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CAN WE DO BETTER THAN AVERAGE?

AN EMPIRICAL APPLICATION OF CENTRE SPECIFIC VERSUS AVERAGED UNIT COSTING

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1. Introduction

Economic evaluations are increasingly conducted on a multicentre basis, particularly alongside large international trials [1-2]. The costing components of such studies have faced challenges regarding the collection and analysis of data, with particular advances been made towards handling missing unit cost data and improving the transferability of analysed data between settings [3-4]. However, less agreement has been reached over whether unit cost data should be collected at a centre specific level or from a perspective of a single centre (standardized) and then applied to resource use. In some cases, both approaches can produce similar results; therefore the approach adopted is not so important. However, if the production functions vary across health care technologies, the choice of unit cost approach becomes important [5].

2. Alternative unit cost approaches

In this paper we are concentrating specifically on the issue of costing, where there are no standard methods for estimating costs alongside multinational studies. Our review of the literature (see later) highlights that some researchers use a multinational approach where country-specific unit costs are assigned to country-specific resource use for every patients in all countries (centre specific), while others tend to apply one country's unit cost estimates to country-specific resource use data for every patients across all countries in the study (standardised). A limited number of authors have produced commentaries papers on issues concerning economic analyses conducted alongside multinational studies, and have given their views on the issue of costing [1, 6-7]. Reed et al. (2003) discuss the pros and cons of the two types of approaches, they

propose that if stochastic data is used then there is a need to maintain the patient level relationship between the relative unit costs and resource utilisation thereby proposing the use of the country-specific approach, however one disadvantage of a multicountry approach using country-specific unit costs and attaching them to country-specific resource use is that it could obscure differences in resource utilisation, they also point out that practical constraints exist in collecting country-specific unit cost estimates. Further, they highlight that the use of a single-centre (standardised) costing approach may lead to biased results due to obvious differences in the costs of healthcare services and substitution effects due to differential costs of resources within countries, and also warn that there are issues in the selection process as to which country's unit costs are employed when using single-centre unit costs in that it could have significant impact on the final results.

Although none of the commentary papers have explored the issue using empirical data, one paper has used a simulation exercise to explore the issue of whether to use centre-specific or standardised unit costs. This study examined a pre-specified production relationship between the different volumes of resource use, and simulating changes in unit costs. The authors compared the collection of unit costs using first a standardised unit cost approach and then a centre specific approach and found that the two methods resulted in statistically different estimates of average treatment costs. This finding held, regardless of the degree of substitutability between the resource volumes, and only differed when considerable uncertainty surrounded treatment centre responses to relative changes in unit costs [5].

The aim of our paper is to examine *empirically* the use of the two main approaches to unit costing for use in multinational economic evaluations. The next section describes a literature review, conducted to examine how published studies have collected and reported resource use and unit costing. Section three reports the alternative methods for this empirical investigation, where centre specific and then standard unit costs are applied to resource use from a European comparison of dialysis therapy for end-stage renal disease (ESRD). The results of these different approaches are then presented and a discussion of the findings and suggestions for future research are finally provided.

3. Methods

Literature review

We conducted a literature review that focused on economic evaluations based on multinational clinical studies published between 1996 and 2003. The search strategy encompassed a MEDLINE and NHSEED search. The initial MEDLINE search was based on the keywords 'multinational' or 'multicountry'(1), 'economic evaluation'(2), 'cost-effectiveness'(3), 'cost-utility'(4). The keywords used to search the NHSEED database were 'multinational' or 'multicountry' in all fields for all economic evaluations.

4. Results from the literature review

For the MEDLINE search combining searches (1) and (2) resulted in 22 manuscripts being identified, (1) and (3) resulted in 29 manuscripts and (1) and (3) resulted in 4 manuscripts. Once the duplicates and non-relevant articles (based on reading the abstract) had been removed, a total of 22 papers were identified. Forty-two papers

were identified in the NHSEED search, of which 20 were applicable for our requirements (after the removal of 14 non-relevant papers and 8 duplicates with the MEDLINE search). The search therefore resulted in a total of 42 manuscripts requiring appraisal. Further reading of the full papers resulted in the elimination of 12 of these papers due to the studies not being performed on a multinational basis, being a proposed study methods paper or not presenting resource use or cost results. Two of the publications (Schulman 1996a, 1996b) related to the same study. Therefore our appraisal is based on 29 separate studies. Whilst this search was not a comprehensive, for the purpose of this particular paper we believed it to be adequate in that it identified papers from which we can draw some conclusions about resource use and costing methods undertaken in multinational settings.

