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**COMPARABILITY OF COSTING ACROSS COUNTRIES: ECONOMISTS  
HUNTING THE SNARK THROUGHOUT EUROPE**

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**Abstract**

As the emphasis on multi-centre research continues, several issues are emerging which require attention. One such issue is that of attempting to cost health care services in different countries on a comparable basis. As it is often not possible to cost on a patient basis, there is the need to rely on available data. This leads to the necessity to identify costing approaches that can provide as much comparison as possible.

This paper presents the preliminary findings of a costing experiment to compare two different costing approaches. These approaches are used in a cost-effectiveness study of dialysis therapy for end stage renal disease, involving ten renal centres across Europe. The paper considers whether there is the potential to devise standardised costing methods, specifically for cross-country costing. It is anticipated that this paper will provide a useful insight for other researchers embarking on costing studies across countries, with a need to do so on a comparable basis.

**Work in progress. Please do not quote without permission**

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## Explanatory Note

Lewis Carroll's epic poem 'The Hunting of the Snark' has been said to describe "the impossible voyage of an improbable crew to find an inconceivable creature". Those of us engaged in the task of establishing comparable health service costs across a variety of settings, including different countries, may find this an apt comparison.

### 1. Introduction

"Just the place for a Snark! I have said it thrice:  
What I tell you three times is true."

In recent years there has been increasing interest in international comparisons of health care systems, despite these being notoriously difficult to carry out and interpret<sup>1</sup>. This trend appears to reflect two main factors. Firstly, the information that such comparisons provide can inform policy development within each country, and secondly, trials of new treatments are increasingly carried out on a multi-national basis. As the emphasis on multi-centre research continues, several issues are emerging which require attention. One such issue is that of attempting to cost health care services in different countries on a comparable basis. While the clinical aspects of trials have been conducted on a multi-national basis for some time, the collection of economic data on a multi-national basis is a more recent development<sup>2,3</sup>.

This paper presents some preliminary findings of a costing study, which is part of a project concerned with the cost-effectiveness of dialysis therapy for end stage renal disease (ESRD) across Europe. Although, as is often the case, it would be more accurately described as costs *and* effectiveness. The paper is very much a think piece, highlighting areas of interest and discussion rather than presenting actual cost figures. The context of the project itself is something of a hybrid, in that it combines aspects of comparing health care systems with an investigation of a specific therapeutic area. The research is comparing two dialysis modalities, hospital haemodialysis (HD) and peritoneal dialysis (PD), and is part of a BIOMED 2 project involving ten renal centres across Europe. The centres are based in Scotland (two centres), France, The Netherlands, Hungary, Russia, Estonia, Greece (two centres) and Albania. The study has not been designed as a clinical trial and is largely concerned with attempting to

identify differences between the centres. These differences are in terms of clinical policy or health care system issues that may impact on either costs or outcomes or both.

The overall objective of the project is to assess the potential to improve the quality of care for patients with ESRD within existing budgetary constraints. The aims of the economic component of the study are:

- to compare the nature of volume and costs of the resources devoted to the provision of chronic dialysis treatment in different centres;
- to establish how the resources are used in the context of the financing and planning systems of a particular country;
- to quantify the relationship of the resources and costs with the patient outcomes;
- to model longer-term scenarios for costs, outcomes and cost effectiveness of service provision for ESRD.

The aim of this paper is three-fold. Firstly, to describe the two different costing methods we have employed within the study. Secondly, to examine the costing, in terms of the issues relating to the two costing approaches. Thirdly, to examine the issues relating to cross centre and cross country comparisons. Finally, to consider whether there is an ideal way to cost across countries and whether such studies have the potential to create policy changes. As such the paper will be structured as followed. The next section will provide background information on ESRD itself and the alternative treatment modalities. Section three will describe the costing methodology. Section four will describe some preliminary results, before the discussion and conclusions in Section five.

