Guidelines on the voluntary reporting of disease-specific expenditures

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This report contains the revised Guidelines on the voluntary reporting of disease-specific expenditures as a deliverable under work package 1.2 according to EU Contribution Agreement 2011 53 01.

A technical report under this work package 1.1 is provided separately.

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1. INTRODUCTION

1. The following guidelines for estimating health expenditure according to disease, age and gender categories use a prevalence-based method with a top-down attribution of costs within the framework of the System of Health Accounts (OECD, 2011). The guidelines are based principally on those developed in the Netherlands as a result of a series of studies published since 1991 (Koopmanschap *et al.*, 1991, Polder *et al.*, 1997, Polder *et al.*, 2002, Slobbe *et al.*, 2003), 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*. This version is the result of a further review and any outstanding issues, based on the experience of ongoing data collections and subsequent work to date, have been addressed.[1] The overall aim is to provide a common and consistent set of guidelines for the production of internationally comparable estimates of health spending.

2. Chapter 2 of the guidelines 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 (age, gender and disease) added by the analysis to the SHA-based accounting system. Classifications for these dimensions are also discussed.

3. In Chapter 3, the methodology for the construction and calculation is described in detail with practical guidelines and examples. Chapter 4 describes the compatibility and implementation of expenditure estimates within the existing dimensions of the SHA. Finally, Chapter 5 deals with the interpretation of the results and also discusses some of the limitations and caveats of using such results.

[1] Under the EU Contribution Agreement 2011 53 01: Getting international measures of health spending right.

2. CONCEPTS AND DEFINITIONS

2.1 Expenditure by disease studies

4. While these guidelines place the emphasis more on '*how*' to estimate health expenditure according to patients' characteristics rather than the '*why*', it is important to discuss the usefulness of what can be a resource intensive exercise as an key input to health policy analysis. In essence, such studies add patient-related information (e.g. 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.

5. 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.

6. 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.

7. Similarly, the expenditure[2] 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.

8. 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 may 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.

9. 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 disease-expenditure 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 biases'. Fortunately, in recent years, the number of internationally comparable studies has increased (Slobbe *et al.*, 2003, Health Canada, 2002, Paris *et al.*, 2003, Statistisches Bundesamt, 2005).

10. 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

[2] Note that in these guidelines the terms costs and expenditures are often used interchangeably.

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.

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

12. Use in international comparisons has lagged up to now, 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.

13. Since the birth of this type of analysis (Rice, 1967), the field has expanded considerably, but can cover quite different types of analysis. What these studies do have in common though is some 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' disease studies which focus on the expenditures on a particular disease and 'general' studies which calculate the spending 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, spending for a given disease is 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 expenditures 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.

14. 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 study.

15. Regarding the integration of disease accounts within the SHA framework, the following aspects are recommended: 1) a general 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 analysis.

16. 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 spending on specific diseases or demographic groups within and between countries.

17. 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, e.g. expenditure on long-term social care. Regarding 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 additional effort. Therefore, for the purpose of dealing with disease accounts within the health accounts framework, it seems most appropriate to exclude these costs and to focus entirely on direct medical costs.

18. 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.

19. For a general analysis, an overall top-down approach to allocation has been generally advised to ensure that the total health care costs from the study equate to the total expenditure from the health accounts. The top-down method ensures no double-counting of costs occurs; each expenditure item is assigned to one disease only. In a bottom-up only approach this cannot be guaranteed, due to existing co-morbidities. Take the example of diabetes, which is a major risk factor for cardiovascular disease. In a bottom-up approach expenditure for the treatment of heart-problems for a patient are counted for 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. 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.

20. 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 high-income 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. Disease accounts 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 the allocation, but expenditure on health protection, as for instance sanitation and road safety, requires more thought.

21. 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 analysis ensures a better comparability of outcomes.

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

23. However, the inclusion of non-personal health care does have a price: one gets the total health care spending for a disease, not the expenditure for patients with a disease (see Chapter 5). This implies that the total expenditure for a disease can be translated to expenditure per capita, but not so easily to costs per prevalent case of a disease.

24. In summary, there should be as much effort possible to align the boundary of the disease accounts with that of current expenditure as defined in the SHA. The reasons for excluding some sections of expenditure can often be put down to a lack of information to allocate. However, the total costs reported according to disease, age and gender should always 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 linking disease expenditure studies to 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.