Table 1. Resource use and unit costing methods in multinational economic evcaluations

Author	Countries (original effectiveness data)	Resource use	Unit costs	Currency
Ament (2000)	Belgium, France, Scotland, Spain, Sweden	All countries	All countries	NCU converted to ECUs using exchange rates
Annemans (1999)	4 countries: Netherlands, France, Spain, Belgium	Based on patients from the Netherlands	All countries	Converted using exchange rates to US$
Caro (2001)	Not specified	All countries	Canadian costs applied to all	Can $
Chevat (2001)	Australia, Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland, UK	All countries	All countries	Converted to US$ using PPPs
Dasbach (1999)	Europe, S.America and US	All countries	US Medicare payments applied to all	US $

De Lissovoy (2000)	Europe, US, Australia and Israel	All countries	US costs applied to all	US $
Doyle (2001)	10 countries Germany, Italy. Netherlands, Poland, Spain, Sweden, Switzerland, UK, US, Venezuala	All countries	All countries (only report key cost drivers)	NCU use exchange rates to convert to US $
Drummond (2003)	10 countries: Germany, Greece, Israel, S Africa, France, UK, Switzerland, Spain, Belgium, Russia.	All countries	French and German unit costs applied to all	Ffr and GM converted to Euros using exchange rates
Erhardt (1997)	14 countries	Swedish patients	Swedish costs applied to Swedish patients	SEK converted to US $ using exchange rates
Glick (1998)	9 European countries, Australia and New Zealand	All countries	Unit costs for 6/11 countries (84% of patient population)	US $
Griffin (2001)	Not specified	All countries	UK costs applied to all	UK£
Grant (1997)	13 countries	All countries	US costs applied to all	US $
Groener (1999)	Not specified	All countries	Dutch costs applied to all	Dutch Kroner converted to US $ using exchange rates.
Hansson (1998)	Sweden, Denmark, UK, Netherlands	All countries	Subsample of costs from Sweden and Denmark applied to all	US $ using PPPs
Herman (2003)	Not specified	All countries	US costs applied to all	US $
Hillner (2000a)	Not specified	All countries	US costs applied to all	US $
Hillner (2000b)	Europe and Australia	All countries	All countries	Converted to US $ using exchange rates
Keown (2001)	Canada, UK, Germany, France, Belgium, Switzerland, Norway	All countries	Applied published costs from Canadian studies to all	Can $

Legendre (2000)	11 European countries and US	All countries	French costs applied to all	Ffr
Menzin (1996)	US	US trial	France, Germany, Italy and UK	NCU converted to US $ using PPPs
Schulman (1996a, 1996b)	12 European countries, US and Canada	All countries	1 US hospital centre applied to all	US $
Schulman (1998)	15 countries	7/15: Australia, France, Germany, UK, Italy, Spain, Sweden	All 7 countries	Exchange rates to convert to US $
Sculpher (2000)	19 countries	All countries	English costs applied to all	UK £
Shear (1998)	Austria, Germany, Switzerland	All countries	All countries	NCU
Smith (1999)	4 countries: Belgium, France, Netherlands and UK	All countries	All countries, (1 centre had more 'in-depth' cost analysis)	NCU converted to US $ using exchange rates
Stalhammer (1999)	UK, Ireland, Germany, France, Italy, Spain	All countries	All countries	NCU converted to US $ using exchange rates
Tunis (1999)	UK, US, Canada	US patients	US costs applied to US patients	US $
Wimo (2002)	5 countries: Denmark, Finland, Netherlands, Norway, Sweden	All countries	Swedish costs applied to all	SEK converted using exchange rates to US $
Underwood (1999)	4 countries: France, Germany, Italy, UK	All countries	UK costs applied to all	UK £

PPP's – Purchasing Power Parities (GDP), NCU- National Currency Units

Table 1 reports the results of our literature and shows that of the 29 studies based on multinational trials or cohort studies, 7 used country-specific resource use and estimated country-specific unit costs for all countries in the study. A further two studies also used country-specific resource use and unit cost methods although one study reported resource use and estimated unit costs for 7 out of a total of 15 countries

that were used in the RCT (Schulman 1998), while the study by Glick and colleagues (1998) reported country-specific resource use for all 11 countries involved in the trial but only estimated unit costs for 6 out of the 11 countries (they did point out that this accounted for 84% of the total number of patients recruited). Sixteen of the studies collected and reported country-specific resource use but applied unit costs estimates derived from a single country (or two countries Drummond (2003), Hansson (1998)) to the country-specific resource use estimates. Two studies only reported resource-use and unit cost estimates for a single country even though both studies were based on multicountry studies (Erhardt 1997, Tunis 1999). Finally, two studies reported using single country estimates of resource use and applied multicountry estimates of unit costs to this (Annemans 1999, Menzin 1996). From the literature review, we concluded therefore that there is currently no single accepted approach to the collection of resource use and unit cost data in multinational economic evaluations.