## **2. End Stage Renal Disease (ESRD) and EURODICE**

“They sought it with thimbles, they sought it with care;  
They pursued it with forks and hope;”

ESRD is a chronic condition and individuals are said to have ESRD when they have an irreversible loss of kidney function. The condition requires expensive lifelong high-technology care, with the treatment seen as highly effective, as untreated patients will certainly die. The only way to keep these individuals alive is by renal replacement therapy, of which there are two types, dialysis and transplantation. Although transplantation is usually the favoured option, the number of donor kidneys is limited. This results in many patients requiring long-term and often life-long dialysis.<sup>4</sup>

Dialysis itself removes fluid, electrolytes and toxins, which the failed kidney is unable to excrete. It allows the buffering of the blood with alkali and so corrects the natural tendency to acidity of the renally impaired patient's body. There are two key modes of dialysis for patients with ESRD, haemodialysis (HD) and peritoneal dialysis (PD). HD is carried out through the use of a machine, which essentially draws out the patient's blood, filters it and then replaces it back into the body. The process usually takes around four hours and is carried out three times per week. This procedure requires the patient to have permanent easy access to the circulation, usually obtained by creating an arterio-venous fistula in the arm. For PD, the human peritoneal membrane is semi-permeable and hence can be used as a dialysis membrane. Dialysate is left in the peritoneal cavity for 6-8 hours allowing equilibration and then drained out and fresh dialysate instilled. This procedure requires a permanent catheter to be inserted into the abdomen. PD can be carried out by the patient themselves at home and does not require a machine<sup>4</sup>. Four exchanges of fluid are required each day.

EURODICE is funded by the EC and is a BIOMED 2 project. The precursor to the project, BIOMED 1, found that survival in 1407 patients with ESRD was significantly influenced by co-morbid illness. Furthermore, it showed for the first time in Europe, that even after adjusting for comorbidity and age there were significant differences in patient survival among the centres<sup>4</sup>. It was unclear whether differences in outcome were associated with the amount of resources invested or the way in which resources were actually used. In the absence of data from randomised trials it was therefore important to evaluate this by comparing outcome, case mix and cost in the different centres. This is essentially the role of EURODICE.

### 3. Costing methodology

“Taking Three as the subject to reason about –  
 A convenient number to state –  
 We add Seven, and Ten, and then multiply out  
 By One Thousand diminished by Eight.

The result we proceed to divide, as you see,  
 By Nine Hundred and Ninety and Two:  
 Then subtract Seventeen, and the answer must be  
 Exactly and perfectly true.”

It is well known that there are considerable difficulties in conducting costing studies across centres, whether these are in the same country<sup>5</sup> or across countries<sup>6</sup>. The concern in most studies is to eliminate, or control for, potential sources of bias due to centre effects rather than treatment effects. However, in the current study the centre effects are of interest and the costing study will attempt to relate cost differences to factors such as:

- differences in clinical policy;
- differences in volume of resources;
- differences in quality of resources;
- differences in mix of inputs.

These are areas where the practice in each centre may impact on both costs and outcomes. The study aims to identify such issues for further investigation.

Additional factors to be taken into account in producing comparable figures for various centres are the differences in what the renal budget covers and differences in relative prices.

The main objective of the costing is to calculate, for each centre, a cost per HD and a cost per PD week. Individual patient costing is not feasible in this study, although data is being collected on complications, procedures and hospital admissions. For the basic dialysis costs, the approach which has been adopted is to cost the activity in two ways; by identifying all the resources directly employed in each session (HD) or week (PD) (bottom up costing) and by separating out the relevant costs from hospital or unit

annual budgets (top down budgeting). It will be necessary to isolate the costs for the two modalities from the entire renal budget and from each other. Hence, dialysis for acute renal failure and renal transplantation will also be estimated in order for these costs to be taken away from the total. Each unit will provide data on the frequency of use of equipment and facilities, and the number of dialysis sessions over a 12-month period.

