FINAL REPORT

ESTIMATING EXPENDITURE BY DISEASE, AGE AND GENDER UNDER THE SYSTEM OF HEALTH ACCOUNTS (SHA) FRAMEWORK

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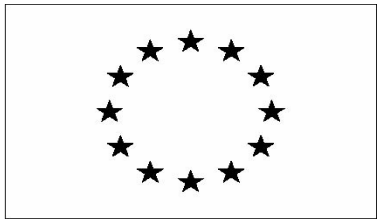

EXECUTIVE SUMMARY

1. In order to answer better the question "*Who gets what, where, and how*?", which are key questions of health policy related to efficiency and equity, the incorporation of further dimensions of health expenditure, namely, by disease, age and gender categories, alongside the existing International Classifications for Health Accounts (ICHA)[1] is required. The incorporation of patient characteristics is key to the enhancement process of the System of Health Accounts (SHA) framework and a main priority area in its ongoing development (OECD, 2000).

2. Attributing health care expenditures according to health, or more particularly disease conditions, and demographic characteristics of age and gender is important for health policy makers in order to analyse current resource allocations in the health care system. The information provided can play an important role in current discussions concerning ageing populations and changing disease patterns by allowing for the analysis of time trends, identifying the drivers of health care spending, and providing an input into the modelling of future health care expenditures. Furthermore, the linking of resource-allocated health expenditures to appropriate measures of outputs (*e.g.* hospital discharges by disease) and outcomes (*e.g.* health status) can provide a useful input in the development of monitoring and evaluation indicators of health care systems.

3. From an international perspective, health expenditure broken down in such a way can also provide important data to help understand the observed variations in overall health spending between countries and thus lead to a broader discussion of the different organisational aspects of health care systems. The adoption of a consistent 'functionally defined' boundary of health care spending proposed by the System of Health Accounts is seen as a necessary precondition for the production of meaningful internationally comparative estimates of expenditure on health.

4. Within this context, this project aims to develop guidelines for compiling such estimates of expenditure by disease categories, and age and gender groups under the SHA framework. With a set of proposed concepts and detailed guidelines, a strategy is then proposed for the incorporation of a relevant module into the established joint OECD, Eurostat and WHO SHA questionnaire to commence a regular data collection from 2010. The proposed guidelines should also serve as an input into the ongoing revision of the SHA manual.

5. Under the first phase of the project, RIVM (Dutch National Institute for Public Health and the Environment), which has extensive experience in developing international methodologies of cost-of-illness studies over a number of years, was

[1] The *International Classification for Health Accounts (ICHA)* – in its 1.0 version – covers three dimensions: health care **functions** (ICHA-HC); health care **service provider industries** (ICHA-HP); and sources of **funding** health care (ICHA-HF).

commissioned to prepare detailed guidelines covering the main concepts and definitions of a cost-of-illness methodology.

6. The second phase of the project tested the feasibility of implementing these draft guidelines under differing health care system characteristics. The project reports from a group of six countries (Australia, Germany, Hungary, Korea, Slovenia and Sweden), which also have varying experience in undertaking national cost-of-illness studies, as well as a project workshop led to number of conclusions and a series of proposals and recommendations that have been taken into account in the amendment of the draft guidelines.

7. The resulting concepts, definitions and methodologies proposed in Annex 1 provide practical guidance for countries to produce comparative estimates of health spending by disease, age and gender groups under the consistent health accounting framework proposed by the SHA. In Annex 2, the final report from RIVM summarises the recommendations from the individual country reports and discussions from the project workshop.

8. Overall, it was found that implementation of the draft guidelines is feasible and concluded that a consistent and solid measure of health expenditure as proposed under the SHA is a necessary prerequisite in order to produce internationally comparable estimates according to the additional dimensions. As such, it was recommended that the final guidelines should further emphasise the key role of the SHA and the pivotal role of the functional classification for effective cross-country comparisons. However, it was acknowledged that due to the differing structure of health care systems and national registrations in some countries, the creation of cost-units along a 'pure' functional dimension may not always be currently possible. Therefore, the guidelines should reflect the different types of health care information systems existing.

9. Pilot implementation of the guidelines also highlighted a number of areas where further consideration is required and where further methodological development is necessary. While the guidelines recommend that total current health expenditure according to the SHA (that is, excluding investment) is used as the definition of health care expenditure to be allocated, some areas of expenditure contained within this boundary remain challenging. For example, although the guidelines propose a possible method for the allocation of administrative expenditure, there are arguments both for and against their inclusion. The inclusion of management and administration expenditure better represents the 'real' health care costs to society, influences the prices of health care services and can therefore indirectly affect resource use. However, the uncertainty involved in the methodology led most countries to leave administrative costs unallocated. Other problematic areas that require methodological solutions and recommended best practices include, for example, the allocation of over-the-counter medicines and some non-specific public health/prevention activities to disease categories.

10. More in-depth analysis of the methodologies used and the data results coming out of the country studies is expected to lead to some further refinement of the guidelines, particularly regarding the recommended detail of the classifications and inclusion of further practical examples into the appendices. These refinements will be made prior to the envisaged inclusion in the Joint OECD, Eurostat and WHO Health Accounts (SHA) data collection.

11. The success of any future data collection and the perceived value of the international comparisons depends not only the application of the final guidelines and the transparency of the methodologies used, but also on the wider issues concerned with the revision of the System of Health Accounts. Methodological amendments concerning areas such as long-term care and private expenditure will obviously have consequences on the allocation across the sub-categories of health care expenditure. It should be noted that the concepts and guidelines themselves will form an input into the revision process.

12. Finally, regarding the adherence of countries to any final guidelines, a guiding principle of 'flexible firmness' should be adopted. The main aim of producing international comparable estimates should be reiterated, albeit accepting the specific national needs and priorities. The establishment of some minimum reporting standards in terms of proposed classifications and reporting frequency is however seen as important to countries seeking some stability in what is generally a resource intensive exercise that requires significant efforts in data collection and management.

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Aims of the project

13. The main aims of the project Estimating Expenditure by Disease, Age and Gender[2] were to:

- Develop guidelines for compiling internationally comparative estimates of expenditure by disease categories, and age and gender groups;
- Develop a feasible strategy for a step-by-step incorporation of the relevant module in the OECD, Eurostat and WHO SHA data collection in 2010;
- Serve as an input for the SHA revision; Unit 11: Classification of Beneficiary/Recipient Characteristics and Unit 16: Basic Accounting Rules and Guidelines[3].

Background and antecedents

14. The System of Health Accounts Manual (Version 1.0), published in 2000, proposes a comprehensive accounting framework for reporting health care expenditure for the purposes of international comparisons. The reporting is internally consistent across three core dimensions - health care **functions** (ICHA-HC); health care **service provider industries** (ICHA-HP); and sources of **financing** health care (ICHA-HF) to order to answer the key questions of *"Who gets what, where, and how"*. A common 'functionally defined' boundary of health care is seen as a pre-requisite for the production of meaningful internationally comparative estimates of total expenditure on health and its sub-components. Disease and age-specific resource allocations of health care are held up as particular examples of such sub-components.

15. Among the proposed standard set of tables contained in Chapter 2 of the original Manual are Table 6. Personal expenditure on health by major ICD categories and Table 7. Personal expenditure on health by age groups and gender. In presenting this set of tables, the Manual points, however, to an *'incremental implementation over several years'* with country experience and international collection activities initially focusing on the production of a "core' set of tables, which cross-classify the functions, financing and provision of health care. In particular, while pointing to the fact that an increasing number of countries provide breakdowns of health expenditure by disease categories, the widely differing coverage and estimation methodologies are highlighted as a barrier to producing comparative estimates. Moreover, although the availability of data by age and gender had been growing in many countries, the Manual considered that the quality of estimates was *'far from satisfactory'* for health policy and planning needs. Although the Manual includes these tables in its standard

2 . For more detail, see [DELSA/HEA/HA(2006)1].

3 . For more detail, see [DELSA/HEA/HA(2007)4].

set of tables, it provides only limited details on how to resolve these issues and insufficient guidance for their compilation. SHA implementation in most cases has not included these tables so far, and the current tables require modification.

16. In taking the ICHA-HC functional classification as a basis, Chapter 3 of the Manual does go on to discuss further possible dimensions for classifying personal health services, reflecting in part on the hybrid nature of national classifications which combine aspects of different patient characteristics, distinguishing between 'target groups', 'client or diagnostic groups', 'broad disease problems', and 'degree of dependency' *e.g.* mental health care, care for the aged, etc, and their relevance to health policy analysis (Table 1).

Table 1. **Further dimensions for classifying personal health care services**

Dimensions	Examples
Target groups	Age and gender, Geographical area, Income level, Social class, Ethnic group
Client or diagnostic groups	Mentally ill, Aged, Children, Pregnant mothers, etc.
Broad disease problems	Main diagnosis of encounter (preferably by ICD-coding)
Levels of care	Primary, Secondary, Tertiary
Clinical specialities	Surgery, General medicine, etc.
Professional categories	Care by physicians, qualified nurses, other paramedics
Degree of dependence	Level of nursing and social support needed

Source: SHA Manual 1.0, Table 3.2

17. Therefore, the Manual suggests complementary and more uniformly standardised reporting for the following subcategories of the functional classification where national information systems in a growing number of OECD countries have made the corresponding data available over the preceding ten to fifteen years (see Table 2). This table is not exhaustive but illustrates how the ICHA-HC classification might be used as a basis for more detailed international comparisons of resource utilisation.

Table 2. **Suggested complementary reporting on selected functions of health care**

ICHA-HC code	Description	Reporting dimensions
HC.1-HC.5	Personal health care	Expenditure by age and gender for major categories of health care
HC.1-HC.5	Personal health care	Expenditure by major disease groups (ICD) (as part of direct cost-of-illness calculations)
HC.1-HC.5	Personal health care	Private household (actual) consumption of health care by deciles of household income
HC.1-HC.5	Personal health care	Expenditure on mental and substance abuse therapy
		Expenditure on elderly patients by category of ADL reductions or similar measures
HC.1.1	In-patient curative care	Expenditure, discharge rates, and length of stay by DRG groups
HC.1.3.1.	Basic medical and diagnostic services	Number of patients and contacts with the primary care system
HC.5.1.1	Pharmaceuticals	Consumption of pharmaceuticals by major ATC-groups

Source: SHA Manual 1.0, Table 3.3

18. The Manual recommends that health expenditure by age and gender should be calculated on a periodic basis for the sub-aggregates of health care services and goods (*i.e.* personal health care) within measured total expenditure on health. It was pointed

out that previous experience with international comparisons of health expenditure by age and gender had demonstrated the importance of not using too broad age categories for uniform reporting (OECD, 1996d). This is especially crucial for higher age groups. The positive relationship between health spending and increased age is a result of higher mortality rates for older age groups. Since the highest levels of spending on health care services tend to occur near death, the positive age gradient associated with health care spending is not due to increased age *per se*, but is a consequence of the greater concentration of persons living the last year of their life being concentrated among the elderly (OECD, 2003). It was therefore recommended that any expenditure surveys should not stop at the age of 75 or 80 but should include higher strata as well (particularly since clusters of diseases appear to move up with age over time and may shift the slope).

19. The SHA Manual also served as a basis for the *Guide to producing national health accounts with special applications for lower and middle-income countries* ("Producer Guide") published by the WHO, World Bank and USAID in 2003. Many WHO Member States have implemented national health accounts according to the SHA Manual and Producer Guide, and many others are initiating the process.

20. The Producer Guide provides some initial suggestions for classification schemes according to demographic and socio-economic characteristics and health status or disease state for the beneficiary population, stressing the need for policy relevant and mutually exclusive and exhaustive categories.

21. Table 4.6 of the Producer Guide provides an indicative classification for age and gender from the Producer Guide with the groupings suggested as being the most relevant for health policy, including infants of less than 12 months, adults of reproductive age and various strata of adults over 65 years of age. The WHO's Global Burden of Disease is also put forward as a possible basis for the disease classification, being based on the ICD-10 and used internationally to generate basic descriptive data. The classification has a broad split between communicable diseases, non-communicable diseases and injuries.

22. Two approaches for compiling disease studies are discussed in the Producer Guide. The first, and the subject of these guidelines, is where total expenditure on health is distributed by diseases. The other, disease-specific health accounts, are more comprehensive since they reproduce a full national accounts methodology in terms of all matrices (financing sources, financing agents, functions and providers), but cover only a sub-section of total health expenditures. Two disease-specific health accounts can track the same expenditure (for example, overlapping between HIV/AIDS and Tuberculosis), and therefore cannot be added up or compared. Recent studies in many low-income countries and supported by the WHO and donor agencies have been done for malaria, reproductive health, HIV and TB.

23. Since the publication of the SHA Manual and the Producer Guide the basic methodological framework of national health accounts has become widely accepted and has been adopted in a large and growing number of OECD and non-OECD countries as the standard accounting framework for statistics on health expenditure and financing.

24. With the purposes of reducing the burden of data collection for the national authorities, increasing the use of international standards and thereby harmonising national health accounting practices, the three organisations established a framework for a joint health accounts data collection to cover OECD and EU member and candidate and accession countries in 2005.

25. The International Health Accounts Team (IHAT), consisting of experts responsible for health accounts work at OECD, Eurostat and WHO, was established and drew up a set of *Practical working arrangements for cooperation between OECD, EUROSTAT and WHO*, resulting in the tables and methodological documentation for the first Joint Health Accounts Questionnaire (JHAQ), sent out in December 2005.

26. These *Practical working arrangements* stated from the outset that as part of the scope and approach of the data collection, the 'feasibility of collecting data by disease category and by age and sex will also be examined for possible inclusion in future data collections'.

27. Expenditure by gender and broad age categories (0-64, 65+, 75+) has also been included for a number of years as part of the regular annual data collection for *OECD Health Data*. However, recent data have been reported via this questionnaire for only around six OECD countries, although it is clear that a higher number of OECD countries are currently producing estimates by age and gender, although perhaps not consistent with the SHA framework.

28. Despite the limited international data collection activity, substantial experience has been accumulated in the field of cost-of-illness studies, and an increasing number of countries have undertaken national studies or included the dimensions of age and gender groups, and/or disease categories in their health accounts (*e.g.*, Australia, Germany, United States). Furthermore, several recent EU funded projects (through EUROSTAT and other Commission services) have examined the availability of data on expenditure by patients' characteristics. These antecedents provide an important input to the project concerned.

Age and gender-specific functional health accounts

29. The Eurostat project during 2001-2003 was undertaken by the Centre for Population Poverty and Public Policy Studies (CEPS) in Luxembourg and the Inspection Générale de la Sécurité Sociale (IGSS) of the Luxembourg Ministry of Social Security. The aims of the project were to:

- Assess the current availability, quality and comparability of data on health care expenditure by function, age and gender in EU/EFTA countries;
- Make recommendations concerning the inclusion of such data in the System of Health accounts.

30. The first two phases of the project collected information, firstly on data sources and studies of age and gender and then on two specific functional areas. The final phase assessed the data quality and undertook a comparative analysis of the data in order to make the final recommendations.

31. The short term recommendation was for a routine collection of expenditure data by function, age and gender covering inpatient curative care and pharmaceutical expenditure within the context of countries' ongoing SHA development. In the medium term it was recommended that this should be extended to other health care functions and be planned in the context of ongoing programmes of Eurostat and others (*e.g.* OECD initiatives), as well as individual countries' SHA efforts.

Feasibility Study of Health Expenditures by Patient Characteristics

32. A further Eurostat project undertaken by BASYS[4] in conjunction with CEPS and IGSS stated as objectives:

- A study of possibilities and problems associated with breaking down health expenditures by age, gender and diseases for all EU member states and EEA/EFTA countries

- A suggestion of a shortlist of diseases/disease categories for use in the project and thereafter, which takes sufficiently into consideration the information needs at EU-level with respect to disease specific prevalence and treatment

- A compilation of results for those countries able to provide the necessary data and willing to have those results analysed and compared

- An evaluation of the results obtained with respect to data quality and comparability, consisting of detailed recommendations as to whether or not health expenditures by age, gender and diseases can and should be collected in the short and medium term at EU level, and whether or not such data collections should be an integral part of the Eurostat routine data collection of SHA expenditure data.

33. On the basis of the data collected and the discussions at a project workshop, the final report recommended the routine collection of the variables in Table 3 such that the trends in the evolution of health expenditure by patients' characteristics may be monitored. There was also a clear consensus that such a collection would be 'feasible, interesting and informative'.

[4] BASYS is a private and independent research and consulting institute. Its stands for "Beratungsgesellschaft für angewandte Systemforschung", which means "Applied Systems Research Consulting Corporation Ltd".

Table 3. Proposed variables for future routine collection of data on health expenditure by patient characteristics

Dimension	Details
ICHA-HF;	HF, 1 digit
Year:	Possibly once every three years. All countries to use same years.
Disease:	ICD 10, 2 digit
Sex:	male, female, no known
Age:	0, 1-4, 5-9, etc.
ICHA-HC:	1 digit except HC.R.1 (Total current expenditure)

Source : Final Report 'Feasibility Study of Health Expenditures by Patient Characteristics''

34. Of particular relevance to this current project were the discussions of possible methodologies with a view expressed that the 'combination of top-down and bottom-up approaches to compiling data on expenditure by patient characteristics will ensure the greatest accuracy.' The workshop discussions also covered the question of reporting requirements and a minimum data set was discussed with disease related expenditure compulsory at the ICD chapter level and voluntary at the disease level. Also of relevance was the relationship to SHA, insofar as the starting point for the data is primarily with health providers rather than with the health functions.

35. Whereas the recent projects related to health expenditure by patients' characteristics were aimed primarily at collecting information on data availability and the available health expenditure data (*e.g.*, inpatient expenditure by age and gender. Data on expenditure by disease may not be available at this moment in several countries, but the necessary information for their estimation (*e.g.*, utilisation data and data sources for making unit costs estimates) may be available. In addition, the aforementioned projects did not, themselves, examine the comparability of the methodologies used across countries. A key concern is to ensure international comparability, hence the need to first develop a set of guidelines, test their feasibility and then encourage their use internationally.

Recent international cost-of-illness studies

36. RIVM (National Institute for Public Health and the Environment, the Netherlands) in particular has undertaken a number of recent international comparative studies.

37. Their 2006 study of five European Union and OECD countries (Netherlands, France, Germany, Australia and Canada) pinpointed the existing differences in methodology and emphasised the need for standardisation in both SHA implementation and COI methodology. However, from the data results the study did conclude that, at an aggregate level, the allocation of costs to disease groups showed that the same groups were the main drivers across the different countries, and that despite the differences in health care systems, the cost patterns were generally similar.

38. A more recent study (2008) compared COI studies from five countries – France, Germany, the Netherlands, Australia and Canada. The authors also identified a further five country studies – Japan, Spain, Sweden, UK and USA – but which were not included due either to their lack of detail or age. The conclusions were that although significant progress had been made, a comprehensive international comparison of all

health expenditure across all dimensions is not attainable (yet). Comparability was compromised due the variation in the share of health expenditure (providers) not being allocated and also in the incomparability of some providers or functions themselves within the SHA framework, particularly with respect to long-term nursing care. The main comparisons were restricted to providers of curative care.

Project methodology and process

39. The project consisted of two main phases, with the following major tasks:

First phase

40. Under the first phase of the project, RIVM was commissioned to prepare a paper covering the main concepts and definitions of the cost of illness methodology together with detailed guidelines for producing expenditure estimates by disease, age and gender under the SHA framework. As mentioned above, RIVM has extensive experience in the field of cost-of-illness studies and have been at the forefront of developing common methodologies to serve the national and international debate on health and health expenditure with a deeper understanding of the interrelationships between demand and supply of health care.

41. In identifying the conceptual and practical challenges in estimating expenditure by disease, age and gender groups, the following key methodological issues were raised in the paper for consideration during the subsequent feasibility phase of the project.

- Combining and reconciling results from top-down and bottom up allocation methodologies. As explained in the concepts and definitions, under the top-down methodology the total health care costs are broken down by inpatient care, out-patient care, pharmaceuticals, etc.; then disease-specific data on health care utilisation for each sector and relevant unit costs are estimated. The bottom up methodology uses patient-based information and has the possibility to connect utilisation of services by the same individual patient in several sectors.

- Defining the adequate level of detail both in terms of disease groups (level of the ICD-categories)[5], age categories and the types of services /interventions.

- The demarcation of health care costs within the SHA framework; that is, the allocation of public health and prevention and administration expenditures to disease, age and gender categories;

- The integration and linking of the functional classification when the starting point for the supply of data is often the health providers.

[5] For example, the current Table 6 only presents the most aggregated structure of ICD (the 18 chapter of ICD-9), among them Diseases of the circulatory system. It would be desirable to create sub-categories, for example: *Ischaemic heart disease, Cerebrovascular diseases and Other diseases of the circulatory system.*

- How to deal with co-morbidity while preserving the need for avoid double counting and ensure that the total of the categories is consistent with total health care costs.

- Other problematic areas of expenditure such as the allocation of over the counter pharmaceuticals and other private expenditure to disease, age and gender categories.

42. The resulting document Draft Guidelines for Estimating Expenditure by Disease, Age and Gender under the SHA framework ("Draft Guidelines")[6]: was presented at the Ninth Meeting of OECD Health Accounts Experts in Paris in October 2007, and based on the comments provided by the OECD Secretariat and delegates was completed by early November 2007.

43. An interim report including the Draft Guidelines together with a timetable for the second phase of the project was delivered to the European Commission at the end of 2007.

Second phase

44. The purpose of the second phase was to test the feasibility of implementing the Draft Guidelines under different circumstances of health system characteristics and data availability A number of countries would be asked to examine whether they would be able to implement one of the proposed estimation strategies and based on the trial implementation, modifications would be made to the Draft Guidelines if necessary. An Invitation for Expressions of Interest in Participating in a case study under the OECD project "Estimating Expenditure by Disease, Age and Gender under the System of Health Accounts (SHA) Framework" was also presented at the OECD Health Accounts Experts in October 2007. The invitation was then sent out to OECD member countries and non-OECD members and candidate countries of the European Union in the first half of November 2007.

