HEDIC

HEALTH EXPENDITURES BY DISEASES AND CONDITIONS

2016 edition

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Acknowledgement

This Working Paper presents the summarised results of the project on Health Expenditures by Diseases and Conditions (HEDIC), carried out by colleagues in a consortium of institutions which participated formally in the contract with Eurostat for this research. These institutions are listed in Annex 9.

In research of this nature, involving the provision of data by a very wide range of institutions, a large number of other people made important contributions to the work. In particular, the project team would like to thank colleagues from the following organisations who attended workshops, contributed to the methodological discussions, commented on drafts, and generally gave us the benefit of their extensive knowledge of disease accounts: DG SANTE, the European Centre for Disease Control, Eurostat, the Hungarian National Health Insurance Fund, OECD, the Polish National Health Fund, and WHO. The team would like to acknowledge the contribution of colleagues from the Estonian National Institute for Health Development, who were not members of the HEDIC consortium, but nevertheless have attended workshops, and provided data for the HEDIC Pilot Data Set. It would also like to thank colleagues in all of the agencies who provided data for the data inventory questionnaire, sent to all EU and EFTA Member States at an early stage of the research.

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Contents

1 Executive Summary

Introduction

This is the final report of the Eurostat-funded project, Health Expenditures by Diseases and Conditions, HEDIC. In November 2013, Eurostat commissioned a 30-month programme of research from a consortium consisting of representatives from 16 European Member States (MS). The primary aim of the research is to develop further the methodology for the consumer health interface under the System of Health Accounts (SHA), and hence to provide more detailed information on health care expenditure in relation to its uses and beneficiaries, as a contribution to the public health statistics available for monitoring EU health.

HEDIC and SHA

The consumer health interface is of particular interest to the study of the relationship between the consumption of health care goods and services and the associated health enhancement of the population. Although health is only partly determined by the consumption of health care, the breakdown of health care expenditures by characteristics of beneficiaries helps to improve the understanding of the observed distribution in overall health spending. Health differences among individuals and population groups are apparent along many dimensions, including age, gender, socioeconomic status and geographic area. Age and gender are demographic characteristics of beneficiaries that form an intrinsic epidemiological part of identifying and measuring the utilisation of health care goods and services by type of disease.

Historically, the HEDIC project builds on work on cost of illness (COI) which began in the 1960's with Rice's work on the economic burden of illness in the US economy, in which direct and indirect costs of illness were estimated. HEDIC is different from COI. One reason is the exclusion of indirect costs. Indirect costs in the estimation of COI, or productivity loss, measure the loss in earnings as a result of death, illness or time spent undergoing treatment for the population as a whole. HEDIC is focusing on direct costs by using the framework of SHA, which offers the possibility of developing consistent expenditure by disease accounts across countries. Employing consistent methodology and data sources can ensure that expenditures for various diseases can be compared and that the sum of expenditures for all diseases equals the estimate of current health expenditure.

Recognising the importance of further developing the methodology for health expenditures by disease to develop public health statistics for monitoring EU health, Eurostat issued an Invitation to Tender. A consortium of representatives from 16 EU MS was commissioned, and has carried out 5 main tasks to deliver the work:

- **Task 1** involved compiling a data inventory, which describes the data available on expenditure by disease, age and gender, in EU Member States and EEA/EFTA countries. Members of the HEDIC consortium completed a questionnaire describing the availability of data on health expenditure by diseases and conditions in their countries.

- **Task 2** comprised the preparation of a HEDIC Manual, which sets out the guidelines for the compilation of expenditure by disease data.
- **Task 3** refers to the pilot projects which were carried out by members of the consortium, in order to test the proposed methodology for compiling expenditure by disease data.
- **Task 4** involved detailed analysis of the pilot project data.
- **Task 5** refers to the three workshops which took place in Stockholm (June 2014), The Hague (March 2015) and Budapest (April 2016).

What data do we need to compile HEDIC?

HEDIC requires both macro and micro data, as well as metadata. At the macro level, it aims to allocate SHA current health expenditure by disease, age and gender. Because different countries compile SHA from different data sources, the HEDIC methodology is flexible, to take this into account. In cases of multi-morbidity, the current convention is to attribute expenditure to the primary diagnosis. Where countries used a different method they are asked to specify this in their metadata. Where possible, countries extract micro data for distributing expenditure by disease age and gender directly from provider or financing data sources. Where data on expenditure by disease was lacking, countries were asked to estimate this using utilisation data and data sources for making unit costs estimates. For pharmaceutical expenditure, countries were invited to use a database of mapped ATC-ICD codes to allocate expenditure.

A manual describing the HEDIC methodology and a data inventory questionnaire was sent to representatives of National Statistical Authorities, Ministries of Health, or research consultancies, in all EU and EFTA countries. Analysis of their responses enabled a HEDIC Pilot Data Set (HPDS) to be specified. Members of the consortium submitted data using this framework.

How does health expenditure vary by age and sex, over time and between countries?

Age and gender-related health expenditure profiles are extensively used in forecasting models of health expenditure, and are important for international comparisons, because demographic structures vary greatly among countries. Chapter 3 discusses:

1. variation in health expenditures by age among countries in a given year
2. the change in expenditure profiles, particularly the steepening of HE by age, over time
3. sex-specific issues of health expenditure by age.

It presents data on expenditure by age as a percentage of current health expenditure for nine countries in 2013; and compares the expenditure profile by age for five countries, in 2012 and 2013.

In order to compare health expenditure between men and women, it is very important to separate the cost for pregnancy and reproduction from other costs, where it is common to attribute these costs to the mother. The same applies to sex-specific diseases such as ovarian and prostate cancer. Health expenditures by age for women's health by ICD-10, for conditions related to pregnancy, are presented for pregnancy, childbirth and the puerperium, in 2013.

The chapter concludes by discussing the use of age-related expenditure profiles for expenditure forecasts.

How does health expenditure by disease vary, over time and between countries?

HEDIC shows major variations in health spending by disease in contrast to former international comparisons. This may be because those studies compared a limited set of providers of Western European countries, but excluded countries in Eastern Europe. Furthermore, differences might be partly explained by differences in exclusion/inclusion of specific functions and providers included in the data. Chapter 4 examines these variations, before looking more closely at three important disease categories.

Data on health expenditure by disease as a percentage of allocated current health expenditure are presented for 2013, for eleven countries; and the deviation of the growth rate of health expenditure by disease from national average between 2012 and 2013 is compared for six countries. For circulatory disease, neoplasms, and mental disorders, data submitted for the HPDS are compared with those presented in other published studies, and the differences in levels of expenditure are commented on.

Does health system design affect levels of expenditure by disease, age and sex?

Data submitted for the HPDS show major variations in the share of expenditure on pharmaceuticals and inpatient care by diseases among countries. The challenge is to distinguish between absolute differences in expenditure on diseases among countries, and those differences which are artefacts of the data available for measuring potential differences. In Chapter 5 we focus on the two areas of pharmaceuticals and inpatient care, in discussing the possible impact of health system design on the distribution of expenditure by disease.

2013 data for ten countries in the HEDIC consortium are presented: on health expenditure on inpatient care by disease as a percentage of total inpatient care; on volume of inpatient care by disease as a percentage of total inpatient volume; and on relative unit costs of inpatient care by disease.

Many countries do not have accurate outpatient medication data by disease, but all countries classify pharmaceutical expenditures by the Anatomical-Therapeutic-Chemical Classification System (ATC). Various methods for mapping ATC data to ICD data are proposed. Data on the distribution of pharmaceutical expenditure, on the volume of this expenditure, and on unit costs of pharmaceutical expenditure, by disease, are presented.

Can HEDIC data improve the international comparability of SHA?

As discussed above, HEDIC adds additional information to health expenditure comparisons. Chapter 6 assesses whether HEDIC would also improve the compilation and comparison of the three core tables of SHA.

Including information on expenditure by disease, age and gender in SHA will improve the international comparability of SHA, by improving the three core tables of SHA, for the following reasons:

- Countries will interrogate their data sources more thoroughly in order to compile these additional dimensions, thereby leading to improvements in the quality of the SHA

compilations, and, in some cases, an increase in the number of data sources used.

- We will gain a better understanding of different levels of spending by function, if we know the age profile of the users of services in different countries. For example there are some important inter-country differences in the age of users of long-term care.

Many of the countries participating in the HEDIC project agree that their search for the data needed to compile HEDIC, has helped them to understand the structures and development of health expenditures within their countries, and as compared to other countries.

HEDIC can help the comparison of existing data collected by Eurostat and OECD by adding more flesh to the bones. For example, it is easier to understand the differences in SHA pharmaceutical expenditures or inpatient care if we have information on distribution by age, sex and disease in addition to the core tables of SHA. Furthermore, HEDIC allows the standardisation of health expenditure.

What is needed to incorporate HEDIC data in routine data collections?

The HEDIC project has attempted to assess the effort needed to incorporate routine collection of data on health expenditure by disease, age and sex, in the European Statistical System. While the HEDIC study has demonstrated the general feasibility of collecting data on expenditure by age, sex and disease, any decision to collect such data routinely must also take into account the resources available for doing so within countries, and countries' current intentions and plans for continuing to work in this area. Countries actively participating in the HEDIC project were asked to describe their current plans for work on disease accounts, and to estimate the resources they would need in terms of appropriately qualified person(s) working in the organisation with principle responsibility for compiling disease accounts. Twelve of the fourteen countries supplying data to HEDIC stated that they plan to continue work on disease accounts. Estimates of the resources needed for regular compilation of disease accounts in the national organisation responsible for this work ranged from 0.25 to 1.9 Full Time Equivalent staff per annum. This range reflects the current state of development of disease accounts in different countries.

Other important considerations relate to the possible need for formal legal arrangements to facilitate inter-institutional exchange of information between institutions within countries; and the importance of maintaining the momentum and expertise developed during the HEDIC project

How can we build on the work of HEDIC?

HEDIC has made considerable progress in estimating expenditure by disease in European countries: for more countries than hitherto, HEDIC can show costs of diseases by ICD chapters; it has compiled health expenditure profiles by age and sex which allow better projections of future health expenditure; and health expenditure values of inpatient care and pharmaceuticals have been split in to volumes and prices. A close link to non-expenditure statistics has been established.

In the final chapter it is recommended that further work be carried out to assess the practical aspects of incorporating HEDIC in the routine health expenditure data collection of Eurostat, in order to improve the analytical capacity and international comparability of SHA. It is argued that it will be desirable to do this because we will be better placed to understand health-specific cost-drivers, and hence contribute to the debate on the disease-specific interventions of health systems, if we have information on expenditure by disease and age. For example, combining information on trends in pharmaceutical costs by disease chapter, and demographic information, will help Member States to understand how and why their country differs from the EU average, and to separate local from international trends.

2 Introduction

Background

Studies of health expenditures by disease and conditions have a long tradition. They are closely linked to Cost of Illness (COI) studies which measure the economic burden of a disease or diseases. COI studies examine the allocation of resources from different perspectives. Who is affected? On whose behalf are decisions made? Depending on the perspective taken they may measure cost to society as a whole, health financing schemes, health care providers, households and/or different population groups. Disparities in health care spending are found within populations along many different social dimensions, all of which may be of policy and analytical interest. Dimensions of particular interest include the type of disease or health care condition, age, sex, geographic area and socioeconomic status.

