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Microcosting *versus* DRGs in the provision of cost estimates for use in pharmacoeconomic evaluation

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Investigating the pharmacoeconomic impact of any diagnostic or therapeutic intervention in the Irish healthcare setting is currently compromised by the lack of detailed cost data. Consequently, we conducted a number of microcosting studies in the areas of acute myocardial infarction, cardiac failure and HIV, from the hospital perspective. The results of these microcosting studies were compared with the costing estimates assigned to hospital admissions, based on the diagnosis-related group system. Differences ranged from -9 to 66%. It was conducted that the diagnosis related group system is a useful estimate of costs for patient admissions in the absence of detailed cost of illness data. However, supplementary costing studies should be performed for certain therapeutic areas – particularly those where investigation and/or treatment costs are high.

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Many countries, including Ireland are hindered by the lack of the availability of detailed cost of illness data, which poses a problem for pharmacoeconomic analyses relevant to the local healthcare system. In the 1960s, a technically and clinically practical system began to emerge in the form of diagnosis-related groups (DRGs). This system compares resource utilisation across groups of patients with the same principal diagnosis and can be used to provide an estimation of costs per DRG. The national casemix program (of which DRGs are a component) was established in Ireland by the Department of Health and Children in 1991. By 1993, 14 public hospitals had a proportion of their budgets adjusted according to the DRG relative values (RVs) [(1)]. The majority of Irish hospital admissions are now included in the casemix budget adjustment system [(2)].

For hospitals participating in the national casemix project, budget adjustments are based on the complexity of the annual hospital patient caseload [(1,3)]. Currently, it is unusual for an Irish hospital to gain or lose more than 1% of total hospital budget [(3)]. Nonetheless, given that the budget for most of the larger Irish hospitals, exceeds €100 million, this adjustment can be significant [(4)]. From this perspective, validation of the DRG system for the provision of costing data are important.

DRG classifications were originally developed at Yale, CT, USA. There are in excess of 500 DRGs, each of which are representative of groups of patients who are expected to receive similar treatment and consume equivalent hospital resources [(5)]. This system therefore facilitates the estimation of patient costs, for use in pharmacoeconomic analyses. However, it was not designed for this function and checking the accuracy of DRG cost estimates for use in cost-effectiveness studies is therefore essential.

RVs of DRGs are key to providing the costs associated with DRGs. They refer to the relative costliness of one DRG compared with another. For example, in the 1999 casemix model, DRG 143 (hypertension) has a RV of 0.5330, whilst DRG 392 (appendectomy >17 years) has a RV of 2.846. This indicates that according to the

DRG classification system, a hospital stay for hypertension is 4.5 times less costly than a hospital stay for a splenectomy [6]. The monetary value assigned to the average RV (i.e., RV of 1) changes annually and across countries, based on the expenditure data provided to update the casemix model, each year.

In 1999, the average Irish RV corresponded to €2234 for group 1 hospitals (hospitals with teaching commitments) and €1716 for other Irish hospitals (group 2 hospitals) [6]. Using the RVs, an estimate of the resource consequences of each coded patient discharge may be determined by the formula:

DRG cost estimate = average monetary value x RV of DRG

For example, for splenectomy in group 1 Irish hospital in 1999, this would equate to €2242 x 2.846 = €6381.

Expenditure data by speciality is provided to the finance unit of the department of health and children via the speciality cost program. This collates national data from the audited accounts of the hospitals participated in the Casemix program. These costs are divided into the following categories: salaries, drugs, blood products, supplies, laboratory tests, procedure, administration, transportation, laundry, food, maintenance of equipment and depreciation [3]. Cost data are applied to a complex model on an annual basis, due to the increasing expenditure by speciality per year. This casemix model also incorporates Irish activity data collated via the national HIPE (Hospital In Patient Enquiry) database. The HIPE database captures patient: age, sex, principal diagnosis, secondary diagnosis (es), length of stay, procedures performed and discharge status for each patient visit, based on information completed on the discharge summary sheet by the attending physician. This data are collated independently by the Economic & Social Research Institute (ERSI) in Ireland [1,3,5].
A casemix index per hospital is also derived form the above formula and is used to compare activity and costs between hospitals and to determine casemix budget adjustments.

$$\text{Casemix Index} = \frac{\Sigma(\text{Total number of cases per DRGs x RV of the DRG})}{\text{Total number of discharge equivalents}}$$

The costing approach used in this study to validate the DRG costs is termed the 'microcosting' method. It identifies, measures and costs, each individual unit of resource used and is therefore the most detailed and almost certainly, the most accurate costing approach [7].