45. A total of six countries submitted a formal Expression of Interest and were all accepted to participate in the second phase of the project. The participating countries were Australia, Germany, Hungary, Korea, Slovenia and Sweden. The countries undertaking the second phase constituted a mix of countries with different health care systems and varying degrees of experience in undertaking cost-of-illness studies. This range of experience was felt to be beneficial to the overall aim of improving the guidelines. In addition, Sweden was accepted to undertake only a partial study allocating expenditure on curative and rehabilitative in-patient care only. The particular methodological issues raised by this proposed Swedish study and the feasibility of extending the methodology to other areas of healthcare were thought valuable to the overall discussions on the guidelines.

[6] The draft of these documents were included in the INTERIM REPORT ON SYSTEM OF HEALTH ACCOUNTS DEVELOPMENTAL PROJECTS IN 2007-2008 OECD PROGRAMME OF WORK [DELSA/HEA/HA(2007)7] presented at the 9th OECD Meeting of Health Accounts Experts.

46. During this implementation phase of the project, an expert from RIVM was also made available for consultation via e-mails for questions of a technical nature regarding the interpretation and implementation of the guidelines.

47. As part of the feasibility studies, each country provided an interim report by 30 June 2008. The purpose of the country interim reports was to report progress to date and the proposed steps to complete the project. The individual country timetables meant that at the time of the interim reports, countries were at varying stages of implementation. The interim reports provided a description of the main sources and methodologies used and, more importantly, in the context of any subsequent amendments to the guidelines, a description of the key issues encountered or envisaged during the implementation of the Draft Guidelines, such as:

- Identification of details of the Draft Guidelines that proved to be insufficiently clear for the particular circumstances of a country.
- Description of the problems encountered during the implementation of the Draft Guidelines due to country-specific circumstances.
- Description of the departures from the Draft Guidelines necessary in order to compile the data. This may include an assessment of whether the departures are due to anticipated problems that may occur in any final implementation of the guidelines or due to country-specific problems encountered in the case study.
- Identification of variables for which the participating team was not able to make an appropriate estimate; as well as the causes of any shortcomings.
- Proposals for amending the Draft Guidelines, in the light of the experience with implementation during the project phase.

In addition, and depending on the individual country progress, some initial data results were also presented.

Main conclusions from the Project Workshop

48. A one day project workshop, held in Paris on 7 October, 2008, brought together the nominated experts from the six participating countries with an expert from RIVM and representatives from international organisations and other interested OECD countries to discuss the issues raised in the interim reports and prepare the next steps for the conclusion of the country reports and final guidelines. The discussions and conclusions from the workshop were also presented at the Tenth Meeting of OECD Health Accounts Experts the following day. The overall conclusions from both meetings are as follows:

- The System of Health Accounts framework would appear to provide a suitable cost framework for undertaking cost of illness studies with the participating countries able to allocate a high share of current health expenditure across the added dimensions. Therefore the use of the SHA should be a prerequisite for the production of internationally comparable estimates of health expenditure by disease, age and gender;

- Application of the Draft Guidelines appears to be feasible based on the countries' experiences during the implementation phase and the participating countries were expected to be able to provide the final presentation tables requested as part of their final reports;

- In terms of allocation methodologies, it would seem appropriate, and indeed advantageous, to promote the use of bottom-up allocation where detailed and accurate data allow this, bearing in mind the need to preserve the mutual exclusivity between classification classes and ensure consistency in an overall top-down model approach, *i.e.* the total of all classes should equate to the total health expenditure under the national health accounts framework.

- Furthermore, in dealing with the co-morbidity issue, it was accepted that there is a necessary trade-off between the complex allocation methodologies, that provide accurate cost estimates at the disease-specific level for national purposes and more simplistic methodologies that can be applied in order to provide overall allocations between diseases for international comparative purposes. It was accepted that the current treatment of co-morbidity in the guidelines is limited and should be the subject of further research to establish best practices.

- The Draft Guidelines need to be less geared towards health care systems with strong health care provider statistics but should provide a more balanced viewpoint, also covering systems where the primary information comes from the financing side. The original slant of the Draft Guidelines towards a provider approach is understandable since they are closely based on the Dutch system. In both these cases there should be more emphasis of the linkage to the key functional classification (ICHA-HC) in order to facilitate international comparisons.

- There is the need for some further refinement of the Draft Guidelines after more analysis of the results from the country studies and consideration of other health care statistics. This is particularly the case with regards a final recommended shortlist for disease categories.

- The final proposed guidelines need to remove some of the ambiguities of the Draft Guidelines and clarify some of the terminology (*e.g.* direct and indirect costs, bottom-up and top-down methodologies, etc.).

- Although the aim of the guidelines is more on the '*how*' rather than the '*why*', the final guidelines should include an enlarged discussion of the policy uses and links to other data sets, *i.e.* measures of outputs and outcomes, in order to justify the not insignificant investment needed to implement the accounts.

- Finally, the issue of how binding any final guidelines should be and whether there should be minimum requirements in reporting requires further consideration. Bearing in mind that the overall aim of the project is to provide comparable international estimates, there needs to be a degree of 'flexible firmness' in recommending the implementation of the guidelines.

49. Annex 2 contains the final report by RIVM which summarises in greater detail the main findings from the country reports[7] and the discussions from the workshop that have been incorporated into the final guidelines.

Final report and next steps

50. The workshop provided a forum to discuss the interim reports and country experiences and recommendations. These discussions shaped the final stages of the project leading to the final country reports. Conclusions and recommendations have also been incorporated into the following sections of this paper Concepts and Methodology and Practical Guidelines for estimating expenditure by disease, age and gender under the SHA framework.

51. The implementation of the guidelines has highlighted a number of areas where further consideration is required and where further methodological development is needed. The guidelines recommend that total current health expenditure (defined as HC.1-7 according to ICHA-HC, *i.e.* excluding HC.R.1 Capital Formation) is used as the definition of health care expenditure to be allocated across categories. However, some areas on expenditure included within this boundary were challenging during the implementation studies. For example, although the guidelines propose a method for the allocation of administrative expenditure, there remain arguments both for and against their inclusion. The inclusion of management and administration expenditure better represents the 'real' health care costs to society, influences the prices of health care services and therefore indirectly affects resource use. However, the uncertainty involved in the methodology led most countries to leave administrative costs unallocated. Other problematic areas that require further methodological solutions and the identification of best practices include, for example, the allocation of over-the-counter medicines and some non-specific public health/prevention activities to disease and demographic categories. The improvement in the validity of cross-country comparisons is dependent on a reduction in the non-allocated share of total health care spending.

52. In line with the Practical Working Arrangements for the Joint OECD, Eurostat and WHO Health Accounts (SHA) Data Collection[8], it is also a stated aim that the feasibility of including an additional module to collect expenditure data by disease, age and gender on a regular basis will be examined.

53. It is planned to produce an OECD Health Working paper during the first half of 2009 based on a comparative study of the methodologies and data results coming out of the country implementation projects. Input from countries not directly involved in the project but who have completed recent similar studies should also be included where applicable.

54. This study is expected to further refine the guidelines, particularly with regard to recommended classifications and final reporting requirements regarding the preparation of requested tables and reference year. This will be necessary for a

7 . The final reports from the participating countries are to be made available as separate documents.

8 . See DELSA/HEA/HA(2008)2.

proposal to be submitted to IHAT in August 2009 for the incorporation of an additional module into the 2010 Joint OECD, Eurostat and WHO Health Accounts data collection.

55. Subject to approval by IHAT, this would then form part of the proposal to be discussed at the 2009 OECD Health Accounts Experts meeting next October, with a view to sending out the 2010 questionnaire in December 2009.

56. This final report will also be the basis for an input into the relevant units of the ongoing *System of Health Accounts* revision process. The concepts and methodology are expected to constitute an input to Unit 11: Classification of Beneficiary/Recipient Characteristics while the methodology and guidelines would also form an input to Unit 16 (Basic Accounting Rules and Guidelines) of the revision of the SHA manual. Both of these units will be open for the submission of input papers during the course of 2009.

The structure of the annexes

57. Annex 1 presents the revised conceptual framework and methods for estimating expenditure by disease, age and gender under the SHA framework.

58. Annex 2 presents the final report from RIVM, providing a summary of the conclusions and recommendations from the interim country reports and workshop discussions. The report also contains a summary of each of the country reports and an appendix to the report contains a table comparing the general characteristics of the country studies.

Contributions for the project

59. The report on estimating expenditure by disease, age and gender under the SHA framework was funded over the period 2007-08 by regular contributions from member countries of the OECD. The project was also supported by a grant provided by the Directorate General for Public Health and Consumer Affairs of the European Commission under Agreement No 2006OECD01. As the project is partly financed by the European Commission, it also includes those EU and candidate countries that are not members of OECD. The additional costs incurred by the national institutions during the implementation phase were covered under the project budget.

ANNEX 1

Guidelines for Estimating Expenditure by Disease, Age and Gender under the System of Health Accounts (SHA) Framework

Acknowledgement

60. This set of guidelines is based extensively on the Draft Guidelines authored by RIVM[9] which themselves drew on the experience on a series of Cost of Illness studies undertaken in the Netherlands. It contains numerous examples from the Dutch 2003 COI-study.

61. The final guidelines have benefitted significantly from the experiences of the country studies undertaken during the testing phase of the project to develop the guidelines. The following national institutions provided the country reports: Australian Institute of Health and Welfare, Statistisches Bundesamt, Yonsei University, Hungarian Health Insurance Fund (OEP), The Centre for Epidemiology (EpC) of the Swedish National Board of Health and Welfare, Statistical Office of Slovenia. Comments on the Draft Guidelines were also received from the European Commission (Eurostat).

9 . The Draft Guidelines were prepared by LCJ Slobbe, Msc R Heijink, Msc and JJ Polder, PhD all of the RIVM, National Institute for Public Health and the Environment, Antonie van Leeuwenhoeklaan 9, PO Box 1, 3721 MA Bilthoven , The Netherlands (JJ Polder also from the Tilburg University, TRANZO Department, Warandelaan 2, PO Box 90153 5000 LE Tilburg, The Netherlands. LCJ Slobbe is the corresponding author.

1. INTRODUCTION

62. The following guidelines for estimating health expenditure according to disease, age and gender categories use a general cost-of-illness (COI) approach within the framework of the System of Health Accounts (OECD, 2000). The guidelines are based principally on those developed in the Netherlands as a result of a series of COI studies published since 1991 (Koopmanschap *et al.*, 1991, Polder *et al.*, 1997, Polder *et al.*, 2002, Slobbe *et al.*, 2003), and then subsequently amended following the recommendations of a feasibility implementation study as part of the OECD project *Estimating expenditure by disease, age and gender under the SHA framework*. The overall aim was to provide a common and consistent set of guidelines for the production of internationally comparable estimates of health spending.

63. Chapter 2 provides an overview of the main definitions and basic concepts including an overview of the main uses of the data. This chapter also includes a description of the three dimensions added by the COI analysis to the SHA-based accounting system: age, gender and disease. Classifications for the dimensions are also proposed.

64. In Chapter 3, the methodology for the construction and calculation will be described in detail with practical guidelines and examples. Chapter 4, Integration of national results in the SHA, describes the compatibility and implementation of COI-estimates within the existing dimensions of the SHA. Finally, Chapter 5 deals with the interpretation of COI-results and also discusses some limitations and caveats of using COI-results.

65. The appendices contain full details about the classifications, give examples of typical output tables and also provide some calculation examples based on the 2003 Dutch study.

2. CONCEPTS AND DEFINITIONS

2.1 Cost-of-illness studies

66. Although this project places the emphasis more on '*how*' to estimate health expenditure according to patients' characteristics rather than the '*why*'; nevertheless, it is important to discuss the usefulness of what can be a resource intensive exercise as an key input to health policy analysis. Cost-of-illness (COI) studies add patient-related information (disease, age, gender) to health expenditure data. In the literature three important uses are addressed (Polder, 2001):

- Providing information on resource allocation in health systems
- Analysing time trends and making projections of future health expenditure
- Making international comparisons of health expenditure

67. The primary applications have been, at least until now, in national debates. First and foremost, health expenditure estimates by disease, age and gender provide a useful perspective on the utilisation and costs of health services (Meerding *et al.*, 2006). However, it should be clear from the outset that there are limitations regarding the interpretation and policy use of this information on resource allocation.

68. The information on its own does not give an indication of whether the current allocation is optimal and should not be used as a pointer for the future allocation of resources; the danger being that priority in future decisions is given to those disease or age groups which are already costly.

69. Similarly the expenditure allocated to any specific disease or groups of disease cannot on its own indicate the possible cost savings to be made by implementing, for example, particular prevention campaigns. Furthermore, for the analysis of specific diseases, a general approach to resource allocation is probably not as sensitive or accurate as a detailed analysis of actual costs incurred by patients with that disease.

70. Debates about resource allocation in health care have tended to focus on highly visible costs, which attract much public attention, such as fees and drug costs (Wilking and Jonsson, 2005). However, these costs usually form only the tip of the iceberg. Although drug costs account for a relatively small proportion of total healthcare expenditure for cancer, it can be argued that because drug acquisition costs can be easier to identify and calculate, they become a greater focus for cost control than some of the more general (and more difficult to calculate) costs of cancer healthcare.''

71. A full assessment can only be made by performing an analysis in which costs for specific diseases and specific providers are placed in the context of total health expenditure. A general COI analysis is especially useful in these types of discussions, because it aims to give all diseases and all types of costs equal attention, thereby avoiding the 'easy-to-calculate bias'. Fortunately, in the last few years the number of internationally comparable COI-studies has increased (Slobbe *et al.*, 2003, Health Canada, 2002, Paris *et al.*, 2003, Statistisches Bundesamt, 2005).

72. By expanding health expenditures by patients' characteristics, a more thorough understanding of health expenditure developments and the drivers behind health expenditure growth can be provided. The usefulness of the information can be enhanced through the linking of the expenditure data together with other data of outputs (*e.g.* hospital discharges by disease) and outcomes (*e.g.* health status) to inform policy makers.

73. The information provided is important in current discussions about ageing populations and rising health expenditure. In this respect it is important to classify across all three additional dimensions as disease patterns are clearly dependent on age and gender.

74. Use in international comparisons has lagged, mainly because health systems differ substantially and countries use different boundaries of services included under health care costs (Polder *et al.*, 2005). However, the introduction of the SHA in 2000 has already significantly improved comparability between countries (Heijink *et al.*, 2006). This highlights the importance of adopting a consistent methodological approach, such that disaggregated health expenditures can provide an important input to understand the observed variations in overall health spending between countries.

75. Since the birth of the COI analysis (Rice, 1967), the field has expanded considerably, and the term is now used to cover quite different types of analysis. What these studies do have in common though is an assessment of the economic burden of disease. Some attempts to classify these different analyses have been made (Evers *et al.*, 2004 and Akobundu *et al.*, 2006). However, the common methodological aspects in which studies differ are:

i) Scope of disease: a distinction is made between 'specific' COI studies which focus on the cost of a particular disease and 'general' studies which calculate costs for all diseases simultaneously. The influential study of Rice was of the general type, but nowadays many studies are high-profile disease specific accounts such as HIV and tuberculosis accounts.

ii) Demarcation of costs: three groups of costs can be distinguished: direct costs, indirect costs and intangible costs. Direct costs can be further divided into direct medical costs for treatment and direct non-medical costs, depending on whether or not the resources have been expended directly in the production of a treatment. For instance, the cost of a bus ticket to reach a hospital would be a non-medical cost. Indirect costs or productivity losses can be seen as the loss in earnings as a result of adverse health outcomes. This may be as a result of death, illness or time spent undergoing treatment. The loss of earnings can be both those of the patient and family members caring for the patient. Intangible costs comprise, for instance, the costs due to loss of life or

quality of life caused by illness or disability. Various combinations of costs involved can be encountered in the literature.

iii) Methods: Most studies use a prevalence based method: that is, all costs due to prevalent cases of disease in a given period are aggregated to total costs. An alternative design is an incidence based method, in which life-time costs are calculated and costs are assigned to the period in which the incidence of the disease occurred. This requires substantially more data than the prevalence-based method and is therefore less often used.

iv) Direction of approach: In a top-down design, costs for a given disease are calculated by multiplying the total health expenditures with the proportion of this expenditure used by a specific disease. Alternatively, a bottom-up design can be used, in which units of health care used on a patient level are multiplied with a price for this unit. All individual costs are then summed up to calculate total health expenditure. A third option is essentially a mixed method whereby a bottom-up methods are adopted where detailed cost information is available but in an overall top down design.

v) Definition of health care: even if studies agree in demarcation of costs, there can still be differences because different sectors are included. Some studies limit health care to personal care while others take a more societal view on disease-costs. Not only the cost made for those who are ill should be included but also the costs made for the direct prevention of illness (*e.g.* screening, vaccination, prevention programmes, awareness programmes) and the administrative costs for running the system or managing insurance schemes.

76. It should be noted that choices regarding these different aspects can be dependent on each other. A bottom-up approach, for instance, is most appropriate when a disease-specific study is performed, whereas an overall top-down approach may be more suitable to meet the data and calculation needs of a general COI-study.

77. Regarding the integration of COI within the SHA framework the following aspects are recommended: 1) a general COI study including 2) direct medical costs only, using a 3) prevalence-based method using a 4) mixed methodology (both top-down and bottom-up) with a 5) broad definition of health expenditure. The following paragraphs will describe in more detail these aspects in relation to the SHA and the following chapters will deal with the data requirements and methods of cost calculation in this type of COI analysis.

78. The choice of a general study as opposed to a specific study is inherent to the purpose of estimating expenditure by patient characteristics: to compare relative amount of costs spent on specific diseases or demographic groups within and between countries.

79. The demarcation of costs depends directly on the designated cost framework *i.e.* direct medical costs as defined by the boundaries of health expenditure under the SHA. Direct medical costs can be seen as equivalent to the costs as defined by the health care functions HC.1 to HC.7 under the ICHA-HC Functional Classification. Some direct non-medical costs can be recognised under the health-related functions

HC.R.1 to HC.R.7. For indirect costs and intangible costs, these fall outside of the SHA framework. They may be calculated using a wide range of data sources and methods, but whereas the demarcation of direct costs is relatively straight-forward and reliable, any extension to cover indirect or intangible costs would require extensive international effort. Therefore, for the purpose of dealing with COI within a health accounts framework, it seems most appropriate to exclude these costs and to focus entirely on direct medical costs.

80. The choice of a prevalence based method is straightforward since an accounting framework such as the SHA advocates the collection and reporting of data on an annual basis.

81. For a general COI analysis an overall top-down approach to cost allocation has been generally advised to ensure that the total health care costs from the COI study equate to the total expenditure from the national health accounts. The top-down method ensures no double-counting of costs occurs; every currency unit is assigned to one disease only. In a bottom-up only approach this cannot be guaranteed, due to existing co-morbidities. An example is diabetes, which is a major risk factor for cardiovascular disease. In a bottom-up approach costs for the treatment of heart-problems for this patient are counted with both heart disease and diabetes. In a top-down approach the resources spent on this patient are (proportionally) distributed among these diseases. However, the price for the desirable avoidance of double counting is an underestimation of the 'true' costs of diseases such as diabetes which often cause other diseases (see *Dealing with co-morbidity* in Chapter 3). However, there needs to be some clarification since country practice has shown that the use of bottom-up calculations for some cost units *within an overall top-down approach* should be allowed and even recommended. This is the case if good enough patient-based data sources exist for a successful direct calculation of expenditure by disease that is consistent with overall health expenditure estimates and avoids the issue of double allocation. Indeed, experience has shown that in some countries more than a half of total current expenditure on health can be allocated in this way.

82. Finally, a broad societal perspective on health care is recommended above a more limited definition such as personal health care. This better represents the real (health care) costs of a disease to society. In most western countries childhood diseases such as measles have been almost eradicated, so the 'treatment' costs are negligible. However, these costs are low, because society has chosen to invest in vaccination programmes for the eradication of diseases. A COI analysis should show the costs of this investment, even if this is not considered to be 'personal health care'. It should be noted, however, that even in a broader perspective questions about the boundaries of health care can still arise, especially in the case of prevention. There is strong evidence to include vaccination and screening in COI, but what to do with expenditure on health protection as for instance sanitation and road safety.

83. Similar reasoning can be applied for the inclusion of costs on management and health care administration. Between different countries or funding schemes differences in management costs can be considerable, which influences the prices charged to customers for health care services under these schemes, so indirectly influencing resource use. Including costs for running the system in the COI analysis ensures a better comparability of outcomes.

84. However, the inclusion of non-personal health care does have a price: one gets the total health care costs for a disease, not the cost for patients with a disease. This implies that the total costs for a disease can be translated to costs per capita, but not so easily to costs per prevalent case of a disease.

85. The limitations on including some sections of expenditure can be put down to a lack of data in most instances. The total costs reported according to disease, age and gender should equate to the total costs according to the other dimensions of SHA. Therefore, for meaningful international comparisons there is a requirement for transparency in reporting and those parts that cannot be attributed should be added to a "not allocated to any specific disease" category to allow for the differences between reported costs to be shown. By extending COI studies to include the dimensions of the SHA, in particular the functional dimension, comparative analyses can be performed at different levels of aggregation where data availability may be greater in the first instance, *e.g.* inpatient curative care, personal health care.

86. Health care expenditure should, however, be limited to current health expenditure, that is, to exclude expenditure on capital formation on health facilities and equipments which can have large outlays and fluctuate from year to year.

2.2 The SHA as a cost framework

87. A cost framework for a COI analysis can be defined as a table of health care costs (in national currency units). The inclusion or exclusion of costs is determined by criteria based on an established definition. Every line in this table describes a single cost estimate in one or more dimensions, using - if available - standard classifications. In this sense COI provides an accounting system for disease costs.

88. Ideally the table should be complete, including all costs within the cost definition. Cost units should also be mutually exclusive: all costs involved should be part of only one cost unit. This ensures that no double-counting occurs.

89. As discussed above, the boundaries of the SHA define the health care costs to be included by limiting the analysis to direct medical costs (as defined by the ICHA functional classification) and by taking a broad societal definition of health care, equivalent to current health expenditure. In the SHA Manual a detailed description of the boundaries of health care is given, showing how costs should be divided among functions and what should be included and what not under the aggregate of current health expenditure. This will not be elaborated upon further in these guidelines.