Since at least the mid-1960s variations in health care expenditures within national populations have been analysed. Rice (1967) made the first attempts to measure the variations in spending by disease, age and sex in the United States. She estimated the national economic burden of all illness in the United States for 1963, from a societal perspective. Her analysis focused on two main types of costs - those of health care resources (direct costs), and those of productivity losses resulting from illness (indirect costs). Rice also noted another cost component – the “intangible or psychic costs” of disease such as pain and grief. The methodology employed became the accepted general framework for COI studies, and is still used in many studies today.

In general, direct costs refer to the value of resources used as a result of disease. With reference to SHA boundaries used in the System of Health Accounts (SHA), they can be divided further into direct health costs and direct social costs[1]. Direct health costs refer to those costs that are within the boundary of health care expenditure as defined by SHA 2011. Social costs refer to expenditures associated with “social care” as defined by SHA 2011. These are goods and services indirectly related to the provision of health care which are outside the health care boundaries.

Disease accounts compiled from a societal perspective provide a comprehensive picture of population health relative to health care spending. These accounts provide a lot of useful information, and should be viewed as one piece of information, or one input, into the decision-making process. It can be argued that policy makers should not make decisions based solely on the results of COI studies. COI studies do not purport to focus on health interventions and their effectiveness. That is left to the field of economic evaluation. COI studies can, however, provide very valuable information for policy makers. In particular, the results from such studies can be used as an input into further types of analyses such as cost-benefit or cost-effectiveness analysis.

As discussed in SHA (2011, p. 227), although health accounts expenditures were already applied to

[1] Social costs, as defined in SHA, would include those components of long-term care not directly related to health or additional social care, for which payment has been made.

disease-specific studies from the early 1990s, the use of standard classifications of expenditure, and in particular SHA, has improved the usefulness of such studies. Various projects since 2000 have assessed the feasibility of analysing health spending by beneficiary characteristics. Both Eurostat and OECD have jointly collaborated on projects to develop a set of guidelines, based on the pioneering work by RIVM, for the distribution of spending by disease, age and gender, which have subsequently been tested in various European MS.

Koopmanschap (1998) gives a detailed summary of some of the potential uses of COI studies:

- Providing information on the burden of specific diseases;
- Estimating disease costs covering the entire classification of diseases, enabling mutual comparison of disease costs and putting these in perspective;
- Prioritizing diseases or topics for future economic evaluation (i.e. by combining COI data with other information such as information about effectiveness of treatment);
- Incorporating COI results in cost-effectiveness analysis, e.g. as a cost estimate of current treatment which can be compared with the program studied;
- Clarifying the most important cost components of treating specific diseases; and
- Explaining recent trends in costs and/or projecting future disease costs, based on demographic, epidemiological and technological change (i.e. when COI data are used as a component of scenario-analysis).

One of the main benefits of using a comprehensive health accounting approach is that all expenditures are allocated to different disease groups in a mutually exclusive manner, which is important in light of the co-morbidities of chronic diseases (see chapter 3). This avoids the issue of double counting which can occur in studies focusing on selected diseases; if the same transaction gets counted in two different studies (i.e. can be linked to two different diseases).

Aims of HEDIC

The project 'Health Expenditures by Diseases and Conditions (HEDIC)' contributes to Eurostat's work on "Public health statistics for monitoring EU health", which aims to increase the use of official public health data at EU level. It will provide important information on burden of diseases by linking health expenditure data with patient characteristics. This builds specifically on three projects carried out over the last fifteen years. The first was a systematic attempt to arrive at a breakdown by patient characteristics of health care expenditure data classified by function, age and gender for the years 1999 or 2000 (IGSS, CEPS 2003). The second project focused on breaking down health expenditures by age, sex and diseases for all EU Member States and EEA/EFTA countries, including a suggestion of a shortlist of diseases/disease categories for selected ICD chapters (BASYS, CEPS, IGSS 2006). In a further project, the OECD (see OECD 2012), collected additional information about expenditures by disease for several EU Member States. HEDIC builds on the experiences of these earlier projects.

HEDIC complements several other strands of work in the EC. A Task Force on Morbidity Statistics, established in 2011, is overseeing Eurostat's work to develop diagnosis-based morbidity statistics, in order to fill an important gap in the information available on the health status of the EU population. This information is crucial for the development of public health indicators at the EU level. From 2005 to 2011, 16 MS participated in pilot studies on diagnosis-specific morbidity statistics. In 2014, the Task Force presented a report on the in-depth analysis of these pilot studies, and made methodological recommendations with regard to sources and best estimates (Eurostat 2014). DG ECFIN's work on long-term age-related expenditure projections, which aims to provide insights into the economic impact of ageing, includes work to project health care expenditure. In developing its health expenditure projections it uses age-gender-specific expenditure profiles supplied by EU MS (European Commission 2014). DG SANTE work to develop and maintain the European Core Health

Indicators will also benefit from and inform the collection of HEDIC data, where these indicators require accurate and internationally comparable data on expenditure by disease[2].

Attributing health care expenditures to diseases and conditions, and demographic characteristics of age and sex, provides basic information on current resource allocations in the health care system related to the morbidity of the population. This HEDIC information can inform current discussions concerning ageing populations and changing disease patterns, by analysing time trends, identifying the drivers of health care spending, and providing an input into modelling of future health care expenditures (European Commission 2014). Furthermore, the linking of health expenditures to measures of utilization (e.g. hospital discharges by disease), prices (e.g. DRGs), and outcomes (e.g. myocardial infarctions) can provide a useful input in the analysis of health expenditure development and in monitoring the performance of health care systems.

Work carried out to deliver HEDIC

Eurostat awarded the HEDIC contract to a consortium consisting of representatives from National Statistical Authorities, Ministries of Health, Social Insurance organisations, and research consultancies, from 16 EU Member States (these are listed in Annex 8.3).

Five main tasks were delivered:

Task 1 involved compiling a data inventory, which describes the data available on expenditure by disease, age and gender, in EU Member States and EEA/EFTA countries. Members of the HEDIC consortium completed a questionnaire describing the availability of data on health expenditure by diseases and conditions in their countries.

Task 2 comprised the preparation of a HEDIC Manual, which sets out the guidelines for the compilation of expenditure by disease data.

Task 3 refers to the pilot projects which were carried out by members of the consortium, in order to test the proposed methodology for compiling expenditure by disease data.

Task 4 involved detailed analysis of the pilot project data.

Task 5 refers to the three workshops which took place in Stockholm (June 2014), The Hague (March 2015) and Budapest (April 2016).

Outline of the report

Chapter 2 discusses HEDIC data requirements, and reports on HEDIC data availability as reported in the data inventory questionnaire sent to all European MS.

This study has analysed pilot HEDIC data supplied by members of the HEDIC consortium using four groups of hypotheses, and these are discussed in Chapters 3 to 6.The first group deals with demographic issues related to presentation of health expenditure by age and sex, this being an important issue in ageing European societies. The second group of hypotheses focuses on disease related questions. As HEDIC comprises the whole landscape of morbidity, it is possible to compare the results of HEDIC with cost-of-illness studies for specific diseases. We compare HEDIC estimates with European cost-of-illness studies for major ICD chapters. The third group of hypotheses relates to aspects of health system design. We investigate whether the organisation of a health system has an impact on levels of expenditure on different diseases, and whether those differences are artefacts of the data available for measuring potential differences. Finally, the fourth group focusses on the

[2] http://ec.europa.eu/health/indicators/indicators/index_en.htm (Accessed 14/03/16).

statistical measurement of health expenditures, and in particular, asks if HEDIC can improve the comparability of compilations of SHA. Chapter 6 discusses what will need to be done to develop HEDIC further, and Chapter 7 concludes the report, and makes recommendations for incorporation of HEDIC in the European Statistical System. Chapters 3 to 6 conclude with an 'Outlook' section which discusses further issues relevant for the future compilation of HEDIC.

Chapter summary

- The HEDIC project is a continuation of work on cost of illness which began in the 1960's with the work of Rice on variation in health spending by disease, age and sex in the USA.
- Information from COI studies can be applied in a variety of ways, including assessing the burden of specific diseases, comparing disease costs across the entire spectrum of diseases, in cost-effectiveness analysis, and in explaining recent trends and forecasting future health care costs.
- From the early 1990s, the use of standard classifications of expenditure, and in particular SHA, has improved the usefulness of disease-specific studies of health expenditure.
- HEDIC builds directly on three earlier projects funded by Eurostat since 2000, examining the feasibility of routine data collection to examine the link between health expenditure and patient characteristics. It complements Eurostat's work to develop morbidity statistics, DG ECFIN work on ageing, and DG SANTE work on ECHI.
- Recognising the importance of developing the methodology for costing illness in order to develop public health statistics for monitoring EU health, Eurostat issued an Invitation to Tender for work to: make an inventory of the data sources available for costing illness in European MS; write a manual for the construction of HEDIC; and to collect and analyse a HEDIC Pilot Data Set from countries able and willing to supply this data.
- Eurostat awarded the HEDIC contract to a consortium consisting of representatives from National Statistical Authorities, Ministries of Health, Social Insurance organisations, and research consultancies, from 16 EU Member States. The work was carried out between November 2013 and May 2016.

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3 Methodology and Data Requirements

Health expenditure accounts as starting framework

HEDIC is using available information both from macro statistics and from micro data. From the macro-perspective, which is recommended by SHA 2011, the challenge of HEDIC might be described as follows. Suppose the annual health expenditures by disease and conditions for the population of a country is described by the vector, *f*, for 1,…., k-type conditions. Under the assumption that the total value of *f* equals the current health expenditures, *g*, compiled by SHA, one can derive the HEDIC vector *f* from SHA by premultiplication of the vector, *g*, with a coefficient matrix Φ (expenditure items x health conditions).

(1) $f = \phi\, g$

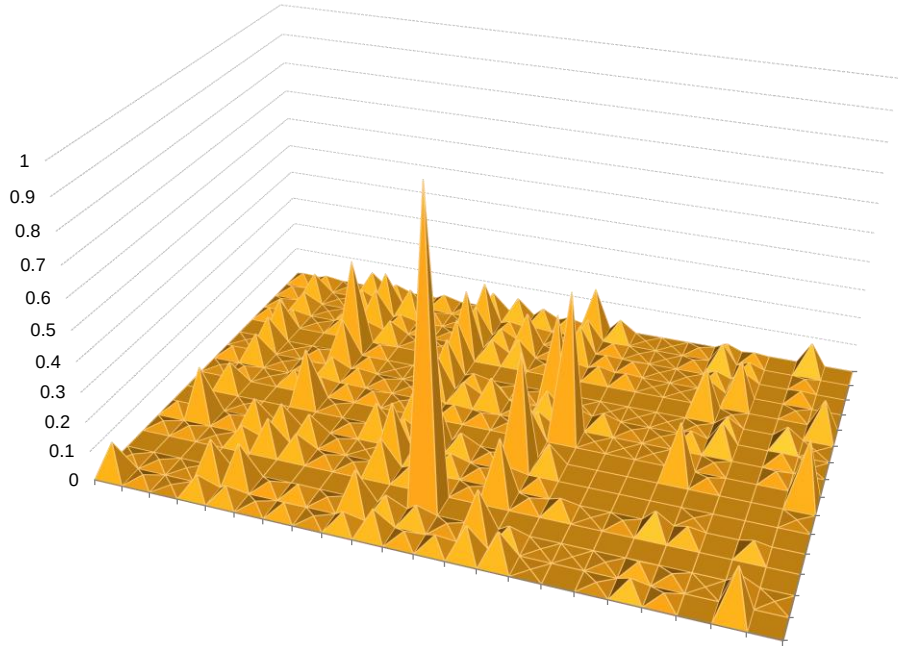
This coefficient matrix Φ with the dimension (k x n) consists of k rows for health conditions and n columns of types of health expenditures by activities (e.g. expenditures by health care functions). Figure 1 shows the structure of this matrix, the case of Germany by 44 ICD groups and 15 health expenditure items.