Aim

The aim of this study was to compare the monetary value of the RVs for the relevant DRGs to mean microcosting estimates performed for acute myocardial infarction, heart failure and HIV patients, from the Irish Hospital perspective.

Method

Patient selection of microcosting studies

'Bottom-up' or microcosting studies were conducted for acute myocardial infarction (AMI) (n = 100), heart failure (n = 30) and HIV disease (n = 69) using patients admitted to an Irish teaching hospital. The cardiac patient cohorts were randomly selected using the HIPE database and focused on patients admitted to hospital

between September 1998 and December 1999, whilst the HIV patients were from consecutive admissions from January to March 2000.

Resource capture

The case records were reviewed for each patient and the following were recorded: demography, risk-factors, referral source, medical cover, length of stay in each ward, diagnostic and treatment procedures performed and medications prescribed during hospital admission.

Application of costs

Drug acquisition costs were derived from a 1999 edition of the Irish Monthly Index of Medical Specialities (MIMS). Procedure and laboratory costs were collected from the relevant hospital directorates and applied, based on the number and types of interventions performed for each patient. Transportation costs for patients who arrived to hospital via ambulance are retrieved from the relevant health boards. Staff costs for consultations, such as speech therapy, physiotherapy, medical social worker and dietician, were based on the number of consultations per patient and were calculated on an hourly rate form average base salary, inclusive of pay-related social insurance (PRSI). Other staff costs included: nursing, medical, pharmacy and domestic staff salaries (inclusive of PRSI) and were allocated per patient on a daily basis, based on the proportion of overall bed occupancy of the individual wards attributable to our cohort of patients. Similar methodology was used for blood products and consumables, which were detailed per ward rather than per patient. Overhead costs (including administration and hotel costs) were assigned to bed occupancy per ward and square footage of each ward as a proportion of total area of the hospital. Average costs per patient were calculated for each of the three therapeutic areas. All costs were converted from Irish Pounds to Euros.

DRG/RV comparison

For our cohort of patients, there was one DRG primarily used for heart failure, four for AMI (three directly associated with AMI and a fourth associated with cardiac procedures used frequently in AMI patients who received angioplasty during their admission for AMI) and two for HIV disease [6]. As a consequence of patient comorbidities, a number of the patients included in the microcosting studies were assigned DRG codes other than those investigated in this study. These patients were excluded when comparing the DRG costs to the microcosts, due to the small patient numbers in theses groups. The 1999 Irish Casemix Model was used to calculate the monetary values for the RVs associated with the DRGs assigned to the patients in question.

Results

The overall mean cost of admission from the microcosting studies was €4481 for AMI (n = 100) [8]. €2725 for CCF (n = 30) [9], and €6861 for HIV disease (n = 69) [10]. When the patients were divided into their assigned DRGs, average microcostings changed somewhat and these results are indicated in TABLE 1. Statistical analysis demonstrated a significant difference ($p < 0.05$) between DRG and microcosting for percutaneous cardiac procedures, uncomplicated AMI, AMI death and HIV with/without other related conditions. There was no significant difference between DRG and microcosting for cardiac failure, complicated AMI and HIV with major related conditions.

Table 1 Comparison of casemix and microcosting per DRG						
DRG no.	**DRG description**	**No. of patients in microcosting cohorts**	**DRG relative value**	**DRG estimated cost (€)[§]**	**Mean microcosting value (€)**	**% Difference**
112	Percutaneous cardiac procedures for AMI	19	1.82	3212	5316	66
121	Complicated AMI	15	1.84	3284	2962	-9
122	Uncomplicated AMI	41	1.41	2488	2776	11
123	AMI – death	14	1.30	2295	3049	33
127	Heart Failure	29	1.26	2224	2160	-3
489	HIV with major related condition	13	2.23	3936	4923	25
490	HIV with/without other related condition	18	1.39	2453	3676	50

[§]The Casemix cost is based on the 1999 Casemix model using the average relative value for group 1 hospitals (€2242) (6). AMI: Acute myocardial infarction.

