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Cost of illness: An international comparison Australia, Canada, France, Germany and The Netherlands

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Abstract

Objectives: To assess international comparability of general cost of illness (COI) studies and to examine the extent to which COI estimates differ and why.
Methods: Five general COI studies were examined. COI estimates were classified by health provider using the system of health accounts (SHA). Provider groups fully included in all studies and matching SHA estimates were selected to create a common data set. In order to explain cost differences descriptive analyses were carried out on a number of determinants.
Results: In general similar COI patterns emerged for these countries, despite their health care system differences. In addition to these similarities, certain significant disease-specific differences were found. Comparisons of nursing and residential care expenditure by disease showed major variation. Epidemiological explanations of differences were hardly found, whereas demographic differences were influential. Significant treatment variation appeared from hospital data.
Conclusions: A systematic analysis of COI data from different countries may assist in comparing health expenditure internationally. All cost data dimensions shed greater light on the effects of health care system differences within various aspects of health care. Still, the study's objectives can only be reached by a further improvement of the SHA, by international use of the SHA in COI studies and by a standardized methodology.

Keywords: Cost of illness; Health expenditures; International comparison

1. Introduction

Since good health is important not only to personal and societal well-being but also to the economy [1], developed countries spend considerable sums of money to improve general health and reduce the burdens of

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disease. However, increasing health expenditures have raised concerns about health care affordability [2]. As a result, national policy makers often compare national health expenditures across countries, in order to draw lessons that may help to improve the efficiency or affordability of the health care system. In addition, European member states have become increasingly interested in cost of illness (COI) studies in recent years [3]. COI studies are detailed descriptions of the monetary burden of disease on the basis of characteristics of supply and demand. They measure health care cost: not only by disease, but also by health care provider and by age and gender of health care users. In the upcoming international data collection of health expenditures these dimensions will be taken into consideration [4].

Although COI studies were primarily developed for national purposes, they can also be helpful in international comparisons of health expenditure. Compared with traditional analyses of health expenditure focusing on the supply side only, they provide greater insight into what drives health expenditure. Additionally, COI studies assist health policy makers in making projections of future health care costs and in resource allocation decisions [3]. COI studies can also serve as input for the analysis of (risk) solidarity within the health care system by comparing disease costs at a more individual level [5].

International comparisons should pay attention to cross-country comparability of COI studies. A previous cross-country study concluded that no decent international comparison of COI studies could be conducted unless (methodological) standardization would be adopted [6]. This article studies whether comparability has improved in more recent COI studies. For this purpose we used the system of health accounts (SHA) framework of the Organisation for Economic Co-operation and Development (OECD) to classify the supply side within the COI framework. The SHA was introduced in order to make health expenditure estimates more comparable across countries. It provides a framework for the standard reporting of health expenditure in different dimensions for which uniform classifications were developed: health care providers, health care functions, and health care funding [7]. The second objective was to analyse cross-country differences comprehensively in order to determine the extent to which COI estimates differ internationally and why this should be so.

2. Materials and methods

COI studies are performed in various ways with various methods [8–10]. In this article general COI studies were compared from five countries. General COI studies estimate health care costs of all disease groups within a single comprehensive (national) framework. COI are calculated following a top-down approach consisting of four steps: (1) the estimation of total health expenditure; (2) the estimation of health expenditure per provider in more or less cost-homogeneous subgroups; (3) the construction of indicators that represent equal health care use by disease (and possibly age and gender) for each provider or subgroup; and (4) the combination of step (2) and step (3) in order to calculate COI. The studies that were compared all followed this methodology. Thus, the influence of methodological differences was minimized. Our comparison of general COI studies was performed along the following three steps:

2.1. Step 1

We started with the COI studies we conducted for France [11–13], Germany [14] and the Netherlands [15] and added similar studies from Australia [16] and Canada [17]. In a systematic literature search we also found COI figures for five other countries – Japan, Spain, Sweden, the UK and the USA [18–21] – but these studies provided insufficient detail for in-depth comparisons. Moreover, some of these studies were rather outdated.

First, a general comparison of total health expenditures was made for these countries. SHA estimates of total health expenditure differ from national health accounts estimates. The latter often include a wider array of expenditures because a broader definition of health care is applied. For example, in the Dutch situation expenditures on homes for the elderly and care for people with disabilities are included in the national health accounts, whereas they fall outside the SHA definition of health expenditure. A second example may be found in the French national health accounts where allowances paid to compensate wage losses due to sickness or workplace injury are included whereas they are not counted in the SHA estimate. A first COI comparison was constructed on the basis of the original published COI figures, without any adjustments.