90. The implementation of SHA in many countries has led to a significant improvement in the comparative estimates of overall health expenditures, although clearly there remain some differences, and the inclusion of some costs within the boundary of health care continue to be the subject of debate. This is especially the case in areas outside of curative care, such as long-term care, informal care and parts of public health and prevention. It is clear that differences in overall measures of health care spending have an impact on the validity of comparisons at a sub-aggregate level by disease and gender. For example, the wider interpretation of long-term care will affect markedly the costs by age and for certain age-related diseases compared with a country employing a narrower definition. Any differences in the overall measurement should be borne in mind when analysing country differences.

91. However, it is clear that for the purposes of making international comparisons, the establishment of a national cost framework along SHA-lines is considered a pre-requisite before attempting to make expenditure estimates.

2.3 COI dimensions

92. This section provides guidance on the descriptions and recommended classifications to be used in individual dimensions of the COI analysis, in both the calculation phase and reporting. For all dimensions it is recommended to use classifications which are in common use internationally, enhancing the prospects for comparability with other data, such as health outputs and outcomes. First the three additional COI dimensions disease, age and gender are described and then briefly, the existing dimensions of the International Classification for Health Accounts (ICHA) of the SHA, namely, the function, provider and financing dimensions. The linking to the functional dimensions for international comparisons is covered in greater detail under Chapter 4 'Mapping national results on the SHA'.

93. For all dimensions some aspects are common, and taken for granted: all classifications in use should be complete. This means that it must always be possible to classify a certain cost within the classification. The individual classes used in a dimension classification should be non-overlapping: costs belong to one group in the classification only.

2.3.1 Disease

94. The International Classification of Diseases (ICD) of the World Health Organisation (WHO) is the most important general classification of diseases. Use of this classification in the attribution of health care use according to disease is strongly recommended. However, there can be several practical problems with this. The first problem is the sheer size of the classification with the ICD containing many thousands of diseases. Analyzing all these is near impossible and, moreover, not desirable since the most common diseases comprise several individual ICD-codes. The second problem is that two different not fully compatible versions of the ICD are in common use (ICD-9 and ICD-10) and many countries also use slightly modified national versions of both these classifications. This is especially a problem with the ICD-9 which was originally introduced in 1977. New diseases such as AIDS and legionella were not always incorporated in the same way in national translations. Furthermore, not every health care registration will use the ICD as its base classification. The use of the ICD is common in hospitals and for in-patient care, but much rarer for other providers such as general practitioners, who tend to use much cruder classifications such as the International Classification of Primary Care (ICPC), or psychiatrists, for example, who use a classification specific for mental disorders (DSM).

95. These problems might largely be solved by an internationally recognized shortlist of diseases. It would then be possible to map locally used classifications onto this shortlist.

96. The special tabulation list for morbidity published in ICD-10 volume 1 consists of 298 groups defined by their ICD-10 codes. However, for international comparisons of hospital morbidity statistics this list has still been regarded as too extensive and different shortlists have been developed by producers of hospital statistics.

97. The Hospital Data Project (HDP) of the European Union Health Monitoring Programme established the International Shortlist for Hospital Morbidity Tabulation (ISHMT) which was subsequently endorsed and accepted by Eurostat, WHO and OECD (Appendix I). The list covers 130 disease groupings below the chapter headings of ICD-10 and, importantly, is defined also for ICD-9 codes allowing comparisons between countries using the two different ICD revisions and the development of time series statistics. A survey of available general COI analyses shows that it is very common to report disease-specific cost data at least at the chapter-level of the ICD (infectious diseases, neoplasm's etc). Further divisions are mainly based on the importance of diseases for national health care policy.

98. In many registrations of health care, an ICD-based disease-group can only be attributed indirectly. Prime examples are registrations of GP's which, as mentioned above, often use an ICPC classification, and pharmaceutical costs, often registered using ATC-codes. Link tables for these classifications with the ICD should be developed, which can be very time-consuming. Because there are local differences in for instance prescription and treatment guidelines, link-tables developed for a specific health care system should be used with caution in other health care systems. However, an important lesson for countries that have no prior experience in COI studies is that the creation of these correspondence tables can be speeded up if they could start with existing link-tables developed in other countries. It is therefore recommended that researchers in countries which have already developed these tables should share them with countries which haven't yet done so.

99. An important consideration in the selection of the disease classification regards the level of detail in which disease-specific data are registered. A rough survey of the most important health care registrations before the start of the analysis should provide information on this. Sometimes registrations contain no diagnostic information at all. In this case it should be checked to see if the registration contains information that can be used as a proxy, and whether this can be linked to a disease. For example, a registration of drug consumption generally will not contain information on disease or diagnosis. Surveys of prescriptions by medical professionals can then be used to link these consumption data to specific diseases by probabilistic methods. It should be remembered that for each disease classification in use in local health care registrations a mapping to the selected diagnostic groups for the analysis must be made.

100. A two-level classification is advised: a 'chapter-level' (based on the ICD-chapter), and a 'group-level' within these chapters. Every chapter should also include a rest group for the classification of costs which belong to the chapter but are not classified in a subgroup (other infectious diseases, other respiratory diseases etc). This structure has also been followed within the ISHMT.

101. These guidelines currently propose the use of the ISHMT classification for the second level but valid objections have been made against this recommendation: ISHMT is less suited for non-hospital care, and difficult to apply if registrations contain less detailed disease descriptions. Some countries have also developed their own shortlists taking the WHO Global Burden of Disease classification as a starting point. Some specific issues have been addressed in these national classifications such as: the need to separate out oral health from diseases of the digestive system since it accounts for a large proportion of health spending on its own; the capacity to report diabetes separately; and grouping all dementias under the same chapter heading

(AIHW, 2005). It is recommended that a comparative study should be made from different second-level groupings currently in use in different countries, and a recommended list of second-level disease groups derived from this study. This could be an important objective of any future analysis of country estimates of cost by disease are compared.

102. In view of the absence of a firm internationally recognized shortlist of diseases to be used in a COI it is recommended that as a minimum general COI analysis should be performed on main groups of diagnosis as defined by the ICD. Because chapters within ICD-9 and ICD-10 differ slightly it is recommended to use the definitions in ICD terms as provided by the ISHMT shortlist which contains a definition of chapters in both ICD-9 and ICD-10 terms. A second step is to identify diseases for which it is nationally or internationally important to collect cost-data. This can be a project in itself, and should be done both on a national and international scale.

103. For national lists of diseases some considerations should be:

- Epidemiology of disease: include diseases which have a high incidence or a high prevalence and therefore potentially high costs.
- Morbidity: include diseases with substantial health care needs.
- Mortality: include diseases with a high mortality.
- Severity: include diseases which have a severe impact on the quality of life, even if they are not associated with high morbidity or mortality.
- Public profile: Some diseases have a high public profile (such as AIDS or tuberculosis) but not always a high incidence or high costs. Still, they should be included in a COI analysis because they are bound to play a role in policy discussions.
- Importance for public health policy: the occurrence of some diseases depends on the effectiveness of public health policy (for instance vaccination campaigns for infectious diseases).
- Association with important risk factors which are subject to public debate, for example smoking with lung cancer and obesity with diabetes.
- Technical reasons: Some groups are not disease at all, but traditionally grouped with health care costs and must be distinguishable because of this. The prime example regards the costs of pregnancy and (normal) childbirth.
- Gender or age specificity: some groups are important diseases in specific age groups or genders, like breast cancer or prostate cancer. If one does not distinguish these groups, overall comparisons, for instance in costs per capita between man and women can be distorted.
- Known high cost: For some diseases it is known in advance that care or cure costs are very high. It is advised to split these groups. In the last Dutch COI study for instance, ‘eye disorders’ and ‘dental diseases’ were split in multiple groups, because from earlier studies it was known these groups

carried huge costs, and it was felt more insight would be gained by subdividing these groups in smaller units. Of course, data should allow for this.

- Classifications in use in national health registrations: it is useless to create a detailed classification of diseases for use in a COI analysis, if the main national health registrations do not register in similar detail. A golden rule for the application of this is hard to give. It is best to look first at the classification used in the main curative sectors: hospital, primary care (general practitioner) and drug prescriptions. If for these important sectors a detailed disease classification is possible, using existing health registrations, then a detailed analysis is feasible. If not, it is better to stick with the basic ICD-chapter classification. If this is also impossible, health registrations have to be improved before a COI analysis is sensible.

104. One way to select diseases is to make a fairly large shortlist from many different sources (for example, ISHMT, local mortality/morbidity lists, surveys under health professionals and public) and score these diseases on the aspects above and select those with the highest scores.

105. It is necessary to add two additional groups which cannot be classified elsewhere: 'Disease unknown' for disease related-costs for which classification was impossible because of lack of data, and 'Not-disease related' for the classification of costs that are by definition not associated with any disease, for instance the medical examination of a healthy person, or of non-medical costs such as living costs in some residential services. Appendix II contains a table from the 2008 Korean country study with expenditure by ICD chapter.

106. A special issue concerns the specification of the costs of accidents and other external causes in disease classifications. In the ICD system the external cause is of secondary importance. In some health care registrations a secondary diagnosis is added in which the external cause can be recognized, which in theory should enable the attribution of costs to external causes. However, in many health care registrations the external cause is not known. It is recommended that if costs of external causes are available, then these should also be published in a separate table, based on a separate analysis of relevant health providers.

2.3.2 Age

107. Many health care registrations contain detailed age information on health care use. Health care use differs markedly with age, so it is important to use a classification which can identify age simultaneously with disease. Important groups to recognize separately in the analysis are:

- Newborn children (<1 year): this group has special health care needs.
- Adults in the reproductive ages (~20-40 women): this age group is also associated with use of specific health services.
- Middle age: The age of the onset of many diseases.

- Older citizens (>65): use of the health care system rises with age. A detailed breakdown in five year classes is recommended for this group, because health expenditure rises quite steeply with age, although in some countries it has been found that per capita expenditure reaches a peak in the 75-84 bracket and declines afterwards (BASYS, 2006). To capture this effect one should distinguish several strata for the 'oldest old'.

108. It is recommended to use a classification of 21 five year groups with newborn children separate (0, 1-4 ,5-9 ,10-14,…. ,90-94, 95+) for allocation purposes. However, a smaller set of age groups should be used for the more general reporting of expenditure estimates (typically consisting of 6 to 8 broad age categories). For research purposes, for instance for making international comparisons of hospital care costs, the more detailed classification may be required.

109. A common problem encountered in COI analysis is that some health registrations do not contain age in sufficient detail. If important registrations (in terms of costs associated) contain an age classification with less detail, outcomes should be analysed and reported for this cruder classification. However, if these costs are relatively minor, one could artificially transform outcomes for these groups to the 21 group-classification, for instance by dividing costs known for 10-year age groups in two five-year groups, using the known population age distribution. Thereby the possibility to report on age in detail is preserved, without sacrificing too much in reliability of outcomes. Appendix II contains a table from the 2008 Korean country study with outcomes for different age-groups. This clearly demonstrates the importance to distinguish data in five-year age groups, especially for per capita costs for the oldest old.

2.3.3 Gender

110. A gender classification (male/female) may seem trivial, but the attribution of costs to gender is not always so. This is especially true for costs associated with pregnancy and reproduction where it is common to attribute these costs to the mother. For reasons of comparing men and women it is very important that the cost for pregnancy and reproduction can be separated from other costs. The same applies to gender specific diseases such as breast and prostate cancer. Appendix II contains a cross tabulation of age and gender taken from the Korean study. Also shown is the share of gender specific costs and the reproduction costs within each group. This clearly shows the importance of distinguishing these costs in separate diagnostic groups.

2.3.4 Dimensions of the International Classification for Health Accounts (ICHA)

111. The dimensions of health care functions (ICHA-HC), health care financing (ICHA-HF) and health care providers (ICHA-HP) are defined according to the International Classification for Health Accounts (ICHA) under the SHA. The classifications themselves are described in detail in the SHA Manual and therefore will not be discussed here.

112. The inclusion and level of detail of the various dimensions will be very country-specific and dependent on the structure of the health care system and the health care registries. For example, a country whose health care statistical system is strongly

based around provider-orientated registrations and data sources may have more limited information on the financing dimension. The reverse may be true for systems based on the financing of the health services and goods. What is important, and mirrors the work in producing the national health accounts, is the ability to link to the key dimension of health care functions.

113. The arrangement of the information, whether from the provider or financing perspective, into homogeneous cost units and the available utilisation data is important and covered in the following chapter. For example, providers may provide many different health care services, and for each type a separate registration may exist. To allow for the attribution of expenditure to disease, age and gender, more homogeneous sets of services, that is, closer to a functional split, should be distinguished among such providers. This subdivision of a provider into several groups may have to be done artificially based on *a priori* assumptions about the use of health services provided by these health care suppliers. Surveys among providers can be a useful tool to make this subdivision more reliable. The degree to which this link-up to the functional classification can be established affects the overall comparability of the results.

114. Ideally it would be best to link the expenditure data to all three ICHA dimensions simultaneously but this requires very detailed and exhaustive health care data registrations.

115. The level of detail for defining the cost units and allocating expenditures will often go beyond the level of reporting according to the ICHA dimensions. However, for the purposes on the main output table, it is recommended, as a minimum, to report the ICHA dimensions (ICHA-HC, ICHA-HP, ICHA-HF) at the first digit level.

3. METHODS

116. Every general COI analysis consists of three phases:

- A definition study to establish whether or not a general COI analysis is feasible, and to specify the dimensions and levels of detail.
- The collection of data on health care utilisation.
- The attribution of costs to the specified dimensions (disease, gender, age and the dimensions of the ICHA).

3.1 Definition study

117. A definition phase is especially important if no COI analysis has been previously performed. It serves to establish whether sufficient data are available for the analysis, and sketches the general contours of the COI output. The exact structure of a definition study depends on the national situation. However, the goals of the study are more or less the same for each country.

118. The main purposes of this stage are:

- To verify that both cost data and health registration data are available in sufficient detail for meaningful outcomes.
- To assess the availability and stability of SHA-based national health accounts
- To produce a comprehensive list of health care use registrations and other data sources (ad hoc surveys, research reports etc) for potential use in the actual COI analysis
- To describe the global properties of these data sources in relation to a COI-analysis
  - Available dimensions (look for disease, age, gender, provider, financing, function). Researchers should be aware that sometimes a dimension in itself is not available, but other types of information are present from which a diagnosis can be determined. Examples are: types of procedures performed, types of care given, types of drugs sold.
  - Available classifications for these dimensions.
  - Time-period: which data years are available?

  - Periodicity: regular, ad hoc, frequency
  - Type of registration (national, regional).
  - Validity of the registration: are the data representative?
  - Available utilisation indicators (sales, hospital days, number of patients treated, number of procedures performed contact time etc)
  - Other relevant properties (sample-size, sample-method etc)
  - Terms of use. Some registrations have very strict rules on use of information, which could prohibit actual use. Some registration holders will charge for the cost of extraction or charge a fee for the use of data.

- To identify gaps in registrations (costs in the framework without a suitable health care utilisation indicator)
- To verify for which dimensions a COI analysis is feasible. As a minimum age, gender, disease and at least one SHA-dimension should be part of the analysis.
- To establish which level of detail is attainable within dimensions.
- To select internationally compatible classifications for these dimensions.
- To create a national network of cooperation. Much of the information needed for the analysis will be dispersed over different registration holders. A successful analysis needs input from these registration holders, because they often have extra information about registered data (quality, reliability etc) which is not regularly published. So creating good working relations with the holders of these registrations, or even participation in the analysis, is essential, and should be part of the project from the start. A central place should generally be given to national statistical offices which commonly keep national accounts; their input will be indispensable, especially for the division of costs into smaller units for analysis.

119. If no previous COI-study has been undertaken it may be necessary to devote a lot of resources to this phase. But after the initial investment in constructing a first successful COI analysis this phase becomes more routine, and consists mainly of checking up on the continuing availability of data sources used in the previous study, and the adding of new sources. If a previous study exists, it is advisable to start the definition phase with an evaluation of the previous study design and identify areas were improvement is possible. Previous studies may also have identified and planned additional data collections and surveys in order to fill gaps in the study.

120. In this definition phase, researchers can also learn much from similar studies that were performed in other countries, possibly via an established international health accounts network that can facilitate the exchange of knowledge and expertise.

3.2 Collection of data on health care use

121. For the purpose of a COI study it is advised to gather, at an early stage, as much information as possible on the exact nature of every cost unit within the framework, if possible a worded description, because this often contains better pointers to where extra information is to be found rather than the bare dimension definition. For instance, if in dimensional terms a cost unit is described as: provider 'academic hospital', function 'medical goods' and financing 'government', this doesn't give much clue to actual nature of this cost unit. A detailed description for this real-life example 'subsidy experimental drug-therapy hereditary endocrine diseases' gives much better information for the COI analysis.

122. From the cost framework of the national health accounts, a cost unit register should be established for every distinct major cost-unit and data on the health care utilisation associated with these costs must be identified. The way data are collected will depend on the national situation. A good starting point in identifying the major cost units can be the SHA tables cross-classifying functions and providers or functions and financing, again depending on the nature of the information sources. For each row of the table, the cost unit groups can be distinguished and the utilisation data across all dimensions identified.

123. Detailed health data may already been collected for the total cost framework on a national level for other purposes, typically, for example, the national health insurance may receive detailed medical claims from institutions for reimbursement purposes. Very often, a structure will exist for the national collection of data, either a collection by provider or source of financing. In this case, data collection can mean negotiating access to this national collection. For a few types of costs it will be necessary to collect additional information, for instance from population health surveys or published research on the utilisation of specific providers. If no such central collection of health data exists, this can be a very time-consuming phase, because each individual registration has to be contacted and terms of use must be negotiated.

Table 3.1: Example of health care data sources

Administrative data of physicians and dentists
DRG Statistics
Health Insurance administrative statistics
Hospital Statistics
Special provider surveys
Annual Family Income and Expenditure Survey
National Health and Nutrition Survey
Central database on pharmaceutical sales
National Patient Registers

124. It is by no means certain that a health registration exists for every cost unit, especially for relatively small units with a specific purpose, and for which a special registration or survey would not be very cost-effective. As long as the costs associated with gaps are relatively small this is not a serious problem, because this will not show up in the total cost analysis, where costs-units are often aggregated to larger units. Usually, other secondary sources can be used to give reliable information on at least some dimensions of the cost-unit.

3.3 Attribution of costs to disease, age and gender

125. As soon as the definition study has been completed and utilisation data are identified and obtained, the cost calculations in a general COI analysis for direct medical costs using a prevalence-based method with an overall top-down attribution of costs is a fairly straightforward procedure, which can be divided into four steps (Figure 3.1):

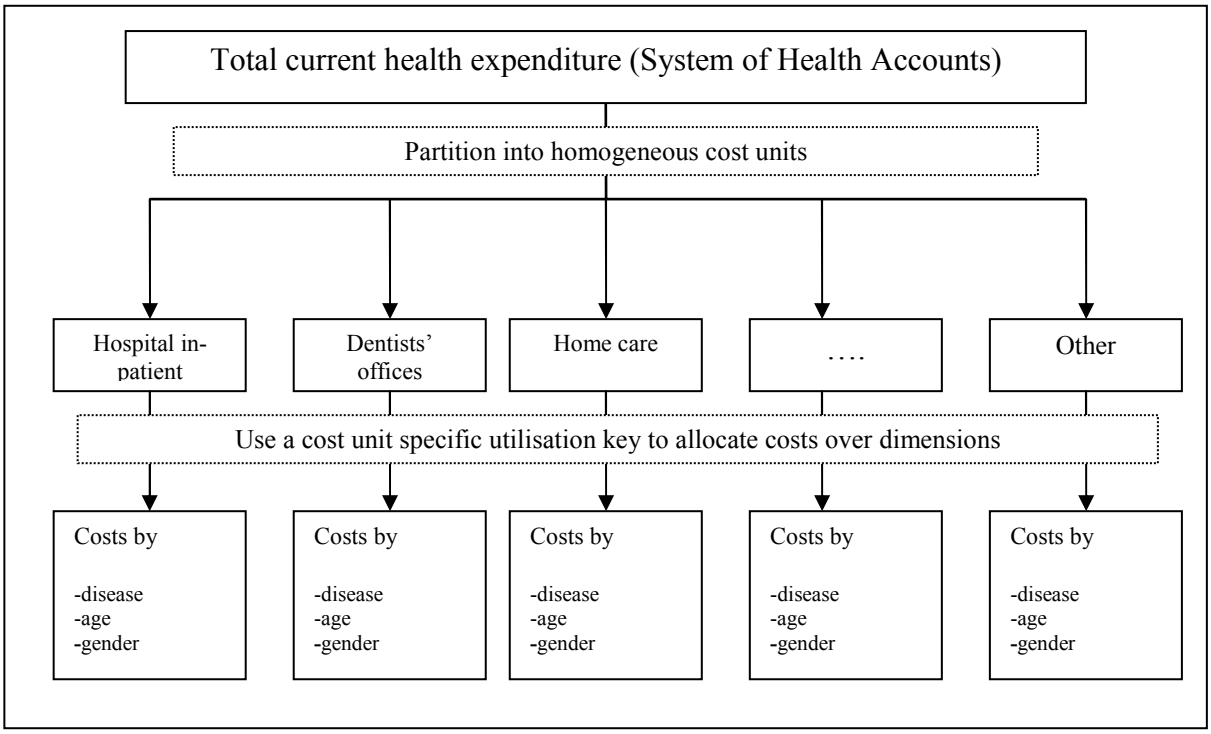
1. Selection of a suitable year for analysis and assessment of total health expenditure.

2. Partition of total current health expenditure into homogeneous cost-units.

3. Construction of cost-unit specific utilisation keys (all combinations of all dimensions) based on health care utilisation data retrieved from the collected data sources.

4. Multiplication of health expenditure for a cost unit (from step 2) with the utilisation key (from step 3) to establish a partial cost of illness table for this unit. Aggregate partial tables for each unit to establish total cost of illness.