2.2 SHA as a cost framework

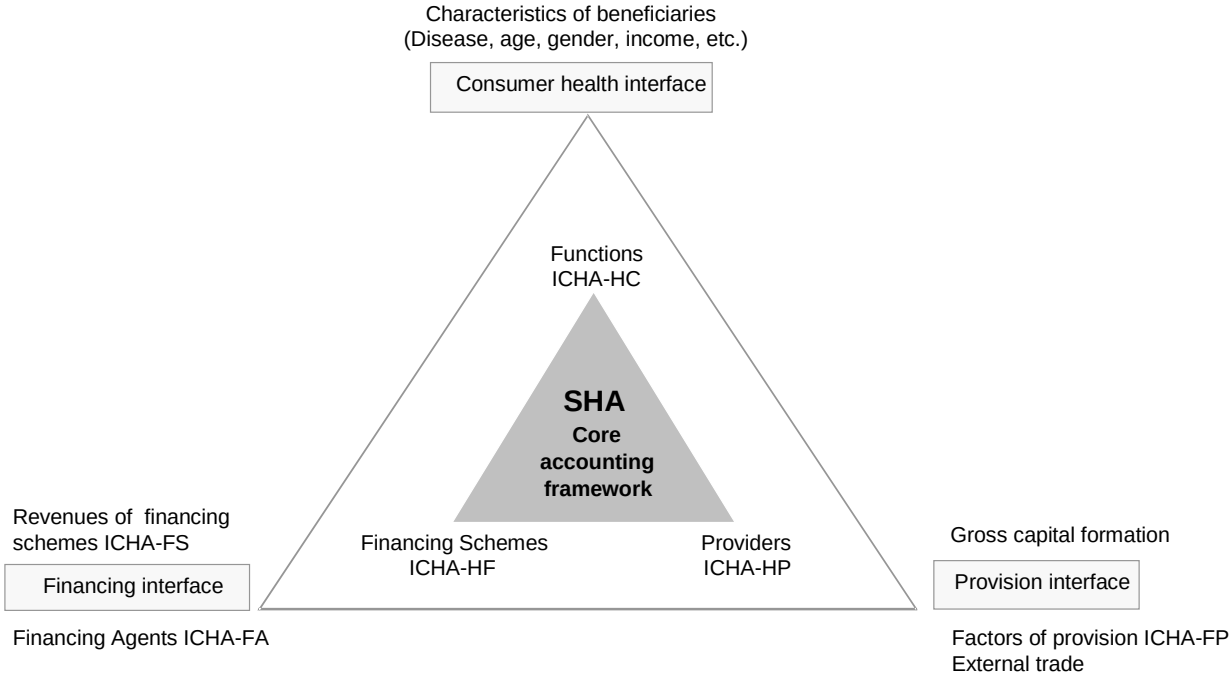
25. A cost framework can be defined as a table of health care costs (in national currency units). The inclusion or exclusion of costs is determined by criteria based on an established definition. Every line in this table describes a single cost estimate in one or more dimensions, using - if available - standard classifications. Ideally the table should be complete, including all costs within the cost definition. Cost units should also be mutually exclusive: that is, all costs involved should be part of only one cost unit. This ensures that no double-counting occurs.

26. Health accounts are an application of an accounting framework for the purpose of monitoring the flow of expenditures related to the consumption of health care goods and services within a country. In 2000, the OECD published *A System of Health Accounts* (SHA 1.0), a manual which provided a standard framework for producing a set of comprehensive, consistent and internationally comparable health accounts. The SHA manual established a conceptual basis of statistical reporting rules compatible with other economic and social statistics. *A System of Health Accounts* has been subsequently revised as part of

a joint project between the OECD, WHO and Eurostat culminating with the release of SHA 2011, providing a single global framework for producing health expenditure accounts that can help track resource flows from sources to uses.

27. *A System of Health Accounts* sets out in detail, the boundaries, the definitions and the concepts for producing health accounts. Individual countries (and data collections) can decide the type and detail of data that is relevant based on their specific requirements. For example, some countries may choose to focus on different aspects such as: tracking of domestic and external sources of financing, price and volume measures; international trade or indeed, allocation of spending by patients' characteristics. Countries producing health accounts according to SHA 2011 will be reporting in a standard internationally comparable way.

Figure 2.1. The core and extended accounting framework of SHA 2011



Source: SHA 2011

28. In summary, SHA is founded on a tri-axial relationship tracking the consumption (based on health functions), provision and financing of health care goods and services. This relationship assumes that all health care goods and services that have been consumed have been provided (produced) and financed (purchased). Thus, SHA (potentially) allocates all health care expenditures according to these three classifications. The level of detail reported by each country will depend on its policy interest, as well as the availability of appropriate data sources. Figure 2.1 presents the relationship between the functions of health care (ICHA-HC), health care provisions (ICHA-HP), and financing schemes (ICHA-HF). In effect, these three core classifications address the three basic questions:

- What kinds of health care goods and services are consumed?
- Which health care providers deliver these goods and services?
- Which financing scheme pays for these goods and services?

Functions and the Consumer Health Interface

29. The key interface with regard to allocation of spending according to disease is the consumer health interface, that is, the interaction between the health care function or types of care (defined according to the functional classification (ICHA-HC)) and the individual or population groups (i.e. beneficiaries) consuming these goods and services. Beneficiaries can be described according to their characteristics such as age, gender, socio-economic, status, and perhaps most importantly their health status (which is ultimately the reason for their interaction with the health care system). A breakdown of expenditures by beneficiary characteristics is a key resource for policy analysis and can provide a better understanding into how resources, in terms of health care goods and services, are reaching various groups of the population. It is thus a key component of interest in the derivation of cost of illness studies.