2.2. Step 2

The five COI studies contained a division of COI by different types of provider, which allowed for a more thorough comparison. Estimates of COI by provider category were compared with expenditure estimates from the SHA by provider classification [23]. The Dutch figures were directly available in SHA-format and in the other studies the provider division was matched with the SHA by provider classification as well as could be done. This matching enabled us to test the international comparability of COI. Expenditures seemed to correspond reasonably well with the SHA expenditure estimates (see Table 6 and [22]) and with national accounts [22].

Expenditure groups were excluded if they were: (1) not allocated to diseases in any of the studies (e.g. nursing care, Canada [17]); (2) not included in one of the COI studies; or (3) did not fit within the SHA boundaries of health care (e.g. research expenditure, Australia [16]). A detailed description of the selection procedure can be found in Appendix A and in [22]. The selected group of providers consisted of: hospitals, physicians, prescribed medicines and dentists. Expenditures on long-term nursing care were examined too, although recent studies have shown that the comparability of long-term care expenditure is limited at this stage [24]. For that reason these expenditures were not included in the final sample of providers. Also, two studies did not allocate these expenditures to diseases.

Expenditures on the selected provider groups were totalled and new, adjusted COI figures were composed. For each disease group per capita costs and a percentage of total cost were calculated by means of US$ Purchasing Power Parities (PPP) to transform different currencies to a comparable monetary unit. For example, the purchasing power of a Euro may differ per country, say France and the Netherlands. In that case simple exchange rates are less reliable. PPPs control for cross-country differences in purchasing power [25]. Expenditure data were not corrected for differences in reference year of study. As there are no longitudinal COI data a time-adjustment would require too many assumptions for detailed COI estimates (by disease, age and gender, health provider). From longitudinal comparisons of Dutch COI we learned that differences in reference year had less influence on the distribution of costs among disease categories than on the nominal per capita expenditure. Although the main focus in this paper is indeed on the distribution of expenditure among diseases, we will also present some estimates of costs per capita. These are meant for the global picture, rather than detailed comparisons.

2.3. Step 3

In order to explain differences in costs, a number of possible determinants were examined with the help of descriptive material. Since COI studies focus on health expenditure from an epidemiological and demographic perspective, we chose epidemiological (prevalence of diseases) and demographic variables as determinants of differences in COI. Epidemiological data were taken from various internet data sources and also from scientific literature searches. Nevertheless, finding comparable data on the prevalence of diseases proved to be difficult. Data on the prevalence of neoplasms were one of the best options available [26]. Mortality data may give an indication of disease prevalence when prevalence data are absent. Mortality data were investigated for diseases of the circulatory system because these diseases form one of the main causes of death in western countries [23]. Prevalence of cancer estimates for Australia and Canada were available in the Globocan 2002 project, including the prevalence of various types of cancer around the world [27]. The estimations for Canada in this database were based on data from the USA and therefore not representative for Canada. A similar problem appeared with the Australian data.

Demographic characteristics were addressed on the basis of health expenditure by age figures. These were based on the initial COI data and could not be divided into different SHA sectors, because age-specific costs per provider were not available for all countries. France and Canada were excluded, because their studies did not contain any data on health care costs by age.

Treatment variation was assumed to be another possible cost-driver [6]. As an indicator of treatment variation, international hospital data from the European Hospital Data Set were used [28]. These hospital data included the average length of stay (ALOS), the number of inpatient cases and the number of day cases. Obviously, this did not reflect all treatment variation within the various health care systems. Still, it was one

of the best available and most reliable data sources on cross-country treatment variation.

3. Results

3.1. Health expenditures

The *first step* was to generate general health expenditure information. Table 1 shows key characteristics of health expenditure and COI studies for Australia, Canada, France, Germany and the Netherlands.

Table 1 demonstrates that these five countries spent a similar share of their gross domestic product (GDP) on health: ranging between 9.0% and 10.6% according to the SHA definition of health expenditure. Average expenditure per inhabitant showed somewhat greater variation. Per capita expenditures in US$ PPP, on the basis of the OECD definition, ranged between US$ 2291 (Canada) and US$ 3043 (Germany) (row 4, Table 1). However, the variation mainly resulted from differences in reference year. Using a single reference year, e.g. 2002, showed that per capita costs range between US$ 2699 (Australia) and US$ 2915 (Germany) only [23]. Differences in the national populations' age structure are shown in Table 1 (row 13). It demonstrates that the German population was older than the population in other countries, which may have influenced their relatively higher expenditures. Germany and the Netherlands also had a somewhat lower male/female ratio within their populations than Australia, Canada and France.

Health care systems have many organizational differences [29] and differ with respect to the types of services provided. Table 2 shows, for example, that France spent a relatively large part of its budget on medical goods. Furthermore expenditures on ambulatory care were relatively large in Australia, while the Dutch spent a considerable part of their budget on nursing and residential care.