Figure 3.1. Schematic overview general COI-analysis using top-down methodology



3.3.1 Establish national health expenditure according to the SHA

126. For international comparisons the use of health expenditures consistent with the concepts of the SHA, with the same definitions of costs, providers, sources of finance and functions, is a prerequisite for undertaking a COI analysis. Collection of the basic cost data is not part of the actual COI analysis and as such an analysis is not feasible without having first established national health accounts compatible with the SHA-system.

127. The institutions normally responsible for producing national health accounts are the national statistical offices or national health authorities. Because the first application of results is on a national level, it is advised to perform the COI for the selected national framework, using national cost definitions.

Long term stability of framework

128. An important issue is the long-term stability of the cost-framework used. To be of any value in future comparisons, definitions of costs, providers, sources of finance should remain roughly the same, and a track record of changes in definitions should be available. Mapping of the cost framework onto the SHA is a trivial exercise if SHA definitions are already in use. If this is not the case, every distinct element in the cost framework would have to be re-classified using SHA-definitions. For detailed health accounts this should not be a problem. Two alternative approaches can be followed. The first is to extract the SHA from the selected framework before performing the COI analysis on the SHA framework. The second is to perform the COI analysis on the national cost framework, and extract the SHA afterwards. The second alternative is to be preferred, because it allows for comparison of outcomes between national health definitions and international health definitions. The disadvantage of this approach is that it requires a more detailed cost framework (which allows for the breakdown in SHA and non-SHA costs afterwards) and also demands more data for the analysis.

Detailed versus aggregated analysis

129. Detail is a two-edged sword in COI analysis. The dimensions of the SHA are defined in multiple levels. Performing the analysis with more aggregated cost data on the highest level speeds up the analysis: less data are needed, but outcomes will be less reliable because many different types of costs have been aggregated. If costs are more detailed a more reliable COI analysis can be performed because individual elements of the cost framework will be fairly homogeneous.

130. There is interplay here with the availability of data for the analysis. If for instance a DRG registration is in use in national hospitals, which keeps track of disease, age and gender of patients and also weights the severity of the case, a top-down division of hospital costs using this DRG registration should give reliable results. If this is not the case it might be necessary to divide hospital costs in several homogeneous groups (for instance ambulatory care, in-hospital care or fees of medical specialists) and analyse these separately using data from different sources. However, this method is much more labour-intensive. Therefore, one should decide on the level of detail after a rough survey of available data sources has been done.

131. Another issue is the availability of resources (time, number of researchers) for the analysis. The amount of costs involved in the analysis has no bearing on the difficulty of the analysis. Small amounts of costs can be as difficult or as easy to analyze as large amounts. This implies a more or less linear relationship between the number of individual cost elements which should be analyzed and the time needed for the analysis. Common sense is also important: if the biggest providers of health care (in terms of costs involved) can only be analysed on a fairly aggregated level, in-depth analysis of other providers will not make much difference in the aggregated outcome (except for some specific diseases catered for by the smaller providers).

Choosing a time-period

132. It is of course desirable to use the most recent data possible for the COI analysis. This ensures outcomes can play a role in ongoing discussions about health resource allocation. Two processes have to be taken into account: a) the speed with which national health expenditure can be established b) the speed with which indicator-registrations become available.

133. In most countries detailed data on health expenditure are already nationally collected in a fully automated process and are available within about one or two years. So in practice it is the second process which determines the choice of the year of analysis.

134. Many different organizations are usually involved in registering health utilisation data, for example, organized on provider level. For some providers there will be nation-wide registrations, for others, only sparse data exists, often at a local level. In many cases data are collected on a local level alongside the process of care delivery, and are aggregated to a national level after the closure of this period. Moreover, there is generally no automatic collection of this type of data by a national institution. So data have to be collected from many different sources (see also Chapter 2). Because information on a wide range of providers must be collected the speed of the slowest providers of data determines the speed of the over-all process. In addition to this the analysis itself and the reporting of results needs some time. Recent COI analyses from countries have been mostly published within 2-4 years after closure of the analysis period.

3.3.2 Partition of national health expenditure in homogeneous cost-units.

135. Use of the SHA-based national health accounts framework for a COI analysis implies in itself a fairly large amount of detail already used in the construction of the health accounts: costs will be split into different cost units, which quite often are already homogeneous across the provider or financing dimension. However, if this is not the case in the publicly available statistics, it will often be possible to go back to the data sources and non-published information from the statistical office or institution which has compiled the national health accounts.

136. The experiences of countries involved show that the main cost unit register is very country-specific, and dependant on the structure of the health care system and related health care registries. A country with provider-oriented registrations may have limited data on the expenditure for different functions and financing at the aggregate level. The reverse may be true for countries in which registrations are more financial oriented. From the provider-orientated perspective, often records of these are kept by individual provider-units (individual hospital, GP-practices etc) and aggregated to total cost for a provider on a national or regional level. However, at the disaggregated provider cost-unit level there is often a clear link to the functional classification, *e.g.* hospital in-patient and out-patient departments. For the financing dimension, complementary registrations can exist, for instance for government financed health expenditure or insurance-financed expenditure. In practice both these sources are used in the construction of national health accounts, because they are often complementary. Obviously it would be best to link expenditure data to all SHA-dimensions simultaneously, but this requires very high health data registration standards. In a

comparative analysis, such data sources may be seen as a kind of 'gold standard' to compare with on the one hand countries with a provider oriented approach, and on the other hand countries which have attributed costs primarily along the financial and functional dimension.

137. Reasons for the further splitting of available cost units fall into three groups:

- Ensuring compatibility with the SHA
- Heterogeneity in key dimensions
- Fitting of cost data to health care utilisation data

Ensuring compatibility with SHA

138. As a first step, in partitioning units costs should be split into two groups if necessary; those costs included in the SHA and those outside the SHA (if any). This may be the case when cost-data are collected mainly along the provider dimension and when it is necessary to go back to the data sources used for the national health accounts. For example: the total costs attributed to a provider will often also include some non-medical costs outside the boundaries of the SHA defined health expenditure. For example, optometrists mostly sell glasses and lenses to correct eye problems. These medical costs are included in the SHA. However, they commonly also sell sunglasses and optical equipment such as telescopes. These costs are non-medical and should be excluded from the perspective of the SHA. Another example of non-medical costs are for instance the income from commercial activities within hospitals (shops, restaurants etc).

Heterogeneity in COI-dimensions

139. Costs-units in a cost framework should also be split into smaller units, if the underlying costs are composites of costs covering quite different products. If, for example, the utilisation key associated with the main product is applied to the total cost-unit this can lead to an underestimate of costs of illness associated with those specific products for relatively minor diseases. An example from the Dutch COI-study is influenza vaccination. This is administered by general practitioners, but paid for from a special budget. The administering of the vaccination is in collective sessions and doesn't show up in the health registration used for GP's, because only individual visits are registered. If GP-costs are analysed as a single cost-unit, costs for most diseases would hardly be affected because of the tiny amount of costs associated with influenza vaccination (~1% of GP-costs). However the total costs for the disease group 'influenza and pneumonia' would be significantly underestimated (by about 10%, as was demonstrated in a post hoc analysis). Therefore, it was decided to analyse influenza vaccination costs in a separate cost unit, split off from other GP-costs. This can be relatively easy if the total costs of the vaccination programme are known.

140. In other cases this may not be so straightforward. For instance the costs for in-hospital use of drug prescriptions may not be able to be separated from total hospital costs, leading to an underestimation of costs of illness for those diseases which are associated with high prescription costs. In some cases, depending on the nature of the

data systems, cost units in the national health accounts may be homogenous across the provider dimension, but information is insufficient for homogeneity across the funding or health care function. However, this issue of allocating across functions is one that will have already been faced in the construction of the national health accounts according to SHA. To split these into homogeneous units might be tempting, but it is useless unless it is possible within health registrations to separate health care use between classes of financing or function.

141. In summary, a cost unit should be sub-divided if: a) a certain amount of the costs within a larger unit is non-homogeneous in one or more COI dimensions; and b) detailed information on health care utilisation is known for the new sub-unit, so allowing for a separate COI analysis.

Fitting of cost data to health care utilisation data

142. Sometimes cost-units have to be split or even rearranged into artificial units, because no health registration is suitable for analyzing the complete unit, but by rearranging the costs in new artificial units, a fit with existing registrations is possible. For example, in the Dutch COI study costs for specialty hospitals form a single cost-unit, but there is no single health registration for these types of hospitals. This is solved by splitting the total costs for specialty hospitals in several artificial units, composed of the costs of specialty hospitals which focus on similar diseases (cancer, respiratory diseases, eye disorders, epilepsy, etc). For these artificial units, analysis is possible using existing health registrations. Sometimes more elaborate rearrangements may be necessary: existing units which can't be analyzed are merged and recombined in artificial units which can be analyzed. Appendix IV shows an example of this.

3.3.3 Construction of utilisation keys

143. After the decomposition of total health expenditure into more or less homogeneous units, a utilisation key should be constructed for every cost-unit in order to distribute costs. A utilisation key is an estimate of the distribution of health care use over distinct combinations of all dimensions. For every key a fraction of total utilisation within the cost-unit is assigned. With up to six dimensions to consider, the size of keys can vary from a few combinations to many thousands. It is important that this key should be complete: fractions in the key must add up to 100% of all care delivered by the cost-unit. Furthermore, the distinct combinations of dimension-classes within a key should refer to the same unit of utilisation only once: no double-counting should occur. The estimate of health care use is based on an indicator for the health care utilisation associated with the cost unit. Appendix III shows an example of such a key for the 'cost unit' 'influenza vaccination' which has a distinct budget in Dutch Health Accounts.

Properties of a suitable utilisation key

144. The main properties of a good utilisation key for a cost unit are:

- it measures the bulk of total care delivered by the unit

- it is an accurate measure of health care utilisation within the cost unit: there is a clear relationship between units of the indicator used to estimate COI and the resource costs of the associated health care services.

145. Direct indicators of utilisation often produce the best results. For instance, for dispensing chemists the number, type and price of prescriptions are often accurately known. If the prescription registration also contains information on the COI-dimensions is also possible to construct a key using the total sales on drugs. It is important to see that total sales (number of prescriptions of a type times price of this type), is a better indicator than for instance the number of prescriptions alone, because there is a huge variation in the costs of individual prescriptions. In fact in this example the number of prescriptions is weighted with the price. Such a weighting procedure is often encountered. These weights account for differences in resource use, and most often (real cost or market) prices are used as a proxy for resource use. For example, in hospitals the number of hospital days is a good indicator for part of the hospital care. However, there is a huge price difference between the costs of a hospital day on a normal ward and a day in an intensive care unit. If the registration also contains an indication of the type of hospital day, this type can be used to weight the number of hospital days with the (estimated) price of the type of hospital stay. The distribution of this weighted number of hospital days is a better indicator of utilisation than an unweighted number of hospital days. This is important since admission rates for normal wards and intensive care vary among diseases.

146. From this example it can be concluded that direct measurements of health care utilisation in monetary terms (units of care x price of a single unit) often produce the best results. However, this type of data is often incomplete (it covers only particular types of funding), and often a diagnosis is missing, especially in health insurance data, because for reasons of privacy, diagnoses are most often neither registered nor even known by insurance companies. Therefore often other, mostly volume-indicators are used. Table 3.2 lists some common examples.

Table 3.2. Commonly encountered indicators of health care utilisation

Cost unit	Often used keys
<all cost units>	health insurance data, national patient register
Hospital in patient	# hospital days, # admissions, # patients, #procedures , DRG's and length of stay
Long-term nursing and residential care	# beds, # in-patient days
Ambulatory health care	# contacts, # visits, # treatment sessions
Medical goods	# prescriptions, sales value
Public health and prevention services	Composition target population, # vaccinations, # screenings

Source: #: numbers of the indicator.

Dealing with co-morbidity

147. A common problem in health registrations is co-morbidity: a patient is diagnosed with multiple diseases. In a top-down COI analysis it is necessary to attribute costs to a single diagnosis, co-morbidity is ignored and the proposed guidelines contain methods to avoid any double-counting.

148. In a top-down COI analysis health care costs should all be attributed to the primary diagnosis, if the hierarchy of diagnosis is known. If this is unknown costs should be divided between all known diagnoses, if possible using a disease specific weight, for instance based on the average costs of a patient with a single disease.

149. For example, it is not taken into account that in several cases the presence of certain chronic disease may increase the treatment cost of the primary cause of the episode of care. It can be the case that the same person is given treatment for different diseases in the same period, involving separate accountable encounters (*e.g.*, high blood pressure and rheumatic disease). However, treatment can also be given for two diseases during the same hospital stay and this raises methodological problems. It is clear that many costs are generated by multiple diseases, especially at older ages and it is acknowledged that a prime area of research should be developing new attribution models for costs of disease, for instance by using econometric modelling or other methods. For example, the Australian country study showed that for residential aged care expenditure a multiple conditions method for attributing expenditure by disease (which splits costs over all contributing diseases) led to significantly different distribution over disease than a main condition method. However, there is a trade off between advocating a methodology which can be applied across the board to enhance international comparisons and more 'accurate' modelling of actual costs which may be more appropriate for national and specific disease based studies. The current treatment of co-morbidity in the guidelines is limited and should be the subject of further research to establish best practices.

3.3.4 Methods for allocation of costs by cost unit

150. The methods used for the allocation of costs differ between the cost units, because they are dependent on the availability of health care utilisation data, but they can be broadly divided in six groups, the first being the most desirable method, the sixth the least desirable method.

1. Direct attribution or 'bottom up' allocation
2. Construction of a utilisation key from a single health registration
3. Combination of health registrations to construct a suitable utilisation key.
4. Fitting cost data to available registrations
5. Using a proxy key based on utilisation keys for other cost units or other COI-studies
6. Other methods

Direct attribution or 'bottom up' allocation

151. The use of bottom-up calculations for some cost-units is allowed and even recommended if good enough data sources exists for a successful direct calculation of expenditure by disease. This in effect is used within a top-down study with total health expenditure allocated across categories but uses mixed methods in estimating expenditure. Such methods are sometimes called direct calculation or direct attribution methods as they clearly describe the process (*i.e.* counting products, multiplying by price and adding up to a total sum) also referred to as direct methods.

152. This is mainly applicable to areas such as in-patient curative care where detailed actual cost information is available (based on patient registers and cost databases or detailed health insurance reimbursement claims). There should be no double counting, that is, allocation to more than one disease category, meaning that the total for the cost unit is not significantly different from the health accounts estimate. If there is a small difference between bottom-up calculated costs for a cost unit and reported costs for this cost unit in national health accounts (there often is a slight difference, because the total costs are often derived from accounting reports, not from bottom-up calculations), the results from the bottom-up calculation should be adjusted so that the results are consistent.

Construction of a utilisation key from a single health registration

153. This method can be used if the cost unit is relatively homogeneous, and a specific health registration exists for the cost unit which accurately registers the delivered care. At least the dimensions age, gender and disease should be registered. An important example is the Dutch national survey under general practitioners, which registers among many other items diagnosis, age and gender, and measures utilisation as time spent on individual patients, which is a very good indicator for health care utilisation by GP's. By using time spent on a patient as an indicator, individual differences between the use of GP-resources by individual patients are weighted automatically. Similar registrations exist for paramedics and for screening programs for diseases. Another example is the registration for the use of mental care services which register age, gender and disease, and measure health care utilisation using a government approved product-list, which carry fixed prices. It is important to see that this type of indicators should be preferred over for instance number of patients treated, because this does not account for differences in time and other resources spent on a patient, which differs both between individuals with the same disease and between individuals with different diseases. Example (1) in Appendix IV shows in more detail how a key of this type is computed.

Combination of registrations

154. This method has been used if no single registration contained all necessary dimensions (disease, age and gender) for the COI analysis. In most cases direct information on the disease was missing from registrations. For this method to work, it is necessary that both registrations contain the same proxy indicator for the missing dimension, and that one of the registrations allows for translation to the dimension-classification actually used in the study. For example, ambulatory hospital care in the Netherlands is measured as the number of visits to a medical specialist. The type of specialist is registered, but not the specific diagnosis. Using referral data from a

general practitioner database (which did contain both specialist type referred to as well as a specific diagnosis), it was possible to estimate a distribution of the use of ambulatory hospital care for the disease-dimension. Example (2) in Appendix IV shows in more detail how a key of this type is computed.

Fitting cost data to available health registrations

155. Sometimes there exists a mismatch between the definition of costs units in the cost framework and health care registrations. If this is the case, costs should be artificially rearranged in units which can then be analyzed using existing registrations. This has already been described in paragraph 3.3.2. In the Dutch health care study this method has been used within the hospital sector. Example (3) in Appendix IV shows in more detail how a key of this type is computed.

Using a proxy key

156. This method is especially useful for non-personal expenditures on health care. An example regards the costs of management and health care administration. In the Dutch COI study it was decided to assign these costs to disease, gender and age proportional to the distribution of total costs paid out under the different insurance schemes. If management costs referred to multiple cost-units, the utilisation keys for these units were added together, using the total cost in the cost-unit as a weight in this addition. In this way an artificial utilisation key was constructed for management costs, by using other already analyzed keys as a proxy.

157. A very different application of essentially the same method occurs if registration data are missing for the chosen year of analysis but are available for other years. Then the utilisation key can be analyzed for the available year, but applied to costs of the year of analysis. If the difference between these years is small, this should give a good approximation. If a larger difference in time exists the approximation can sometimes be improved by adjusting for demographic shifts over the elapsed period. However this can only be done under the assumption resource use within distinct demographic groups has remained constant, which is obviously not always the case.

Other methods

158. If all else fails there are several methods for still completing a COI analysis for a cost unit. One method is to model a key instead of extracting this from a registration. An example from the Dutch COI-study regards the costs for medical care within the military services, for which no direct registration was available. Based on data on the demographic composition of the army, and assumptions on the use of these services an artificial key was created for this cost unit.

159. If no method could be found relatively small cost-units have been merged to larger cost units, and the key of the larger unit has also been applied to the smaller unit. Only for a few cost units this was necessary, an example from the Dutch COI-study is the costs of blood products, which have been merged with hospital cost-units, assuming most of the blood products were used in this sector. As a rule of thumb for inclusion of a smaller cost unit; if it can be assumed that the distribution by age, gender and disease would not be substantially different from the basic population on the basis of the major cost unit. This can apply to using the same utilisation key for

different financing agents if they are assumed to fund the same range of services and providers.

160. Overall, the method of allocation of each cost unit needs to be made transparent in order to gauge the suitability of the methods used and the appropriateness of including the cost unit in the final allocation across disease, age and gender classes. This is important in assessing the value of international comparisons where different interpretations of suitability are used in national studies and is clearly an area where harmonisation is required.

161. Not every cost unit can be included in the study if a suitable allocation key cannot be found. Some of the areas where it has been difficult to establish utilisation keys are dental care, long-term care and collective services such as prevention and public health services and administration. Health care services paid directly by households are another area where data to construct keys are problematic. The clear identification of non-allocated cost-units is important in seeking possible solutions through the exchange of information with other countries' experts and the planning of additional surveys and data collections for future exercises. For example, specific surveys linked to dental care and other specialist services may be required.

3.3.5 Creating the basic output table

162. After an utilisation key has been constructed for every cost unit, a complete analysis is easy to perform by multiplying the costs for every cost unit with the utilisation key for this unit, and then aggregating the costs over the study dimensions. This produces the basic output tables: one column with costs and additional columns which describe every dimension in the study at the most detailed classification level. From this basic table all other aggregations of costs can be produced.

163. These results should be examined carefully. It is recommended to start with basic plots of costs per age group for every disease. Based on the epidemiology of diseases, and known demographic composition of the population certain patterns should emerge. Most diseases start to appear from a certain age, and cost will rise quite gradually with age from this moment. Among the older ages total costs (per age group) should fall, as mortality increases (and population numbers decline). This pattern is quite general, although details might differ among countries, due to differences in absolute numbers of people per age group, depending on the population history of a country. If strange anomalies appear from this pattern one should re-examine important utilisation keys to check the validity of the analysis.

164. Typical output from an analysis is a multi-dimensional table which lists cost estimates for all combinations of all variables, such as health provider, health funding, health function, disease, gender and age. The table size depends upon the number of dimensions involved, and the level of detail in the classifications used to describe these dimensions. From this table secondary outcomes can be computed like costs per capita or per disease case.

165. As for cost per capita, these are calculated by dividing the costs in every record of the basic output table by the appropriate number of citizens to which costs in this record apply, as described by the gender and age dimension. Remember that a prevalence-based method is used, so we must divide costs by the average population

in the year of study. There is a small caveat here: if a population group is relatively small and has a high mortality (which in most countries is the case for instance in the 95+ population), different methods for calculating the average population for age/gender classes in a given year can give markedly different results. Therefore one should always explicitly report how the average population was calculated especially for the older age groups. For example, in the Dutch COI study average population was calculated by averaging the size of age classes on January the 1st and December 31st. Costs per capita for 95+ differed up to 20% if other methods were used (such as using the July 1st population as an estimate), while for other age-groups there was almost no difference in calculated costs per capita.

3.4 Verification of data and outcomes

166. Verification might be applied upon different parts of the COI study, for example the original data (*e.g.* utilisation keys) or on final outcomes (after application of utilisation keys and subsequent aggregation). Verification requires that extra data or figures, to verify the original data and outcomes with, are available. This will prove to be difficult in most cases, because in most cases only one data source is available.

167. Standard statistical methods, for example the computation of confidence limits on final outcomes, cannot be applied to a general COI-analysis, because many assumptions underlying the analysis are not able to be verified in a quantitative manner. For instance, a basic assumption in utilisation keys is that one unit of product (be it costs, time spent, days in hospital etc) corresponds to an equal amount of health care resources used. However, in practice this is not the case, and an unknown distribution underlies the average ratio between unit of product and amount of health care resources used. Sometimes this distribution can be estimated (for example by making a distinction between low-medium and high care hospital days, and weighting these with different tariffs), but in many cases this won't be possible. An implicit assumption of the COI analysis is that these individual differences in resource use are largely cancelled out when applied to total costs within a cost unit. It should also be remembered that the goal of a general COI analysis is to establish and compare relative distributions over diseases and demographic categories, NOT comparing point estimates.