The costing for the EURODICE study is experimental in the sense that the two approaches are being carried out independently, rather than being combined. The intention here is to attempt to compare the process of the two approaches as well as the results. The costing for both approaches is carried out through detailed costing questionnaires, site visits to the renal centres, and plenary meetings.

### **3.2. Top-down approach**

The aim of the top-down budgeting process is to identify, on a comparable basis, the sources of funding for renal services and what is covered by such funding. This information is largely derived from the accounts of the renal unit and any other relevant sources. The top-down costing questionnaire, which is sent to each centre, is in the form of statements, which the respondents are asked to check, and specific questions. The statements are based on information derived from previous EURODICE plenary meetings and appropriate literature. The respondents are asked to: describe the process of budget allocation to the renal unit; describe the coverage of the renal budget; discuss whether the budget has to be competed for with other departments; specify whether the contract or budget identifies separate amounts for HD and PD; whether these are on an actual cost basis, or are they allocated from a larger budget; what is included as direct and indirect costs; identify any element of hospital overheads and to describe any allocation methods used to estimate costs.

When the costing questionnaire has been completed, it is then a matter of checking the information and clarifying any areas of uncertainty on the site visits. On the actual site visits, meetings are being held with a main contact person in the finance department of the hospital, who is responsible for the renal service accounts. This enables us to confirm information received via the costing questionnaire and to attain

information about any costs which fall into the hospital budget. The process is largely a case of attempting to disentangle the renal budget.

### **3.3. Bottom-up approach**

The aim of the bottom-up (ward level) approach is to obtain detailed information at the level where the dialysis actually takes place. The bottom-up questionnaire needs to be completed by staff working on the ward (clinician, nurse or administrator). The focus of the bottom-up approach is to identify very specific items of resource use for a typical dialysis session and build this up to an entire session. A template of the categories of resource use and specific items likely to be used is provided in the questionnaire.

*Capital:* With regard to building costs, we were undecided as to what strategy to adopt. Therefore, we have used for the centres costed so far the method we used for our first centre, Aberdeen. This was to establish the size of the renal unit's floor space (m<sup>2</sup>) and apply a unit cost from Aberdeen as a basis. An equivalent annual cost calculation is performed, at a 6% discount rate, over a 50-year life span. Equipment items largely pertain to the cost of the dialysis machines. As it may be extremely difficult to locate the costs of machines in some centres, particularly where machines have been donated, a replacement cost has been calculated based on current costs, obtained from manufacturers. This has the potential of being more comparable than actual costs, which could have been based on bulk purchases and discounts given. Again an equivalent annual cost calculation is performed at a 6% discount rate, this time over a 10-year life span. Other items of equipment include water sterilisation systems, anticoagulation monitors and computers. It is intended to use and compare other approaches to costing capital as the study develops.

*Consumables:* Consumables have been costed by identifying each specific item used for a haemodialysis session and PD week. These are largely dialysis fluids, drugs, needles and syringes etc. Once the items have been identified a local unit cost has been applied, with the intention being to vary this in the sensitivity analysis.

*Staff:* To calculate staff costs, staff grades are first recorded and the proportion of time spent on HD and PD is then allocated. Due to potential difficulties in accurately

identifying staff time, time allocation questionnaires were designed. Three approaches were piloted in Aberdeen: predicted time allocation; actual time allocation and observer time allocation. The predicted time allocation was chosen as the method to use in the other centres, as it compared favourably with the actual time allocation. The observer time allocation was slightly different, but was perceived as too resource intensive to carry out in all the centres.

*Overheads:* Overheads have been estimated by using the bills from the dialysis units where available. If they are not available, then it has been necessary to include some element of top-down information.

### **3.4. Further costs**

As part of dialysis (both HD and PD) a number of surgical procedures are performed. The main procedures are those performed to provide access. Not only are there various ways in which these procedures are performed, but the costs (and consequences) may differ according to the patients risk group and also the number of re-treatments required. In addition, such access once created may 'fail' and have to be repeated. Therefore, we have attempted to identify the costs and consequences of the initial and if necessary, further surgical procedures. The frequency of complications is derived from the clinical data collected for the study.