3.2. Published COI

The first overview of COI studies (Table 3) shows substantial variation across countries (see variation coefficient in the last column). In all countries expenditures on circulatory disease and diseases of the digestive system formed the primary cost components. Expenditures on mental disorders were relatively large in the Netherlands. The figures also indi-

Table 1
Country characteristics and COI-studies

		AUS (2000)	CAN (1998)	FRA (2002)	GER (2004)	NETH (2003)
1	Total health exp in NCU[a] thousand million	61.7	83.8	165.2	234.0	57.5
2	OECD total health expenditure in NCU thousand million[b]	60.4	82.5	155.0	234.0	45.1
3	Per capita health exp (1) in US$ PPP[c]	2458	2326	3075	3043	3854
4	Per capita health exp (2) in US$ PPP	2406	2291	2886	3043	3022
5	Health exp (1) as % of GDP	9.2%	9.3%	10.7%	10.6%	12.7%
6	Health exp (2) as % of GDP	9.0%	9.2%	10.0%	10.6%	9.9%
7	Total COI in NCU thousand million	60.9	84.0	129.5	225.0	45.1
8	(7) in US$ thousand million	33.3	56.7	122.2	277.7	50.7
9	ICD-version used in COI study	ICD-10	ICD-9	ICD-10	ICD-10	ICD-9
10	Number of (main)sectors	(7) 20	(5) 24	(5) 20	(7)15	(21)81
11	Number of age groups	10	6	–	6	21
12	Male/female ratio in expenditure[d]	44/56	45/55	–	42/58	42/58
13	Age structure[e]	12.7	12.3	16.2	18.3	13.7

[a] NCU = National currency unit; source national accounts: AUS: Australian Institute of Health and Welfare; CAN: Canadian Institute for Health Information; GER: Federal Statistical Office Germany; NETH: Statistics Netherlands; FRA: Ministère de la Santé (DREES).

[b] Source: OECD Health Data 2005 [23] or COI study (Netherlands).

[c] PPP based on PPP for GDP [13]: 1 US$ = 1.31 AUD ('00); 1.19 CAD ('98); €1.06 FRA ('02); €0.93 GER ('04); €0.92 NETH ('03). Source: OECD Health Data 2005 [23] and COI study (Netherlands).

[d] All male/female ratios are based on total direct COI per sex.

[e] Age structure is defined by the percentage of the population aged 65 and over.

Table 2
Health expenditure per provider category (as percentage of total health expenditure)[a]

	AUS (2000)	CAN (1998)	FRA (2002)	GER (2004)	NETH (2003)
HP.1. Hospitals	33.8	32.8	38.1	28.9	35.5
HP.2. Nursing and residential care facilities	6.9	9.7	2.2	7.6	11.8
HP.3. Providers of ambulatory care	31.9	27.7	23.6	29.4	22.1
HP.4. Retail sale and other providers of medical goods	17.1	17.8	21.8	19.9	16.0
HP.5. Provision and administration of public health	–	6.3	3.1	0.9	1.7
HP.6. General health administration and insurance	4.4	1.8	7.8	6.2	4.1
HP.7. Other industries (rest of the economy)	–	0.3	1.1	3.3	2.8
HP.9. Rest of the world	–	–	–	–	1.0
Total current expenditure on health care	94.0	96.5	97.6	96.1	95.1
Capital formation of health care provider institutions	6.0	2.8	2.3	3.9	4.9
Undistributed	–	0.7	–	–	–
Total health expenditure	100.0	100.0	100.0	100.0	100.0

Source: OECD Health Data 2005 [23].
[a] HP is Health Provider Classification in SHA.

cate that comparability may be hampered by several excluded disease groups. Additionally, the percentage of costs that could not be allocated to diseases varies widely. Most notable is the 45% unallocated in Canada, jeopardizing the comparability of their COI figures.

3.3. Adjusted COI

As a *second step* of this study, provider groups were selected (see Appendix A). As was mentioned before, the provider group nursing and residential care was excluded from this selection. A short analysis of nurs-