168. Verification of individual keys is generally not useful. In most cases only one source for data on utilisation is available, and this has been used in the creation of utilization keys. If multiple sources are available they can usually be ranked a priori on logical grounds for reliability. An example of this is given in Appendix IV, example 1, the screening of cervical cancer. Three alternative sources for the age distribution of women involved in the screening are available, but the measurement of actual turnout by age for the screening gives of course the best estimation, and so this is used in the actual utilisation key. It would be pointless to compare outcomes of this key with alternative keys which were judged *a priori* more unreliable. Only in rare cases, where two keys of equal reliability are available it could be useful to compare alternative utilisation keys from these multiple sources. If one finds large differences it is an indication the key is unreliable.

169. In most cases it is better to start verification by examining final outcomes, after application of utilization keys. It is recommended to use the basic outcome table to make some simple aggregations first, and examine these qualitatively. Create simple

one-dimensional tables which aggregate costs for age groups, both genders and main diagnostic groups. Do the patterns match expectations, or are they comparable to results of previous studies or similar studies in other countries?

170. If these seem fine, then start making some two-dimensional tables. It is recommended to start with basic plots of costs per age group for every disease. Based on the epidemiology of diseases, and known demographic composition of the population certain patterns should emerge. Most diseases start to appear from a certain age, and cost will rise quite gradually with age from this moment. Among the older ages total costs (per age group) should fall, as mortality increases (and population numbers decline). This pattern is quite general, although details might differ among countries, due to differences in absolute numbers of people per age group, depending on the population history of a country. If strange anomalies appear from this pattern one should re-examine important utilisation keys to check the validity of the analysis.

171. In the end the comparison with previous studies and studies in other countries still does not provide a hard verification. Face validity is what counts in this case.

172. A comparison of outcomes with those of other countries requires detailed studying of underlying differences. We would propose that, also for efficiency reasons, a (detailed) international comparison should be performed at a central (international) point.

173. If countries start international comparisons by themselves they should gain insight into a number of issues. For example differences in data and utilization keys, differences in health system structures or differences in prevalence of diseases. These can be used as a starting point for similar comparisons.

3.5 Reporting on outcomes

174. The basic COI outcome table (see 3.3.5) lists costs for all existing combinations of dimensions. This can be a very large table particularly if all six dimensions are included in the study and the classifications are detailed. This table forms the base of all public reporting on the COI study. The large detail provided by the basic table is useful for research purposes, and for communicating results to the wider research community[10]. It is recommended to make data available to other researchers in as much detail as possible, because this opens up the outcomes for scrutiny by other research groups and enhances the applicability of outcomes for other types of research.

175. The basic table is also used for creating tables and graphs which should provide a quick overview of the most relevant outcomes. At least the following tables should be provided when reporting to a national audience. Examples of these tables are included in Appendix II.

1. Current health expenditure by disease category. Disease should be classified on the ICD-chapter level as a minimum.

[10] A website (www.costofillness.eu) is available where researchers can create specific tables and graphs, based on this basic output table.

2. Current health expenditure by age and gender.

3. Current health expenditure by disease and function. Disease should be classified on the ICD-chapter level as a minimum.

4. INTEGRATION OF NATIONAL RESULTS IN THE SHA

176. In an ideal health care accounts system the exact location within all three dimensions is known for all cost units, and for each element a health care use registration is known in which the provider, functional and financial dimensions can also be recognized. However, this requires very high health data registration standards. Detailed patient registrations or insurance reimbursement systems are necessary for a successful attribution of expenditure by disease to all three COI-dimensions simultaneously. Such data information systems can be seen as a kind of 'gold standard' to compare with on the one hand countries with a provider oriented approach, and on the other hand countries which have attributed costs primarily along the financial and functional dimension.

177. As has been demonstrated in the methodological guidelines the breakdown of a COI analysis along the provider, financing and functional dimension is strongly determined by a) the compilation of the national health accounts and b) available health registrations.

178. In many countries, however, it may be more problematic to combine the three dimensions (disease, age and gender) with the three dimensions of provider, financing and function. For instance, in some countries a fairly detailed breakdown of costs along the provider dimension is possible, because both costs and health care use along the provider dimension was fairly well known. But in other countries, costs may be subdivided using a classification with both aspects of a provider and a functional classification. This is derived directly from the structure of the national health accounts.

Allocation of national health cost data

179. In the example of the Netherlands, cost data are collected by Statistics Netherlands from both providers (ICHA-HP) and financing scheme/agent (ICHA-HF). The functional dimension, using ICHA-HC classification is also added, sometimes based on the nature of the provider or financing: for instance costs of the screening program for breast cancer were allocated to the ICHA-HC function prevention and public health services. In other cases, a more detailed product registration has to be used to allocate costs to function. For instance, the costs for a regular check-up with the dentist were added to prevention. This was only possible because this check-up is a distinct product in product registrations. In many other cases no such registration exists and an estimate has to be made, for instance for the share of prevention cost in occupational services.

180. Estimates often have to be made too for financing, especially for households' co-payments, because these are generally not available on a patient level, and have to be inferred from aggregated data, by, for example, subtracting total costs in insurance

schemes (which exclude co-payments) from billing registrations of individual providers (which include co-payment). The validity of the allocation of co-payments is therefore aligned to the major cost unit where patient level information is available therefore needs to be assessed. The use of these estimates in the financing and functional dimension limits the use of these allocations for a COI-analysis.

Incompleteness of health registrations

181. Using a dimension in a COI analysis is only useful if a distinct use of utilisation for these functions can be found. If in a country, the cost of provider is reliably known, then three scenarios are possible:

1. The costs for a provider can be attributed to a single health care function or financing category.

2. The costs for a provider is attributed to multiple health care functions or financing, but these are only partial or not distinguishable in the health care registrations. If a COI analysis is forced on this type of cost unit, the same utilisation key is used for every artificial unit. One way of forcing is by a priori dividing the unit in artificial units homogeneous in all three SHA dimensions

3. The costs for a provider is attributed to multiple health care functions or sources of funding, and these are distinguishable in the health care registration, for instance because different functions or sources of funding use different products.

182. If the first situation and second cases dominate, the two other dimensions then tend to reduce to alternative aggregations on the provider dimension and do not provide any extra insight in resource allocation over these dimensions. Only in the third situation new insights can be gained.

183. The relative importance of these situations depends on the classifications used. For the financing dimension in the Netherlands the first and second situation dominate, especially for insurance-based health care and co-payments. Co-payments are generally indistinguishable in health registrations used, or incompletely registered. Other sources of funding such as special government programs can be distinguished, because they are accounted for separately in Dutch health accounts, so although COI-analysis adds in these cases information on how resources are allocated for these types of funding, reporting on the funding level does not add extra information above reporting on the provider level.

184. For the functional dimension a similar situation exists. Only the health care function prevention was fairly distinguishable in different health registrations, and distinct utilisation keys could be made for the allocation of the costs of prevention. In some countries the financing dimension will be much more important as a starting point for a COI analysis, but in these cases often the provider dimension is less well known.

185. From the point of view of international comparison, it is clearly desirable to have information on the functional dimension of health care, fully integrated within

the COI analysis. Differences in opinion about the allocation of costs to functions, should not withhold countries from trying to attribute costs of illness to health care functions. From the comparisons of different results more insight could be gained into what the most fruitful direction in this field is. The best approach would probably be to start with broader definitions of health care functions at an aggregate level of personal care and prevention or a first digit level (*e.g.* curative care, medical goods, prevention, etc), and to achieve firm international comparison of results in these dimensions before more detailed functions can be used.

5. INTERPRETATION OF RESULTS

186. As outlined in Chapter 2, the methods used in allocating costs set limits on the use of COI data. In this paragraph some final remarks are made about the interpretation of outcomes of a COI analysis.

Average costs per patient

187. In these guidelines a prevalence based method for a COI analysis is described. That means translating costs to average costs per prevalent disease case is theoretically possible. However, there are several caveats. In the first place it is often very difficult to establish the number of patients, and different costs attributed to the same disease may in fact refer to different patient groups. An example regards the number of Dutch patients with arthritis. About ten times as many patients are treated for this condition by a primary care giver than in a hospital. The number of people with arthritic complaints is even much bigger than those seeking treatment. (Slobbe *et al*., 2004). This situation arises because population prevalence is based on self-reported complaints, and prevalence in hospitals on detailed diagnostic tests, which are only used in severe cases, with prevalence in primary care in between. It is clear that average costs per patient can only be computed with much uncertainty in such a situation. Only if very clear, undisputed definitions of diseases are available costs per patient can be computed with any certainty. This is for instance the case for most types of cancer.

188. Another problem is that many diseases have an intermittent character, and severity may vary with long periods without complaints. That means that the costs attributed to the prevalent patients with this disease in a given year are in fact often generated by only a part of the prevalent population, also adding uncertainty.

189. Before average costs are computed one should always consult researchers or health professionals with in-depth knowledge of the disease.

Interpretation

190. The main interpretation of results of a COI analysis should be in the relative importance of all diseases and trends in these. Interpretation of results for specific diseases, ages or gender as exact point estimates of costs should be done with the greatest caution. The main reason for this is that it is impossible to establish firm limits of confidence on the individual point estimates. In both the division of costs in cost units and the derivation of utilisation keys to analyse these units many assumptions have to be made. Sometimes full registrations have been used in other cases relatively small samples. Therefore it is impossible to quantify limits of confidence around individual COI estimates.

Cross-sectional data

191. COI analysis offers a cross-sectional view on the use of health care resources, within a fixed time period. Only if multiple COI estimates are available, for different time-periods, it is possible to give a more dynamic interpretation of the changes of resource use over time. Having said this, the cross-sectional data of a single COI study are sometimes used in more longitudinal interpretation. Costs for different demographic groups (age, gender) from these studies have been used in models to estimate for instance lifetime costs of healthcare, or to predict future demand for health care services.(Hollander *et al.*, 2007). This is useful in estimating the potential effects on resource allocations. However, these results should not be interpreted as predictions of future resource use, but rather as indications for how current use of health care resources should be interpreted. For real longitudinal analysis of dynamics in resource use patient groups should be followed over prolonged periods of time. This falls outside the limits of COI analysis.

Cost-effectiveness

192. A COI study shows the division of costs over the selected dimensions. It provides a background to current resource use, a 'canvas' against which other research outcomes can be interpreted, for instance when comparing the cost-effectiveness of two treatment options for a single disease. In this case COI data can be used to estimate an average for total costs on a national level. It is important to stress that a COI analysis in itself does not provide information on the desirability of outcomes. High costs for a disease with a low prevalence could point to expensive treatment, but also to a very effective prevention of this disease, without which costs would be even higher.

193. For this reason one should not interpret results of a COI analysis as potential savings, for instance in a prevention programme. If costs for one disease are brought down, costs for other diseases could rise. Some diseases are each others 'natural enemy'. For instance, since mortality due to coronary heart disease has fallen sharply in many countries, prevalence and costs of chronic heart failure experienced an upward trend. Another variant of this is that even if prevention is successful this could result in higher future health care costs if life expectancy also increases. A fine example of this – partially based on Dutch COI data – can be found in Feenstra *et al.*, 2005.

194. A similar argument applies to interpreting high costs in certain providers as potential targets for cost containment, this could easily lead to higher costs in other providers, the classical example being that restrictions in the capacity for long term care leads to higher hospital costs, because it becomes more difficult for hospitals to find a place for patients in long term care institutions. On the other hand the opposite might also be possible: investments in particular health care services could substitute or postpone much higher expenditure in other parts of the health care system. In this context the Lindenberg Hypothesis should be mentioned, which states that higher drug expenditure will save hospital costs.

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Appendices

Appendix I: Disease Shortlist ISHMT.

Chapter-groups highlighted.

Source: http://www.who.int/classifications/apps/icd/implementation/hospitaldischarge.htm

International shortlist for hospital morbidity tabulation (ISHMT) - Eurostat/OECD/WHO					
Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
I		**0100**	**Certain infectious and parasitic diseases**	**A00-B99**	**001-033, 0341-0992, 0995-134, 1360, 1362-139, +042-044 or 2795, 2796 for HIV (varies according to country)**
I	1	0101	Intestinal infectious diseases except diarrhoea	A00-A08	001-008
I	2	0102	Diarrhoea and gastroenteritis of presumed infectious origin	A09	009
I	3	0103	Tuberculosis	A15-A19, B90	010-018, 137
I	4	0104	Septicaemia	A40-A41	038
I	5	0105	Human immunodeficiency virus [HIV] disease	B20-B24	042-044 or 2795, 2796 (varies according to country)
I	6	0106	Other infectious and parasitic diseases	remainder of A00-B99	remainder of 001-139, except 0340, 0993, 0994, 135, 1361
II		**0200**	**Neoplasms**	**C00-D48**	**140-239**
II	7	0201	Malignant neoplasm of colon, rectum and anus	C18-C21	153, 154
II	8	0202	Malignant neoplasms of trachea, bronchus and lung	C33-C34	162
II	9	0203	Malignant neoplasms of skin	C43-C44	172, 173
II	10	0204	Malignant neoplasm of breast	C50	174, 175
II	11	0205	Malignant neoplasm of uterus	C53-C55	179, 180, 182
II	12	0206	Malignant neoplasm of ovary	C56	1830
II	13	0207	Malignant neoplasm of prostate	C61	185
II	14	0208	Malignant neoplasm of bladder	C67	188
II	15	0209	Other malignant neoplasms	remainder of C00-C97	remainder of 140-208
II	16	0210	Carcinoma in situ	D00-D09	230-234
II	17	0211	Benign neoplasm of colon, rectum and anus	D12	2113, 2114
II	18	0212	Leiomyoma of uterus	D25	218
II	19	0213	Other benign neoplasms and neoplasms of uncertain or unknown behaviour	remainder of D00-D48	remainder of 210-239
III		**0300**	**Diseases of the blood and bloodforming organs and certain disorders involving the immune mechanism**	**D50-D89**	**135, 2790-2793, 2798, 2799, 280-289**
III	20	0301	Anaemias	D50-D64	280-285
III	21	0302	Other diseases of the blood and bloodforming organs and certain disorders involving the immune mechanism	D65-D89	135, 2790-2793, 2798, 2799, 286-289

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Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
IV		**0400**	**Endocrine, nutritional and metabolic diseases**	**E00-E90**	**240-278**
IV	22	0401	Diabetes mellitus	E10-E14	250
IV	23	0402	Other endocrine, nutritional and metabolic diseases	remainder of E00-E90	remainder of 240-278
V		**0500**	**Mental and behavioural disorders**	**F00-F99**	**290-319**
V	24	0501	Dementia	F00-F03	2900-2902, 2904-2909, 2941
V	25	0502	Mental and behavioural disorders due to alcohol	F10	291, 303, 3050
V	26	0503	Mental and behavioural disorders due to use of other psychoactive subst.	F11-F19	292, 2940, 304, 3051-3059
V	27	0504	Schizophrenia, schizotypal and delusional disorders	F20-F29	295, 2970-2973, 2978-2979, 2983-2989
V	28	0505	Mood [affective] disorders	F30-F39	296, 2980, 3004, 3011, 311
V	29	0506	Other mental and behavioural disorders	remainder of F00-F99	remainder of 290-319
VI		**0600**	**Diseases of the nervous system**	**G00-G99**	**320-359, 435**
VI	30	0601	Alzheimer's disease	G30	3310
VI	31	0602	Multiple sclerosis	G35	340
VI	32	0603	Epilepsy	G40-G41	345
VI	33	0604	Transient cerebral ischaemic attacks and related syndromes	G45	435
VI	34	0605	Other diseases of the nervous system	remainder of G00-G99	remainder of 320-359
VII		**0700**	**Diseases of the eye and adnexa**	**H00-H59**	**360-379**
VII	35	0701	Cataract	H25-H26, H28	366
VII	36	0702	Other diseases of the eye and adnexa	remainder of H00-H59	remainder of 360-379
VIII	**37**	**0800**	**Diseases of the ear and mastoid process**	**H60-H95**	**380-389**
IX		**0900**	**Diseases of the circulatory system**	**I00-I99**	**390-459 except 435 and 446**
IX	38	0901	Hypertensive diseases	I10-I15	401-405
IX	39	0902	Angina pectoris	I20	413
IX	40	0903	Acute myocardial infarction	I21-I22	410
IX	41	0904	Other ischaemic heart disease	I23-I25	411-412, 414
IX	42	0905	Pulmonary heart disease & diseases of pulmonary circulation	I26-I28	415-417
IX	43	0906	Conduction disorders and cardiac arrhythmias	I44-I49	426, 427
IX	44	0907	Heart failure	I50	428
IX	45	0908	Cerebrovascular diseases	I60-I69	430-434, 436-438
IX	46	0909	Atherosclerosis	I70	440
IX	47	0910	Varicose veins of lower extremities	I83	454
IX	48	0911	Other diseases of the circulatory system	remainder of I00-I99	remainder of 390-459 except 435 and 446
X		**1000**	**Diseases of the respiratory system**	**J00-J99**	**0340, 460-519**
X	49	1001	Acute upper respiratory infections and influenza	J00-J11	0340, 460-465, 487
X	50	1002	Pneumonia	J12-J18	480-486

International shortlist for hospital morbidity tabulation (ISHMT) - Eurostat/OECD/WHO					
Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
X	51	1003	Other acute lower respiratory infections	J20-J22	466 (acute lower respiratory infections other than acute bronchitis, acute bronchiolitis and pneumonia were not separated in ICD-9, no J22 equivalent)
X	52	1004	Chronic diseases of tonsils and adenoids	J35	474
X	53	1005	Other diseases of upper respiratory tract	J30-J34, J36-J39	470-473, 475-478
X	54	1006	Chronic obstructive pulmonary disease and bronchiectasis	J40-J44, J47	490-492, 494, 496
X	55	1007	Asthma	J45-J46	493
X	56	1008	Other diseases of the respiratory system	J60-J99	remainder of 460-519
XI		**1100**	**Diseases of the digestive system**	**K00-K93**	**520-579**
XI	57	1101	Disorders of teeth and supporting structures	K00-K08	520-525
XI	58	1102	Other diseases of oral cavity, salivary glands and jaws	K09-K14	526-529
XI	59	1103	Diseases of oesophagus	K20-K23	530
XI	60	1104	Peptic ulcer	K25-K28	531-534
XI	61	1105	Dyspepsia and other diseases of stomach and duodenum	K29-K31	535-537
XI	62	1106	Diseases of appendix	K35-K38	540-543
XI	63	1107	Inguinal hernia	K40	550
XI	64	1108	Other abdominal hernia	K41-K46	551-553
XI	65	1109	Crohn's disease and ulcerative colitis	K50-K51	555, 556
XI	66	1110	Other noninfective gastroenteritis and colitis	K52	558
XI	67	1111	Paralytic ileus and intestinal obstruction without hernia	K56	560
XI	68	1112	Diverticular disease of intestine	K57	562
XI	69	1113	Diseases of anus and rectum	K60-K62	565, 566, 5690-5694
XI	70	1114	Other diseases of intestine	K55, K58-K59, K63	557, 564, 5695, 5698, 5699
XI	71	1115	Alcoholic liver disease	K70	5710-5713
XI	72	1116	Other diseases of liver	K71-K77	570, 5714-573
XI	73	1117	Cholelithiasis	K80	574
XI	74	1118	Other diseases of gall bladder and biliary tract	K81-K83	575, 576
XI	75	1119	Diseases of pancreas	K85-K87	577
XI	76	1120	Other diseases of the digestive system	remainder of K00-K93	remainder of 520-579
XII		**1200**	**Diseases of the skin and subcutaneous tissue**	**L00-L99**	**680-709**
XII	77	1201	Infections of the skin and subcutaneous tissue	L00-L08	680-686
XII	78	1202	Dermatitis, eczema and papulosquamous disorders	L20-L45	690-693, 6943, 696-6983, 6988, 6989
XII	79	1203	Other diseases of the skin and subcutaneous tissue	remainder of L00-L99	remainder of 680-709
XIII		**1300**	**Diseases of the musculoskeletal system and connective tissue**	**M00-M99**	**0993, 1361, 2794, 446, 710-739**

International shortlist for hospital morbidity tabulation (ISHMT) - Eurostat/OECD/WHO					
Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
XIII	80	1301	Coxarthrosis [arthrosis of hip]	M16	Not a concept in ICD-9 at four-digit level. Can only be defined by using the optional fifth digit 5 to 715, *i.e.* 715.15, 715.25, 715.35 and 715.95
XIII	81	1302	Gonarthrosis [arthrosis of knee]	M17	Not a concept in ICD-9 at four-digit level. Can only be defined by using the optional fifth digit 6 to 715, *i.e.* 715.16, 715.26, 715.36 and 715.96
XIII	82	1303	Internal derangement of knee	M23	717
XIII	83	1304	Other arthropathies	M00-M15, M18-M22, M24-M25	0993, 711-716, 718, 719, 7271*, 7284*
XIII	84	1305	Systemic connective tissue disorders	M30-M36	1361, 2794, 446, 710, 725, 7285
XIII	85	1306	Deforming dorsopathies and spondylopathies	M40-M49	720, 721, 7230, 7240, 737
XIII	86	1307	Intervertebral disc disorders	M50-M51	722
XIII	87	1308	Dorsalgia	M54	7231, 7234, 7236, 7241-7243, 7245
XIII	88	1309	Soft tissue disorders	M60-M79	726*, 7270*, 7272-7279*, 7280-7283, 7286-7289, 729
XIII	89	1310	Other disorders of the musculoskeletal system and connective tissue	M53, M80-M99	remainder of 710-739
XIV		**1400**	**Diseases of the genitourinary system**	**N00-N99**	**0994, 580-5996, 5998-629, 7880**
XIV	90	1401	Glomerular and renal tubulo-interstitial diseases	N00-N16	580-5834, 5838, 5839, 5900-5902, 5908, 5909, 591, 5933-5935, 5937, 5996
XIV	91	1402	Renal failure	N17-N19	5836, 5837, 584-586
XIV	92	1403	Urolithiasis	N20-N23	592, 594, 7880
XIV	93	1404	Other diseases of the urinary system	N25-N39	0994, 587-589, 5903, 5930-5932, 5936, 5938, 5939, 595-597, 5980, 5981, 5988, 5989, 5990-5995, 5998, 5999, 6256
XIV	94	1405	Hyperplasia of prostate	N40	600
XIV	95	1406	Other diseases of male genital organs	N41-N51	601-608
XIV	96	1407	Disorders of breast	N60-N64	610, 611
XIV	97	1408	Inflammatory diseases of female pelvic organs	N70-N77	614-616
XIV	98	1409	Menstrual, menopausal and other female genital conditions	N91-N95	6250-6255, 6258-627
XIV	99	1410	Other disorders of the genitourinary system	remainder of N00-N99	remainder of 580-629
XV		**1500**	**Pregnancy, childbirth and the puerperium**	**O00-O99**	**630-676 (no exactly equivalent ICD-9 codes for the three phases)**
XV	100	1501	Medical abortion	O04	635
XV	101	1502	Other pregnancy with abortive outcome	O00-O03, O05-O08	630-634, 636-639
XV	102	1503	Complications of pregnancy predominantly in the antenatal period	O10-O48	640-646, 651-659