5. Empirical investigation of resource use and unit costing

Data

The data used to explore alternative unit costing methods were taken from the European Dialysis and Cost-Effectiveness Study (EURODICE) [8]. This compared two dialysis modalities, hospital haemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD). These technologies involve different mixes of resource input, particularly with respect to staffing and consumables. The study involved ten renal centres based in Scotland (two centres), France, the Netherlands, Hungary, Russia, Estonia, Greece (two centres) and Albania. Six centres provide both HD and CAPD and four HD alone.

HD is performed using a machine, which essentially draws out the patient's blood, filters out toxic waste and excess fluid and then returns the blood to the body. This procedure requires permanent and easy access to the patient's circulation, generally by an arterio-venous fistula in the arm. HD is usually performed three times per week with each session lasting around four hours. Although possible to perform in the patient's home, the modality is more commonly carried out in a hospital or free-standing dialysis centre setting. For CAPD, the patient's semi-permeable peritoneal membrane is used to make the exchange of toxins and fluids. Dialysate (dialysis fluid) is left in the peritoneal cavity for 4-8 hours, drained out and fresh dialysate instilled. This procedure requires a permanent catheter to be inserted into the patient's abdomen and patients generally carry out four daily exchanges themselves, usually at home [6].

Resource use

The basis of the EURODICE costing was an HD session and a CAPD week. Resource data were collected using a consistent method throughout the study centres. Questionnaires and site visits by health economists and clinicians from the co-ordinating centre, collected information on the volume of resource use for the two therapies. Detailed descriptive information was collected on these resource items to ensure the inputs were as homogenous as possible

To examine alternative unit costing approaches, data on the main costs drivers for the two modalities were used. These dialysis items account for around 80% of total costs for most centres. For HD, the cost of nursing staff, erythroproetin (EPO), a drug used to reduce the anemia suffered by those on dialysis) dialysers (artificial kidney), capital

(excluding building), medical staff and bloodlines were chosen. For CAPD, bags of peritoneal fluid, nursing staff and EPO were selected. Transport costs are excluded here due to wide differences in who pays for the transport and overheads because they were not main costs drivers in most centres. The cost data presented here are deterministic rather than stochastic and are for the year 1999. Tirana is not included in this analysis, due to difficulty interpreting certain data provided and Veria because the data are still being analysed.

Application of centre specific unit costs

Centre specific unit cost data were collected during the time of the study. Using a micro level approach costs were collected at a highly detailed level using information from the dialysis centres themselves and hospital finance. For this paper these unit costs are applied to the main dialysis cost drivers described above. The results are compared across centres by converting costs from the national currency of each centre using gross domestic product (GDP) purchasing power parities (PPPs), expressed in Sterling (£).

Application of unit costs from one centre (standard)

For the application of unit costs from one centre, the unit costs from Aberdeen were applied to the resource use information. This centre was chosen simply because it was the co-ordinating centre, but other centres could just have easily been used. The cost results are expressed in Sterling (£).

6. Empirical results

Data on resource use for the six HD main cost drivers are presented for each patient on an annual basis in Table 2. These results highlight that there is greater similarity across the centres for the volume of consumables used as compared to staff. For dialysers and bloodlines, one of each item is required for every dialysis session, allowing no real variation for these items. For EPO, whilst most centres administered this drug at an average rate of 6000 ml units per week, two centres departed from this with Dundee administering 50% less and St Petersburg typically not using EPO at all. In terms of staffing, nursing and medical staff are presented as a cost per whole-time equivalent (WTE) and centres tended to use much more nursing than medical staff for HD, with Debrecen and St Petersburg using slightly more medical staff.