### **3.5. Presenting the costs on a comparable basis**

The data from the costing could be presented by inflating all values to a common year and changing all costs to a common currency (maybe £'s or \$'s and ECU's), or a real exchange rate could be used. However, the most likely option will be to calculate a purchasing power parity (PPP) exchange rate which can be obtained for the relevant countries and all relevant time periods.

Results from the costing will be added to the assessment of treatment modality outcomes, quality of life data (Euroqol and SF36) and analysed by operational research methods. A Markov chain will be used to combine data from BIOMED 1 and 2, plus additional data from national renal registries, and the literature. These data will be used to examine different practices in the dialysis centres and



subsequently forecast the consequences of the different ways of organising services at a national level. The model will take into account case-mix using the various risk groups and will allow the analysis of the consequences of different patient mix. The Markov chain model will forecast the development of patient numbers, costs and clinical outcomes and quality of life data for 5-year scenarios. The financing and administrative information on each country will then be used to interpret the results of the operational modelling.

#### **4. Preliminary findings**

“For the Snark’s a peculiar creature, that won’t  
Be caught in a commonplace way.  
Do all that you know, and try all that you don’t:  
Not a chance must be wasted today!”

To date the centres that have been costed are the two Scottish centres, in Aberdeen and Dundee, Nijmegen (The Netherlands), Tallinn (Estonia) and St Petersburg (Russia). The next section discusses some of the issues relating to the comparison of top-down and bottom-up and those relating to cross country/cross centre comparisons.

##### **4.1. Issues relating to the comparison of top-down and bottom-up**

###### *4.1.1. Availability of information*

The availability of information has so far been variable. Overall, information acquired using the bottom-up approach has probably been more comparable. This is largely because the information is derived from our specific requests. Alternatively, the top-down approach has proved more problematic. In Nijmegen for instance, there were very detailed accounts held from the entire renal unit and the dialysis unit. However, this level of detail made the task complicated. In Aberdeen and Dundee, there was top-down information available, but it had to be acquired from various sources. This is mainly as a result of the information we required not necessarily being held for the purpose we required it for. The account held for the entire renal budget holds information which was not easily broken down to the ward level. Further, at the ward level, there is no separation between HD and PD, which made it necessary to try and tease the information out. In Tallinn, there was very little information at the finance

level. While the accounts process is fairly simple, we were able to obtain all the information needed. As complex accounting methods had not been used in Tallinn, it was relatively simple to use the information we were given, without the need for considerable follow-up questions, with respect to how costs had been calculated locally.

#### *4.1.2. Comparability of information across countries*

To date it is too early in the project to provide an overall picture of the comparability of the costing across the different countries. However, it is possible to say something about the costs we have obtained from the centres so far. The information we have been able to obtain has been sparse in some areas, yet abundant in others. Consumables in particular are fairly easy to compare. This is partly due to the items used being quite discrete and well defined. It is also due to dialysis having only a handful of private suppliers for consumables, who provide detailed lists of items and their costs for the centres.

As might be expected, the bottom up process is more likely to provide comparable information across centres as it is being collected using the same structured format in each centre.

#### *4.1.3. Different approaches to particular costs*

This section highlights some of the main differences that we have observed in resource use.

##### *Capital*

With respect to the top-down approach, capital expenditure in all the centres is based on annual outlays only. Alternatively, the bottom-up approach has provided information on the stock of capital, from sources such as assets registers. Further, in Tallinn and St Petersburg, the dialysis machines have been donated. The dates of donation are known, but not the year of purchase or price. This raises the question of how to deal with machines that are charitable donations. Do you use a replacement cost for the machines, based on the current price of the machine, or do you use a zero cost for the centre. They are a cost somewhere, but not in the health care system being examined. Clearly, the top down approach would not identify such costs, although the bottom-up might.