International shortlist for hospital morbidity tabulation (ISHMT) - Eurostat/OECD/WHO					
Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
XV	103	1504	Complications of pregnancy predominantly during labour and delivery	O60-O75	660-668, 6690-6694, 6698, 6699
XV	104	1505	Single spontaneous delivery	O80	650
XV	105	1506	Other delivery	O81-O84	6695, 6696, 6697
XV	106	1507	Complications predominantly related to the puerperium	O85-O92	670-676
XV	107	1508	Other obstetric conditions	O95-O99	647, 648
XVI		**1600**	**Certain conditions originating in the perinatal period**	**P00-P96**	**760-779**
XVI	108	1601	Disorders related to short gestation and low birth weight	P07	765
XVI	109	1602	Other conditions originating in the perinatal period	remainder of P00-P96	remainder of 760-779
XVII	**110**	**1700**	**Congenital malformations, deformations and chromosomal abnormalities**	**Q00-Q99**	**740-759**
XVIII		**1800**	**Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified**	**R00-R99**	**780-799 except 7880, but including 5997**
XVIII	111	1801	Pain in throat and chest	R07	7841, 7865
XVIII	112	1802	Abdominal and pelvic pain	R10	7890
XVIII	113	1803	Unknown and unspecified causes of morbidity (incl. those without a diagnosis)	R69	7999
XVIII	114	1804	Other symptoms, signs and abnormal clinical and laboratory findings	remainder of R00-R99	remainder of 780-799 except 7880, but including 5997
XIX		**1900**	**Injury, poisoning and certain other consequences of external causes**	**S00-T98**	**800-999**
XIX	115	1901	Intracranial injury	S06	8001-8004, 8006-8009, 8011-8014, 8016-8019, 8031-8034, 8036-8039, 8041-8044, 8046-8049, 850-854 (Definition includes relevant ICD-9-CM codes.)
XIX	116	1902	Other injuries to the head	S00-S05, S07-S09	8000, 8005, 8010, 8015, 802, 8030, 8035, 8040, 8045, 830, 870-873, 900, 910, 918, 920, 921, 925 (Definition includes relevant ICD-9-CM codes.)
XIX	117	1903	Fracture of forearm	S52	813
XIX	118	1904	Fracture of femur	S72	820, 821
XIX	119	1905	Fracture of lower leg, including ankle	S82	823, 824
XIX	120	1906	Other injuries	S10-S51, S53-S71, S73-S81, S83-T14, T79	805-812, 814-819, 822, 825-829, 831-848, 860-869, 874-897, 901-904, 911-917, 919, 922-924, 926-939, 950-959

International shortlist for hospital morbidity tabulation (ISHMT) - Eurostat/OECD/WHO					
Version 2006-11-24					
ICD Chapter	Group	Code	Heading	ICD-10 Code	ICD-9 Code
XIX	121	1907	Burns and corrosions	T20-T32	940-949
XIX	122	1908	Poisonings by drugs, medicaments and biological	T36-T65	960-989
XIX	123	1909	Complications of surgical and medical care, not elsewhere	T80-T88	996-999
XIX	124	1910	Sequelae of injuries, of poisoning and of other consequences of	T90-T98	905-909
XIX	125	1911	Other and unspecified effects of external causes	remainder of S00-T98	990-995
XXI		**2100**	**Factors influencing health status and contact with health services**	**Z00-Z99**	**V01-V82**
XXI	126	2101	Medical observation and evaluation for suspected diseases and conditions	Z03	V71
XXI	127	2102	Contraceptive management	Z30	V25
XXI	128	2103	Liveborn infants according to place of birth ("healthy newborn babies")	Z38	V30-V39
XXI	129	2104	Other medical care (including radiotherapy and chemotherapy sessions)	Z51	V071, V58
XXI	130	2105	Other factors influencing health status and contact with health services	remainder of Z00-Z99	remainder of V01-V82
		0000	All causes	A00-Z99 (excluding V, W, X and Y codes)	001-V82 (excluding E800-E999)

Appendix II: Standard tables from a COI study

The following tables are based on the 2008 Korean case study: disease (ICD-10 Chapter), age and gender, functions (ICHA-HC). Costs for 2006 in billion won and share of current health expenditure according to the SHA definition.

Table II-1: Costs by disease-chapter

ICD chapter	Code	Heading	Costs (billion won)	Share (%)
All diseases			50,830	100.0
Ⅰ	A00-B99	Certain infectious and parasitic diseases	1,588	3.12
Ⅱ	C00-D48	Neoplasms	3,607	7.10
Ⅲ	D50-D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	214	0.42
Ⅳ	E00-E90	Endocrine, nutritional and metabolic diseases	1,944	3.82
Ⅴ	F00-F99	Mental and behavioural disorders	1,787	3.52
Ⅵ	G00-G99	Diseases of the nervous system	1,009	1.98
Ⅶ	H00-H59	Diseases of the eye and adnexa	1,996	3.93
Ⅷ	H60-H95	Diseases of the ear and mastoid process	676	1.33
Ⅸ	I00-I99	Diseases of the circulatory system	6,288	12.37
Ⅹ	J00-J99	Diseases of the respiratory system	5,069	9.97
ⅩⅠ	K00-K93	Diseases of the digestive system	7,854	15.45
ⅩⅡ	L00-L99	Diseases of the skin and subcutaneous tissue	1,117	2.20
ⅩⅢ	M00-M99	Diseases of the musculoskeletal system and connective tissue	6,036	11.87
ⅩⅣ	N00-N99	Diseases of the genitourinary system	2,561	5.04
ⅩⅤ	O00-O99	Pregnancy, childbirth and the puerperium	485	0.95
ⅩⅥ	P00-P96	Certain conditions originating in the perinatal period	98	0.19
ⅩⅦ	Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities	130	0.26
ⅩⅧ	R00-R99	Symptoms, signs and abnormal clinical and laboratory findings, NEC	493	0.97
ⅩⅨ	S00-T98	Injury, poisoning and certain other consequences of external causes	4,629	9.11
ⅩⅩ	V01-Y98	External causes of morbidity and mortality	-	-
ⅩⅩⅠ	Z00-Z99	Factors influencing health status and contact with health services	1,281	2.52
Not allocated			0	0.00
Not disease related			1,969	3.87

Table II-2 Cost by age and gender

Age group	gender (billion won)				costs for reproduction and gender-specific diseases (billion won)				per capita costs (thousand won)		
	total	male	female		total	male	female		total	male	female
Total	50,830	23,954	26,875		1,954	408	1,546		1,052	987	1,118
0	482	271	211		1	1	0		788	868	705
1_4	1,735	958	777		6	5	1		786	868	705
5_9	2,013	1,096	917		4	3	1		745	807	682
10_14	1,288	742	547		5	2	3		461	528	393
15_19	1,206	675	531		16	2	14		451	503	399
20_24	1,614	753	861		91	4	87		450	418	483
25_29	2,187	933	1,254		321	7	314		655	556	755
30_34	2,618	1,163	1,455		355	11	345		666	589	744
35_39	2,995	1,473	1,523		188	13	175		733	718	749
40_44	3,563	1,788	1,774		153	14	138		825	824	825
45_49	4,587	2,242	2,345		170	20	150		1,066	1,037	1,095
50_54	4,495	2,189	2,307		131	26	105		1,289	1,249	1,330
55_59	4,340	2,126	2,214		105	37	68		1,584	1,544	1,624
60_64	4,575	2,176	2,398		105	54	51		2,022	1,915	2,131
65_69	4,789	2,161	2,628		111	68	43		2,419	2,172	2,668
70_74	3,844	1,588	2,256		91	63	27		2,606	2,142	3,074
75_79	2,524	945	1,579		58	44	15		2,663	1,984	3,348
80_84	1,327	467	860		29	24	6		2,507	1,756	3,267
85_89	487	160	327		10	9	2		2,287	1,494	3,088
90_94	121	33	87		2	2	0		1,343	738	1,954
95+	38	15	23		1	0	0		1,594	1,278	1,913

Table II-3 Costs by ICD-10 disease chapter and ICHA-HC health care function

ICD chapter	codes	Function (billion won)						
		total	HC.1	HC.3	HC.4	HC.5	HC.6	HC.7
total		50,830	32,344	582	135	14,893	907	1,969
Ⅰ	A00-B99	1,588	781	11	0	664	132	0
Ⅱ	C00-D48	3,607	2,901	23	0	586	98	0
Ⅲ	D50-D89	214	175	2	0	34	2	0
Ⅳ	E00-E90	1,944	640	28	0	1,255	20	0
Ⅴ	F00-F09	1,787	1,367	119	0	228	73	0
Ⅵ	G00-G99	1,009	594	52	0	353	10	0
Ⅶ	H00-H59	1,996	983	0	0	998	14	0
Ⅷ	H60-H95	676	393	0	0	276	6	0
Ⅸ	I00-I99	6,288	2,902	242	0	3,063	81	0
Ⅹ	J00-J99	5,069	3,000	33	0	1,983	52	0
ⅩⅠ	K00-K93	7,854	6,516	6	0	1,263	69	0
ⅩⅡ	L00-L99	1,117	632	10	0	465	11	0
ⅩⅢ	M00-M99	6,036	3,766	28	0	2,188	54	0
ⅩⅣ	N00-N99	2,561	1,850	7	0	679	25	0
ⅩⅤ	O00-O99	485	470	0	0	10	5	0
ⅩⅥ	P00-P96	98	96	0	0	1	1	0
ⅩⅦ	Q00-Q99	130	112	0	0	17	1	0
ⅩⅧ	R00-R99	493	319	3	0	166	5	0
ⅩⅨ	S00-T98	4,629	3,823	16	135	622	34	0
ⅩⅩ	V00-Y98	-	-	-	-	-	-	-
ⅩⅩⅠ	Z00-Z99	1,281	1,026	0	0	41	214	0
Not allocated		0	0	0	0	0	0	0
Not disease - related		1,969	0	0	0	0	0	1,969

Appendix III: Example of the construction of a utilisation key

The table shows the full utilisation key for the cost-unit 'influenza vaccination'. This cost-unit is a specific government budget for the vaccination of vulnerable groups against influenza. The product indicator used in this case is the number of people vaccinated distributed over age and gender. Numbers are converted to fractions by dividing the number of people vaccinated for every age/gender combination by the total number of vaccinations. The first column is a counter, the next six are used to describe the six dimensions of a COI-study, in order of appearance: provider, financing, function, disease, gender and age. The last column gives the share of production for this cost-unit. Shares add up to 100%, indicating the utilisation key is complete (all costs accounted for) and lines are non-overlapping (prevents double-counting of cost in final result).

Shares are converted to costs by multiplying with total costs for this cost-unit. The cost-unit 'influenza-vaccination' has been used on the analysis level, because of its specificity and can be linked directly with a particular function. Under the SHA it is included in HP.3.1: providers of ambulatory care, because general practitioners administer the vaccination, and get paid out of this budget.

This example has been adapted from a cost unit used in the 2003 Dutch COI study.

Cost unit: Influenza-vaccination

#ID	ICHA-HP	ICHA-HF	ICHA-HC	ICD-10	gender	Age class	fraction
1	HP.3.1	HF.1.1	HC.6.3	J10-18	male	10-14	0.8%
2	HP.3.1	HF.1.1	HC.6.3	J10-18	male	15-19	0.7%
3	HP.3.1	HF.1.1	HC.6.3	J10-18	male	20-24	0.3%
4	HP.3.1	HF.1.1	HC.6.3	J10-18	male	25-29	0.8%
5	HP.3.1	HF.1.1	HC.6.3	J10-18	male	30-34	1.2%
6	HP.3.1	HF.1.1	HC.6.3	J10-18	male	35-39	1.2%
7	HP.3.1	HF.1.1	HC.6.3	J10-18	male	40-44	2.3%
8	HP.3.1	HF.1.1	HC.6.3	J10-18	male	45-49	2.8%
9	HP.3.1	HF.1.1	HC.6.3	J10-18	male	50-54	4.0%
10	HP.3.1	HF.1.1	HC.6.3	J10-18	male	55-59	4.9%
11	HP.3.1	HF.1.1	HC.6.3	J10-18	male	60-64	7.5%
12	HP.3.1	HF.1.1	HC.6.3	J10-18	male	65-69	7.3%
13	HP.3.1	HF.1.1	HC.6.3	J10-18	male	70-74	5.2%
14	HP.3.1	HF.1.1	HC.6.3	J10-18	male	75-79	3.1%
15	HP.3.1	HF.1.1	HC.6.3	J10-18	male	80-84	1.3%
16	HP.3.1	HF.1.1	HC.6.3	J10-18	male	85-89	0.4%
17	HP.3.1	HF.1.1	HC.6.3	J10-18	male	90-94	0.1%
18	HP.3.1	HF.1.1	HC.6.3	J10-18	male	95+	0.4%
19	HP.3.1	HF.1.1	HC.6.3	J10-18	female	10-14	0.7%
20	HP.3.1	HF.1.1	HC.6.3	J10-18	female	15-19	1.0%
21	HP.3.1	HF.1.1	HC.6.3	J10-18	female	20-24	1.6%
22	HP.3.1	HF.1.1	HC.6.3	J10-18	female	25-29	0.8%
23	HP.3.1	HF.1.1	HC.6.3	J10-18	female	30-34	0.8%
24	HP.3.1	HF.1.1	HC.6.3	J10-18	female	35-39	1.2%
25	HP.3.1	HF.1.1	HC.6.3	J10-18	female	40-44	1.9%
26	HP.3.1	HF.1.1	HC.6.3	J10-18	female	45-49	2.0%
27	HP.3.1	HF.1.1	HC.6.3	J10-18	female	50-54	3.2%
28	HP.3.1	HF.1.1	HC.6.3	J10-18	female	55-59	3.7%
29	HP.3.1	HF.1.1	HC.6.3	J10-18	female	60-64	2.7%
30	HP.3.1	HF.1.1	HC.6.3	J10-18	female	65-69	8.0%

#ID	ICHA-HP	ICHA-HF	ICHA-HC	ICD-10	gender	Age class	fraction
31	HP.3.1	HF.1.1	HC.6.3	J10-18	female	70-74	9.2%
32	HP.3.1	HF.1.1	HC.6.3	J10-18	female	75-79	7.9%
33	HP.3.1	HF.1.1	HC.6.3	J10-18	female	80-84	6.0%
34	HP.3.1	HF.1.1	HC.6.3	J10-18	female	85-89	3.3%
35	HP.3.1	HF.1.1	HC.6.3	J10-18	female	90-94	1.4%
36	HP.3.1	HF.1.1	HC.6.3	J10-18	female	95+	0.3%

Appendix IV: Calculation Examples from the Dutch COI study 2003

In this section some 'real life' example of actual calculations for a general COI analysis for direct medical costs using a prevalence based method will be given.

Example (1) screening cervical cancer

An easy example of cost allocation in a COI study is the allocation of costs for the screening on cervical cancer. In the Netherlands a special screening programme exists, which targets all women aged 30-60. Be aware that in some other COI-studies these costs would not be included because it is not personal health expenditure. However, in the Netherlands public health expenditure is included in the study, and costs are attributed to the target population participating, and the diseases which should be prevented.

First step is to identify the total screening expenditure as a homogeneous cost unit in the national health accounts. This is easy, because cervical screening has a specific budget, which covers both the actual screening as well as the management costs of the programme. This cost unit is actually homogeneous for all three dimensions: there is one provider (the screening programme) There is also one source of finance: in 2003 a budget of 23.8 million euro provided for by Exceptional Medical Expenses Act (AWBZ). All insured persons in the Netherlands pay an income-dependent contribution under this law. Finally all costs belong to the health care function 'prevention'.

Second step is to construct a utilisation key for the top-down allocation of costs over disease, age and gender. For this we have to select a suitable production indicator from a registration of production data for this provider. In this case both gender (female) and disease (cervical cancer) are known in advance. So we only have to find a way to allocate costs over the five-year age-groups in the study. Typically for every women turning out after a call for participation, a Pap smear is made. This accounts for the bulk of the costs within the program. So as an indicator for production in the programme we could simply count the women participating, classify by age, and allocate proportionally. We have several alternatives for getting these numbers.

- Alternative 1: Simply use national population statistics. All women between the ages 30 and 60 get a regular call for participation, so if we count the women within these age groups we should get a fairly good estimate of the age distribution. However, there will be some error because actual turn-out for the screening may differ with age.

- Alternative 2: Use a population survey. The Dutch national bureau of statistics (Statistics Netherlands) surveys the health of the population on a continuous base. Every year ~10,000 citizens (~0.064% of the population) are questioned (house-visits). Participation in the screening programme is part of the questionnaire. So results should give insight in actual turnout. However, there is also a disadvantage: the questionnaire is concerned with self-reported health, and this introduces some errors, for instance recall bias or response bias.

- Alternative 3: Use a specific health registration. The programme management monitors turnout continuously, and classifies this to age groups. This is of course the best indicator to use, because it measures 100% of the real turnout.

The third step is to multiply the share of the allocation key with the costs for the program. In table IV-1 results are shown. The real turnout (alternative 3) has been used as allocation key. In this case the key is very simple, because it is uniform for all dimensions, except age, and consists of only seven lines. Other keys for other providers are sometimes much bigger (several thousands of lines) but the principle is the same: total shares add up to 100% of the costs attributed with the key, and every line refers to a distinct combination of our six dimensions (provider, finance, function, disease, gender, age). As shown, in this case the share of population (alternative 1) would have given a good approximation of the age distribution as well.

Finally the results of the partial COI analysis for this provider were added to those of the other providers to get a total COI- analysis for Dutch national health accounts.

Table IV-1. Commonly encountered indicators of health care utilisation

Age	Alternative 1: share of population	Alternative 3: share of actual turnout	Cost distribution (million euro) (based on distribution turnout)
30-34	16%	14 %	3,3
35-39	16%	17 %	4,0
40-44	16%	18 %	4,3
45-49	15%	15 %	3,6
50-54	14%	14 %	3,4
55-59	13%	13 %	3,2
60-64	10%	9 %	2,1
total		100 %	23,8

Source: #: numbers of the indicator.

Example (2) prescription drugs for out-patients

A more difficult example is the partial cost of illness analysis for prescription drugs for out-patients by dispensing chemist. In this case multiple registrations have to be used in the construction of a utilisation key.

First step is to identify the costs for this provider. In Dutch national health accounts, expenditure for dispensing chemists were in 2003 about 5.3 billion euro. This includes both medical and non-medical sales (for instance liquorice). Because non-medical sales are not part of the SHA, and we want to be able to report a COI analysis for both national and SHA cost definitions, we have to split the costs for this provider in two groups, and analyse these separately. Fortunately this could be done fairly easy, because Statistics Netherlands keeps these two types of sale separate.

Non–medical sales are attributed to a special disease group: 'not disease related', because these sales are unrelated to any disease. In this example we will focus on the analysis of the medical sales.

Second step is to construct a utilisation key for the top-down allocation of costs over disease, age and gender. For this we have to select a suitable production indicator from a registration of production data for this provider. Several registrations which could be useful exists

- Registration 1: a survey among general practitioners, in which a nationally representative selection registers which prescriptions are given to patients. The advantage of this registration is that it contains both patient information (age, gender, disease) and information about prescribed drugs, using the internationally recognized Anatomical Therapeutic Chemical Classification System (ATC-code) developed by the WHO. The registration has also several disadvantages: disease is not coded using the ICD system, but uses the International Classification of Primary Care (ICPC), which is less specific. A more important disadvantage is that it records prescriptions and prescribed doses, but it does not log the time the prescription is used or every change in the dose. It also does not contain information about prices and actual use. Another disadvantage is that prescriptions of other medical professionals are only partially included.

- Registration 2: a cost registration for expenditure which is based on the medical sales for >90% of all dispensing chemists. It logs some patient information (age and gender) and detailed prescription information (ATC-code, dose, sales). The advantage of this registration is that it measures actual sales, which is a much better indicator for production than the number of prescriptions, because it takes in to account both price differences between prescriptions as well as the duration of the use. A second advantage is that it is an almost complete registration. The disadvantage is that it does not contain information about the actual disease.

- Registration 3. A registration of insurance declarations exists. Main disadvantage is that contains only data for compulsory insured, which in 2003 covered only 60% of the population, mostly low-income groups and elderly. It also does not contain diagnostic data.

- Registration 4. A specialized scientific registration among GP's for detecting adverse effects of drugs. The advantage is that this source can provide detailed information on both patients and prescriptions. The main disadvantage is that it does not contain information on sales, and is regionally oriented.

- Registration 5. A commercial database which registers data on drug use on GP-level, using a representative selection. It contains both patient and prescription information, including sales. Main disadvantage is the fairly high costs involved in using this source.