Table 3
COI for five countries as percentage of total COI

	AUS (2000)	CAN (1998)	FRA (2002)	GER (2004)	NETH (2003)	cv
Infectious diseases	2.1	1.1	2.1	1.7	2.4	26.7
Neoplasms	5.1	2.9	6.4	7.9	5.0	33.9
Endocrine. nutritional and metabolic diseases	4.2	1.9	4.2	5.3	2.6	37.6
Diseases of the blood/blood-forming organs	–	0.3	0.7	0.5	0.5	32.7
Mental and behavioural disorders	6.5	5.6	9.0	10.1	15.6	42.0
Diseases of the nervous system[a]	8.6	3.4	8.6	8.2	7.3	30.5
Diseases of the circulatory system	9.6	8.1	11.4	15.7	10.9	25.6
Diseases of the respiratory system	6.5	4.1	6.5	5.2	4.6	20.3
Diseases of the digestive system	10.9	4.2	11.0	14.8	10.2	37.4
Diseases of the genitourinary system	3.6	3.1	4.8	3.8	3.6	16.6
Pregnancy and childbirth	2.3	1.5	2.3	1.4	3.3	35.5
Diseases of the skin and subcutaneous tissue	2.4	1.8	1.4	1.6	1.9	20.7
Diseases of the musculoskeletal system	8.1	3.2	7.4	10.9	7.7	37.0
Congenital malformations and chromosomal abnormalities	0.4	0.2	0.4	0.5	0.6	35.3
Certain conditions originating in the perinatal period	0.6	0.4	0.4	0.4	0.8	34.4
Symptoms: signs and ill-defined conditions	9.7	2.1	4.0	4.6	9.4	57.2
Accidents	–	–	–	–	3.6	–
Injury and poisoning[b]	7.0	3.8	5.8	4.9	–	25.3
Additional categories	–	6.9	5.5	2.5	0.8	70.7
Unallocated	12.5	45.4	8.0	0.0	9.3	94.9
Total	100.0	100.0	100.0	100.0	100.0	

– means that these disease groups were not used in COI study, cv = coefficient of variation = standard deviation/average (per disease group).
[a] Including diseases of the eye and the ear.
[b] For Germany: including accidents.

Table 4
COI for nursing and residential care facilities (HP.2)

	AUS		CAN		FRA		GER		NETH		cv
	%	p.c.	%	p.c.	%	p.c.	%	p.c.	%	p.c.	
Neoplasms	0.9	1	–	–	–	–	10.0	23	1.6	6	122
Mental disorders	58.2	97	–	–	–	–	29.2	67	51.7	184	33
Dementia		81	–	–	–	–		48		154	
Nervous system	6.8	11	–	–	–	–	9.2	21	6.2	22	21
Circulatory system	13.5	22	–	–	–	–	27.0	62	15.6	56	39
Respiratory system	2.3	4	–	–	–	–	1.0	2	2.4	9	41
Digestive system	0.9	1	–	–	–	–	0.8	2	2.4	9	66
Musculoskeletal	12.4	21	–	–	–	–	3.8	9	2.1	7	91
Genitourinary	0.4	1	–	–	–	–	0.3	1	0.5	2	25
Subtotal	95.4	158					81.3	187	82.5	294	
Total		166		222				230		356	

– means that these disease groups were not used in COI study, p.c. = per capita expenditures in US$ PPP, cv = coefficient of variation = standard deviation/average (per disease group).

ing and residential care expenditure showed widely diverging variations in the distribution of cost over diseases (Table 4). In Table 4 costs of eight diseases are shown for nursing and residential care. Per capita expenditures on mental disorders, for example, varied from US$ 67 in Germany to US$ 184 in the Netherlands.

After selection we retained expenditures on hospitals, physicians, dentists and prescribed medicines forming our sample for an adjusted COI comparison. Table 5 demonstrates that the coefficient of variation decreased for most disease groups after the provider group selection (compared with (Table 3)). The unallocated part of total expenditures also decreased substantially in all countries.

In general a roughly similar COI pattern appeared for these countries. All countries faced high cost of circulatory disease, mental disorders and diseases of the digestive system, followed by musculoskeletal disease and cancer (neoplasms). Furthermore, the cost of pregnancy and childbirth, perinatal and congenital disorders and diseases of the blood ranked low in all countries. Apart from these similarities, significant differences were found as well: higher cost of circulatory disease and musculoskeletal disease in Germany, relatively high cost of respiratory disease in Australia and high cost of mental disorders in the Netherlands.

The provider groups included in the COI figures of (Table 5) cover only part of total health expenditure: 64% for Australia, 66% for Canada, 59% for Germany, 57% for France and 57% for the Netherlands. For some disease groups the selection led to the exclusion of a substantial part of their costs. For example, mental disorders such as dementia are often treated in nursing and residential care facilities (Table 4). Because of the nature of the selection, in Germany only 54.5% and in the Netherlands 47.7% of the total cost of mental disorders were included in the final comparison of Table 5. The selection of provider groups, however, was justified for reasons of comparability.

3.4. Epidemiology

In the *final step*, several explanations were sought for differences in costs, for example epidemiological differences. Fig. 1 shows the 1-year prevalence of all types of cancer. Overall, France had the highest prevalence of neoplasms in 1998: 324 per 100,000 inhabitants, compared with 297 for Germany and 300 for the Netherlands. The 5-year prevalence of neoplasms revealed almost exactly the same pattern (1302, 1171 and 1195 per 100,000 inhabitants, respectively [26]).

Fig. 1 shows that types of cancer with the highest prevalence were similar for all countries: breast, colon/rectum, prostate and lung cancer. If it is assumed that the prevalence rates for the years around 1998 did not deviate substantially from those presented here, the epidemiological data provide no explanation for differences in expenditure on neoplasms. France, for example, showed the highest prevalence but not the highest costs.