Table 2. Haemodialysis centre resource use

Centre	**Resource use per dialysis year***					
	Nursing staff (wte per annum)	**EPO**	**Dialysers**	**Capital** ** (hours per annum)	**Medical staff** (wte per annum)	**Bloodlines**
Aberdeen (UK)	0.33	312000 (6000)	156	624	0.03	156
Dundee (UK)	0.27	156000 (3000)	156	624	0.01	156
Nantes (France)	0.34	312000 (6000)	156	624	0.02	156
Nijmegen (The Netherlands)	0.39	312000 (6000)	156	624	0.03	156
Thessaloniki (Greece)	0.19	312000 (6000)	156	624	0.03	156
Debrecen (Hungary)	0.34	312000 (6000)	156	624	0.07	156
Tallinn (Estonia)	0.19	312000 (6000)	156	624	0.03	156
St Petersburg (Russia)	0.14	0	156	624	0.06	156

* Based on 3 dialysis sessions per week, 52 weeks per year

** Based on the use of dialysis machines for 4 hours 3 times per week

In Table 3 the centre specific unit costs for HD are presented. These costs are based on 4-hour dialysis sessions and are expressed in national currency units (study was performed before the widespread use of EURO's) and also in GDP PPPs expressed in Sterling (£).

Table 3. Haemodialysis centre specific unit costs

Centre						
	Nursing staff (wte per annum) **National currency (Sterling, £)**	**EPO** (1000 units) **National currency (Sterling, £)**	**Dialysers** (Each) **National currency (Sterling, £)**	**Capital** (4-hour use) **National currency (Sterling, £)**	**Medical staff** (wte per annum) **National currency (Sterling, £)**	**Bloodlines** (Each) **Own currency (Sterling, £)**
Aberdeen (UK, £)	18891	9	8	6	27352	4
Dundee (UK, £)	21990	9	7	6	36504	4
Nantes (France, Francs)	265732 (27339)	75 (8)	241 (25)	61 (6)	760500 (78241)	48 (5)
Nijmegen (The Netherlands, Guilder)	65944 (21136)	26 (8)	46 (15)	29 (9)	210756 (67550)	18 (6)
Greece (Thessaloniki, DR)	4222969 (11842)	4500 (13)	15000 (42)	1744(5)	7599020 (21309)	1100 (3)
Debrecen (Hungary,Florints)	823203 (5342)	2000 (13)	4000 (26)	390 (3)	981173 (6368)	1500 (10)
Tallinn (Estonia, EEK)	60700 (6584)	163 (18)	240 (26)	271 (29)	146068 (15843)	58 (6)
St Petersburg (Russia, Roubles)	8268 (1325)	-	506 (81)	154 (25)	12090 (1938)	165 (26)

The total cost column in Table 4 highlights that the centre with the lowest annual cost is Dundee at £10,274 per patient and the centre with the highest cost is St Petersburg at £20,935. In terms of the breakdown of these total costs, for centres in Western Europe (Aberdeen, Dundee, Nantes and Nijmegen), nursing staff form the largest proportion of costs (47-58%). In contrast Eastern European centres devote a much smaller proportion of total costs to nursing staff (1-15%). In these centres consumables, especially dialysers form a much larger proportion of total costs.

Table 4. Haemodialysis combined resource use and unit costs (centre specific)

Centre	Annual cost per patient (Sterling (£)*) (% of total cost)						
	Nursing staff	**EPO**	**Dialysers**	**Capital**	**Medical staff**	**Bloodlines**	**Total**
Aberdeen (UK)	6234 (49%)	2739 (22%)	1209 (10%)	964 (8%)	821 (6%)	660 (5%)	12627
Dundee (UK)	5937 (58%)	1370 (13%)	1041 (10%)	964 (9%)	365 (4%)	597 (6%)	10274
Nantes (France)	9295 (49%)	2407 (13%)	3860 (20%)	976 (5%)	1565 (8%)	774 (4%)	18877
Nijmegen (The Netherlands)	8243 (47%)	2574 (15%)	2322 (13%)	1426 (8%)	2027 (12%)	884 (5%)	17476
Thessaloniki (Greece)	2250 (15%)	3937 (27%)	6562 (45%)	763 (5%)	639 (4%)	481 (3%)	14632
Debrecen (Hungary)	1816 (15%)	4050 (33%)	4050 (33%)	394 (3%)	446 (4%)	1519 (12%)	12275
Tallinn (Estonia)	1251 (7%)	5499 (33%)	4051 (24%)	4584 (27%)	475 (3%)	973 (6%)	16833
St Petersburg (Russia)	186 (1%)	-	12658 (60%)	3861 (18%)	116 (1%)	4114 (20%)	20935

*Converted using GDP PPPs (sources OECD and World Bank). Based on 3 dialysis sessions per week, 52 weeks per year.