30. The functional classification responds to the criteria laid out to define health care activities and thus delineates the boundaries of health care expenditure. The rationale of the classification refers to the health purpose of the goods and services being consumed. The basic dividing lines for structuring the health care functions are individual versus collective health care goods and services, the basic purposes of health care (e.g. curative, rehabilitative, and long-term care), and the modes of provision (e.g. inpatient, outpatient). Table 2.1 shows the classification of health care functions at the first-digit level. It is important to note that the compilation of data according to health care functions is challenging as national health statistical systems seldom provide data which corresponds to a classification based on health *purpose*.

Table 2.1. Classification of health care functions at the first-digit level

HC.1	Curative care
HC.2	Rehabilitative care
HC.3	Long-term care (Health)
HC.4	Ancillary services (non-specified by function)
HC.5	Medical goods (non-specified by function)
HC.6	Preventive care
HC.7	Governance and health system and financing administration
HC.9	Other health care services not elsewhere classified (n.e.c.)

Source: SHA 2011.

31. For the purposes of allocating expenditures under the health accounts framework, the distinction between individual versus collective consumption is a key consideration but poses a potential challenge to allocation by patient characteristics. While it may be possible, although not necessarily straightforward, to (partially) allocate some collective functions by disease (e.g. prevention or screening campaigns aimed at particular diseases or population groups) it may be more challenging to allocate other collective functions (e.g. administrative spending) to such characteristics.

Provision interface / Health Care Providers

32. Health care providers encompass the organisations and actors that deliver health care goods and services as their primary activity, as well as those for which health care provision is only one among a number of activities. They vary in their legal, accounting, organizational and operating structures. However, despite the huge differences that exist in the way health care provision is organised, there is a set of common approaches and technologies that all health care systems share and that helps to structure them. The classification of health care providers (ICHA-HP) therefore serves the purpose of classifying all organisations that contribute to the provision of health care goods and services, by arranging country-specific provider units into common, internationally applicable categories.

33. The principal activity exercised is the basic criterion for classifying health care providers. This does not mean, however, that providers classified under the same category perform exactly the same set of activities. Hospitals, which are major health care providers, usually offer not only inpatient health care services, but, depending on specific country arrangements, may also provide outpatient care, rehabilitation, long-term care services and so on. For the purpose of international comparisons, the value added of the ICHA-HP classification lies in two advantages: first, its connection with the functional classification, which gives an insight into the variety of country-specific settings for the provision of health care services, and second, its combination with the financing classification, which sheds light on the variety of health care funding mechanisms that exist across countries.

34. Often, the data sources required for an allocation to beneficiary characteristics are organised according to the provider classification (i.e. hospitals, physicians' offices, etc.) rather than a pure functional approach, such that often the main linkage with health accounts is via the provider dimension. That said, the methodology (outlined in Chapter 3) points to the identification of homogeneous units as sub-components of providers (e.g. hospital outpatient clinics) that are clearly linked to the SHA functions.

Financing interface

35. The financing interface, as its name implies, focuses on how, and by whom, the health system is financed. It covers the classification of financing schemes (ICHA-HF), the revenue of financing schemes (ICHA-FS) and financing agents (ICHA-FA) which focuses on the institutional units of health financing. The three classifications together provide the tools to comprehensively account for health care financing and describe the flow of financial resources in the health system. Health financing systems mobilise and allocate money, within the health system, to meet the current health needs of the population (individual and collective), with a view to expected future needs. Individuals may have access to care by means of direct payment for services and goods or through third-party financing arrangements, such as with a National Health Service, social insurance or voluntary insurance

36. In terms of the focus on allocating health spending by disease categories, the financing interface may appear to be of lesser importance amongst the three dimensions of the health accounts. However, its significance should not be minimised. For example, from a societal point of view, it is important that all costs associated with the provision of health care are captured regardless of the type of financing, i.e. both private and public financing. However, there will likely be different data sources, of varying degrees of quality, covering the provision of publicly financed and privately financed (including out-of pocket expenditures) health care services. In fact, for some countries there may be a lack of high quality, or perhaps any, data for some privately financed services. This will severely limit the ability to conduct a thorough allocation of all expenditure by disease.

37. 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 expenditures should be divided among functions and what should be included under the aggregate of current health expenditure. This will not be elaborated upon further in these guidelines.

38. 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 will 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 markedly affect 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.

39. 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 Dimensions

40. This section provides guidance on the descriptions and recommended classifications to be used in individual dimensions of the 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 dimensions disease, age and gender are described and then briefly, 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'.

41. 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 expenditure item within the classification. The individual classes used in a dimension classification should be non-overlapping: expenditures belong to one group in the classification only.

2.3.1 Disease

42. For standardised comparisons, consistent diagnostic categories must be employed across countries. The International Classification of Diseases[3] is the standard system used to classify diseases. At its most detailed level – with up to 16000 codes - ICD allows for a very fine and exhaustive classification of diseases and conditions. For policy relevance and analyses, however, the aggregation of detailed disease classes into much broader groupings needs to be taken into consideration. For example, the ICD-10 chapter level consists of 21 broad disease categories. 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).