Mortality data may give an indication of disease prevalence when actual prevalence data are absent. In

Table 5
Adjusted COI: sum of COI for hospitals (HP.1), physicians (HP.3), prescribed medicines (HP.4) and dentists (HP.3)

	Australia 2000		Canada 1998		France 2002		Germany 2004		Netherlands 2003		cv
	%	p.c.	%	p.c.	%	p.c.	%	p.c.	%	p.c.	
Infectious diseases	2.6	39	1.6	25	2.4	39	2.0	36	3.0	51	24.2
Neoplasms	6.3	97	4.5	67	7.1	118	8.1	146	6.0	103	20.9
Enodcrine diseases	5.3	82	2.9	44	4.3	71	6.0	109	2.9	50	33.2
Blood diseases	–	–	0.4	6	0.5	8	0.6	11	0.6	11	18.2
Mental disorders	6.1	95	8.7	132	10.9	181	7.5	135	13.1	225	28.4
Nervous system	4.5	70	5.2	79	6.1	102	6.4	115	5.9	101	13.2
Circulatory system	11.3	175	12.6	191	13.6	226	15.1	273	12.2	210	11.8
Respiratory system	7.7	118	6.4	97	7.1	119	6.0	108	5.6	96	12.9
Digestive system	14.7	227	18.2	276	13.4	222	18.6	336	13.9	240	13.9
Genitourinary	4.9	76	4.8	73	5.3	89	4.5	82	4.0	69	11.0
Pregnancy/childbirth	3.2	50	2.4	37	2.8	46	1.7	30	3.3	57	27.7
Skin diseases	2.6	40	2.7	42	1.6	27	1.9	34	2.4	41	21.1
Musculoskeletal	8.0	124	4.9	74	7.1	118	9.8	177	7.6	131	26.7
Congenital malform.	0.4	7	0.3	5	0.5	8	0.6	10	0.7	11	30.9
Perinatal diseases	0.9	13	0.6	9	0.5	9	0.6	11	1.1	19	37.3
Symptoms: ill-defined	12.4	191	3.3	50	4.4	73	3.2	57	10.8	186	65.4
Accidents	–	–	–	–	–	–	–	–	–	–	–
Injury: poisoning[a]	9.0	138	6.0	91	6.0	99	4.8	86	4.1	70	31.7
Additional category	–	–	10.8	163	5.9	97	2.9	52	–	–	61.0
Unallocated	–	–	3.6	54	0.5	8	–	–	2.7	47	70.4
Total 4 provider groups	100.0	1543	100.0	1512	100.0	1659	100.0	1808	100.0	1719	
Total health expenditure[b]		2406		2291		2886		3043		3022	
Percentage included		64%		66%		57%		59%		57%	

– means that these disease groups were not used in COI study. p.c. = per capita expenditures in US$ PPP. cv = coefficient of variation = standard deviation/average (per disease group).

[a] For Germany: including accidents.

[b] Total health expenditure = total health expenditure in Table 1, row 4, therefore including capital formation.

the case of circulatory diseases, Germany showed relatively high mortality rates and also relatively high cost [22]. This may be an indication of an epidemiological explanation for the relatively high cost of circulatory diseases in Germany. For most other disease groups no adequate epidemiological information was found [22].

3.5. Demography

As epidemiological explanations were lacking, demographic differences may be more revealing. Demographic aspects of health expenditure are an important part of most COI studies. Fig. 2 shows how

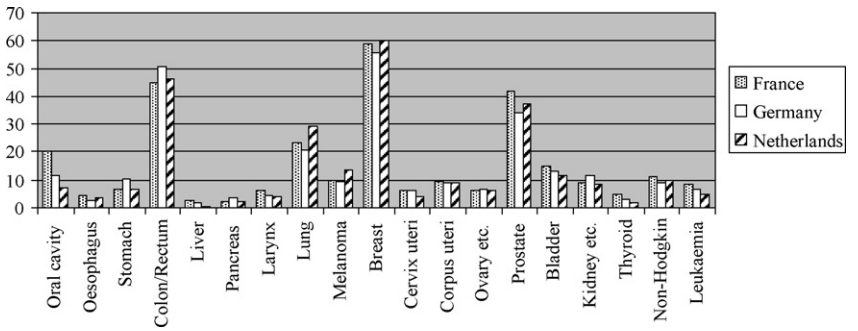

Fig. 1. 1-year prevalence of neoplasms in 1998 (per 100,000 inhabitants, age 15+).