The pattern of coefficient matrix Φ depends very much on the specialization of health care providers: whether their activities are directed to specific diseases, e.g. dental care, or are general, like general medicine, general hospital care, and pharmaceuticals.

An important issue in computing the coefficient matrix Φ is that in many cases multiple issues (multi-morbidity) underlie the consumption of a unit of health care. There are three potential options for dealing with this issue (see SHA 2011, OECD 2008, 2013):

1. to classify expenditures according to the primary diagnosis;
2. to equally pro-rata the expenditures over the applicable diagnoses;
3. to distribute expenditures across the applicable diagnoses using disease-specific weights that reflect the relative resource intensity involved.

Figure 1: Example: structure of a matrix Φ (probability map) in the case of Germany 2008



Source: BASYS.

Although the third is conceptually the most ideal and provides a clear link between disease and total spending, in practice the data requirements to support such an approach are immense and in most countries will not currently be met. The second option is more feasible, but in many situations the available data will only have recorded the primary diagnosis, and not all co-morbidities. Given this, it is generally agreed that the standard approach should follow the first option. That is, to classify expenditures according to the primary diagnosis, except in those instances where the primary diagnosis cannot be differentiated from other diagnoses in the available data, in which case the expenditures should be pro-rated equally across all relevant conditions. Therefore, the HEDIC methodology recommends that health care costs should all be attributed to the primary[3] diagnosis, if the hierarchy of diagnosis is known.

However, in many cases this hierarchy is not well known, or is open to question. For instance if the diabetic condition of a patient causes kidney failure, should these costs be attributed to diabetes as the underlying condition, or to kidney failure, as this is the condition which generates the use of health care? An alternative to attribution to the primary diagnosis is a proportional division over all diseases and conditions, preferably weighted, so outcomes are adjusted to the severity of a disease. Countries should provide information on which method was/will be used in compiling expenditure by disease.

Disease specific data

The micro information for distribution of expenditures by HEDIC categories should be extracted directly from financing or provider sources. From a technical point of view, this extraction should include items of the core dimensions of SHA (health care functions, provisions, and financing) as well as the HEDIC categories. Countries are free to collect these data on a very detailed level and to be

[3] In practice, this might be the discharge diagnosis.

flexible with regard to national and international reporting.

As with information collection on age and gender, the majority of EU countries collect diagnostic information at specialist hospitals, general hospitals and outpatient facilities, but not at residential, day treatment or primary health care facilities.

Utilisation and unit cost

Utilisation unit and cost unit must correspond to each other. Utilisation is usually measured in different units for different expenditure items, such as hospital days, number of patients treated, number of procedures performed, contact time, etc. Information on the utilisation unit is collected in the metadata.

Data on utilisation are important for three reasons:

1. Data on expenditure by disease may not be available, but the necessary information for their estimation (e.g. utilisation data and data sources for making unit costs estimates) may be available.
2. The breakdown of expenditure by the coefficient matrix Φ for each expenditure item into volume and price, can help countries to understand better the changes in expenditures over time.
3. The decomposition of the expenditures by disease across European countries can help to explain the reasons for the variation (see Dunn et al 2013).

For the compilation of the matrix Φ it is useful to understand the utilization of health care activities and prices. Each column of the matrix Φ can be decomposed further into the volumes and prices by disease categories. The probability vector of the health activity j, denoted $\varphi_{.j}$, is the product of the diagonal matrix of disease prices[4] $diag(d_{.j})$and the utilization vector, $x_{.j}$ divided by the total expenditure for the activity j, the scalar e_j. This leads to equation (2)

(2) $$\phi_{.j} = diag(d_{.j})\ x_{.j}/e_j$$

Often, one cannot observe the prices directly, only the volumes of utilization by diseases which are gathered by non-expenditure statistics. Therefore, the disease based prices are derived from values and volumes.

(3) $$d_{.j} = diag(1/x_{.j})\ (\phi_{.j}\ e_j)$$

The vector $d_{.j}$, represents the vector (k × 1) of disease based prices. The first term on the right side of equation (3), the diagonal matrix $= diag(1/x_{.j})$ shows the reciprocal of the volumes $1/x_{.j}$ of health activity j by all diseases and conditions. The second term, $(\phi_{.j}\ e_j)$, presents the expenditures for the health activities by disease. This decomposition helps tracing back changes in HEDIC in volume and prices, and in a further breakdown into prevalence rates and access to care.

Although comprehensive information about unit costs is routinely collected at the level of health care providers (see Eurostat, OECD 2012), information about prices by disease groups is still limited. Such prices are presented in chapter 0 for inpatient care and in chapter 0 for pharmaceuticals

[4] See Bradley et al (2010) for discussion of disease based prices.

Risk profiles

Of particular interest are deviations of expenditures across population groups. For comparisons across health activities and population groups, we must standardize the expenditure ratios, volumes and prices. Suppose the column vector e^a provides the values of the distribution of health expenditures across age groups. Divided by the respective numbers of individuals in each age group, n^a , we receive the average expenditure per age (e^a/n^a). Standardized by the average expenditure over all age groups we receive a profile which varies around the mean.

(4) $e^* = (e^a/n^a) \ /(ie^a/in^a)$

The vector *i* in formula 4 presents the unit vector for summation over all age cohorts.

Metadata

Metadata is “data about data”. It is descriptive information about a particular data set, object, or resource, including how it is formatted, and when and by whom it was collected. For the national purposes of construction and updating of HEDIC at a minimum, background information should include the sources of data, data items, how data were validated (especially in the case of multiple data sources), the reasoning behind the selection of the data used in the estimation, the procedures applied to make the data usable, and more. Solid, comprehensive metadata facilitates an appropriate interpretation and use of the health accounts results. For example, trends in health expenditures by disease groups can be analysed better when there is knowledge about, say, changes in the accounting system.

Hence, in the data inventory questionnaire (discussed below), and in subsequently supplying pilot HEDIC data, countries were asked to provide metadata.

Data availability

An inventory of data sources for compiling the HEDIC Pilot Dataset (HPDS) was prepared, based on information supplied by representatives from Ministries of Health, Central Statistical Offices, National Insurance Organisations and consultancy organisations, in EU MS and EFTA countries. A manual describing the HEDIC methodology was developed in a series of workshops involving HEDIC participants, and representatives from international organisations. The manual describes in detail how to compile the HEDIC data set. The methodology is flexible, in that countries may use any of the SHA dimensions of functions, finance and activity, as their starting point in compiling HEDIC.

A questionnaire requesting information on HEDIC data sources was sent by the project in March 2014, to those EU MS and EFTA countries participating actively or as observers in HEDIC, and in a second round, to all other MS and EFTA countries not involved in the HEDIC project. In total, 19 countries supplied detailed information about the data sources available for compiling HEDIC. The questionnaire requested information in six sections:

- country contact details;
- current health expenditure items;
- current health expenditures by disease;
- indirect cost;
- COI studies involving the country responding to the questionnaire metadata.

It is important to note that the expenditure items selected for the breakdown by disease, age, and gender, are likely to be different among MS, because data sources vary, reflecting differences in the organisational structure and approach to financing of different countries’ health care systems. For

example, one MS might only report the breakdown for acute hospitals, another for all hospitals.

A data inventory was prepared based on the responses to the questionnaire described above. This helped to assess the suitability of these sources for compiling a HEDIC Pilot Data Set (HPDS). The content of the HPDS was agreed at the second HEDIC workshop in Den Haag, based on the following criteria:

- Access to data (legal, institutional or technical barriers);
- Need for harmonisation of the assumptions, procedures and compilation rules including definitions and classifications, with the statistical requirements;
- Possibility of linking data to other sources (unique identifier/key variables or possibility of using probabilistic linking);
- Coverage;
- Completeness;
- Quality;
- Availability of metadata.

Assessing data available for compiling HEDIC

To date fourteen countries have delivered the HPDS, with some differences in the level of detail (e.g. of age groups) and years covered. Table 1 shows the variation of reporting dimensions of the data sets provided by countries, for Allocated Current Health Expenditure (ACHE)[5]. The reasons for these variations are manifold, and reflect legal, technical and financial aspects of compiling HEDIC. Protection of personal health data has priority in all European countries. It is not permitted to process these data for non-medical reasons. Under certain conditions however, statistical analysis in anonymised form or at least with secure pseudonymisation is possible. In the case of HEDIC, anonymised data for population groups are sufficient for the compilation.

Other reasons for differences in the coverage of the HPDS include:

- Variation in national standards used for age groups used to compile administrative statistics;
- Absence of diagnostic coding for some disease categories;
- Lack of diagnostic coding for some types of hospital case;
- The need for formal legal arrangements to be in place for inter-institutional exchange of data;
- Lack of resources currently available for processing large volumes of data.

[5] The term “Allocated Current Health Expenditure” is used because, despite using a top-down approach some expenditures are not allocated to disease because no disease-specific information for this expenditure item is available. For example, not all hospital cases are classified by disease.

Table 1: Characteristics of HEDIC Pilot Data Set supplied by countries

Items \ countries	BG	CZ	DE	EE	EL	LV	LT	LU	HU	NL	AT	SI	FI	SE
1. Expenditure														
CHE		x	x			x	x		x	x		x		
CHE Public	x		x		x	x	x		x	x		x([6])	x	x
CHE Private	x		x		x	x	x			x		x([6])		
2. Breakdown by age groups and gender														
by age (number of groups)	3	21	21			21	18	21	21	21	19	21	21	21
by gender (3 items)		3	2		3	2	2	2	3	3	2	2	2	2
3. Table by ICD 10 chapters														
by ICD 10 chapters (number)	20	22	22	22	22	22	22	22	22	18	20	22	21	22
and by age (number of groups)	3			2				21		21		21	21	21
and by gender	x			x	x			x	x	x	x	x	x	x
and by age x gender				x				x	x	x		x	x	x
4. Price and volume measures by disease														
Inpatient (expenditure)	x	x	x	x	x	x	x	x	x	x([5])	x	x	x	x
Inpatient (unit cost)	x	x	x	x	x	x	x	x	x	_	x	x		x
Inpatient (volume)	x	x	x	x	x	x	x	x	x	_	x	x		x
Pharmaceuticals (expenditure)		x([1])	x			x	x([4])		x	x([4])		x	x	x
Pharmaceuticals (unit cost)		x([1])	x			x	x([4])		x	x([4])		x		
Pharmaceuticals (volume)		x([1])	x			x	x([4])		x	x([4])		x		
5. Years														
2011								x		x				
2012	x	x	x		x		x	x			x	x	x	x
2013	x	x	x		x	x	x	x	x	x	x	x	x	
2014				x			x	x						
6. Expenditure items not included														
Primary care	x	([2])		x				x			x			
Long-term care	x	([3])									x			x
Physiotherapy	x			x				x			x	x([7])		x
OTC Market	x			x	x			x	x		x	x	x	x
Public health		([2])		x				x			x			
Administration		([2])		x				x			x		x	x

([1]) prescribed medicines reimbursed by health insurance only
([2]) included in CHE, but complete allocation to ICD chapters was not possible
([3]) inclusion of LTC in the current SHA is likely incomplete and will be improved in the near future
([4]) beside pharmaceuticals inclusion of other medical goods
([5]) refers to hospitals
([6]) only applies to the year 2012
([7]) physiotherapy financed by Public Health Insurance Fund and Private Health Insurance Companies are included; physiotherapy financed by households is not included.