Problem here is that none of these registrations are ideal for use. Therefore we decided to use a combination of registration 1 and 2. Registration 2 is vastly superior

to the others in registering the complete sales, but does not contain a diagnosis. However, most drugs have a fairly narrow spectrum of use in medical terms. From registration 1 we were able to construct a distribution of prescriptions classified by drug type over diseases. Costs were allocated to other diseases in proportion to the share of prescription. Table IV-2 shows an example for a particular class of drugs (NO6A, Antidepressants). About 44% of its prescriptions were for patients diagnosed with depression, and therefore 44% of sales were attributed to depression. Actual allocation was a bit more complicated as in this example, because we also did take age and sex into account (available in both registrations) in the construction of the disease distribution for particular classes of drugs.

By this method we could construct a utilisation key by age, gender and diagnosis.

Allocation to the dimensions of function and finance proved more problematic. Allocation to the functional dimension was based on the type of drug prescribed and the disease for which it was used. The large majority were attributed to the curative function; some drugs (notably those for hypertension) were attributed to prevention, because the main use of these drugs is to prevent future health care problems. Note that this differs from the view SHA takes on health care functions, which would allocate all costs to 'supply of medical goods'. The financial dimension could not be fully resolved in the Dutch payment system. It is difficult to make a division between insurance-based payments and co-payments. Only on an aggregated level these costs can be separated. This implies that construction of a distinct key for the allocation of these two sources of finance over the other dimensions is not possible. In this situation it is not useful to separate co-payments from insurance-based payments because no difference would show up in the use of these two costs. In the Dutch study therefore these two types of sources of finance are combined, and all sales were attributed to 'insurance-based payments including individual co-payments'. Remark that this is an example of a country-specific problem. In other countries it might be much easier to separate these costs within health registrations itself, and therefore it could be possible to construct a different allocation key for both these types of cost.

Table IV-2 example linking prescriptions-diseases for ATC-group N06A (antidepressants)

Disease	proportion	cumulative proportion
depression	44.3	44.3
anxiety disorder	17.0	61.3
other psychic disorder	14.0	75.4
symptoms	7.1	82.5
All other diseases	17.5	100

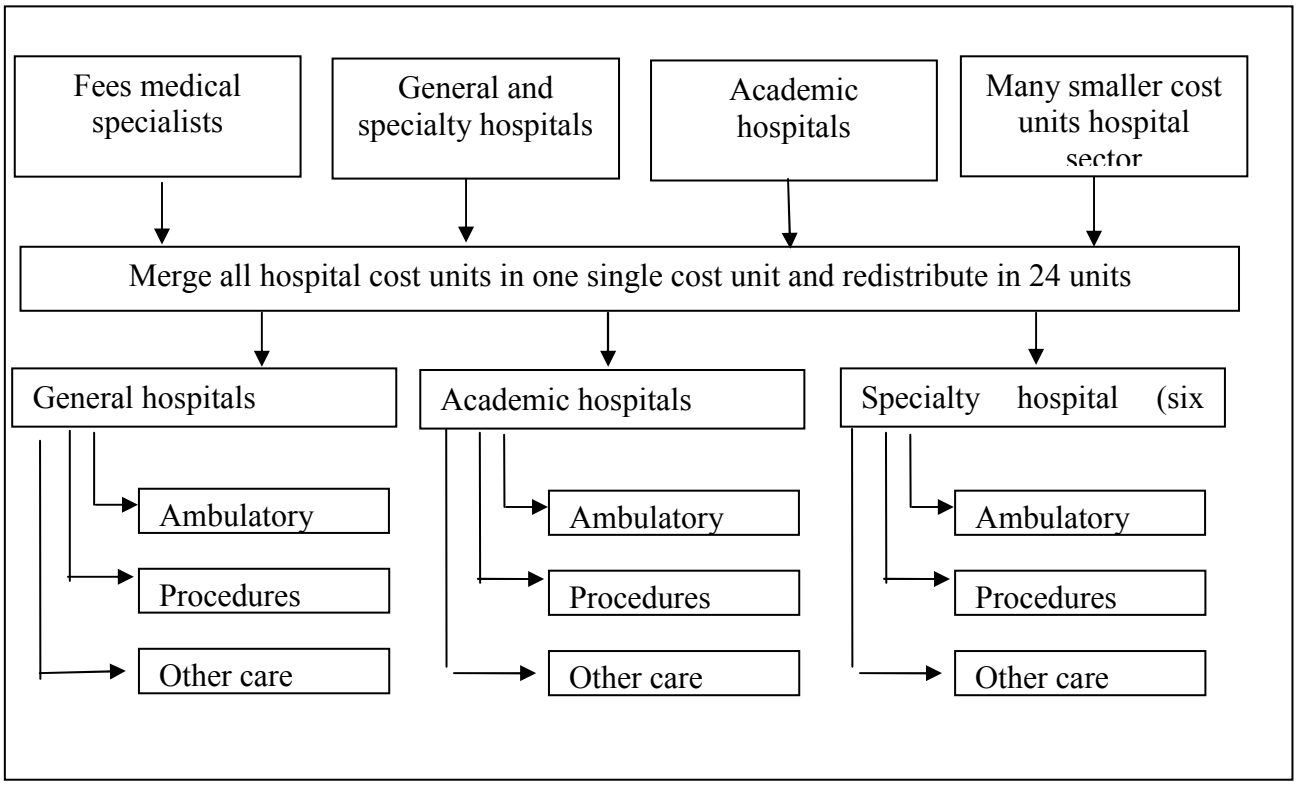
In this way a table distributing all sales over the dimensions of the study was constructed. As in the previous example every line contains a different combination of dimension-classes, and the share in the total costs. Total shares added up to 100%. This distribution was multiplied with total costs for this provider. As in the previous example total costs for dispensing chemists were multiplied with the share to get a

cost distribution over the dimension-classes. Finally the results of the partial COI analysis for this provider were added to those of the other providers to get a total COI-analysis for Dutch national health accounts.

Example (3) hospital costs

One of the most complex partial COI analyses in the Dutch COI analysis was made for the hospital sector (excluding mental care hospitals). The total budget (about 25% of total health care costs in the Netherlands) is fairly well known, but it is distributed over many providers and no overall registration which links costs to health care use exists for these providers. Partially because of the complexity, an allocation model is used to pay hospitals and medical specialists, mostly based on number of beds and other parameters based on production in previous years. A positive is that some very good and detailed registration exist for some production parameters (like hospital days, procedures performed), but these registrations could not be directly linked to individual providers. For instance, separate registrations for in-hospital care and ambulatory hospital care exist in the Netherlands. However, hospital costs are not separately known for these types of care. The same problem exists for other providers like the fees of medical specialists.

Figure IV-1 Rearranging hospital costs in artificial units



In the first step all costs for providers in the hospital sector were pooled together (see figure IV-1). The pooled costs were used to make an estimate for costs in artificial costs units in such a way that existing registrations could be used. Input for this estimation was given by a Dutch research institute for the hospital sector. In this estimation about 30% of all hospital costs were attributed to ambulatory care, and 10% of hospital costs were attributed to the performance of operational procedures. The remainder, 60% was attributed to the costs of in-hospital care and all other

running costs of the hospital (diagnostic laboratory, in-hospital drug prescription, maintenance, cleaning etc). For each of these three groups a suitable indicator was selected:

- Ambulatory care: A registration of the number of ambulatory patient visits to medical specialists was used. Age and sex of the patient were known, as well as the total number of first time visits. Also available was an (anonimized) hospital identifier, the type of hospital and the type of specialist visited by the ambulatory patient. For about 45% of all hospital visits the number of subsequent visits was also known. These data were used to make an estimation of total visits to specialist, by age, sex and type of specialist. A direct diagnosis was not known, but this could be estimated using referral data from general practitioners. These referral data contained age, sex, type of specialist and diagnosis. Final result was an estimated distribution of visits of age, sex and disease. This was used as utilisation key.

- Procedures: A nation-wide registration of all operational procedures was used. This covered 99% of all hospitals. Procedures were described in detail, using a Dutch classification (CMSV). For every procedure, age, sex and diagnosis were known, as well as the type of hospital. Total number of performed procedures was used as an utilisation key, weighted by the standard price of procedures. For many procedures a standard price was known, for those procedures for which a standard tariff was unknown, the tariff of a similar procedure with known price was used. A bottom-up calculation of total costs for procedures by aggregating weighted costs was found to be in good agreement with the 10 % of total hospital costs a priori assigned in a top-down fashion.

- Other care: The remainder of hospital costs were for the largest part of costs connected to the length of stay in the hospital, and therefore the number of hospital days by age, gender and disease was used as utilisation key. Data were derived from the same registration as data on procedures. Hospital days were weighted with the estimated price of the two main types of hospital care: day care and clinical care. In-hospital use of medical goods like drug prescriptions could not be separated from the other costs of hospital care, and were also allocated using this key based on length of stay. For diseases with high in-hospital drug costs (like some cancers or endocrine diseases) this means total costs attributed will be slightly underestimated. However, this is only a small error, because costs of in hospital drug prescriptions aggregate to about 3% of total hospital costs.

These derivations of utilisation keys were repeated for every type of hospital (general, academic and six specialty hospitals). A consequence of the procedure followed is that it is not possible to report separate COI estimates for the original group of hospital providers. Therefore, in the final reporting the results of the 24 artificial cost units were aggregated to a COI estimate for all hospital providers combined.

ANNEX 2: RIVM REPORT BY ON IMPLEMENTING THE DRAFT GUIDELINES

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Remark: this report is based primarily on the interim country reports from Australia, Hungary, Korea, Slovenia, Sweden and initial comments received from Germany and separate written comments on the draft guidelines received from Eurostat. In this final version, comments made at the OECD Workshop on Estimating Expenditure by Disease, Age and Gender (7 October 2008, Paris) have also been included. A section with recommended changes to the guidelines based on the discussions at the workshop has been added as a separate document.

The comments are divided into a general section, and six country-specific sections. The comments focus on the application of draft guidelines drafted in October 2007 by the Dutch team.

Appendix: table of comparison between the country studies

General

In general, the application of the draft guidelines has not posed any significant problems. This might be partially due to the fact that all countries involved have already adopted national health accounts in accordance with SHA guidelines, which provide a consistent framework. Some ambiguities were found during the implementation phase, which in most cases can be solved by a rephrasing of the draft guidelines. It was inevitable that the first version of the draft guidelines was slightly biased towards the experiences of the authors. The country reports clearly point to some of these biases (in methods advocated, analysis techniques mentioned). This is something which should be addressed in the next version, by incorporating the experience of the countries involved in the project into the draft guidelines.

Some countries are able to produce very complete Cost of Illness (COI) studies (Korea, Germany and Australia). Perhaps unsurprisingly, these countries are also those with previous experience in the field of COI. The interim reports of Slovenia and Hungary do not contain output data yet, but indications are that these countries, although relatively new in the field will be able to produce COI tables for more than 50% of total health expenditure (THE), which is very encouraging.

Sweden is a bit of a special case: the Swedish team questions the methodology used, and recommends limiting the COI study to those areas of health expenditure for which a bottom-up attribution is possible. Only in-patient curative care and

rehabilitative care will be covered in the final Swedish report. However, the Swedish presentation at the workshop showed the difference with the approach of other countries is not as big as it seems from the interim report. In fact, the Swedish approach for in-patient cost data is very similar to methods used in other countries – for instance Australia and Korea – which use direct methods (based on DRG-registrations or claims data) for the same type of cost unit, and incorporate the results of this in a top-down study.

The draft guidelines focus on using the provider dimension as the main axis of analysis. This reflects the country-specific experience of the Dutch authors of the draft guidelines. The interim reports clearly show that in other countries it is often more appropriate to use the functional or financial dimension as the main axis of analysis. Guidelines should be modified so they will become less 'provider-biased', while at the same time comparability between country-studies should be guaranteed.

The boundaries of health care included in the estimation of expenditure deserve some extra discussion. The current draft guidelines propose a broad definition, including not only personal health care, but also propose to attribute expenditure on community prevention programs, and administration of health care to COI-dimensions. In the Netherlands this has been traditionally included in a COI-study, on the grounds that these costs form an integral part of health care. In some of the interim reports a similar position is taken. However, it is clear that some other countries take a different view to all or part of these costs being included, and leave them out of the COI on the ground they cannot be attributed to specific diseases. Some adopt a pragmatic stance by only including costs of this type which can be attributed to personal health care use (for instance some cancer screening programs).

It is proposed that inclusion of these types of costs should be optional, not compulsory. This should be made clear in the guidelines. If SHA classification of functions or providers is used, it should be easy to separate attributions within these functions or providers from the functions or providers of personal health care.

Mixed methods instead of pure top-down are the norm in attributing expenditure to COI-dimensions. The draft guidelines seem to advocate only indirect attribution (estimates using utilisation keys[11]). This was not the intention. If direct attribution is possible (for instance because detailed claims databases exist or DRG-type registrations), it is recommended that this path should be followed. In fact, wherever this is possible, countries in the project have already done so. This is also a point on which some modification of the guidelines is required.

When comparing the different country reports there is considerable common ground:

[11] A utilisation key is an estimate of the distribution of health care use over distinct combinations of all dimensions. To every key a fraction of total utilisation within the cost-unit is assigned. With six dimensions, the size of keys varies from a few combinations to many thousands. It is important that this key should be complete: fractions in the key must add up to 100% of all care delivered by the cost-unit. Furthermore, the distinct combinations of dimension-classes within a key should refer to the same unit of utilisation only once: no double-counting should occur. [DELSA/HEA/HA(2007)7]

All countries involved in the project are able to produce SHA-type health accounts, and use this as a starting point for estimating COI-expenditure.

All countries are able to collect data for recent years; all studies are based on data over 2005 or 2006. This is indirect evidence that where data registries exist, they can be put to use without much delay.

For curative care functions and, to a somewhat lesser extent, distribution of medical goods (retail prescriptions) a COI-study seems feasible in most countries.

All countries are able to produce output in the form of tables suggested in the draft guidelines, although the detail differs. All countries are able to provide output at least at the ICD chapter level, and in most cases much more detailed. Some countries are able to classify age into the recommended 21 groups. Other countries have not provided an age classification in their reported data, and it is not clear from the interim reports if a more detailed age-classification would be available, if requested.

Also some problematic areas are identified:

In many countries accessing data on long-term nursing care will be a problem due to both a lack of data and to different definitions for this type of care.

There is debate about the inclusion of public health expenditure in the COI. In most countries general prevention is not included, except in some cases for a few specific programs (vaccination, cancer screening) for which target populations and diseases are clearly identifiable. The administrative costs of running health systems and insurance schemes are sometimes included – but in different ways – and are sometimes left out altogether.

Most countries have cost units where data collection is a problem, but this can hardly be seen as country-specific problems. It is significant that units with problematic data are in fact quite similar between countries: long-term nursing care, public health expenditure, transport, sometimes out-patient curative care, out-of-pocket expenditure to name some of the most important units.

A few country-specific problems are reported. Most of these are related to the SHA itself and not to estimating COI-expenditure. Sometimes it is impossible to separate functions or finance in sufficient detail, in other cases local forms of health care exists (such as herbal medicine in Korea) which are difficult to fit in the SHA. Related to this is a comment from Eurostat on the guidelines: in some countries providers use revenues of services not related to health care to subsidize health care activities. At the moment it is difficult to fit these revenues in the SHA[12].

The real proof of the usefulness of the guidelines will be if their application leads to meaningful comparisons of expenditure by disease, age and gender between countries. One point to make here is that the guidelines might be too permissive. They contain some recommendations (for instance about classifications to use), but they don't enforce these classifications. As for the attribution of expenditure to COI dimension some hierarchy of methods is given (use the best method data allow), but

[12] See DELSA/HEA/HA(2008)3

again no explicit do's and don'ts are mentioned. This permissiveness was in fact intended when the draft guidelines were written (to accommodate for country-specific differences, and to encourage countries to start with COI-projects), but the comparison of the country reports shows many countries use in fact very similar methods for similar cost units. Therefore, the usefulness of the guidelines as well as the comparability of final results might improve if firmer recommendations are made, and do's and don'ts added.

However from discussions the workshop it is clear that most countries in this stage of the process are opposed to more restrictions imposed on how to conduct a COI study. Moreover the current flexible approach will produce country reports of good quality as evidenced by both interim reports and workshop presentations. Most countries therefore don't see the need for compulsory guidelines. Conducting a comparative study of outcomes could provide more information for an informed decision on this point. A decision on the status of the guidelines should only be taken after this study has been completed and evaluated.

But there is one important point on which we should be firm in demands of countries: the format of the output tables, and the classifications used. Collecting expenditure data requires considerable resources, and funding agencies will have to be convinced that it is necessary to fund these efforts. Part of this conviction should come from provided examples for the use of COI-data., but it will also be very helpful if the OECD, preferably in cooperation with other international agencies, clearly and unambiguously state what type of output is demanded and what kind of classifications should be used. Having said this, the requested formats for output need not be part of the guidelines, but could also be put in a revised SHA.

Australia

Australia has been involved in COI studies since 1993-4, and the present study follows a design which closely matches earlier studies. The Australian study design is also very similar to the design outlined in the draft guidelines. The main difference between the Australian study and the design proposed in the guidelines is that Australia adopts a narrower view on disease costs.

Which part of the guidelines need clarification?

The report states: 'There are no aspects of the draft guidelines that are not sufficiently clear'.

Which country specific problems were encountered in implementing draft guidelines?

None reported. As already mentioned, Australia has been involved in COI studies for many years the study design developed is very similar to the design outlined in the draft guidelines.

Deviations from the draft guidelines?

In contrast to the broad view recommended, the Australian study adopts a narrow view on health care costs, by including only expenditure devoted to those who are ill. Some cost areas are also excluded due to lack of appropriate data:

- Public health expenditure was not allocated to a specific disease, with the exception of cervical screening and breast cancer screening. Other areas were excluded, because of a lack of data, and because target diseases and populations of public health expenditure are not always obvious. The Australian team estimates the impact on results to be slight, because public health spending accounts for less than 2% of THE in Australia.

- For similar reasons, administration expenditure was excluded. In earlier studies, costs were attributed to disease, age and gender in proportion to health expenditure in the costs administered. But it is felt this introduces too much uncertainty into the results.

- Patient transport services are excluded because appropriate data for estimating expenditure are missing. With some effort a proxy key might be constructed, but the Australian team questions if benefits outweigh the effort, as transport expenditure is less than 2% of THE.

- Health aids and appliances were excluded because of a lack of data.

- Expenditure on high and low-level care in residential age care facilities is considered as having a welfare purpose, and it is therefore not included in the estimates of national health expenditure

- Australia uses an age classification (10 groups) different from the recommended 21-group classification in the guidelines.

Recommendations for changes in the guidelines?

No direct recommendations for change are made. However, the Australian interim report identifies some issues which have not been sufficiently addressed in the guidelines. The Australian study specifically excludes capital expenditure on health facilities and equipment from the COI-study on the grounds they cannot be allocated to a specific disease or injury and the added problem of being characterized by large outlays that fluctuate greatly from year to year. It advocates limiting the COI study to recurrent costs, and excluding capital expenditure. This seems to us a useful addition to current guidelines.

Does a suitable cost framework exist?

Yes, the Australian NHA is based on a WHO framework of the 1970s. The health expenditure database behind this framework is structured in such a way that expenditure data can be provided according to both NHA and SHA classifications.

Are there gaps in data sources?

Expenditure data are generally available for all three SHA dimensions. But for some areas no reliable data are available for attributing it to a specific disease. Some of these have already been listed under deviations from the guidelines. In addition, expenditure on outpatient hospital services, over-the-counter drugs and visits to other health practitioners – except optometrists – were excluded. No reliable data are available for attributing it to a specific disease. In previous studies the National Health Survey was used for attributing these costs, but this is no longer possible, because the survey no longer reports utilisation information allowing expenditure to be categorized by all diseases. In the final results these costs will be attributed to a residual group such as ‘not able to be allocated’.

Is a COI-analysis possible?

Yes, 70% of total health expenditure can be allocated by disease for 2004-2005.

Germany

Since the 1990s Germany is involved in COI studies. In recent years Germany has invested in creating a routine process for estimating expenditure by disease, age and gender. The German interim report contains an extensive description of the methodology and of this routine process. Since 2002 bi-annually an estimate is made, the latest for 2006. The German methodology is basically the same as in the draft guidelines.

Because of the advanced position within COI-studies, the calculation has become routine. The production of the bi-annual study is embedded in existing structures and covered by long-term agreements with other institute who on a routine base provide data. This has the advantage that data-sources and classifications used are the same for successive studies, which enhances comparability.

The establishment of a routine process provides valuable information not only for Germany but is an example for other countries as well. For instance, the German production schedule can be of advantage for the implementation of similar projects in other countries. For data acquisition and the calculation process 15 months are scheduled, followed by verification and publication. The whole process takes 20 months. With this in mind Germany recommend a time-span between COI-studies of at least two years.

But in a way the success has also a down-side. For instance classifications used are embedded in agreements with data providers. Germany is reluctant to change these agreements unless there is a compelling reason to do so, for instance international agreement on standards on desired output.

Creating output which differs from the established national standard in Germany is technically possible, but this would often be accompanied by accelerated efforts of the Federal statistical office and the associated data-holders:

- check-up if data holders can provide the desired information

- re-accounting of Cost of Illness of former reporting years

- additional organizational work

- renewed discussions and probably new agreements have to be negotiated

- more work for data holders.

Therefore for minimizing the efforts for countries that have already invested in COI studies, Germany appreciates the definition of binding standards as soon as possible.

Another recommendation is that countries should synchronize reporting years. This will improve international comparisons. Frequency should be once every two years or rather more.

The German report contains a very thorough description of methodology. It is felt guidelines would benefit if some of the figures and material would be incorporated in a future edition of the guidelines.

Which part of the guidelines need clarification?

Germany wants a clearer status for the guidelines, and would appreciate binding standards for outcomes.

Which country specific problems were encountered in implementing draft guidelines?

Germany has used a different age-classification. The only major omission is the impossibility of discriminating costs for new-born infants within the age group (0-4).

Which country specific problems were encountered in implementing draft guidelines?

No real country specific problems were found in estimating expenditure. German estimates are linked to SHA by provider. Technically it is possible to generate cost-units also by health care function or health care financing, but health care utilisation data sources that fit to these particular cost-units are very difficult to find. It is not top be expected that this changes in the near future.