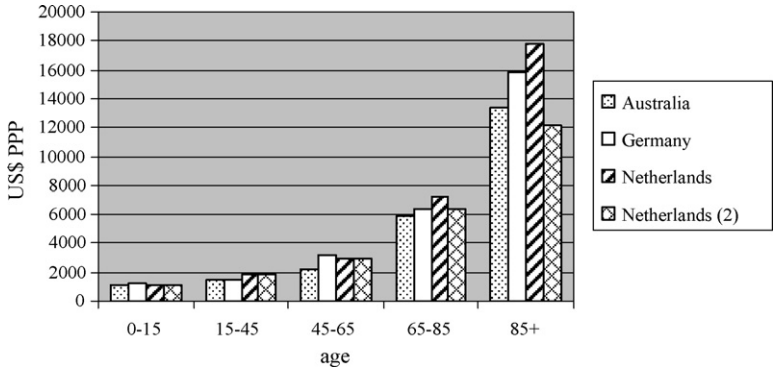

Fig. 2. Total COI per inhabitant by age (in US$ PPP).

costs were distributed among age groups. All countries experienced rising per capita expenditures with age. A substantial difference was found in the 85+ category, where the Dutch faced relatively high per capita expenditures. This probably originated in the nursing and residential care sector that predominantly caters to the elderly and was found to be relatively large in the Netherlands, even in terms of the (limited) definitions of the SHA (Table 5). We examined what would happen if expenditures on nursing care in the Netherlands were similar to the German and Australian situation. To that end, these expenditures were declined to 7% of total expenditure and an extra bar (Netherlands (2)) was included in the graph.

Fig. 3 shows the age pattern of costs for a specific disease group: circulatory disease. Graphs related to other disease groups can be found in [22]. Costs per male were higher in all age groups up to 85. Only in the 85+ age group costs per female were higher for Germany and the Netherlands. The high expenditures for elderly females in Germany were remarkable. Table 5 already demonstrated that Germany had the highest cost of circulatory disease.

3.6. Treatment variation

Cross-country treatment variation was mentioned as another determinant of differences in COI [6]. Significant treatment variation appeared in the use of hospital services. Fig. 4 shows in-hospital average length of stay (ALOS) for circulatory disease in three European countries in 1999. It shows a relatively low ALOS for France in all age groups. Germany had a relatively high ALOS in age groups below 85 which could be related to the cost differences under 85 shown in Fig. 3. In contrast treatment variation does not explain cost differences in the age group over 85, where German ALOS is lower but costs are substantially higher (Fig. 3).

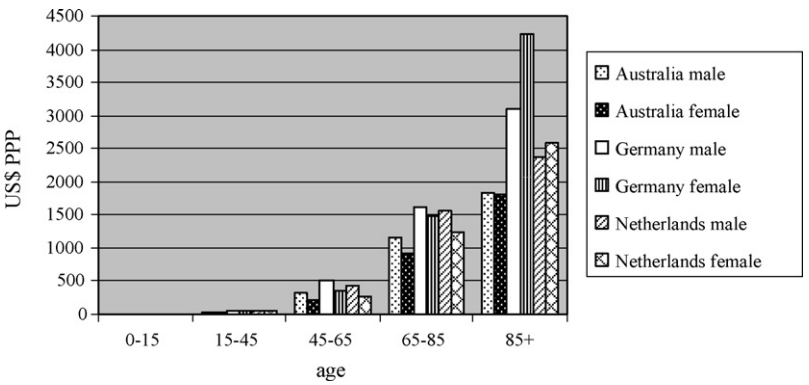

Fig. 3. Cost of circulatory disease by gender and age in Australia, Germany and the Netherlands (in US$ PPP).

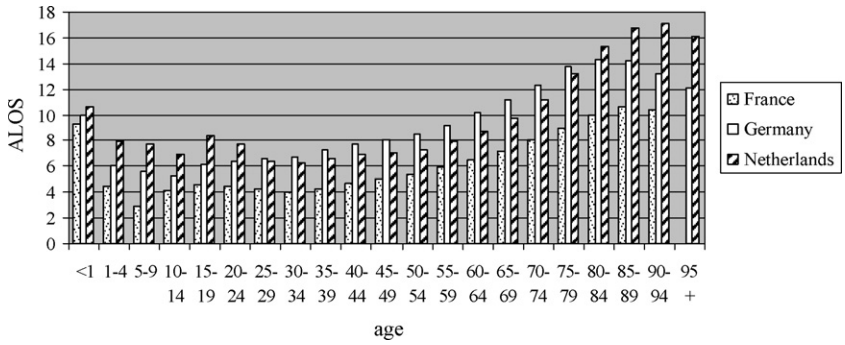

Fig. 4. ALOS for circulatory diseases in French, German and Dutch hospitals in 1999.

4. Conclusion and discussion

4.1. Limitations

The results show that a comprehensive international comparison of all health expenditures across all dimensions is not attainable (yet). The comparison in this study had to be restricted to providers of curative care. Comparability is hampered when studies do not provide an allocation of all providers to disease. For example, in the Canadian study 45% of all expenditures could not be allocated—because data on health care use within these provider groups was missing.