Chapter summary

- HEDIC uses information from macro statistics and from micro data, and recommends that expenditure be attributed on the basis of primary diagnosis, in cases where the hierarchy of diagnosis is known.
- Microinformation for distribution of expenditures by HEDIC categories is extracted directly from financing or provider sources, recognising that this is most likely to be available for specialist hospitals, general hospitals and outpatient facilities, but not at residential, day treatment or primary health care facilities.
- Data on utilization and unit cost are collected for 3 reasons: to estimate expenditure where cost by disease data is not directly available; to help to explain changes over time; and to assist in explaining international differences in disease-related costs.
- Countries are asked to supply metadata, for national purposes of constructing and updating HEDIC, and to assist in interpreting international differences. This should include the

sources of data, data items, how data were validated (especially in the case of multiple data sources), the reasoning behind the selection of the data used in the estimation, and the procedures applied to make the data usable.

- A data inventory questionnaire was completed by all participants in the HEDIC project and three other MS. MS used an early draft of the HEDIC Manual to assist them in preparing their responses. Compiling the data inventory also informed subsequent development of the manual.
- Responses to the questionnaire were used to assess the suitability of data sources for compiling a HEDIC Pilot Data Set (HPDS).
- Fourteen countries have delivered the HPDS, in varying levels of detail and for different years.

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4 Health expenditure profiles by age and sex

Demographic structure

The need for health varies by women and men over the life-cycle. It is important to understand the utilisation of health services over this cycle in light of the respective population age structure. Expenditure profiles by age and sex summarise the individual expenditures at a given point in time. In addition to the impact of age on the need for health care, several other factors affect the forms of these profiles, such as the organisation of health care, and access to services in different age cohorts.

Interest in the analysis of expenditures by age and sex has grown, with increasing attention being given to the implications of population ageing for health care system organisation and health care financing. Health expenditure profiles by age and sex are extensively used in forecasting models of health expenditure (see Astolfi et al 2012, European Commission 2014). They are also important for international comparisons, because demographic structures vary greatly among countries (see Finkenstädt, Niehaus 2015). Below we discuss the following aspects of such expenditure profiles:

1. variation in current health expenditures by age among countries in a given year
2. the change in expenditure profiles, particularly the steepening of expenditure by age, over time
3. sex-specific issues of health expenditure by age.

Our analysis of health expenditure profiles uses the following data from the HPDS submitted by countries: Current health expenditures by age and male, by age and female, for both 2012 and 2013, and the respective population data. Although the changes of profiles are rather small in such a short period, it is important to understand these changes.

Variation of health expenditure by age across countries

This subsection describes the variation of allocated current health expenditure by age among HEDIC countries.

Following the methodology of HEDIC, all expenditures should be allocated by age. The distribution of expenditure depends on the number of individuals in each age class. For example, one can expect a higher share of expenditure in the class 85-89 in a country with more elderly people. In contrast one would expect that countries with relatively fewer births spend less for the age class 0 (see Table 2). In fact, Germany has the lowest birth rate and shows the lowest expenditure share for the age class 0. However, Sweden, with the highest birth ratio, shows an expenditure share of 2.1 percent, but below Latvia, with a share of 2.3 percent despite a lower birth ratio. Clearly, other factors contribute

to this distribution such as availability of services for higher age groups.

Table 2: Health expenditures by age as percentage of ACHE, 2013
(%)

Class	CZ	DE	LV	LT	HU	NL	SI	FI	SE(1)
0	1.8	0.7	2.7	2.1	1.9	0.9	1.5	1.9	2.0
1-4	2.5	1.5	2.2	3.5	1.9	1.5	2.2	1.8	2.2
5-9	2.2	1.8	2.5	2.2	2.1	1.9	2.2	2.1	2.0
10-14	2.1	2.1	2.6	2.5	2.3	2.9	2.0	2.6	2.3
15-19	2.3	2.3	3.2	3.1	2.7	3.0	2.2	3.1	3.9
20-24	2.6	2.5	2.5	3.3	2.3	3.6	2.5	3.0	3.8
25-29	3.4	2.9	3.8	3.2	3.0	3.9	3.2	3.6	4.2
30-34	4.3	3.4	3.9	3.6	4.0	4.0	4.6	4.1	4.4
35-39	5.3	3.4	4.3	4.2	5.0	4.1	4.9	3.8	4.6
40-44	4.7	4.9	4.6	5.2	4.7	5.0	5.0	3.6	4.8
45-49	5.2	6.2	5.3	5.8	5.2	5.9	5.4	4.6	5.7
50-54	5.8	6.7	7.6	7.8	6.8	6.5	6.8	5.6	5.9
55-59	8.4	7.1	8.5	8.1	10.8	6.7	7.7	6.8	6.7
60-64	10.5	7.9	9.5	8.3	10.6	7.2	8.9	8.4	8.1
65-69	11.7	7.9	9.1	9.3	10.0	7.8	8.5	9.7	9.9
70-74	9.3	10.4	10.5	9.8	9.2	7.2	8.2	8.4	8.4
75-79	7.3	9.4	8.5	8.7	7.5	7.5	8.1	8.5	7.4
80-84	6.0	8.7	5.6	9.3	5.6	8.0	7.6	8.4	6.5
85-89	3.3	6.1	2.6	:	3.0	7.1	5.3	6.4	4.6
90-94	1.1	3.4	0.5	:	1.1	4.1	2.5	2.9	2.0
95+	0.1	0.8	0.1	:	0.2	1.3	0.7	0.7	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) 2012 instead of 2013
(:) not available

The variation in health expenditure by age among HEDIC countries is not only determined by the structure of the population, but also by the risk profiles for the individuals depending on their age. Risk profiles show the average variation in health expenditures for individuals. We compiled these risk profiles dividing the health expenditures for each age class by the respective population and standardized them by the mean. These standardized expenditure profiles per capita are presented in Figure 2. Health expenditures per capita are divided by the average expenditures per capita of the respective country. They show expenditure in a given age class as compared to the average.

For long-term expenditure projections in the field of health care and long-term care it is necessary to decompose the figures of Table 2 into expenditure per capita and number of individuals (see European Commission 2014).When interpreting the data in Table 2 and Figure 2, the proportion of health expenditures without recorded age should be born in mind (e.g. in the case of Czech Republic and Lithuania).

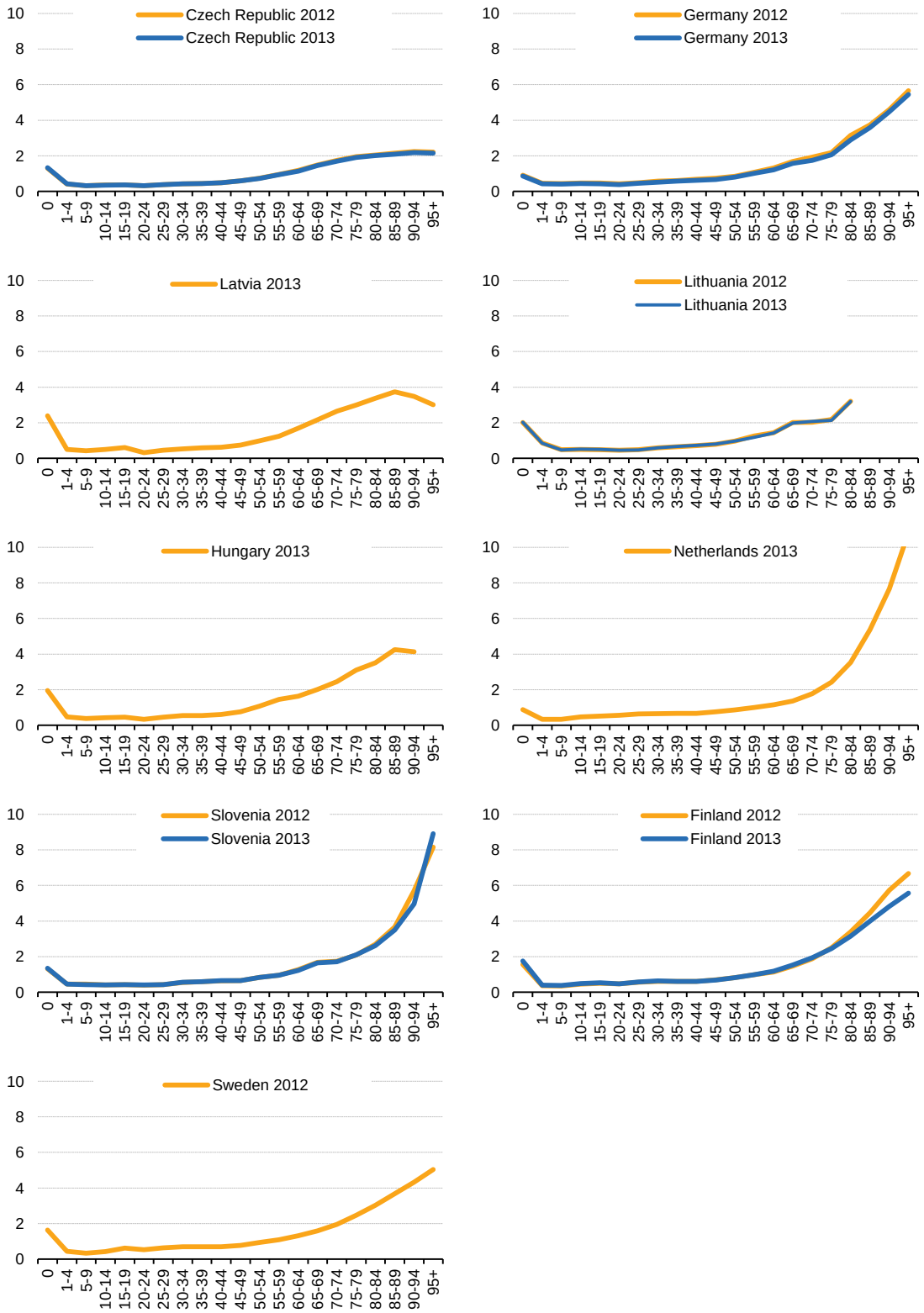
It is also important to note how differences in the organisation of care may affect these projections. In the Netherlands, for example, relatively more people aged 80+ are institutionalised in, for example, nursing homes and elderly homes.

In projecting future expenditure it is also important to know how “steep” the profiles are and whether these “risk profiles” are stable or change over time. The risk profiles shown in Figure 2 are much steeper than those used by the European Commission in its health care expenditure projections (see European Commission 2015, Graph II.2.1):

As the risk profile for long-term care expenditure is much steeper than that for health expenditure one can expect steeper profiles where the share of dependent individuals in long-term care is greater. This is partly the case because the costs related to long-term care are very high for institutionalised individuals, and the share of institutionalised

individuals increases sharply among persons aged over 80.

Figure 2: Health expenditure profiles per capita between 2012 and 2013
(country average per capita = 1)



Change of risk profiles between 2012 and 2013

One may expect only small changes of the risk profiles, when comparing consecutive years. Several factors contribute to the change:

- population changes (socio-demographic composition),
- changes in expenditure (volume and prices),
- other causes (e.g. ad hoc major health events such as epidemic outbreaks), and
- changes in recording and coding methodology.

A one year period (2012 -2013) is certainly too short to expect major changes. It will clearly be interesting to analyse longer periods to understand better the changes in age-related risk profiles. For some countries time series are currently available which would allow such analysis.