Table 5 presents the resource use for HD (Table 2) and the standard unit costs from our selected centre, Aberdeen (Table 3, row 2). The total cost per patient each year ranges from £10,109 to £21,146 in Dundee and Debrecen respectively.

Table 5. Haemodialysis resource use and standardised unit costs

Centre	Annual cost per patient (% of total cost)						
	Nursing staff	**EPO**	**Dialysers**	**Capital**	**Medical staff**	**Bloodlines**	**Total**
Aberdeen (UK)	6234 (49%)	2739 (22%)	1209 (10%)	964 (8%)	821 (7%)	660 (5%)	12627
Dundee (UK)	5046 (50%)	1370 (14%)	1041 (10%)	964 (10%)	1028 (10%)	660 (7%)	10109
Nantes (France)	6531 (37%)	2739 (16%)	3627 (21%)	964 (5%)	3083 (18%)	660 (4%)	17604
Nijmegen (The Netherlands)	7421 (42%)	2739 (16%)	1209 (7%)	964 (6%)	4522 (26%)	660 (4%)	17515
Thessaloniki (Greece)	3562 (27%)	2739 (21%)	1209 (9%)	964 (7%)	3905 (30%)	660 (5%)	13039
Debrecen (Hungary)	6531 (31%)	2739 (13%)	1209 (6%)	964 (5%)	9043 (43%)	660 (3%)	21146
Tallinn (Estonia)	3562 (27%)	2739 (21%)	1209 (9%)	964 (7%)	4111 (31%)	660 (5%)	13245
St Petersburg (Russia)	2672 (21%)	-	1209 (9%)	964 (7%)	7399 (57%)	660 (5%)	12904

In terms of the breakdown of these total costs, for centres in Western Europe, nursing staff costs again form the largest proportion of total costs (42-50%). However, Eastern European centres now also devote a much larger proportion of total costs to staff compared with the use of centre specific unit costs. Indeed both nursing and medical staff costs in these centres are now actually higher than the proportion of cost attributed to dialysers, a result which is a complete reversal of the centre specific unit cost approach. Moreover, there is also much less variation in capital and bloodline costs in all centres with the standard unit cost approach.

Table 6 presents the information on the resource use for CAPD. For peritoneal fluids the centres all use 2000 units per exchange (internationally recogonised level), which explains the uniformity. In contrast to the HD results, nursing resource use is much lower and EPO use varies from 1000 weekly units in Tallinn to 4000 in Nijmegen. In Table 7 the centre specific unit cost data are reported for CAPD.

Table 6. Continuous ambulatory peritoneal dialysis centre resource

Centre	**Resource use per dialysis year**		
	Fluids	**Nursing staff** (wte per year)	**EPO**
Aberdeen (UK)	2912000 (4*2000 units daily)	0.07	104000 (2000 units weekly)
Dundee (UK)	2912000 (4*2000 units daily)	0.04	104000 (2000 units weekly)
Nijmegen (The Netherlands)	2912000 (4*2000 units daily)	0.08	208000 (4000 units weekly)
Thessaloniki (Greece)	2912000 (4*2000 units daily)	0.04	156000 (3000 units weekly)
Tallinn (Estonia)	2912000 (4*2000 units daily)	0.05	52000 (1000 units weekly)

Table 7. Continuous ambulatory peritoneal dialysis centre specific unit costs

Centre	**Unit costs**		
	Fluids (Per 2000 fluid bag) **National currency (Sterling, £)**	**Nursing staff** (wte per annum) **National currency (Sterling, £)**	**EPO** (1000 units) **National currency (Sterling, £)**
Aberdeen (UK)	5.81	18891	8.78
Dundee (UK)	3.26	21990	8.78
Nijmegen (The Netherlands, Guilder)	21.82 (7)	65944 (21136)	25.74 (8)
Thessaloniki (Greece, DR)	4645 (13)	4222969 (11842)	4500 (13)
Tallinn (Estonia, EEK)	160 (17)	60700 (6584)	162.50 (18)

Table 8 presents the results of combining the resource information and centre specific unit costs from Tables 6 and 7 respectively for CAPD. One common feature in the table is that peritoneal fluids form the largest proportion of total costs in all five centres providing this dialysis modality (66-95%). In terms of total costs, the final column reveals that the centre with the lowest annual cost is Dundee at £7,179 per patient and the centre with the highest annual cost is Tallinn at £26,518.