Additionally, when providers are included in all studies they can still be incomparable, for instance providers of long-term nursing care. In the Dutch national accounts and within SHA, the exact line between health care and social care has not been unambiguously formulated [30]. The substantial variation found in Table 4 supported the idea of a lack of cross-country comparability in long-term care and the need for an international definition of long-term care to be adopted in the SHA and implemented in COI. Furthermore, not all studies made it possible to compare COI by age, simply because age-specific expenditure data were not available in a few studies.

Comparability was also limited by the use of different reference years in all studies, and therefore comparisons of per capita estimates should be interpreted with extra caution (Figs. 2 and 3), even though it can be assumed that the distribution of health expenditure over diseases is not seriously affected by a mere difference in reference years. Finally, only descriptive evidence was used in the analyses. Alternative techniques such as regression analysis would have required more (and more detailed) data in order to create sufficient statistical power. Comparable epidemiological data turned out to be scarce, for example. Alternative methods to be used in future analyses may generate additional information. In addition a richer set of COI data might be available within a few years, if the OECD manages in achieving a regular COI data collection in OECD member states [4].

4.2. Policy implications

First of all, COI studies generate more detailed information about health expenditures than comparisons based on total health expenditure (as percentage of GDP) only. They create a more thorough understanding of health expenditure developments, which is required for meaningful international comparisons.

Secondly, data on health expenditure by age and gender enable the correction of health expenditures for demographic differences. This study was rather inconclusive about the role of epidemiology. More complete prevalence data would be needed to analyse the influence of disease prevalence. The role of age and gender looks clearer and is easier to obtain. For example, in the case of Germany Fig. 3 shows that besides the influence of an ‘older’ population, higher costs per person among the elderly also influence expenditure levels. If this difference in age-specific costs continues in the future, ageing will result in higher expenditure on circulatory diseases in Germany, compared with Australia and the Netherlands. It shows that not only demographic differences but also age-related differences in

Table 6
Matching health expenditures in SHA and COI (in National Currency Unit thousand million)

Provider	AUS		CAN		FRA		GER	
	SHA	COI	SHA	COI	SHA	COI	SHA	COI
HP.1. Hospitals	20.4	20.4	27.1	26.3	59.1	54.7	67.6	67.6
HP.2. Nursing and residential care facilities	4.2	3.9	8.0	8.0	3.4	-	17.8	17.7
HP.3. Providers of ambulatory care	19.3	18.8	22.9	24.5	36.6	39.7	68.8	68.7
HP.4. Retail sale and other providers of medical goods	10.3	10.2	14.7	12.4	33.8	35.1	46.6	46.5
HP.5. Provision and administration of public health	0.02	1.0	5.2	4.9	4.8	–	2.1	2.1
HP.6. General health administration and insurance	2.6	1.9	1.5	1.6	12.1	–	14.5	14.4
HP.7. Other industries (rest of the economy)	–	–	0.2	–	1.7	–	7.7	7.0
HP.9. Rest of the world	–	–	–	–	–	–	–	0.8
Total current expenditure on health care	56.8	56.2	79.6	77.7	151.3		224.9	225.0
Capital formation of health care provider institutions	3.6	3.6	2.3	2.2	3.6	–	9.1	–
Undistributed	–	–	0.6	1.7	–	–	–	–
Total health expenditure in SHA (row 2 in Table 1)	60.4	59.8	82.5	81.5	155.0	129.5	234.0	225.0
Outside SHA		1.1		2.5		–		–
Total health expenditure in COI (row 7 in Table 1)		60.9		84.0		129.5		225.0

SHA = SHA health expenditure estimates. Source: OECD Health Data 2005 [23] or COI study (Netherlands). COI = Health expenditure according to COI study: aggregated to provider groups. HP = Health Provider Classification of the SHA.

costs (in general or for particular diseases) may explain country-specific trends in health expenditure.

Thirdly, it could be hypothesized that similar disease patterns result in similar cost patterns in these western countries (which is what was observed), despite their differences in health care systems. Following this line of thought, differences that do in fact show up would be a result of differences in other health care aspects (e.g. supply of care), rather than disease, resulting in useful health policy information. For this reason, it may well be better to view results obtained in COI studies in a broader perspective, rather than to explain costs from epidemiological differences. It would seem that the countries in our study have similar spending patterns, but that this only concerned curative care.

There may be more significant differences in health care systems apart from curative care (as was observed in nursing care expenditures). This will undoubtedly, originate from the separation between purely medical/clinical care – which in developed countries will be on similar technological levels – and more welfare-oriented care – where larger differences will be found. The latter phenomenon is probably related to cultural differences (e.g. regarding informal care), and also to differences in defining cost of non-curative care, as was mentioned before. It also shows the need for a consistent methodology across countries to calculate and classify these costs since the disease perspective is not the most relevant.