Another important issue in the context of population effects on health expenditure is the spending on health care treatment in the last years of life. Zweifel, Felder, Meier 1999 showed that the cost of dying was significant during the number of quarters remaining until death while the age of the persons was not. Therefore, a naïve estimation that does not control for proximity to death will grossly overestimate the effect of population ageing on aggregate health care expenditure.

Sex-specific issues

The patterns of age-related health care expenditure profiles significantly differ by sex. Broad causes of disease for girls under 5 years are congenital abnormalities, preterm birth complications, lower respiratory infections, neonatal encephalitis and sepsis, iron-deficiency anaemia, diarrhoeal diseases and sudden infant death syndrome. Among girls aged 5–14 years, they are road injuries, asthma, major depressive disorders and anxiety (see WHO Europe 2015).

In order to compare health expenditure between men and women, cost for pregnancy and reproduction should be separated from other costs (See OECD 2008 p. 30). Therefore, countries were asked to report specifically on data sources for reproductive health expenditures. However, the separation of these costs is rather difficult on the level of the HPDS. The WHO ‘Guide to producing reproductive health subaccounts within the national health accounts framework’ (2009) lists relevant activities and conditions/diagnoses, which should be considered here (see also SHA 2011, Annex A, p 390: HC.RI.3.1 Maternal and child health, family planning and counselling).

Table 3: Health expenditures by age as percentage of ACHE for women's health in HEDIC, 2013 (%)

Class	CZ	DE	LV	LT	HU	NL	SI	SE(1)
0	1.5	0.6	2.3	1.7	1.6	0.8	1.3	1.7
1-4	2.1	1.3	1.9	2.8	1.5	1.1	1.8	1.8
5-9	1.8	1.6	2.1	1.8	1.6	1.5	2.0	1.7
10-14	1.9	2.0	2.3	2.1	1.8	2.5	1.8	2.1
15-19	2.3	2.4	2.6	2.8	2.5	2.8	2.2	3.9
20-24	2.8	2.7	2.6	3.4	2.4	3.4	2.5	4.3
25-29	3.9	3.4	4.3	3.3	3.2	4.1	3.2	4.9
30-34	4.9	4.2	4.0	3.6	4.3	4.2	5.0	5.4
35-39	5.7	3.7	3.8	4.2	5.2	4.2	5.3	5.3
40-44	4.8	4.9	4.0	4.9	4.6	4.8	5.3	5.1
45-49	5.2	5.8	4.5	5.5	5.1	5.6	5.4	5.8
50-54	5.7	6.1	6.8	7.5	6.5	6.1	6.5	5.9
55-59	7.7	6.3	7.8	7.8	10.3	6.0	7.2	6.4
60-64	9.2	6.6	9.2	7.9	10.0	6.3	7.8	7.4
65-69	10.7	6.7	9.1	9.3	9.6	6.9	7.4	8.8
70-74	9.0	8.9	11.4	10.2	9.3	6.5	7.6	7.7
75-79	7.6	9.1	9.8	9.8	8.3	7.4	8.1	7.1
80-84	7.0	9.6	7.0	11.4	6.5	9.0	8.4	6.7
85-89	4.3	8.1	3.6	:	3.9	9.1	6.7	5.1
90-94	1.5	4.8	0.8	:	1.5	5.8	3.4	2.5
95+	0.2	1.1	0.1	:	0.2	2.0	1.0	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Not allocated								0.3

(1) 2012 instead of 2013
(:) not available

Table 3 gives an overview of the distribution of health expenditures for women's health by age classes.

Table 4 gives an overview on the share of health expenditures devoted to the chapter "O00–O99 Pregnancy, childbirth and the puerperium". Bulgaria, Greece, and Latvia report the highest spending shares for pregnancy, while the Czech Republic, Hungary, Slovenia, and Germany have the lowest shares.

In interpreting the results shown in Table 3 and Table 4 we must consider the coding practices of health expenditures on pregnancy, childbirth and the puerperium by ICD-10 in the countries. For example, the low value for the Czech Republic in Table 4 is not backed by a low expenditure ratio for the age class 30-34 in Table 3. For this age class 30-34 Lithuania shows the lowest value, but, in contrast, nearly the threefold expenditure share in Table 4. Care for physiologic pregnancy (including delivery) would be largely covered by the Z30-Z39 codes, which could not be further elaborated from the minimum dataset.

Table 4: Health expenditures for women on ICD chapter O: Pregnancy, childbirth and the puerperium in 2013

Countries	O00–O99 as % of Allocated Current HE	O00–O99 as % of Allocated Inpatient HE	O00–O99 (ACHE) per capita in € (PPS)	O00–O99 (AIHE) per capita in € (PPS)	O00–O99 (ACHE) per 1,000 live births	O00–O99 (AIHE) per 1,000 live births
Bulgaria	3.1	4.0	15.0	13.7	1 636.5	1 488.7
Czech Republic(1)	1.1	3.0	17.1	9.4	1 680.8	922.5
Germany(1)	1.8	3.5	64.2	49.6	7 602.7	5 869.4
Estonia	:	4.9	:	14.7	:	1 434.3
Greece	3.4	7.2	51.5	50.3	6 001.8	5 854.2
Latvia	3.3	5.9	21.1	14.0	2 052.9	1 364.1
Lithuania	2.7	4.6	9.2	4.0	905.2	392.3
Hungary	1.6	3.1	21.3	13.0	2 374.8	1 447.1
Netherlands (2)	2.7	3.9	103.6	55.8	10 160.9	5 469.6
Austria	:	3.8	:	36.3	:	3 871.9
Slovenia	1.8	5.5	34.7	29.7	3 386.9	2 895.5
Finland	2.4	4.6	41.9	32.1	3 919.0	3 002.1
Sweden (3)	2.2	4.9	41.7	35.7	3 521.3	3 011.1

(1) Part of pregnancy care is coded under the ICD10 chapter 21 and is therefore excluded from this table.
(2) Also includes care for healthy infants Z32-Z39. It is not possible to separate these from O00-O99.
(3) 2012 instead of 2013
(:) not available

Outlook

This chapter has discussed variation in health expenditures by age and sex. Compilation of health expenditures by age and sex will improve the data base for the analysis of the impact of demographic changes on health expenditures. Almost all countries and European Institutions make such investigations (see European Commission 2015).

Population ageing in EU Member States will continue to increase demands on health and long-term care systems[6] in the years ahead. It would be interesting to estimate CHE costs for 2020, 2030 and 2040 using the current Eurostat population forecast, utilizing the age cost-profile of 2013 and other years. In addition we could calculate the percentage of expenditures for the age groups 65+ and 75+.This would show the demographic pressure of health care expenditure on total budget.

In this context an issue for further investigation is the connection between s*teepening* health expenditure profiles and expenditures at the end-of-life (see Gregersen, 2014). If there is a substitution effect between different health care services, excluding other services could potentially lead to biased results. It may be plausible that the profile steepens for inpatients, but the opposite effect is observed in other health care services. Additional research should therefore take place in other parts of the health care sector in order to confirm this pattern outside inpatient care.

The complex interplay of biological, behavioural, psychological and social protective and risk factors contributing to health expenditures across the female and male lifespan also requires further attention. Applying a life-course approach includes looking at women's health needs beyond their potential role as mothers. Women are living longer but have an increased risk of developing disease and disability earlier in life. This is partly due to threats from non-communicable diseases and their risk factors (see WHO Europe 2015).

[6] In HEDIC LTC is limited to health; the social care components are almost certainly larger, and probably growing faster.

Chapter summary

- Interest in expenditures by age and sex has increased, with increasing consideration of the impacts of population ageing for health care systems and health care financing.
- Analysis of the HPDS shows that health expenditures vary by age among countries in 2013.
- The age–related expenditure profiles for 2012 and 2013 are compared for five countries: Czech Republic, Germany, Finland, Lithuania, and Slovenia. The changes are small because they are for two consecutive years, but may be due to changes in the socio-demographic composition of the population; the evolution of volume and prices; and ad hoc major health events such as epidemics.
- In this study a preliminary investigation of the determinants of sex differences has been made.
- In order to compare expenditure on men and women, it is very important to separate the cost for pregnancy and reproduction (the latter for both men and women), from other costs. The same applies to sex-specific diseases such as ovarian and prostate cancer.
- Data from the HPDS are presented on expenditure by age for women's health by ICD10 for 2013; and on expenditure on pregnancy, childbirth and the puerperium by ICD10 as percentage of Allocated Current Health Expenditure (ACHE), as percentage of Allocated Inpatient Health Expenditures (AIHE), per capita and per 1,000 live births.
- It is necessary to consolidate the compilations and to decompose profiles across financing and provision as well as over time.
- We need to investigate further the differences and dynamics of profiles, which among other things will need longer time series of data.
- Ongoing analysis of long-term care developments is needed to understand differences in risk profiles.
- Further work is needed to develop standardised indicators.
- Outlook: Compilation of health expenditures by age and sex will improve the data base for the analysis of the impact of demographic changes on health expenditures, in a context of increasing demand for health and social care as Europe's population gets older.

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5 Disease related expenditure profiles

Grouping of diseases

HEDIC uses the International Classification of Diseases (ICD) of the World Health Organisation (WHO) in the attribution of health care expenditure according to disease. The sheer size of the ICD classification, which contains many thousands of diseases, requires them to be grouped. Based on the country studies of earlier projects, HEDIC groups them into chapters, as a first step.

Former international comparisons show rather similar shares of total health care spending by chapters of diseases among developed countries (see Heijink et al 2008, Slobbe et al 2009). Our initial comparisons among HEDIC countries do not confirm this result. One major reason may be that those studies compared a limited set of providers of Western European countries but excluded countries in Eastern Europe. Furthermore, differences might be explained by differences in exclusion or inclusion of specific functions or providers. Below we look more closely at these variations. After showing the deviations from the standard structure, we analyse three major disease categories.

Circulatory Diseases: Expenditure is highest for circulatory diseases in most countries. We suppose that the growth of this expenditure is stagnating because treatment is getting cheaper. As a consequence, the share of health expenditure devoted to circulatory diseases is diminishing compared to previous years.

Neoplasms: Expenditures for neoplasms are increasing because European populations are ageing. Unit costs of treatment are sometimes very expensive. As a consequence the share of health expenditures devoted to neoplasms is increasing. This is only part of the story. Improved survival rates and longer treatment periods contribute also to this rise.

Mental Diseases: Expenditure for mental disease is also increasing, partly as result of population ageing, partly with rising living standards.

In order to separate the ageing effect from other growth determinants, it is necessary that a multidimensional HEDIC data set is compiled, such as those for the Netherlands and Finland.

Variation of profiles among countries

This subsection describes the variation of health expenditures by ICD Chapters among HEDIC countries.

Various factors may explain international variations in the share of health expenditures devoted to different disease chapters, including: 1) differences in prevalence / incidence and in demand for treatment; 2) differences in access to health care services and the local supply of technology; and 3) differences in coding and reporting practices.

Differences in reporting practices influence substantially the presentation of data for disease and age related health expenditures. For example, in the case of Bulgaria, the only reliable source of data for

inpatient and some providers of outpatient care is the National Health Insurance Fund. Estimations for disease disaggregated data for Central and Local Government and out-of- pocket expenditures of households are only possible for some classes of diseases.

On average, health expenditures for ICD chapter 9 “Diseases of the Circulatory system” is the most important category in all countries, including about one sixth of current health expenditures (see Table 5). Other major expenditure categories are chapter 2 “Neoplasms”, chapter 5 “Mental and behavioural disorders”, chapter 11 “Diseases of the digestive system”, and chapter 13 “Diseases of the musculoskeletal system and connective tissue”.