43. An alternative regrouping of ICD codes which has also been used is the Global Burden of Disease (GBD) classification. GBD has the advantage over ICD Chapters by taking a more health-system wide approach and identifies separately some categories such as oral health, and communicable diseases. However, for more detailed disease-specific analysis – a halfway point between the individual codes and the chapter level might be necessary (e.g. for the identification of dementia costs as part of mental health, Chapter V of ICD-10).

44. 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 (Annex 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

[3] The 10th ICD Revision came into use in WHO Member States as from 1994. The 11th revision of the classification has already started and will continue until 2015. http://www.who.int/classifications/icd/en/

statistics. It is grouped by epidemiologically relevant groups where patients have similar problems and share similar patterns of treatment. One of the features of ISHMT, which might be also considered as a shortcoming, is that, as the name implies, it was developed towards a specific tool for hospital procedures and inpatient cases. Therefore, this may lead to less comprehensive coverage of disease categories with regard to other sectors of the health care system components such as ambulatory care providers.

45. 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.

46. 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.

47. Countries may also include different disease groupings for national purposes. **However, it is recommended that, at a minimum, countries report the expenditures by diseases at the ICD-10 chapter level**. A survey of the disease expenditure accounts done to date shows that it is very common to report disease-specific cost data at least at the chapter-level of the ICD (infectious diseases, neoplasms etc.).Where available, however, further breakdowns according to the ISHMT categorization should be employed.

48. 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.

49. 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.

50. In many registrations of health care, an ICD-based disease-group can only be attributed indirectly. This is particularly important in the important areas of outpatient care and pharmaceutical expenditure. Registrations of GP's, as mentioned above, often use an ICPC classification, and pharmaceutical costs are 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 national (even regional) 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 disease accounts 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.

51. 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 study 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.

2.3.2 Age

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'.

52. **It is recommended to use a classification of 21 five year groups with new-born 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.

53. A common problem encountered 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.

2.3.3 Gender

54. 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.

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

55. 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 2011 Manual and therefore will not be discussed here.

56. The functional dimension is often a more useful classification for studying specific diseases. Thus, it is encouraged that countries provide expenditure by disease data according to the functional categories. As not all countries are capable of allocating expenditures across all of the HC categories, it is important that as much detail as possible is included so that data can be re-grouped if necessary, in order to maximize (guarantee) the international comparability of the results.

57. 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.

58. 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.

59. 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.

60. 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. METHODOLOGY

61. Prior to attributing disease-specific expenditures according to the various dimensions under the SHA framework, there is a certain amount of preparatory work required to ascertain whether or not expenditure by disease study is feasible, and to specify the dimensions and levels of detail. After the definition study, there will then be a need to collate the necessary data identified prior to allocating the expenditures according to the various dimensions. The following sections cover in more detail these different phases.

3.1 Definition study

62. A definition phase is especially important if disease accounts have not been previously performed. It serves to establish whether sufficient data are available for the analysis, and sketches the general contours of the study. The exact structure of a definition study depends on the national situation. However, the goals of the study can be generalised as follows:

- To assess the availability and stability of SHA-based national health accounts;
- To verify that both cost data and health registration data are available in sufficient detail for meaningful outcomes;
- 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 study;
- To describe the global properties of these data sources in relation to an expenditure by disease study;
  - Available dimensions (look for disease, age, gender, provider, financing, function); Note 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;
  - Periodicity;
  - Type of registration (national, regional);
  - Validity of the registration: i.e. are the data representative?
  - Available utilisation indicators (e.g. sales, hospital days, number of patients treated, number of procedures performed contact time etc.);
  - Other relevant properties (e.g. 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 the study is feasible. As a minimum disease, age, gender, 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.

63. 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 considered a prerequisite for undertaking a expenditure by disease analysis. Collection of the basic cost data is not part of the actual analysis and as such an analysis is not feasible without having first established national health accounts compatible with the SHA-system.

64. If no previous study has been undertaken this initial phase can require a significant amount of time and resources. However, after the initial investment in constructing the first accounts 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 where improvement is possible. Previous studies may also have identified and planned additional data collections and surveys in order to fill gaps in the study.

65. 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

66. It is advised to gather as much information as possible at an early stage 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 resulting disease accounts.

67. From the framework of the 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 expenditures must be identified. The way data are collected will depend on the national situation. A good starting point can be the SHA tables that cross-classify 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.

68. 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: Examples 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

69. Many different organisations 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.

70. 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.

71. 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 study for the selected national framework, using national cost definitions.

72. In most countries detailed data on health expenditure are already collected nationally 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.