### *Overheads*

For the bottom-up costing of the Scottish and Dutch centres, a common approach to costing overheads has been adopted. The cost for the overheads of the entire hospital is identified and then allocated by the proportion of the total floor space of the hospital that is occupied by the dialysis area. This is then allocated between HD and PD and by the level of activity (number of dialysis sessions/PD weeks per year). However, in Tallinn a different approach has been adopted so far, based on the technique used by their accountant. The approach is calculated using salaries. The proportion of salaries the dialysis unit uses relative to the entire hospital budget spent on salaries, is used as a basis for calculating overheads. Therefore, if the dialysis unit uses 5% of the overall hospital budget on salaries, then 5% of the hospital overheads are attributed to the unit. The methods of allocating overheads in the top down approach are far from clear. In some centres, it appears that allocating to clinical areas is never undertaken. Where it is undertaken, the methods can be fairly ad hoc. The top down budgets may or may not allocate overheads to the renal unit. St Petersburg, is so far the only centre that does so.

#### *4.1.4. Identification of volume and mix*

Top-down budgets will generally only provide the total spend under specific headings. The bottom-up costing approach allows for a separation between the volume of resources employed and the unit cost. This will be an essential element both in explaining cost differences between centres and in allowing comparisons to be made on a comparable basis.

With respect to staffing, in Scotland there were differences in the salaries between the two centres, due to one centre having a different skill mix resulting in slightly higher salaries. The most marked difference in salaries, however, was between countries. For example, the salary of a consultant nephrologist in Scotland is over ten times that of the equivalent personnel in Tallinn. Further, nursing salaries for the same centre are around one seventh of the Scottish centres. This is likely to have a significant impact, even when adjusted for living standards, because hospital staff are paid low wages compared with other professions in the economy. Whilst top down budgets would identify differences in total salary costs, there may not be sufficient information in all budget systems to identify the source.

With respect to consumables, an interesting difference between the Scottish centres is that the price Dundee pay for their PD fluids, is substantially less than Aberdeen (£3.65, compared to £5.81). As four fluid bags are used per day, seven days per week, this creates a significant difference in the final cost.

## **4.2. Issues relating to cross country / cross centre comparisons**

### *4.2.1 Coverage*

With regard to the coverage of the respective renal budgets, there were some interesting findings. Firstly, while what is included as direct costs, that is, staffing, drugs, dressings, instruments etc, were quite similar in the five centres we have costed so far, the coverage of indirect costs is not so easily identifiable. While the renal budget for most of the centres does not cover indirect costs such as cleaning, heating, power and light, building repairs and maintenance and administration, laundry, porters etc, the renal budget in St Petersburg does cover such costs. Secondly, the centres all use different combinations of prospective and retrospective budget setting.

### *4.2.2. Relative prices*

There were interesting findings with respect to the relative prices of some of the items of resource use. For example, staff costs in Tallinn were very low in comparison to consumable costs. This is a reflection of the low salaries in this centre. It is also a reflection of the consumable costs being very similar to the centres in Western Europe.

### *4.2.3. Cost differences relating to centre treatment policies.*

A crucial part of the costing has been to obtain extensive information on the treatment policies of the centres. Some of these policy differences are unlikely to have a significant impact on the costing while other have the potential to make a substantial impact. To date, five treatment policies have been identified as being potentially important for the costing and possibly the clinical outcomes.

Firstly, Dundee re-uses its dialysers (artificial kidneys), rather than disposing of them after each dialysis session. They are cleaned with a dedicated machine and used again

between 12-20 times. This implies additional costs for staff, in that it requires someone to clean the dialysers after every dialysis session.

Secondly, the policy towards administering iron to dialysis patients also differs between centres. Aberdeen administers IV iron far less frequently than Dundee and Nijmegen, for example.