Table 5: Health expenditures by disease as percentage of ACHE in 2013
(%)

ICD 10	Description	BG(1)	CZ(2)	DE	EL	LV	LT	HU	NL	SI	FI	SE(3)
I	Infectious	2.0	2.3	1.9	1.5	3.0	3.5	2.4	1.4	2.2	2.1	2.0
II	Neoplasms	8.4	10.0	8.4	12.5	8.0	9.7	13.1	7.7	9.3	11.9	7.4
III	Blood	0.6	1.1	0.8	1.9	1.1	1.2	2.0	0.7	1.1	1.0	0.7
IV	Endocrine	2.9	5.8	5.0	9.2	4.0	4.5	7.9	3.8	3.0	5.1	3.4
V	Mental	2.2	5.3	11.1	7.4	10.7	6.6	6.8	24.8	8.3	11.6	9.8
VI	Nervous	2.3	4.0	3.5	2.9	4.2	4.1	4.7	8.3	4.1	5.7	2.6
VII	Eye	3.0	3.5	1.8	2.4	5.4	3.8	2.1	:	4.4	1.8	1.9
VIII	Ear	1.1	0.6	1.3	0.4	2.3	1.2	1.1	:	0.9	0.9	1.1
IX	Circulatory	22.5	17.2	13.8	16.9	19.2	23.5	16.6	12.9	12.8	15.3	10.4
X	Respiratory	7.4	6.7	6.4	5.5	6.8	8.2	7.2	4.8	5.4	6.2	4.8
XI	Digestive	19.4	11.6	14.0	10.4	8.5	9.5	7.0	9.0	9.8	8.8	15.8
XII	Skin	1.6	1.5	1.4	0.6	1.4	2.2	1.8	1.6	1.6	1.4	1.9
XIII	Musculoskeletal	5.0	7.5	11.7	7.5	7.2	6.5	8.5	8.3	7.9	7.3	8.1
XIV	Genitourinary	8.1	6.4	4.2	6.5	5.2	4.4	4.7	4.1	5.4	4.0	3.4
XV	Pregnancy	3.1	1.1	1.8	3.4	3.3	2.7	1.6	2.7	1.8	2.4	2.2
XVI	Perinatal	0.4	0.9	0.3	0.9	0.7	1.1	0.7	0.2	0.5	1.1	1.0
XVII	Congenital	0.6	0.4	0.4	0.3	0.6	1.0	0.5	0.4	0.8	0.9	0.8
XVIII	Symptoms	0.6	3.8	5.1	4.2	0.2	0.8	3.0	5.8	4.5	3.5	6.2
XIX	Injury	:	4.3	4.4	2.9	6.5	5.3	3.8	3.6	6.8	6.1	6.8
XX	External	2.6	0.1	:	0.2	0.1	:	0.2	:	0.0	0.0	0.0
XXI	Factors	6.1	6.0	2.7	2.6	1.9	0.3	4.3	:	9.5	2.8	9.7
XXII	Special	0.0	0.0	0.0	0.0	2.6	0.8	2.1	:	0.0	0.0	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Not allocated	32.1	10.0	2.1	11.0	2.6	0.8	2.1	15.1	:	:	12.9

Ann.: The percentages are standardized on the sum of the allocated health expenditures in each country.
(1) structure refers to total inpatient and outpatient expenditures for 2013.
(2) expenditures for GPs and households-financed care were not completely allocated and are therefore not fully included.
(3) 2012 instead of 2013
(:) not available

When interpreting Table 5, we should also bear in mind expenditure which is not reported. The not allocated part of current health expenditures varies between 32.1 % in Bulgaria and 0.8 % in Lithuania, and 2.1% in Germany.

Expenditures for chapter 11 “Diseases of the digestive system are particularly high due to dental expenses in Bulgaria, Sweden and Germany.

Chapter 21 “Factors influencing health status and contact with health services” contains expenditures for interventions other than for a disease, injury or external cause. It is designed to include check-ups, screening, normal reproduction, etc. The coding practices for chapter 21 seem to be differently applied between countries and not directly comparable.

Some countries used the ICD 10 chapter 22 “Codes for special purposes”, which contains new diseases of uncertain aetiology or emergency use and encounters with resistance to antimicrobial and antineoplastic drugs. The codes of chapter 22 are not always accessible in electronic systems.

Variation of expenditures by disease between 2012 and 2013

In recent years, and in particular after the economic crisis in 2008, European countries have implemented or strengthened a number of cost-containment policies (see OECD 2015). HEDIC provides information which helps to assess the impacts of these policies on resource allocation by disease.

Figure 3: Deviation of growth of health expenditures by disease from national average, 2012/2013
(%)

ICD 10	Description	BG	CZ	DE	EL	SI	FI
I	Infectious	-12.4	5.4	1.9	-0.3	4.6	-1.3
II	Neoplasms	3.2	3.8	-0.3	-2.5	9.2	8.0
III	Blood	-0.5	6.9	2.3	4.0	4.8	2.9
IV	Endocrine	1.2	-3.0	-0.3	10.4	0.7	4.5
V	Mental	33.2	-3.9	2.2	1.5	-2.2	-1.1
VI	Nervous	3.0	1.8	0.3	-1.5	-1.1	-3.7
VII	Eye	3.4	-3.3	-0.7	2.3	1.3	3.4
VIII	Ear	2.4	3.7	-2.5	4.5	8.1	5.2
IX	Circulatory	2.4	-2.6	-3.4	1.4	-1.4	-4.0
X	Respiratory	-0.1	2.6	6.0	1.9	2.2	-4.2
XI	Digestive	-1.3	1.2	0.4	-2.8	-4.4	5.2
XII	Skin	0.0	-2.7	1.2	-19.8	6.9	3.0
XIII	Musculoskeletal	8.4	-4.1	0.6	-6.2	12.4	4.4
XIV	Genitourinary	-0.4	-1.6	-4.9	-2.5	-10.4	-3.7
XV	Pregnancy	-2.5	1.8	1.1	-0.4	4.3	13.1
XVI	Perinatal	-17.7	5.5	0.4	-7.2	-24.0	13.0
XVII	Congenital	0.6	-0.9	3.2	0.9	-5.8	16.1
XVIII	Symptoms	1.3	4.4	-0.6	0.7	8.1	1.9
XIX	Injury	-0.2	1.6	1.0	-1.6	-10.0	-0.3
XX	External	-1.2	7.4	5.6	-1.4	-9.3	:
XXI	Factors	-5.6	6.0	2.0	2.9	-1.2	:
XXII	Special	:	:	:	:	:	:

(:) not available

The analysis of health expenditures by disease over time can give further insight into the consequences of cost containment policies. Economic, fiscal and health policy reacted rather differently on fiscal deficits. In Greece for example, the economic crisis led to a massive reduction of current health expenditures. But, impacts on the treatment of disease were not uniform. In Greece, some diseases areas lost more resources than others. On average health expenditures fell 9.6 percent in the period 2012-2013. Figure 3 shows the deviation of growth in each disease area as compared to the national average growth rate.[7] Especially, expenditures for diseases of the skin and the subcutaneous tissue, diseases of the musculoskeletal system and connective tissue, and for certain conditions originating in the perinatal period were cut. Cost containment in Bulgaria focused on certain conditions originating in the perinatal period, but also on certain infectious and parasitic diseases as well as factors influencing health status and contact with health services. At this stage of the investigation it is not possible to assess the public health consequences of these policies. An analysis based on several years would certainly be useful.

[7] Please note that the national growth rate for the health care activity *j* varies across countries. The deviation $w_{dj} - w_j$ between the growth of the disease specific expenditures w_{dj} and the growth on average w_j allows comparing the structural change of the disease expenditure across countries.

The analysis of health expenditures by disease over time can give further insight into the consequences of cost containment policies. The data presented in Figure 3 show that, in Greece for example, the economic crisis led to a massive reduction of current health expenditures. Especially, expenditures for diseases of the skin and the subcutaneous tissue, diseases of the musculoskeletal system and connective tissue, and for certain conditions originating in the perinatal period were cut. Cost containment in Bulgaria focused on certain conditions originating in the perinatal period, but also on certain infectious and parasitic diseases as well as factors influencing health status and contact with health services. At this stage of the investigation it is not possible to assess the public health consequences of these policies. An analysis based on several years would certainly be useful.

Circulatory diseases

Cardiovascular Diseases (CVD), defined by the ICD-10 codes I00-I99, cover a range of illnesses related to the circulatory system, including heart attack and cerebrovascular diseases such as stroke. The European Heart Network (EHN) has published several studies of the cost of CVD (see for example Nichols et al, 2012). The methodology applied differs from that used in HEDIC for five main reasons: (1) The EHN approach focuses only on one group of diseases; (2) Costs are derived using aggregated data on morbidity, mortality, hospital admissions, disease related costs, and other health related indicators from various national and international sources, partly at different times, but updated to the year 2009; (3) The boundary of CVD health care services is narrower than SHA, excluding preventive activities, physiotherapy, long-term nursing care, medical devices, and administration; (4) Private spending was often estimated by using the total proportion of private spending on health care. (5) Age and sex specific expenditures were not compiled.

The EHN estimates the CVD cost to the health care systems of the EU at just over €106 billion in 2009. This represents a cost per capita of €212 per annum, around 9% of the total health care expenditure across the EU. The cost of inpatient hospital care for CVD patients accounted for about 49% of these costs, and that of drugs for about 29%. The amount spent on health care for people with CVD varies widely across the EU. Cost per capita varied ten-fold in 2009, from €37 in Romania to €374 in Germany expressed in exchange rates[8]. Percentage of total health care expenditure on CVD varied from 4% in Luxembourg to 17% in Estonia, Latvia and Poland (see Nichols, Townsend, Luengo-Fernandez et al. 2012).

As a consequence of the different approaches used by HEDIC and EHN one might expect that the HEDIC analysis would show higher expenditures for CVD both in total, and as share of current health expenditures. In fact, Table 6 shows for all countries that the HEDIC approach leads to higher expenditure estimates for circulatory diseases than the EHN study.

[8] The EHN study used the exchange rate on the last day of 2009 (see Nichols et al, 2012).

Table 6: Share of health expenditures devoted to circulatory diseases in 2013
(%)

Countries	HEDIC as % of ACHE [1]	EHN Study 2010 as % of CHE [2]	Deviation [3]=[2]/[1]
Bulgaria	22.5	13.0	57.7
Czech Republic	17.2	14.0	81.5
Germany	13.8	11.0	79.9
Greece	16.9	11.0	65.2
Latvia	19.2	17.0	88.4
Lithuania	23.5	12.0	51.0
Hungary	16.6	14.0	84.1
Netherlands	12.9	8.0	61.8
Slovenia	12.8	8.0	62.5
Finland	15.3	12.0	78.4
Sweden (1)	10.4	8.0	77.0

Ann.: The share refers to the sum of the allocated expenditure across all ICD10 chapters.
(1) 2012 instead of 2013

A one year comparison 2012/13 is certainly not enough to reach conclusions about expenditure trends by disease, partly due to uncertainty in measuring this variation. Compare for example the Netherlands where the share stays about the same between 2003 and 2011. The most likely explanation is that the decreasing incidence and possible lower treatment costs (of statins for example) are largely offset by an increase in life-expectancy for patients, combined with ageing, and that prevalence stays about the same.