Discussion

The total estimated expenditure for the Department of Health and Children in Ireland was €5.5 billion in 2000. This represented over 26% of total governmental estimates for supply services, with more resources allocated to the provision of healthcare than any other public supply service. Approximately half of the Department of Health and Children's budget as allocated to hospitals services that year [(11)]. Knowledge of how and where the healthcare budget is consumed is essential before the cost benefits and/or savings of new therapies can be appropriately investigated.

The casemix adjustment in Ireland is budget neutral, which implies that the Department of Health and Children do not gain or lose from casemix adjustments to hospital budgets. Instead, if one hospital within a group looses a proportion of their budget as a result of the casemix adjustment, then another hospital within that group gains this money. Casemix budget adjustments are also calculated retrospectively using the most recently available activity and cost data. In 1999, the adjustment data were based on 1997 costs and activities [(3,6)]. Irish inflation rates were 1.4 and 2.45 for 1997 and 1998 respectively, so it could be expected that DRG estimated costs would be lower than actual expenditure for a given year [(101)]. However, if RV estimates were exact, we would expect that estimations would be consistently lower than microcostings across all DRGs. If this were the case, it would not matter that the expenditure and activity data were 2 years out of data in terms of budget adjustments, as each DRG would be relative to each other and resulting budget adjustments between hospitals fair. We found differences in the range of -9 to +66% (-12 to +59% when inflation was added to the casemix costs). This indicates that whilst RVs may be good estimates for some DRGs compared with the microcosting studies, they differ substantially for others.

Heart failure accounts for approximately 1-2% of total healthcare budgets and was therefore one of the illnesses microcosted [9]. In 1999, HIPE statistics indicated that there were 5655 admissions to our public hospitals with a primary diagnosis of heart failure and further 15,000 with this condition as a comorbidity [2]. There was only 35 differences between the microcosts and DRG costs for this diagnosis [6,9]. Hence, the DRG system is a good estimate for cost of treating heart failure in the Irish setting, when compared to microcosts.

AMI was the largest single cause of death in Ireland in 1999 (almost 14% of all deaths) [12], with over 6000 hospital admissions related to this condition [2]. The numbers of patients receiving expensive primary interventions, such as percutaneous transluminal coronary angioplasty, used frequently in AMI patients has increased in recent years [8,13]. The lag period between receiving activity and cost data for the casemix program might explain in part why the microcosting determination was 66% higher than the RV estimation for such cases. These procedures are only performed in specialized hospitals and this underestimate would have implications for the annual budget adjustment. It is important for hospitals to be aware of such differences.

A similar study in France indicated a 3, 29 and 21% underestimate for uncomplicated AMI, complicated AMI and AMI resulting in death, respectively. The French authors concluded that although the differences between the current cost of treating AMI and the reimbursement schedule were not large, close monitoring of costs associated with this cohort of patients is necessary particularly in view of the rapid technological changes for the treatment of AMI [14].

The third area we focused on was HIV, whose management has changed markedly since the adoption of highly active antiretroviral therapy (HAART) as standard of care in 1996. HAART has been associated with an unprecedented improvement in HIV-associated morbidity and mortality but it is associated with high drug acquisition cost and therefore has contributed to increased expenditure on pharmaceuticals as a constituent of the cost of in patient care. The greater proportion of cost is attributed to pharmaceuticals for HIV-related DRGs and the recent availability of more expensive, albeit more effective, agents may explain the disparity observed between the estimated and measured cost of HIV-related admissions [10].

Expert opinion

Ideally, systems that provide detailed and accurate cost data on an individual patient basis, are required to give a true picture of the difference in patient complexity and associated costs between hospitals. Currently, this is not feasible in Ireland and RVs associated with the DRG system may be a useful alterative. Many European countries are now using the DRG system as a framework within which hospital costs may be determined for use in cost-effectiveness studies, but the accuracy of DRG cost estimates is largely unknown [15].

It is appreciated that the numbers involved in our microcosting studies are small. However, from the data presented here, it is apparent that application of the casemix project in Ireland provides relevant estimated costs for conditions, such as congestive cardiac failure, where drug treatment and associated costs has remained relatively constant in recent years. However, the reliability of DRG estimates for conditions where diagnostic or treatment intervention costs are high and evolving (e.g., MI and HIV) is not as good. In this setting, support with up-to-date microcosting studies is

advised, particularly if the data are to be utilized in cost-effectiveness evaluation of therapies.