3.3 Attribution of costs to disease, age and gender

73. As soon as the definition study has been completed and utilisation data are identified and obtained, the direct medical cost calculation by disease, using a prevalence-based method with a top-down attribution of costs, is a fairly straightforward procedure (Figure 3.1). It can be divided into four steps:

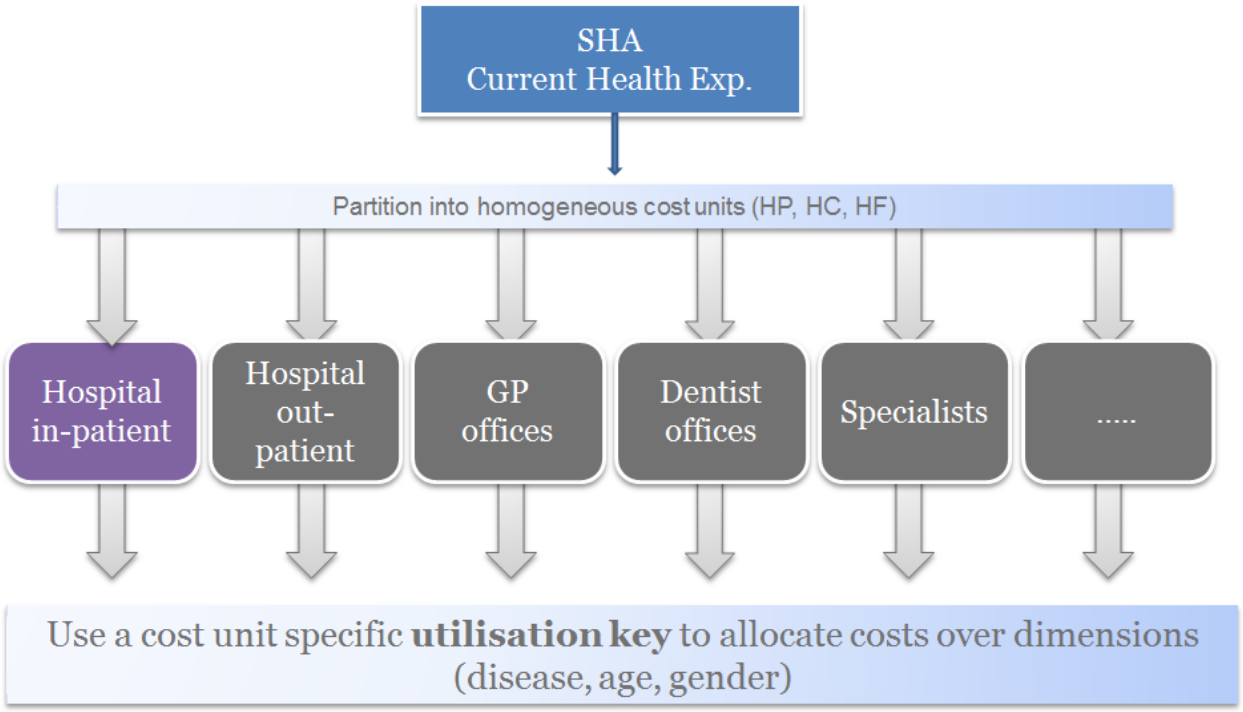
1. Selection of a suitable year for analysis and assessment of total health expenditure.

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 allocation table for this unit. Aggregate partial tables for each unit to establish total allocation accounts.

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



Source: OECD, 2008

Step 1: Establish national health expenditure according to the SHA

Choosing a time-period

74. This first step involves identifying and acquiring the data and the health accounts (SHA) for a reference year. Ideally, this should be completed for the most recent year in which all necessary additional data exists and for which there are the necessary resources to complete the project. This ensures that the results can play a role in ongoing discussions about health resource allocation. However, two factors 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.

Long term stability of the cost-framework

75. 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 into the SHA is a straightforward task 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 to SHA-definitions. For detailed health accounts this should not be a problem. Two alternative approaches can be followed. The first is to map from the selected framework before performing the allocation with the resulting SHA framework. The second is to perform the allocation on the national cost framework, and then map the results to the SHA afterwards. The second alternative may 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

76. Performing the analysis with more aggregated expenditure data at the highest level speeds up the analysis: less data are needed, but the results will be less reliable and informative because many different types of costs have been aggregated. If the allocation is at a more detailed level a more reliable analysis can be performed because individual elements of the cost framework will be fairly homogeneous.

77. There is a balance to be made 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 (resource intensity) 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 into 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.

78. Another issue is the availability of resources (time, number of researchers) for the analysis. The level of expenditure for a particular cost unit has no bearing on the difficulty of the analysis. Small amounts of expenditures can be as difficult or as easy to analyse as large amounts. This implies a more or less linear relationship between the number of individual cost elements which should be analysed 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).

Step 2: Partition of national health expenditure into homogeneous cost-units

79. Current health expenditure from the SHA-based health accounts should be partitioned into homogeneous cost-units across the provider and/or functional dimensions. In producing the health accounts it is likely that expenditures will already have been split into different cost units, which quite often are already homogeneous across the provider or financing dimension. If this is not the case, 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.

80. The main cost unit registers tend to be 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 financing based. 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.

81. It some cases it may be desirable to further split the available cost units for the following reasons:

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

Ensuring compatibility with SHA

82. As a first step, expenditures should be split into two groups (if necessary); those costs included in the SHA boundary of health spending and those outside the SHA. This may be the case when expenditure 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 and these expenditures are included in the SHA. However, they may also sell sunglasses and optical equipment such as telescopes. These costs are non-medical and should be excluded. Another example of non-medical costs is the revenues from commercial activities within hospitals (shops, restaurants, etc.).