Neoplasms

Here we compare HEDIC data with estimates for cancer costs based on data published in the Lancet Oncology (Luengo-Fernandez et al, 2013). The researchers from Oxford University and King's College London (OUKCL) estimated direct and indirect costs of diseases of ICD chapter C00-C97 in the year 2009 for 27 EU MS. They used the same macro approach for this group of diseases as in the case of CVD (see section 0). Costs associated with breast (C50), colorectal (C18–21), lung (C33–34), and prostate (C61) cancers were estimated separately. The results revealed substantial disparities between different countries in the EU in spending on healthcare and drugs for cancer. (It should be noted that for many European countries there were large gaps in the data in this study. These were partially filled by utilizing German and Dutch data. which were available in much more detail than in other countries.)

In the OUKCL study, Luxembourg and Germany spent the most on healthcare for cancer per person, with Bulgaria spending the least. The researchers conclude that these results show wide differences between countries, the reasons for which need further investigation. However, these data contribute to public health and policy intelligence, which is required to deliver affordable cancer care systems and inform effective public research funds allocation.

Table 7: Share of health expenditures devoted to neoplasms in 2013
(%)

Countries	HEDIC as % of ACHE+ [1]	Luengo-Fernandez et al 2009 as % of CHE [2]	Deviation [3]=[2]/[1]
Bulgaria	8.4	5.0	59.8
Czech Republic	10.0	5.0	50.1
Germany	8.4	5.0	59.4
Greece	12.5	5.0	39.9
Latvia	8.0	3.0	37.6
Lithuania	9.7	5.0	51.7
Hungary	13.1	5.0	38.1
Netherlands	7.7	3.0	38.9
Slovenia	9.3	4.0	43.2
Finland	11.9	5.0	41.9
Sweden (1)	7.4	3.0	40.7

Ann.: The share refers to the sum of the allocated expenditure across all ICD10 chapters.
(1) 2012 instead of 2013

Table 7 shows for all countries that the HEDIC approach leads to higher expenditure estimates devoted to cancer diseases than the Luengo-Fernandez et al 2013 study: They have underestimated the cost of cancer as compared to HEDIC. In addition to the use of a narrower boundary, one reason seems to be the lower expenses for pharmaceuticals. Also the variation of expenditures among countries is much lower in the OUKCL study, which is maybe the result of the variation in access to expensive cancer drugs today.

The cancer burden differs by sex, age and population group. Large variations exist in cancer incidence[9] across European countries. Cancer incidence is highest in northern and western European countries and lowest in in some Mediterranean countries such as Greece (see Ferley et al. 2013). Various studies investigated the relationship between cancer survival rates, health care and socioeconomic factors. However, countries with high total national expenditure on health generally had better survival rates than did countries that spent less (De Angelis et al 2013).

Mortality rates from all types of cancer among men and women have declined at least slightly in most EU member states since 2000, although the decline has been more modest than for cardiovascular diseases, explaining why cancer now accounts for a larger share of all deaths. Exceptions to this declining pattern can be found in Latvia, Lithuania and in Bulgaria, where cancer mortality has remained stable or increased (see OECD 2014a).

Mental Health

There is huge variation in spending for mental health across countries. Within the HEDIC countries, the lowest share is reported for Bulgaria and the highest for the Netherlands. It is likely this variation is the result of health care organisation and other factors including the coding of disease, rather than differences in prevalence rates. The analysis of European morbidity statistics suggests that some diseases such as schizophrenia are well defined and coded similarly in different countries and mostly treated using medication, and others like dementia, often treated in institutions, are underreported. The use of hospital statistics may explain the low ratio of Sweden. Hospital data does not appear to be the best source for any of these mental and behavioural disorders, as most of these conditions do

[9] Cancer incidence rates are based on numbers of new cases of cancer registered in a country in a year, divided by the population.

not normally require admission (excluding late stages of eating disorders) (Eurostat 2014). More and better data on long term care might be needed to explain the variations.

In contrast to our findings, a mental health study of WHO Europe reports a higher ratio of mental expenditures for Sweden than for the Netherlands (WHO Europe 2008). The WHO data are from a survey which asked about the mental health budget or expenditure as a proportion of the total public health budget or expenditure. The WHO study lists the following items which were particularly difficult to identify:

- mental health services provided in primary care, which represent a significant part of overall mental health care in some countries;
- reimbursement of drugs;
- private psychiatric practices contracted by health insurance;
- some outpatient services;
- mental care in nursing homes;
- expenditure on mental health promotion programmes or mental disorder prevention programmes;
- expenditure from local authorities; and
- out-of-pocket expenditure (formal or informal).

However, while some EU MS such as the Netherlands or Luxembourg have well documented information about mental health in nursing homes, coding by ICD-10 does not play the same role in the documentation of the health status of these patients as in clinical care.

A first estimation of mental health expenditures in Europe was made by the Mental Health Economics European Network (see European Commission 2005). The compiled proportions of the health budgets dedicated to mental health were highly variable across MS, Luxembourg spending 13% and Slovak Republic 2% of health expenditures. Also the European study “cost of brain disorders” shows a wide range of shares, includes not only diseases of chapter F but also selected diseases across various ICD chapters G, C, D, I, and S (Gustavsson et al, 2011). Therefore, the comparison with HEDIC must consider the different definitions[10].

[10] The study distinguished between a) direct health care costs (i.e. all goods and services related to the prevention, diagnosis and treatment of a disorder; e.g. physician visits, hospitalizations and pharmaceuticals), b) direct non-medical costs (i.e. other goods and services related to the disorder; e.g. social services, special accommodation and informal care), and c) indirect costs (i.e. lost production due to work absence or early retirement). The definition of health expenditures by SHA contains long-term care expenditures; indirect costs are excluded.

Table 8: Share of health expenditures devoted to mental diseases
(%)

Countries	HEDIC 2013 as % of ACHE+ [1]	EU Green Paper 2004 as % of THE [2]	"Cost of brain disorders 2010" Chapter F [3]	Ratio [4]=[2]/[1]	Ratio [5]=[3]/[1]
Bulgaria	2.2	:	1.7	:	77.8
Czech Republic	5.3	3.0	2.2	56.3	41.3
Germany	11.1	10.0	2.5	90.0	22.5
Greece	7.4	:	2.7	:	36.7
Latvia	10.7	5.0	2.3	46.8	21.5
Lithuania	6.6	7.0	2.2	105.9	33.3
Hungary	6.8	8.0	2.3	118.0	33.9
Netherlands	24.8	8.0	2.3	32.3	9.3
Slovenia	8.3	:	2.6	:	31.2
Finland	11.6	:	2.6	:	22.3
Sweden(1)	9.8	11.0	3.0	112.3	30.6

Ann.: The share refers to the sum of the allocated expenditure across all ICD10 chapters.
(1) 2012 instead of 2013
(:) not available

The study "cost of brain disorders" derived age-specific 12-month prevalence figures for each disorder from the epidemiologic reviews and on the basis of age-specific prevalence in terms of number of persons affected by this disorder. The data presented in Table 8 show that as compared to HEDIC, this study has underestimated the direct expenditures for mental health. But, most ambulatory and institutional care for mentally handicapped persons is expensive. This is well documented as the case of the Netherlands demonstrates.

Mental and Behavioural Disorders as a group encompasses a wide range of conditions, from substance abuse to mood disorders and depression, to schizophrenia, and dementia. For further insight into the differences in expenditures by type of mental illness, it might be wise in future studies to split mental health first into major categories (dementia, depression, mental handicap etc.) and to compare each category between countries. Already today some countries are able to provide a more detailed breakdown of spending in these categories of mental illness[11].

Outlook

Not all EU countries have achieved universal (or near universal) coverage of a basic benefit package, which includes prevention, primary, secondary and tertiary health care services, long-term care, pharmaceutical prescriptions and medical devices. The above discussion of the variation in expenditure by disease between countries shows the importance of a complete analysis of both the health care services on the one hand, and disease patterns on the other, in order to be able to explain this variation. Although CVD is still the leading cause of mortality and hospitalisation in all European countries, CVD is no longer the most important expenditure class.

Chapters of ICD give a very rough structure of the disease landscape. It would be interesting for health policy to discuss major diseases such as breast cancer, lung cancer, colorectal cancer, stroke, heart failure, dementia, depression, diabetes, and COPD. It would be informative to look beneath the level of chapters and compare expenditure on specific diseases with the epidemiological data across countries. HEDIC does not advocate the use of prevalence data at this stage. It is too

[11] The International Short List of Hospital Morbidity Tabulation (ISHMT) provides a useful categorisation of ICD groupings for more detailed analysis of some diseases that many countries can work with. This can be used for further comparisons.

problematic to get comparable prevalence data. Ongoing work on disease accounts should take close account of Eurostat's work on the development of morbidity statistics, which has considered the use of prevalence data in depth.

Chapter summary

- HEDIC uses the International Classification of Diseases (ICD) of the World Health Organisation (WHO) at the (22) Chapter level in the attribution of health care expenditure according to disease.
- Other studies cited in this chapter which have made international comparisons of expenditure by disease show rather similar shares of total health care spending by chapters of disease, among developed countries. Our initial comparisons among HEDIC countries do not confirm this result, perhaps because those studies excluded countries in Eastern Europe. Some variation might be explained by differences in exclusion or inclusion of specific functions and providers.
- After considering deviations from the standard structure, three major disease categories are analysed: cardiovascular disease, neoplasms and mental health.
- Expenditure by disease (for 22 ICD chapters) in 2013 (2012 for 6 countries) is presented. The growth rate from 2012 to 2013 on expenditure by disease is examined for six countries.
- Expenditure on CVD based on analysis of the HPDS is compared to estimates from the European Heart Network.
- HPDS data on cancer costs is compared with cost estimates for 27 European countries published by Luengo-Fernandez et al in 2013. Both sets of estimates show wide inter-country variation.
- HPDS data on mental disease costs is compared with data published by Gustavsson et al in 2011; and similarly wide variation is seen in both sets of estimates. Analysis below ICD chapter level may be necessary to explain some of this variation.
- Comprehensive approach is useful and preferable as compared to a single disease approach. Whether to focus further on specific expensive and/or high-volume diseases, or pursue the comprehensive approach beneath the 22 chapter level may be an issue for individual countries to pursue in their own disease accounts. Further discussion is needed of how to allocate screening costs, costs of episodes recorded as 'no symptoms', how to distribute non-allocated expenditure
- Expenditure trends by disease need further estimates and elaboration as do sex differences by disease.
- It would be desirable to include more countries in order to be able cluster countries with similar approaches to health system organisation and financing.
- Outlook: The international variation in expenditure by disease evidenced in the HPDS and in published studies shows the importance of a complete analysis of both health care services on the one hand, and disease patterns on the other, preferably at a less aggregated level than ICD chapters, in order to be able to explain this variation. Although cardiovascular disease is still the leading cause of mortality and hospitalisation in all European countries, CVD is no longer the most important expenditure class.

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6 Health system characteristics

Dimensions of health systems considered in SHA

The three core dimensions of SHA describe differences of health systems by financing, provision and functions. The compilation of HEDIC data is flexible in relation to these three dimensions, to enable countries to use the most appropriate data, including data outside the ESS. However, the compilations show major similarities in the share of expenditure on pharmaceuticals and inpatient care by diseases among countries. The challenge is to distinguish between absolute differences in expenditure on diseases in different countries, and those differences which are artefacts of the data available for measuring potential differences. We will focus on the two areas of pharmaceuticals and inpatient care and pharmaceuticals, in discussing the possible impact of health system design on the distribution of expenditure.

Inpatient care

This subsection will add further information to the data on variation in expenditure by disease, by describing health expenditures on inpatient care[12]. This will add to reporting on non-expenditure data on inpatient care, which is already part of the ESS.