Five-year view

Increases in expenditure on medicines above the level of increases in healthcare generally are a feature of most western health systems. The indications are the significant growth in pharmaceutical expenditure will continue and many governments are now requesting pharmacoeconomic assessment of new high cost products. Therefore, an increasing requirement for good cost data are likely. The availability of DRG cost estimates facilitates their use in pharmacoeconomic evaluation however these may not always be an accurate reflection of resource use particularly in therapeutic areas with high procedure/intervention costs and/or significant drug acquisition costs. Recent developments including procedures, such as coronary artery stenting and the increasing use of high cost drugs e.g., statins will render DRG cost estimates less useful for pharmacoeconomic evaluation in the future.

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Key issues

- Many countries, including Ireland, are hindered by the paucity of detailed cost of illness data for pharmacoeconomic analysis. In the 1960s a system comparing resource utilization across groups of patients with the same principal diagnosis was developed, i.e., diagnostic related groups (DRG). In the absence of reliable cost data for pharmacoeconomic evaluation, DRG costs have been used however the accuracy of this approach has been questioned. Microcosting, where each component of resource use is estimated and a unit cost determined for each, is regarded as one of the most precise costing methods. In this study, we compared DRG and microcosting data for three therapeutic areas, i.e., heart failure, myocardial infarction and HIV.

- The cost estimates were similar for patients with heart failure, however, they differed significantly for patients with myocardial infarction and HIV where DRG costs underestimated resource utilisation.

- It is apparent the DRG estimates for conditions with high cost diagnostic or treatment interventions (myocardial infarction and HIV) are less reliable and supplementary costing studies should be considered.

References

Papers of special note have been highlighted as:

- • Of interest
- •• Of considerable interest

1. Wiley M. Budgeting for acute hospital services in Ireland: the case-mix adjustment.
   J. Irish Colleges Physicians and Surgeons 24, 283-290 (1995).

   •A good review of the casemix adjustment in the Irish healthcare context.

2. Economic & Social Research Institute in Ireland. Hospital in-patient enquiry file.
   ESRI (1999).

3. Casemix Unit. *Casemix Measurement in Irish Hospitals: A Guide to the Main Features.* Department of Health and Children, Dublin, Ireland 1-25 (2001).

4. Irish Healthboards. Personal correspondence with eight Irish healthboards regarding annual hospital budgets (2001).

5. Wiley M, Fetter R, Measuring Activity and Costs in Irish Hospitals: a study of Hospital Casemix. General Research Series Paper No. 147, ERSI 1-125 (1990).

6. Casemix Unit. Casemix Model: Department of Health and Children in Ireland (1999).

7. Jacobs P, Roos N. Standard Cost Lists for Healthcare in Canada. Pharmacoeconomics 15, 551-560 (1990).

8. Heerey A, McGowan B, Ryan M, Walsh M, Feely J, Barry M. Cost of treating acute myocardial infarction in an Irish teaching hospital.
   IMJ 94, 144-146 (2001).

9. McGowan B, Heerey A, Ryan M, Barry M. Cost of treating Heart Failure in Ireland.
   IJMS 4, 241-244 (2001).

10. Ryan M. The impact of Highly Active Antiretroviral Therapy on the Pharmacoeconomics and Pharmacoepidemiology of HIV disease in Ireland. Pharmacology and Therapeutics, University of Dublin, Dublin, Ireland (2001).

11. Department of Finance in Ireland. Revised Estimates for Public Services 158-160 (2000).

12. Irish Central Statistics Office. Vital statistics, fourth quarter and yearly summary. Compiled by the Irish Central Statistics Office on behalf of the Department of Health and Children 1-112 (1999).

13. Irish Department of Health and Children. Public Health Information System Version 4: Information Management Unit – Department of Health

and Children (2000).

14. Montagne O, Chaix C, Harf A et al. Costs for acute myocardial infarction in a tertiary care centre and nationwide in France. Pharmacoeconomics 17, 603-609 (2000).
•Provides a good insight into the use of DRGs in the setting of acute myocardial infarction in France.

15. Le Penn C, Berdeux G. Diagnosis related group costs in a regulated environment. Pharmacoeconomics 17, 115-120 (2000).
•Good discussion of the limitations and possible biases when using DRG's for economic studies

Website

www.cso.ie (2201).
Irish Central Statistics Office. Consumer Price Indexes (1992-2000)