Thirdly, the number of dialysis sessions per week is similar for most of the centres. Usually there are four hour sessions, three times per week. Tallinn, however, has almost 50% of its patients having only two sessions per week. This is more in line with policy in some areas of the United States. When the clinical information is all collected, specifically on complication rates, we will be able to see whether any cost savings were made by having less dialysis sessions, or were additional costs incurred due to a higher level of complications, possibly as a result of less dialysis sessions. We will also be able to compare quality of life information for different policies.

Fourthly, an obvious difference between the centres has been in the skill mix of staff in the dialysis units. In Tallinn for instance, one consultant carries out all the clinical tasks, also doing a large share of the administrative tasks. Nijmegen, on the other hand, has a senior nurse responsible for much of the administrative work. Aberdeen and Dundee are similar in that they both employ a full time renal administrator.

Finally, one very 'hot topic' in dialysis at the moment is that of patient transport, specifically how it is paid for. While the intention of this project was not to examine societal costs, we thought it useful to attempt to cost transport as it is currently a largely debated issue. The policy in the Scottish centres is similar, in that a patient transport ambulance collects the patient from home and takes them to the dialysis unit, via the homes of other (not necessarily dialysis) patients. However, in Nijmegen, the policy is that all patients take a taxi to and from the dialysis unit, irrespective of the distance between the patient's home and the unit. The majority of this cost is met by the health insurance companies, with the patient often only paying 10% of the cost. This suggests that if transport is included in the final cost for a dialysis session, centres such as Nijmegen that use taxis will appear to have higher costs. Alternatively, the use of ambulance transport results in the patients often waiting long periods of time,

which arguably could influence their quality of life. Transport costs are also an important component in the difference in social costs between HD and PD.

## 5. Discussion and conclusions

*“But oh, beamish nephew, beware of the day,  
If your Snark be a Boojum! For then  
You will softly and suddenly vanish away,  
And never be met with again!”*

*“For the Snark was a Boojum, you see.”*

This paper has presented some preliminary findings of the costing part of a project examining the cost-effectiveness of renal replacement therapy across Europe. The costing in the project can best be described as exploratory rather than explanatory. Two different methods have been adopted and compared. The different approaches have provided different, but interesting answers. Several problems have emerged which are common for any costing, such as availability and level of detail. Others however, are specific to the design of the project. For instance, we might have been able to produce more detailed costs at the patient level, if the study had been set up to include this. Further, while we are collecting patient transport costs, costs to society have generally not been included, due to the design of the study and resource constraints.

The costing approaches developed in this study have been pragmatic and designed to maximise the amount of comparable data that can be collected from centres with different budget systems and with which direct contact time is limited. Given the multiple objectives of the study, it is not sufficient to measure the cost differences, but the data must also be examined for potential explanations of the cost differences. These must be attributed, where possible, to real differences in the nature of the resources employed or to the effects of differential pricing.

The source of differences in price may pose some challenges in disentangling economic costs from the price data. The issue of purchasing power parity rather than exchange rates for converting prices to a common base has been referred to above. Differences in rates of remuneration for staff require consideration of whether or not

these reflect “quality” differences, in the sense that different grades or types of staff are employed for the same task. The wider study is collecting information that should allow staff grades to be compared across different countries. The question to be addressed will then be whether or not differences in skill mix appear to be reflected in better outcomes.

A further issue arises from the policy of companies offering discounts of various kinds, sometimes in exchange for a centre using supplies from only one company. On the face of it, the ability to offer generous discounts, might suggest that the quoted prices are above the economic cost of the goods being supplied. However, it is also possible that cross-subsidisation is taking place either between products or between centres.

The results of the costing study will also be incorporated into a Markov Model, alongside clinical data and quality of life data. It is hoped that the results of the costing part of the study will assist other researchers embarking on costing studies across countries, with a need to do so on a comparable basis. However, it is possible that potential difficulties could await us, as a result of methods we have adopted for the costing.

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