
ALOS of Low-Rank DRGs (RV = < 0.5)

Key: (RVs in brackets)
- 324 Urinary Stones (0.4744)
- 422 Viral illness & Fever (0.4676)
- 251 Sprains, dislocations etc (0.4661)
- 70 Otis Media (0.4450)
- 30 Traumatic Stupor & Coma (0.4401)
- 184 Esophagitis, gastro etc (0.4388)
- 364 D&C (0.4320)
- 60 Tonsillectomy &/or Adenoidectomy (0.4216)

Top 20 DRGs Nationally

A second set of DRGs was also examined for possible links between teaching intensity and length of stay. The ALOS of the "top 20" DRGs (as measured by number of discharges in the sample) are set out by teaching hospital, non teaching hospital and all hospitals in the sample in figures C and D below.

These 20 DRGs (out of a total of 492) account for almost one-quarter of all discharges in the sample. As in the case of the analysis of DRGs by Relative Value above, there is no consistent trend linking lengths of stay with teaching status. Only in four of the top ten DRGs (figure C) is the ALOS higher in teaching than in non teaching hospitals, and this applies in just two of the next ten DRGs (figure D). In many cases there is virtually no difference in the ALOS per DRG between teaching and non teaching hospitals, while in a number of other cases the ALOS is noticeably higher in non teaching hospitals.

If broadly representative of the sample overall, analysis of the DRGs above suggests that there is no obvious relationship between teaching intensity and ALOS.
Figure C
ALOS of Top 10 DRGs by Hospital Type

Key:
183 Esophagitis etc 184 Esophagitis (other) 88 Pulmonary Disease 98 Bronchitis etc 143 Chest Pain
Appendectomy 39 Lens Procedures 70 Otis Media 127 Heart Failure & Shock 29 Traumatic Stupor

Figure D
ALOS of DRGs 11-20 by Hospital Type

140 Angina 122 Circulatory Disorders 364 D&C 14 Cerebrovascular Disorders 60 Tonsillectomy &/or Adenoidectomy
119 Vein Ligation & Stripping 410 Chemotherapy 243 Medical Back Problems 30 Traumatic Stupor & Coma 359 Uterine
& Adnexa Procedures
Appendix F: Adjusting Main Cost Centres for Casemix

When adjusting the main cost centres for complexity of cases in chapter 3, it was necessary to select the most appropriate casemix index (CMI) for the purpose. As noted in that chapter, it could not be assumed that a CMI calculated from the hospital's global activity could validly be applied to separate elements of it, such as individual main cost centres. Each MCC might not necessarily use the same combination of resources upon which calculation of the overall CMI was based.

At the beginning of this study only a global CMI for each of the fifteen hospitals was available. On request, the Department of Health then calculated CMIs by specialty, and later a CMI for treatment and care costs, in respect of thirteen hospitals. (These CMIs could not immediately be estimated in the case of Beaumont and Blanchardstown for technical reasons).

There were virtually no differences between the results produced by the specialty CMIs and the overall CMIs. On balance the overall CMI was preferred because no specialty CMIs could be estimated for two hospitals.

As this study was being finalised, a treatment CMI for thirteen hospitals (again excluding Beaumont and Blanchardstown) became available from the Department of Health. Figure E shows that there is relatively little difference between the results produced by both CMIs. The main effect of the treatment CMI is to reduce marginally the adjusted cost per case in teaching hospitals and to increase it slightly in non teaching hospitals.

![Figure E: Alternative Methods of Adjustment - Treatment versus Overall CMIs](image)

The results from applying the overall CMI to each main cost centre are compared with those produced by the treatment CMI in figure F below. It can be seen that the orders of magnitude remain the same. Only in the case of medical pay is there a noticeable difference; there the treatment CMI pushes costs per case in non teaching hospitals slightly above those of teaching hospitals, whereas the overall CMI has the opposite effect.
However, the overall trend remains the same irrespective of the type of CMI applied: while significant differences in costs per case remain in most other MCCs, the gap between the medical pay costs per case of teaching and non-teaching hospitals is virtually eliminated after adjustment for case complexity has been made. Since a separate treatment CMI is not readily available for two hospitals it was again decided to use the overall CMI in chapter 3. As illustrated here, there is little difference between the results produced by the alternative treatment CMI.

Figure F: Adjusted Costs per Case using Alternative CMIs

Overall CMI Adjustment  Treatment CMI Adjustment

F2
Appendix G
International Approaches to Estimating Teaching Costs

**England: Service Increment for Teaching and Research (SIFTR)**

The Service Increment for Teaching and Research (SIFTR) is designed to cover that proportion of additional costs per case of teaching hospitals that could be attributed to the presence of undergraduate students during their clinical training. The original payment related only to teaching costs; the research element was included later. At present SIFTR relates only to undergraduate costs, but the methodology is currently being refined to cover postgraduate costs also.

SIFTR is calculated according to a model of teaching and non-teaching hospital costs. The *baseline costs* from a sample of non-teaching acute hospitals are estimated by regression techniques using such variables as overheads per case, treatment costs per case by specialty and hospital costs per case. Then the *excess costs* of teaching hospitals are estimated by subtracting the baseline costs per case from *actual costs* per case in selected teaching hospitals, and making allowance for other factors that would increase costs in any event, such as location of a hospital in London. Explanation of the excess costs is then attempted by reference to factors such as the number of students, junior doctors and academic staff, and medical research expenditure.

The allowance is paid to England's fourteen regional health authorities (RHAs) in proportion to the projected number of clinical undergraduates. The RHAs then allocate the money directly to teaching hospitals through a separately negotiated SIFTR contract.

Substantial reforms took place in the UK's National Health Service in 1991 involving the use of service contracts and increased competition between hospitals. Since then SIFTR's role has become all the more important; teaching hospitals now rely on it to ensure fair competition by reimbursing them for their teaching-related costs. There is some dissatisfaction with the effect on certain hospitals of the current SIFTR formula. The task of refining its methodology has been allocated to a management consultancy, whose report is expected towards the end of 1993.

**USA: Indirect Medical Education (IME) Adjustment**

The US Prospective Payments Assessment Commission (ProPAC) makes annual recommendations on the appropriate indirect medical education (IME) adjustment to be made to teaching hospitals under the state Medicare system. It is intended to take account of higher teaching-related costs arising from more severe or complex illnesses, more intense services and a costlier mix of staff. It is intended that the IME will also cover capital costs eventually.

The basic IME is calculated using regression analysis on factors such as ratio of medical residents to beds; certain adjusted elements of DRG revenue and the number of bed days available. These variables have produced a *payment factor* to be applied to relevant
discharges in teaching hospitals, but there is controversy over the size of this, and at one stage a political decision was taken to double it. This factor has gradually been reduced to nearer its original level.

However, as discussed earlier, there have been refinements of the methods of grouping tests/procedures into DRGs which make them much more sensitive to teaching-related costs. It is possible that, subject to separate payments for research and postgraduate medical education and a more sophisticated adjustment for case complexity, a separate adjustment such as IME will no longer be required in the US Medicare system.