Table 8. Continuous ambulatory peritoneal dialysis combined resource use and unit costs (centre specific)

Centre	Annual cost per patient (Sterling, £) * (% of total cost)			
	Fluids	**Nursing staff**	**EPO**	**Total**
Aberdeen (UK)	8459 (79%)	1323 (12%)	913 (9%)	10695
Dundee (UK)	4745 (66%)	1521 (21%)	913 (13%)	7179
Nijmegen (The Netherlands)	10183 (75%)	1654 (12%)	1716 (13%)	13553
Thessaloniki (Greece)	18965 (88%)	529 (2%)	1969 (9%)	21463
Tallinn (Estonia)	25267 (95%)	335 (1%)	916 (3%)	26518

*Converted using GDP PPPs (sources OECD and World Bank).

Table 9 presents the results of the combined resource information for CAPD (Table 6) and the standard unit costs from Aberdeen (Table 7, row 2). The total cost per patient per annum range from £9,445 to £11,344 in Tallinn and Nijmegen respectively. Interestingly, the costs for Tallinn reveal around a three-fold difference in total costs between the two approaches.

Table 9. Continuous ambulatory peritoneal dialysis resource use and standardised unit costs

Centre	Annual cost per patient (% of total cost)			
	Fluids	**Nursing staff**	**EPO**	**Total**
Aberdeen (UK)	8459 (79%)	1323 (12%)	913 (9%)	10695
Dundee (UK)	8459 (83%)	860 (8%)	913 (9%)	10232
Nijmegen (The Netherlands)	8459 (75%)	1059 (9%)	1826 (16%)	11344
Thessaloniki (Greece)	8459 (82%)	463 (4%)	1370 (13%)	10292
Tallinn (Estonia)	8459 (90%)	529 (6%)	457 (5%)	9445

In terms of the breakdown of these total CAPD costs, for all centres peritoneal fluid again forms the largest proportion of total costs (75-90%). The main difference with the total costs results with the centre specific approach for CAPD is that nursing staff costs reported in Table 9 are lower than those reported in Table 8.

Discussion and conclusions

This paper has reported the results of an empirical investigation to compare alternative methods for unit costing in the context of a multinational study. The aim was to test whether the centre specific compared to a single centre (or standardised) unit cost approach would produce different results, which could influence decisions drawn for policy making.

The results revealed that in some centres, the total patient cost per annum was quite similar across the two approaches; however other centres demonstrated quite large differences. With regard to HD results, centres in Western Europe showed similar

results for the centre specific and standard unit cost approaches. For example, the cost difference between the centre specific and standardised unit cost was only +£39 in Nantes. However, the results in the Eastern European centres revealed much larger differences, with Debrecen having the largest difference at +£8,871. With respect to the CAPD results, again centres in Eastern Europe revealed larger differences than Western Europe, although for the latter, there were much larger differences compared with the HD results.

In interpreting the results from our empirical investigation there are important issues to take into account. One issue and part of the explanation for the results from the centre specific approach relates to the use of GDP PPP's. These published conversion rates, had an inflationary influence on our Eastern European dialysis centres. Although the use of standard unit costs appeared to overcome the conversion issue and possibly more accurately reflected resource use and 'true' staff costs in Eastern Europe. The results from our empirical investigation suggest that a health care technology where consumables are largely purchased on Western markets and if consumables form a fairly large proportion of total costs (CAPD), then the two costing approaches are likely to yield reasonably similar results. However, in technologies with a significant component of staff input (HD), results could vary substantially. For example the CAPD results for Tallinn showed a difference of £17,073 between the two approaches.

The results in this paper are comparable with those found by Rakiou et al (2000). Our future research with this paper aims to explicitly address the issues of substitutability and production function influences using our empirical data.

In conclusion, the approach taken to unit costing can affect the interpretation of results from economic evaluations, particularly where the input mix varies substantially (HD and CAPD very different). Although centre specific unit costing is time consuming, the results themselves are potentially more informative than those obtained using an averaged approach, largely because it is possible to explain differences in the inputs of resources more easily. However, conversion of data into a common currency base can make the results difficult to compare when GDP PPPs are used, particularly in Eastern Europe. The findings in our exercise suggest that caution may be required when collecting unit cost data particularly when the choice of comparison method could affect the way conclusions are drawn for policy making.

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