Finally, we argue that COI studies, including all dimensions of supply and demand, could be used to generate broader discussions concerning the organization of health care systems, especially with a view to international comparisons. The in-hospital length-of-stay results showed differences in treatment variation, influencing costs of hospital care. Differences, however, may balance out at an aggregate level, because other indicators, such as number of inpatient days or day cases, indicate different treatment variation results [22]. Besides, outside hospitals treatment variation will exist, too. Furthermore, treatment can be substituted between providers (e.g. from hospitals to nursing homes), especially in the case of chronic diseases.

From a disease perspective we could acquire deeper insight into supply side characteristics, for example for the ageing population (dementia, disability) or the (increasing) number of chronically ill. For these (disease) groups one could study by which providers or by what types of financing health care has been organized on the basis of international COI results.

4.3. Increasing comparability

In order to reach all objectives, the following points should be considered. First of all, more extensive use of the SHA classification system is needed to improve comparability. Some (minor) differences were found between SHA and COI estimates of health expendi-

ture (Table 6). The use of SHA estimates also requires improvement of the SHA estimates themselves, especially in areas outside curative care. COI studies should also make use of the expenditure data dimensions that are available within the SHA: a functional dimension (e.g. curative or rehabilitative care) and a source of finance dimension (e.g. public finance or out-of pocket payment).

Secondly, methodological standardization is necessary regarding a number of issues in order to improve comparability of cost estimates across countries, although the methods used were similar in the included studies: all used the top-down approach. Only within step three of the top-down methodology, where indicators and weights are selected to allocate expenditures to diseases, is more standardization required. Furthermore, the use of similar ICD and age-group classifications will be useful. COI figures should also be updated periodically on the basis of similar reference years for all countries. Frequently updated data enhance insights into developments of health expenditures over time. Another feature that would create better understanding is the separation of expenditure developments into a healthcare-specific price and volume component. This will explain whether changing health care prices or utilization caused the differences.

Standardization requires considerable effort and patience. Still, when we consider the extent to which comparability has improved since the introduction of the SHA, in health expenditure as well as in COI, investments in this process would seem to be worth their while. Nevertheless, standardization needs to leave enough room for optimum use of country-specific data. The national application of COI studies needs to be guaranteed, because the first goal of the COI studies is to embed them in national health care research and to answer country-specific questions. It is therefore recommended that COI-studies simultaneously use national and international perspectives on health expenditure—as was done in the Dutch 2003 study [15].

These steps and considerations are expected to result in improved COI figures that serve the national and international debate on health and health expenditure with a deeper understanding of the interrelationships between health care demand and supply. It creates a possibility to monitor trends in health expenditure as well as its various cost drivers. We expect that COI statistics – when provided on a regular basis and in a systematic way – will help us gain a better understanding of the effects of health care system reforms across countries from a disease perspective as well as from demographic perspectives. This may be termed promising in a continuously globalizing world in which more and more attention is paid to international comparisons.

Appendix A

This Appendix shows which groups were included and excluded on the basis of the criteria that have been mentioned in the article. Each COI study uses its own health expenditure classification according to their data and national accounts classification. Nevertheless, we were able to fit them into the SHA classification, because both hold a provider perspective. On the basis of the SHA provider classification [7] COI provider groups were classified in SHA groups.

The table underneath shows which provider groups were included and excluded in the analysis. Within each provider category (HP.1–HP.9) subgroups are shown that were defined in the COI studies. Provider groups included in the adjusted COI figures are shown in the second column. The third column shows in which countries certain provider groups were not available and for that reason were excluded from the final comparison.

Health provider	Included in COI comparison	Excluded	
		No disease information available in one or more countries	Outside SHA boundaries
HP.1. Hospitals	All		
HP.2. Nursing and residential care facilities		Canada, France	
HP.3. Ambulatory care			
GPs	All		

Appendix A (*Continued*)

Health provider	Included in COI comparison	Excluded	
		No disease information available in one or more countries	Outside SHA boundaries
Dentists	All		
Ambulance services		Australia, Canada	
Other health professionals/paramedics[a]		Canada	
Outpatient community services		Australia, Canada, Germany, France	
Home care		Australia, Canada	
HP.4. Providers of medical goods			
Prescribed medicines	All		
Non-prescribed medicines		Canada	
Aids and appliances		Australia, Canada	
HP.5. Public health		Canada, France	
HP.6. Administration and insurance		Australia, France	
HP.7. Other industries		Australia, Canada, France	
HP.9. Rest of the world		Australia, Canada, France	
Capital formation		Australia, Canada, France	
Research			Australia, Canada
Homes for the elderly			Netherlands
Disabled care			Netherlands
Playgrounds for toddlers			Netherlands

[a] The actual content of 'paramedics' was widely diverging across these studies (see [22]).

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