Recommendations for changes in the guidelines?

Germany advocates binding guidelines for classifications and outcomes, for reasons stated above. The final guidelines should give reliable instructions for their setup of an international comparable core data set on Cost of Illness. Each country should be allowed to depart from these recommendations if the realization of a Cost of Illness study according to the guidelines is not practical for country-specific reasons.

Hungary

The interim report of Hungary does not refer directly to the draft guidelines. However, the description of the Hungarian application of the guidelines is clear. The procedures followed by the Hungarian team match closely the recommended procedure in the guidelines. The conceptual framework of the SHA is already in use in Hungary, so no problems are expected for the collection of suitable cost-data. Within the project, total health expenditure for 2006 has been divided in homogeneous cost units, using the functional and financial dimension within the SHA.

Up to now, 123 cost units have been identified. For every unit, a check has been undertaken to ascertain whether data are available for analysis along four dimensions; age, gender, disease and provider. Detailed utilisation data is available for more than 50% of Hungarian health expenditure. Most data are available for curative functions. Gaps are seen for long-term care, public health and preventive care and administrative care.

In attribution of costs, Hungary seems to follow a mixed model. Bottom-up calculation is used if detailed utilisation data are available, top-down if this is not the case.

Which part of the guidelines need clarification?

No specific recommendations are made within the interim report. But the Hungarian team provides impressive input for expansion of the guidelines, to the profit of countries which haven't done yet a COI-study. The Hungarian team has very methodically conducted a definition study before they started with the actual COI-analysis, and applied results by splitting units in health accounts in homogeneous units and identifying health registrations which can be used for estimating expenditure by disease age and gender for these units. Because of the systematic approach gaps in data-infrastructure are easily identified and for every cost unit the availability of data for a COI study has been established, even before the final analysis. This part of the Hungarian project is a fine example on how to conduct such a study, and should in some way be incorporated in a redraft of the guidelines.

Which country specific problems were encountered in implementing draft guidelines?

- No specific problems are mentioned. Hungary has used the financial dimension as the main axis of analysis. For the linking to registrations and specific utilisation keys it was sometimes necessary to subdivide into smaller units. The interim report explicitly states that no specific problems were encountered in this field.

- The report mentions the fact that for most cost units no direct attribution of costs to COI-dimensions is possible, but indirect attribution (estimates using utilisation keys) is possible for >50% of THE for Hungary.

Deviations from the draft guidelines ?

- No deviations are mentioned. Judging on the basis of the interim report Hungary has closely followed the draft guidelines.

Recommendations for changes in the guidelines?

- No explicit recommendations are made.

Does a suitable cost framework exist?

Yes; SHA has been used in the construction of Hungarian NHA, so no problems in this area.

Are there gaps in data sources?

- Yes, for about 50% of costs attribution to disease, age, gender and provider is possible, for the remainder this is not possible. Gaps seem to be distributed over all health care functions.

Is a COI-analysis possible?

For the >50% of costs with utilisation keys a COI is possible. Hungary will publish tables in the final report.

Korea

Korea has a long tradition of undertaking COI analysis. In the past this was limited to health care procedures covered by the national health insurance. In this study the field covered has been extended to cover all health account data.

The main purpose of the project was testing the feasibility of the draft guidelines. Judging from the results Korea did not encounter large problems with the guidelines themselves. However, Korea did encounter some problems, but these seem to be due to difficulties in adapting classifications of the SHA to local needs. Korea has extensive health databases, which have been used for this study, and which contain detailed data about costs (claims), diagnosis and patient characteristics, so for many cost units direct attribution of health care expenditure to all three SHA dimensions and the COI-dimensions, age, gender and diagnosis is possible. In some cases (for instance out-of-pocket payments) results from household surveys have been used for estimations using utilisation keys. The interim report already contains detailed output.

Which part of the guidelines need clarification?

The Korean team pointed out some ambiguities. These have been resolved in direct communication with the team. An important ambiguity related to the nature of transport costs which should be included in the COI study (section 12, point 2 'demarcation of costs', which seems to suggest emergency transport should not be included). In future versions of the guidelines it should be made clear that transport costs as defined by SHA health care function 4.3 should be included. This means that emergency transport and other transport directly related to treatment (for instance after dialysis or cancer treatment, often but not necessary involving specially modified vehicles like ambulances) and reimbursed by insurance schemes should be included. Other types of transport, generally paid for out of pocket (for instance bus tickets to reach the hospital) should not be included.

Which country specific problems were encountered in implementing draft guidelines?

- oriental medical services and herbal medicine are difficult to fit in the current SHA

- sometimes different interpretation on where costs should be allocated in SHA.

- financial dimension is much more useful than provider dimension as a starting point for analysis.

Deviations from the draft guidelines?

- The Korean study uses methods similar to the guidelines. Both in methods and in cost definition it adheres to recommendations made in the guidelines; a general COI study, including direct medical costs only, based on a prevalence based method, and using a broad definition.

- As for methods, the Korean team has used a mixed design with both bottom-up and top-down approaches. This is not seen as a real deviation from the guidelines, but points to the fact current draft guidelines do not mention the use of direct attribution of costs to COI dimensions using a bottom-up approach, if the quality of data sources allow this, as is clearly the case in Korea.

- For administrative costs, Korea has not attributed costs in proportion to the associated medical expenditure like the example in the draft guidelines. However, this should not be seen as a deviation, because current guidelines do not make an explicit recommendation for a specific method.

Recommendations for changes in the guidelines?

Korea raises several issues, which are not only related to the guidelines for a COI but also or even exclusively to the definitions of the SHA itself:

- The boundaries of health care should be subject of a debate. Korea advocates a clear distinction between public and private spending on prevention. Private spending is in Korea generally included in HC1, services of curative care.

- In line with these the definitions and naming of the current Health care function HC.6 (prevention and public health services) should be changed to HC.6 'Public health services', with a less detailed subdivision than the current groups, Korea proposes: 'HC.6.1 Prevention', 'HC.6.2 Promotion of a healthy life-style' and 'HC.6.3 others'.

- Oriental medical services and herbal medicine play a much larger role in Korean medicine than in many other countries, and are on an equal footing in both status and required qualifications with practitioners of western medical services. According to the current SHA-manual these traditional services should be classified as offices of other health care practitioners (HP.3.3). Korea proposes that in the specific Korean situation these should be classified as 'Offices of Physicians (HP.3.1).

- Korea also proposes a renaming of HP.7 (other industries) to for example 'other providers', with a subdivision which includes worksites, households, education and training institutes , research institutes, NGO's and 'others'.

Does a suitable cost framework exist?

Yes; national health accounts based on SHA. There are therefore no difficulties in constructing appropriate cost units, and linking cost units to registrations also poses few problems. The interim report already contains output for a full COI.

Are there gaps in data sources?

For publicly financed health care detailed registrations exist (claims database). The allocation of private sector spending is based on an annual household survey on income and expenditure, and therefore more limited in the detail that can be provided for privately financed health care. New sources for private expenditure are being developed. For the surveys it was assumed that they are representative for the whole Korean population. From the description of the survey it is clear that sufficient information has been gathered to attribute data to age, gender and disease, and also about the use of relevant health care resources.

Is a COI-analysis possible?

Yes; Korea has excellent data registrations which allow for many cost units direct attribution to both SHA-dimensions on expenditure to disease, age and gender, in high detail.

Slovenia

Slovenia has followed the draft guidelines very closely. The interim report contains detailed information of available data sources and problems encountered, which makes it like the Hungarian contribution very useful in assessing the feasibility of the guidelines.

An important point made in the Slovenian interim report is that the draft guidelines focus on the production-approach while an analysis along the financial and functional dimension is more applicable in Slovenia. As for international comparison, Slovenia proposes the functional dimension as the main axis of analysis.

No output-tables have been included yet, but from the interim report it is clear these tables can be produced. The diagnostic dimension in final output will be detailed to the ICD-chapter-level. This will be a partial COI-analysis, covering most of the curative care, including prescribed medicine.

Which part of the guidelines need clarification?

Draft guidelines focus on production approach. More information on a functional approach should be included, for countries which use this approach to estimate expenditure.

Which country specific problems were encountered in implementing draft guidelines?

- For some areas no data registrations or very incomplete registrations exists.

- Where data sources exist they are sometimes not very detailed (as in the case of age) or do not contain detailed diagnostic data. In estimating expenditure, broad age categories in registries have been transformed to a standardized five-year age categories using the known population distribution of age groups.

- For diagnosis, data sources allow attribution to the ICD-chapter level but in the final report no attribution to a more detailed group level will be made. However, this seems to be mainly due to time-constraints, not due to lack of data.

Deviations from the draft guidelines?

Although the Slovenian team list several deviations from the draft guidelines some of these do not appear to be real deviations. For instance, the distribution of administrative costs using the costs of diseases administered is in compliance with suggested procedures in the guidelines, if no other data are available. Also the use of the financial dimension as primary axis of analysis is within the guidelines. The Slovenian remarks in this field indicate current guidelines might be a bit biased towards an analytical approach in the provider dimension.

The only real deviation is the use of ATC-codes in the disease-dimension for prescription medicine. Because the description in the interim report is short, it is not fully clear how this interpretation of the guidelines was achieved. It is not straightforward how to assign prescription medicine to a disease-chapter or group solely based on the ATC-codes, because many medicines have applications within

different diseases. Hopefully, this point will be clarified when final results are published.

Recommendations for changes in the guidelines?

- The Slovenian team proposes more emphasis on the functional dimension in the analysis of costs by disease, over the production approach now advocated in the guidelines. The main reason is that in Slovenia large providers deliver many different functions, and prices are predominantly linked to functions, and only in exceptional cases to the provider. This makes an analysis along the provider-dimension from a technical point of view more cumbersome.

As indicated in the previous section, it might be advisable to rephrase draft guidelines, so they will be less 'provider-biased' in approach.

- The Slovenian team also remarks that for analysis of medicine registers the ATC classification should be used to define group level ICD-10 groups.

Does a suitable cost framework exist?

Yes; national health accounts compiled according to OECD's SHA guidelines are available, and have recently been compiled for 2003-2006

Are there gaps in data sources?

- For some regroups in SHA-classifications (HC.4.1, or HF 2.3) no costs are yet available, and other groups can't be fully separated. Costs have been divided using the three SHA classifications, and using a national functional classification, which is more detailed than the HC-classification. Most problematic was the estimation of household expenditure, which for the COI-analysis has been broken up into more detailed groups than in the National health accounts. The main dimension of analysis will be the financial dimension.

- For utilisation data, register data on health care providers were used. For curative care (both in and out patient) and prescription medicine, sufficient data are available for estimating expenditure by diagnosis (chapter-level), age and gender.

- For other types of care, no data (dental care) or very limited data (nursing care) exists, so a COI is not feasible in these areas.

Is a COI-analysis possible?

A partial COI analysis, limited to areas with sufficient data is possible. Curative care and prescribed medicine are the areas covered. From published Slovenian health accounts it is inferred that about 75% of total health expenditure will be covered.

As for classifications, it will be possible to do an ICD-chapter level analysis. Although there is not enough time to implement a more detailed classification, important data sources do contain information which could be used to implement a more detailed group-level.

Some data sources use broad age-categories. But it will be possible to make an estimate using five-year categories, using the known population distribution.

Sweden

The Swedish team decided to take a very different approach compared with the other studies. Instead of a top-down approach, a bottom-up approach has been followed. The Swedish paper calls into question the top-down approach proposed in the draft guidelines. It advocates the use of bottom-up approach based on real data as much as possible. This necessarily limits the scope of a COI-study to those fields for which patient-specific data are available.

The results are proof that for the selected costs the result is very encouraging: bottom-up calculated costs differ only slightly from similar costs in National Health Accounts. However, the Swedish study also clearly shows the limitations of a bottom-up approach. Allocation of expenditure to COI dimensions was currently possible for only one type of costs (in-hospital curative and rehabilitative care). Some expansion to out-patient care or primary care might be possible, but it will take many years to build up the necessary data for a successful bottom-up approach.

Because the Swedish team disagrees on the general approach proposed in the guidelines, it is not possible to evaluate problems with implementing the draft guidelines in more detail. However form the presentation on the workshop it is clear there is no really fundamental difference between the Swedish approach and that of other countries. The other countries apply sometimes the same type of bottom-up calculations, and the Swedish team is willing to consider using a top-down methodology for other units in future studies.

Within the limits of their study, the Swedish team did not encounter grave data problems. All tables suggested in part 5 of the draft guidelines could be produced easily.

Which part of the guidelines need clarification?

The status of the draft guidelines needs clarification. The Swedish team proposes to make the guidelines voluntary.

Which country specific problems were encountered in implementing draft guidelines?

Not applicable due to different methodology.

Deviations from the draft guidelines?

The Swedish team uses a different methodology, bottom-up instead of the top-down methodology advocated in the guidelines.

Recommendations for changes in the guidelines?

- Apart from a recommendation to make guidelines voluntary, the Swedish team proposes to limit the scope of a COI analysis to curative costs directly related to healthcare, which they define as providers HP.1 and HP.3. Other costs (for instance transport and medical goods) should be allocated as overheads.

- If good data exist for a bottom-up calculation, these should be preferred. Estimates (based on a top-down approach) should be avoided, if possible.

Does a suitable cost framework exist?

Yes; national health accounts compiled according to OECD's SHA guidelines are available, and have recently been published for 2000-2006. The main dimension used in the COI is the functional dimension. Some problems exist with separation of cost over SHA classifications. The report mentions the impossibility of separating in-hospital curative and rehabilitative costs (HC.1.1 + HC.2.1).This is viewed as a country specific problem. The Swedish Health account data provided by the Swedish team shows similar problems exist for other classes, although a first digit-level separation seems generally possible.

Are there gaps in data sources?

The scope of the Swedish study has been defined by the availability of data for a bottom-up approach based on an integral patient-level registration of the volume of care used, weighted by reliable price-data for different types of care. This approach is currently feasible for about 25% of total health expenditure (in-patient curative and rehabilitative care). If data sources continue to improve, the Swedish team predicts the methodology could be expanded to include out-patient care, although it will take several years to collect the necessary data. Based on costs listed in Swedish health accounts, it is inferred that eventually about 60% of THE would be reported in a COI study. According to the Swedish team, other costs, for which a bottom-up calculation is impossible, should be treated as overhead costs.

Is a COI-analysis possible?

Using the Swedish bottom-up methodology a full COI analysis of total health expenditure is not possible. Whether a COI analysis for Swedish THE is possible using top-down methods cannot be assessed from the interim-report. A partial COI analysis is possible, and from a top-down point of view, results will be comparable with partial analysis of other countries.

Appendix: General characteristics country studies, based on interim reports

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Institute involved	Australian Institute of Health and welfare (AIHW)	Federal Statistical Office, Wiesbaden	Central Statistical Office Hungary	Centre for Health Policy and Statistics of the YIHW (Yonsei Institute for Health and Welfare) in collaboration with other institutes.	Statistical office of the Republic of Slovenia in collaboration with the Institute of Public Health (IPH)	Centre for Epidemiology (EpC), a department of the Swedish National Board of Health and Welfare
COI methodology & Scope						
General study?	Yes	Yes	yes	yes	yes	No
Only direct medical costs?	Yes	Yes	yes	yes	Interim report defines boundaries as: 'cost for medical treatment and non-medical cost'	Yes
Uses a prevalence based method?	Yes	yes	yes	yes	yes	Yes
Top-down allocation of costs	Yes	yes	yes	Mixed design, with direct estimation (bottom-up) if data sources allow for this, top-down if this is not possible	yes	No

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Adopts a societal perspective on costs?	No, a narrow perspective has been adopted (personal health care only)	yes	yes	yes	Interim report states: personal health care is included. It is also intended to include prevention and administration costs for running the system	No, Sweden wants to limit study to cost units for which bottom-up attribution is possible from integral registers. COI-study limited tot HC1.1 + HC2.1 for hospital providers
Previous Experience with COI-studies	Yes, first general study for 1993-4	Long term history, since 1990s. Process has become routine. Since 2002 bi-annual reporting	No previous COI study	Previous studies were limited to costs covered by National health insurance	First evaluation by age and sex for 2004, for part of health expenditure (hospitals, rehabilitation and prescription medicines)	According to interim report no previous COI in terms of SHA.
Cost Framework						
National Health Accounts	Based on WHO example 1970s, more extensive in functional definition than SHA. Additional functions: capital expenditure / research and development / food hygiene and drinking water control /environmental health	National health expenditure accounts.	Based on SHA manual	Since 2003, based on SHA manual	Based on SHA manual	In 2008 published for the first time

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
SHA framework derived from NHA?	Yes	Yes, since revision national health accounts in 2006 complete harmonization with SHA has been reached.	Yes	Yes, have been compiled for period 1980-2006	Yes	Yes. Sweden has recently published health accounts in SHA terms for 2001-2006
Period	2004-05	2006	2006	2006	2006	2006
Any significant gaps/problems/deviations reported	All expenditure for residential aged care facilities classified to welfare, not included in estimates of health expenditure	No, process has been automated and is currently routine. Estimates are made for total current health expenditure, as defined by SHA-functions HC!-HC7	For about 75% of cost units no data for direct allocation are available, but the interim report states that for those units top-down allocation keys will be designed. In terms of value, about 50% of cost unit lack data for direct allocation.	Main problem is incorporating traditional/herbal medicine in SHA, which is important and has in society an equal standing with western medicine. Korea makes several suggestions for adaptation of SHA framework.	For some groups (HC4.1 or HF 2.3) no costs are yet available, other groups can't be fully separated. Estimation of household expenditure was most problematic area.	Some units difficult to separate in data-registers. Therefore HC1.1 and HC2.1 have been analyzed together.

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Allocation Expenditure						
Significant data-gaps reported for cost-units covered by THE	Patient transportation, public health, administration cost, capital expenditure not allocated. Allocated to a residual group 'no data available for allocation':: outpatient hospital services, over-the counter-drugs, other health practitioner services (apart from optometric services)	No, Germany has invested in long-term relations with data providers, who on a routine basis provide input data.		No, most health care paid for by national health insurance for which an extensive database exists. Expenditure on public health difficult to estimate, due to lack of national data sources. Administration costs have been allocated to a residual-group (not disease related)	For curative care and prescription medicine sufficient data sources exist for allocation, for other types of costs no utilisation data exist (dental care) or is very limited (nursing care)	Outpatient data sources are not yet good enough for application of the Swedish methodology, but this area will be included if data sources improve
Derivation of homogeneous cost units for analysis	NHA is derived from a wide variety of sources; a detailed database for cost-units exists, so homogeneity seems not to be an issue.	Yes, part of the process of allocating costs	On of the main goals of the project was identifying homogeneous cost units. A separate cost unit register has been compiled, mainly based on SHA functional and financing classifications.	Financial dimension is a useful starting point, because most data registrations are by source of finance.	Functional classification was most useful dimension in defining cost units, provider less useful.	Not an issue, because Sweden uses a bottom-up approach

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Estimated share of THE which will be allocated in final report.	70% of recurrent THE (=THE excluding capital formation)	100% estimated.	About 123 cost units have been identified. Direct allocation to COI dimensions is possible for >50% of total value (THE). For other cost units a top-down approach will be followed.	All costs have been allocated, 3.9% is not disease related.	~75% (2)	About 25% (1). After inclusion outpatient curative services 60% seems possible
Methods consistent with guidelines?	Yes	Yes		Yes, where bottom-up methods have been used this has been done in a way full compatible with a top-down approach	yes	No, but direct estimate Sweden uses for estimating expenditure adds up very close to THE for selected cost units, so would in fact be a very good key for top-down allocation
Disease						
Allocated on chapter-level ICD?	No. Australia uses a disease classification with 19 main groups, which differs slightly from ICD-10 chapter level. However, based on provided ICD-10 definitions of subgroups a translation to ICD-chapter level should be possible.	Yes, ICD-10 chapter level	Not commented on in interim report	Yes	yes	Yes

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Allocated on a more detailed group level?	Yes. The same as used in Australian burden of disease studies, defined in ICD-10 terms. Many groups have a counterpart in for instance ISHMT groups.	Yes, 136 sub-groups. This list of subgroups has been developed in a separate methodological research project, and has been tried and tested in German routine reporting, it might assist in the development of an international shortlist for COI-studies.	Not commented on in interim report	Yes, follows special tabulation list for morbidity WHO (page 92-93 ICD-10 2nd edition volume 2	No	Yes, based on codes provided probably International Shortlist for Hospital Morbidity Tabulation (ISHMT), as proposed in guidelines. Data for 17 subgroups presented in interim-report
# Specific groups	176	136	Not commented on in interim report	298 groups		If full ISHMT available, 130 groups.
Which classification-framework has been used in defining chapters and groups?	ICD-10	ICD-10	Not commented on in interim report	ICD-10	ICD-10	ICD-10

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
Age						
Allocated to 21 age groups?	no	Germany accounts for 19 age-groups. Compared to the draft guidelines newborn children (<1) and 95+ are missing.	Not commented on in interim report	yes	five-year age groups will be used, if registers uses broader groups these will be artificially transformed using the known age distribution in the population	no
If not, which classification has been used	0-4, 4-14,15-24,25-34,35-44,45-54,55-64,65-74,75-84,85+	0-4,5-9,10-14,…85-90,90+				almost similar 19 age group classification, with 85+ as highest
# age groups	10					19
Gender						
Available?	yes		yes	yes	yes	yes
Output						
Any problems reported regarding production suggested output tables? (as stated in draft guidelines 3.5 Reporting on outcomes?	Not explicitly stated in interim report, but based on description, there should be no problem in creating desired output-format	No, but because Germany has created a routine-process for estimating expenditure by disease, age and gender, it will be difficult to	Not commented on in interim report, but based on description methods followed, there seems to be no problem in creating	no, as evidenced by tables	no, as evidenced by proposed output tables final report	No, as evidenced by presented tables.

	Australia	**Germany**	**Hungary**	**Korea**	**Slovenia**	**Sweden**
		change existing agreements with registration holders about for instance the classifications used in delivering data.	recommended output			

(1) estimated by reviewer from published Swedish Health Accounts

(2) estimated by reviewer from published Slovenian Health accounts