Heterogeneity in key dimensions

83. Costs-units in a cost framework should also be split into smaller units, if the underlying costs are composites covering quite different products. If, for example, the utilisation key associated with the main product is applied to the total spending of the cost-unit this can lead to an underestimate of spending for relatively minor diseases associated with specific products. An example might be influenza vaccination. This may be 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. Therefore, it would be advisable 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.

84. In other cases this may not be so straightforward. For instance the costs of in-hospital use of drug prescriptions may not be able to be separated from total hospital costs, leading to an underestimation of expenditures allocated to 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 to separate health care use between classes of financing or function within health registrations.

85. 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 of the dimensions; and b) detailed information on health care utilisation is known for the new sub-unit, so allowing for a separate analysis.

Fitting of cost data to health care utilisation data

86. Sometimes cost-units have to be split or even rearranged into artificial units, because no health registration is suitable for analysing the complete unit, but by rearranging the costs in new artificial units, a fit with existing registrations is possible. For example, expenditures 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 analysed are merged and recombined in artificial units which can be analysed.

Step 3: Construction of a detailed probability map (or utilisation key)

87. 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. That is, the proportional distribution across all combinations of all dimensions) based on health care utilisation data retrieved from the collected data sources. For every key a fraction of total utilisation within the cost-unit is assigned. With up to six dimensions to consider (HC, HP, HF, ICD code, gender and age group), 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.

88. 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 expenditure allocations and the resource costs of the associated health care services.

89. 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 disease, age and gender, it 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 fac,t 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.

90. 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. Beyond weighting hospital days by ward type, they should also, ideally, be weighted by the diagnostic category or type of disease as different diagnoses use different amounts of resources. For example, the daily costs of treating cardiovascular disease or cancer patients is greater than the daily costs of treating mental health patients due to the greater use of resources. The distribution of this weighted number of hospital days is a better indicator of utilisation than an unweighted number of hospital days. The distribution of patients using intensive care beds and normal ward beds should be included in these weights since admission rates for normal wards and intensive care vary among diseases.[4] Methods based on Diagnostic Resource Groups (DRGs) or similar methodologies are, generally, employed by countries to derive hospital expenditures by disease.

91. From these examples, 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 may only cover 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 other, mostly volume-indicators are often 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

#: numbers of the indicator.

[4] Note that if all bed days used similar levels of resources, there would be no need to weight according to disease. Information on number of bed-days alone, and total associated expenditures, would suffice to derive expenditures by disease. A separate analysis investigating the use of bed-days and DRG based methods to derive expenditures by disease for acute-care, curative, hospital expenditures has provided useful results.

Dealing with co-morbidity

92. A common problem in health registrations is co-morbidity: a patient is diagnosed with multiple diseases. In a top-down allocation it is necessary to attribute costs to a single diagnosis, the primary diagnosis and co-morbidity is ignored. The proposed guidelines contain methods to avoid any double-counting. If the hierarchy of diagnosis is unknown, costs should be divided between all known diagnoses, if possible using a disease specific weight, based for example on the average costs of a patient with a single disease.

93. However, 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 may 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, a related study in Australia 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 distributions over disease than a main condition method.

94. In summary, 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.

Allocating costs by cost unit

95. The methods used for the allocation of expenditure 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 allocation studies
6. Other methods

Direct attribution or 'bottom up' allocation

96. As shown, the use of bottom-up calculations for some cost-units is 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 direct 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).

97. 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

98. 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 a minimum, the dimensions age, gender and disease should be registered. An example could be a national survey for general practitioners, which registers, among many other items, diagnosis, age and gender, and records the time spent on individual patients, which is a very good indicator for health care utilisation by GPs. 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 may 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, with fixed tariffs. It is important to see that this type of indicator should be preferred over, for instance, the number of patients treated, because this does not account for differences in time and resources spent on a patient, which can differs both between individuals with the same disease and between individuals with different diseases.

Combination of registrations

99. This method can be used if no *single* registration contains all the necessary dimensions (disease, age and gender) for the allocation of direct costs. In most cases it is the direct information on the disease or diagnosis that is 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 might be 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 might contain both specialist type referred to as well as a specific diagnosis), it is possible to estimate a distribution of the use of ambulatory hospital care for the disease-dimension.

Fitting cost data to available health registrations

100. 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 analysed using existing registrations.

Using a proxy key

101. This method is especially useful for non-personal expenditures on health care. An example regards the costs of management and health care administration. It may be appropriate 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 refer to multiple cost-units, the utilisation keys for these units can be added together, using the total cost in the cost-unit as a weight in this addition. In this way an artificial utilisation key can be constructed for management costs, using other already analysed keys as a proxy.

102. 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 analysed for the available year, but applied to expenditures 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 may not always be the case.

Other methods

103. If all else fails there are several methods that can allow the allocation for a cost unit. One method is to model a key instead of extracting this from a registration. An example could be 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 can be created for this cost unit.

104. Relatively small cost-units can be merged to larger cost units, and the key of the larger unit can also been applied to the smaller unit. Obviously, the fewer cost units this has to be done for, the better. An example might be the spending on blood products, which could be merged with the main hospital cost-unit, assuming that most of the blood products were used in this sector. As a rule of thumb for inclusion of a smaller cost unit; if should 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. However, in the latter example, there may be a quite different profile of disease, age and gender distribution between, for example, public and private health insurance funded care.

105. 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.

106. In some cases a specific 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, transport, and sometimes out-patient curative care, and pharmaceutical expenditure. 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.

107. All efforts should be made to allocate as large a proportion of current health expenditures as possible. Some of these components may only account for a small percentage of the overall health spending and therefore may not warrant the additional resources required to properly attribute them to diagnostic categories.

108. This may mean that in the final analysis some data remain unallocated or excluded from the analysis for certain countries. However, to be able to reach valid conclusions from any cross-country analysis of distribution by disease it is important that countries include the same cost components in the expenditures that are allocated. In order to preserve overall comparability and linkage to the overall health spending boundary, it will be necessary to allocate on a *pro rata* basis. Moving forward, the improvement in the validity of cross-country comparisons is dependent on a reduction in this 'non-allocated' share of health care spending.

Administration

109. 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 allocating such costs across disease, age and gender tends to result in administrative costs remaining unallocated. As mentioned above, the most appropriate method may be to assign these costs to disease, gender and age proportional to the distribution of total costs paid out under the different insurance/financing schemes. In such a case, for the calculation of overall or per capita expenditures, the administrative expenditures are assigned to diagnostic categories on a *pro-rata* basis.

Public Health and Prevention

110. Countries have tended to take different approaches towards the inclusion or exclusion of collective services. Some prevention and public health activities and programmes (vaccination campaigns, cancer screening, etc.) can be specifically linked to disease categories (or to a particular population group by age and gender) – either at an aggregate chapter(s) level or in some cases at a more detailed level. Other more general public health spending may be more difficult to allocate and in this case the residual spending should be treated in the same way as administrative spending and allocated on a pro-rata basis. For the calculation of actual spending by disease, it is recommended that this process be followed by all countries.

Financing agents and schemes

111. In several countries comprehensive data allowing expenditures to be allocated by disease are currently only made for public funded expenditures (for example, in the Czech Republic and Hungary). As mentioned, the profile across diagnostic categories for public and private spending on health is likely to be quite different and the application of the same profile can diminish the validity of the disease accounts in any comparative study. The extent to which private financing plays a role in the overall health financing in a country is an important factor in this respect. For the distribution of household spending, it will be important to strengthen the information sources such as the various household surveys to link beneficiary information to household spending. In any case, the percentage of total expenditures allocated by function and provider should be clearly identified.

Other allocation challenges

112. The following cost components for which it was generally difficult to allocate expenditures according to disease: long-term nursing care; transport; out-patient curative care; and out-of pocket expenditures. 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.

113. The exclusion of certain spending components can have a lesser or greater effect on specific disease categories. For example, the exclusion of expenditure on long-term care (function or providers) by one country will likely underestimate the allocation to mental health diseases, specifically dementia, making comparisons with countries fully distributing long-term care problematic. This example also raises more general questions of the health boundary of total health spending itself and the fact that country-specific interpretations of long-term care - even if allocated - will also have detrimental effects on comparability. A narrower interpretation may exclude community and low-intensity residential care compared to another country.

Step 4: Derivation of accounts tables

114. In this step the basic output table is created. This involves multiplication of health expenditure for a homogeneous unit (from Step 2) with the probability map (from Step 3) to establish a partial cost of illness table for this unit, and then aggregate partial tables for each unit to establish the total spending allocation. The basic output tables consist of one column with expenditures and additional columns which describe every dimension in the study at the most detailed classification level. From this basic table all other aggregations of spending can be produced.

115. These results should be examined carefully. It is recommended to start with basic plots of expenditure 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 expenditures will rise quite gradually with age from this moment. Among the older ages total expenditures (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.

116. Typical output from an analysis is a multi-dimensional table which lists spending 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 outputs can be computed like expenditure per capita or per disease case.

117. As for expenditure per capita, these are calculated by dividing the spending in every record of the basic output table by the appropriate population 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 expenditure 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, the average population may be calculated by averaging the size of age classes on January the 1st and December 31st. Expenditure per capita for 95+ can differ significantly if other methods were used (such as using the July 1st population as an estimate), while for other age-groups there may be almost no difference in calculated costs per capita.

3.4 Verification of data and results

118. Verification might be applied upon different parts of the analysis, for example, the original data (*e.g.* utilisation keys) or on final results (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.

119. Standard statistical methods, for example the computation of confidence limits on final results, cannot be applied to a general study, because many assumptions underlying the analysis are not able to be verified in a quantitative manner. For instance, a basic assumption in employing 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 analysis is that these individual differences in resource use are largely cancelled out when applied to total costs within a cost unit. However, it should also be remembered that the goal of a general distribution exercise is to establish and compare relative distributions over diseases and demographic categories, and not to compare point estimates.

120. 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 utilisation keys. If multiple sources are available they can usually be ranked *a priori* on logical grounds for reliability. 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.

121. In most cases it is better to start verification by examining final results, after the application of utilisation keys. It is recommended to use the basic results table to make some simple aggregations first, and examine these qualitatively. Create simple one-dimensional tables which aggregate spending 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?

122. If these seem fine, then some two-dimensional tables can be verified. It is recommended to start with basic plots of expenditure 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 costs will rise quite gradually with age from this moment. Among the older ages total spending (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.

123. In the end the comparison with previous studies and studies in other countries still does not provide a hard verification. A comparison of results with those of other countries requires a detailed study of underlying differences. It is suggested that, also for efficiency reasons, a (detailed) international comparison should be performed at a central (international) point.

124. If countries start international comparisons by themselves they should gain insight into a number of issues. For example, differences in data and utilisation 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 results

125. The basic results table (see 3.3.5) lists expenditures 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 study. The detail provided by the basic table is useful for research purposes, and for communicating results to the wider research community[5]. It is recommended to make data available to other researchers in as much detail as

[5] An example is the Dutch website (www.costofillness.eu) which is available for researchers to create specific tables and graphs, based on this basic output table.

possible, because this opens up the outcomes for scrutiny by other research groups and enhances the applicability of outcomes for other types of research.

126. 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.

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

- Current health expenditure by age and gender.

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

4. INTEGRATION OF RESULTS IN THE SHA

127. In an ideal health care accounts system the exact allocation to all patient 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 health data registration of a very high standard. Detailed patient registration or insurance reimbursement systems are necessary for a successful attribution of expenditure by disease to all three additional dimensions simultaneously. Such data information systems might be seen as a kind of 'gold standard'.

128. As has been demonstrated in these guidelines the breakdown of spending by disease, age and gender along the provider, financing and functional dimension is strongly determined by a) the compilation of the national health accounts and b) available health registrations.

129. 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 spending 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, expenditures 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

130. 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.

131. 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 the analysis.

Incompleteness of health registrations

132. Using multiple SHA dimension in a disease allocation study is only useful if a distinct use of these additional dimensions can be identified from the data sources. If in a country, the expenditure by provider is reliably known, then three scenarios are possible:

- The spending by provider can be attributed to a single health care function or financing category.
- The spending 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 the study is forced to use

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

- The spending 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.

133. If the first situation and second cases dominate, the two other SHA 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 can new insights be gained.

134. The relative importance of these situations depends on the classifications used. For the financing dimension, the first and second situation might 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 the health accounts, so although in the disease accounts 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.

135. For the functional dimension a similar situation can exist. For example, perhaps only the health care function of prevention is distinguishable in different health registrations, and distinct utilisation keys can 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 the exercise, but in these cases often the provider dimension is less well known.

136. 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 distribution. Differences in opinion about the allocation of costs to functions, should not withhold countries from trying to attribute spending 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

137. As outlined in Chapter 2, the methods used in allocating expenditure set limits on the use of the resulting data. In this section, some final remarks are made about the interpretation of the results of the attribution exercise.

Average costs per patient

138. In these guidelines a prevalence based method for allocating health spending is described. That means that translating expenditure to average spending per prevalent disease case is theoretically possible. However, there are several important issues to consider. 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. Take for example, the number of patients with arthritis. In the Netherlands, about ten times as many patients are treated for arthritis by a primary care giver than in a hospital. The number of people with arthritic complaints is much bigger than those actually 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 somewhere in between. It is clear that average expenditure per patient can only be computed with a high degree of uncertainty in such a situation. Only if very clear, undisputed definitions of diseases are available can expenditure per patient be computed with any certainty. This is, for instance, the case for most types of cancer.

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

140. Before attempts are made to calculate average costs for a particular disease one should always consult researchers or health professionals with in-depth knowledge of the disease.

Interpretation

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

Cross-sectional data

142. Such distributional analysis offers a cross-sectional view on the use of health care resources, within a fixed time period. Only if multiple 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 study are sometimes used in more longitudinal interpretation. Spending 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 this analysis.

Cost-effectiveness

143. A distributional study shows the division of spending over the selected dimensions. It provides a background to current resource use, a 'canvas' against which other research outputs can be interpreted, for instance when comparing the cost-effectiveness of two treatment options for a single disease. In this case disease account data can be used to estimate an average for total costs on a national level. It is important to stress that the 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 spending would be even higher.

144. For this reason one should not interpret results of the 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 other's '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.

145. A similar argument applies to interpreting high spending in certain providers as potential targets for cost containment; this could easily lead to higher spending in other providers. The classic 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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ANNEX 1: 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

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
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
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

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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
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

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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**
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

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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
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
XIX	121	1907	Burns and corrosions	T20-T32	940-949

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XIX	122	1908	Poisonings by drugs, medicaments and biological substances and toxic	T36-T65	960-989
XIX	123	1909	Complications of surgical and medical care, not elsewhere classified	T80-T88	996-999
XIX	124	1910	Sequelae of injuries, of poisoning and of other consequences of external	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)