Across EU Member States, the main conditions leading to hospitalisation in 2012 were circulatory diseases, pregnancy and childbirth, injuries and other external causes, diseases of the digestive system, respiratory diseases and cancers.

If we focus on inpatient care and compare mental health spending to the other main ICD categories, we can see that for a larger group of EU countries spending on mental illness accounts for between 5% and 19% of total inpatient expenditures, typically below circulatory diseases and cancer (Table 9). It should be borne in mind that differences in the level of inpatient spending can reflect the organisation of a country's health care system and specific policies related to the treatment of mental health care. For example, variations between the countries in the way services are provided, differences in the boundaries of spending (e.g. between health and social care), and differences in included expenditures (e.g. excluding or including pharmaceutical spending) can create difficulties in interpreting any apparent variation in levels of expenditure.

Table 9 shows health expenditure on inpatient care by disease chapters as percentage of total inpatient care in the year 2013. The variation of health expenditure between countries can be

[12] Here including day cases; however the definition of day cases in practice may vary and might be included in some countries in outpatient care.

influenced by a number of factors, including demographic structure and disease patterns, as well as institutional arrangements and clinical guidelines for treating different diseases.

Circulatory diseases account for the highest share of inpatient spending in eleven countries (Bulgaria, Czech Republic, Germany, Estonia, Greece, Latvia, Lithuania, Austria, Slovenia, Finland and Sweden). Expenditures for cancer treatment take highest position in Hungary and mental diseases in the Netherlands (see Table 9). When interpreting the results particular attention has to be given to organisational issues such as the organisation of long-term care.

Table 9: Health expenditure on inpatient care by diseases as percentage of allocated inpatient care in 2013
(%)

ICD 10	Description	BG	CZ	DE	EE	EL	LV	LT	HU	NL	AT	SI	FI	SE(1)
I	Infectious	2.2	2.6	2.2	3.0	1.3	3.9	4.0	1.5	1.1	2.2	3.0	3.2	2.7
II	Neoplasms	10.6	8.3	10.7	9.2	12.4	9.4	11.6	21.4	11.8	15.5	16.1	11.6	11.2
III	Blood	0.7	0.6	0.5	0.8	1.5	0.3	0.6	0.8	1.1	0.5	0.7	0.7	0.7
IV	Endocrine	2.8	2.1	2.1	1.9	2.7	1.0	1.6	2.1	1.4	2.2	2.1	1.6	2.0
V	Mental	2.5	8.6	13.4	7.4	7.1	11.5	9.5	4.9	20.1	7.1	5.7	9.0	10.0
VI	Nervous	2.5	3.5	3.6	2.4	2.9	4.2	2.3	2.7	8.0	3.2	2.6	4.5	2.9
VII	Eye	2.8	0.8	1.2	0.6	2.7	2.8	1.9	3.1	0.0	2.6	0.7	1.3	0.4
VIII	Ear	1.1	0.3	0.6	0.5	0.3	1.6	0.4	0.6	0.0	0.7	0.3	0.4	0.4
IX	Circulatory	25.0	24.1	15.8	24.8	16.3	24.5	24.6	19.4	14.5	16.9	17.1	17.3	17.6
X	Respiratory	8.1	7.5	5.0	5.4	5.7	4.2	7.8	4.9	3.5	5.4	7.3	5.9	6.2
XI	Digestive	11.1	7.2	7.2	6.9	5.8	5.6	6.8	5.4	4.6	7.8	7.0	7.2	7.3
XII	Skin	1.7	0.9	1.2	0.9	0.7	0.7	1.4	1.6	1.4	0.9	0.9	0.9	0.8
XIII	Musculoskeletal	5.6	6.7	10.1	7.2	9.1	7.5	6.8	11.4	7.2	10.6	9.2	8.0	7.0
XIV	Genitourinary	9.4	3.8	3.8	3.7	9.5	4.8	4.8	5.7	5.7	5.0	4.5	4.2	3.8
XV	Pregnancy	4.0	3.0	3.5	4.9	7.2	5.9	4.6	3.1	3.9	3.8	5.5	4.6	4.9
XVI	Perinatal	0.5	3.3	0.7	1.8	2.0	1.7	2.1	2.1	0.3	1.7	1.3	2.6	2.5
XVII	Congenital	0.8	0.8	0.4	1.0	0.5	1.2	1.0	0.7	0.6	0.9	0.8	1.4	1.3
XVIII	Symptoms	0.6	2.0	7.4	3.9	4.3	0.1	0.3	1.7	3.1	2.4	2.4	3.4	4.5
XIX	Injury	0.0	8.7	7.9	7.1	5.7	9.0	7.4	6.9	4.8	10.3	9.6	10.9	10.9
XX	External	2.9	0.0	0.0	0.0	0.3	0.0	0.0	0.0	7.0	:	0.0	0.0	0.0
XXI	Factors	5.1	5.3	2.8	6.6	1.9	0.2	0.7	0.0	0.0	0.2	3.3	1.2	2.9
XXII	Special	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Not allocated	25.9	7.0	3.0	1.2	20.7	0.0	0.0	2.5	6.5	:	0.0	0.0	0.0

(1) 2012 instead of 2013
(:) not available

Due to coding practices, part of inpatient expenditure in Table 9 may be allocated to ICD10 chapter 21 instead of the particular organ system related chapter. Notably, this applies to chapters 2, 13, 14, and 15.

Table 10: Volume of inpatient care in 2013
(%)

ICD 10	Description	BG	CZ	DE	EE	LV	LT	HU	AT	SI	SE(1)
		case	day	case	case	day	case	day	case	case	case
I	Infectious	2.2	2.5	2.8	4.0	6.3	3.8	1.5	2.2	3.6	3.0
II	Neoplasms	7.1	7.4	9.8	11.9	9.3	9.5	8.6	15.1	10.2	7.7
III	Blood	0.8	0.5	0.7	0.9	0.5	0.7	0.7	0.8	1.4	0.9
IV	Endocrine	3.4	2.5	2.5	2.0	1.6	1.5	4.7	2.2	2.2	2.2
V	Mental	2.4	16.8	8.0	6.4	26.7	5.0	5.1	4.8	3.0	7.4
VI	Nervous	3.6	4.6	3.8	3.6	2.6	3.5	2.4	4.2	2.9	3.0
VII	Eye	3.2	0.4	1.6	0.8	0.3	3.9	4.6	6.9	1.4	0.6
VIII	Ear	1.6	0.4	0.7	0.8	0.4	0.8	2.5	0.9	0.4	0.6
IX	Circulatory	14.1	16.5	14.8	18.2	13.8	18.9	9.3	11.2	12.0	14.7
X	Respiratory	10.2	6.5	6.2	8.9	8.0	9.8	5.4	5.6	8.5	7.0
XI	Digestive	8.7	5.9	8.9	8.4	5.1	8.7	3.8	8.6	7.9	7.7
XII	Skin	2.0	1.4	1.4	2.0	1.2	2.0	3.4	1.3	1.5	0.8
XIII	Musculoskeletal	5.3	6.6	10.6	6.5	8.3	7.1	20.9	9.9	6.5	6.0
XIV	Genitourinary	7.2	3.9	4.8	5.5	2.9	7.3	7.9	6.0	7.0	4.8
XV	Pregnancy	6.2	3.2	4.4	8.8	4.1	6.4	2.2	4.4	9.0	8.7
XVI	Perinatal	1.0	0.9	0.8	1.5	1.0	1.6	0.4	0.5	1.3	1.0
XVII	Congenital	0.3	0.3	0.5	0.9	0.7	0.8	0.6	0.7	1.1	0.7
XVIII	Symptoms	0.7	2.5	4.9	1.1	0.1	0.7	5.1	4.1	4.9	9.8
XIX	Injury	0.0	8.4	9.4	6.8	6.8	6.3	10.8	9.8	9.2	9.8
XX	External	5.1	0.0	0.0	:	0.0	0.0	0.0	0.0	0.0	0.0
XXI	Factors	14.7	8.8	3.4	1.0	0.2	1.7	0.0	0.7	6.0	3.9
XXII	Special	0.0	0.0	0.0	0.0	0.0	0.0	11.8	0.0	0.0	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) 2012 instead of 2013
(:) not available

Except for Austria, Bulgaria, Czech Republic, Hungary, and Latvia, the highest volume of inpatient care is reported in the chapter circulatory diseases (see Table 10). Clearly the allocation depends on the measurement of the volume of inpatient care. Four of ten countries (Czech Republic, Hungary, and Latvia) use day units as the volume measure, six countries (Bulgaria, Germany, Estonia, Lithuania, Sweden and Slovenia) use episodes as the measure of volume.

Table 11: Relative unit cost on inpatient care in 2013
(country average = 100)

ICD 10	Description	BG	CZ	DE	EE	LV	LT	HU	AT	SI	SE(1)
		case	day	case	case	day	case	day	case	case	case
I	Infectious	101.9	102.8	80.2	74.6	61.8	71.2	101.4	101.7	83.4	90.8
II	Neoplasms	148.7	112.1	109.5	77.0	101.0	121.9	248.2	102.3	157.5	145.8
III	Blood	92.0	114.0	81.1	89.0	52.5	84.9	115.1	63.7	50.5	80.0
IV	Endocrine	81.1	81.0	81.4	92.5	58.6	102.0	44.0	99.5	96.2	89.8
V	Mental	106.0	51.3	167.9	115.1	43.2	174.0	96.6	147.9	191.7	135.6
VI	Nervous	68.5	74.9	95.3	66.5	158.1	64.8	112.6	76.0	87.1	96.5
VII	Eye	86.6	188.9	80.1	81.1	970.0	48.6	67.1	37.2	51.0	64.2
VIII	Ear	65.4	74.4	80.6	53.6	372.3	48.8	23.4	71.5	68.5	73.8
IX	Circulatory	177.2	146.2	106.2	136.5	176.8	129.8	207.9	150.8	142.4	120.4
X	Respiratory	79.5	116.5	81.1	60.2	52.5	78.9	90.4	97.4	85.7	89.3
XI	Digestive	126.9	122.8	80.2	82.3	110.6	101.3	141.7	91.1	88.2	94.3
XII	Skin	84.4	62.6	81.3	44.1	60.7	70.1	46.7	68.9	56.3	100.5
XIII	Musculoskeletal	106.6	102.3	94.5	111.1	90.1	95.4	54.8	106.9	141.6	116.0
XIV	Genitourinary	129.8	96.6	80.1	68.3	164.7	65.2	71.9	82.3	64.4	80.5
XV	Pregnancy	63.7	96.6	80.0	56.1	143.6	71.4	144.0	85.9	61.4	56.9
XVI	Perinatal	52.0	350.7	80.0	121.3	175.1	135.4	475.0	366.1	99.2	243.9
XVII	Congenital	268.6	251.3	80.8	114.4	171.9	133.7	107.9	143.4	78.0	195.0
XVIII	Symptoms	79.5	79.8	150.0	357.7	57.4	48.1	33.3	57.5	48.9	45.6
XIX	Injury	:	104.2	84.1	104.4	133.1	117.6	64.0	105.5	105.3	111.8
XX	External	57.4	333.8	:	:	76.6	0.0	16.1	:	:	:
XXI	Factors	35.0	60.2	83.1	636.0	114.8	49.0	:	35.8	54.2	73.7
XXII	Special	:	:	:	:	:	:	17.5	:	:	:
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) 2012 instead of 2013
(:) not available

The relative unit cost in Table 11 is derived from Table 9 and from Table 10. It is calculated by dividing inpatient expenditures by volumes and standardization on the national average.

There are some outliers in Table 11 which need further investigation.

A further insight into the structure of inpatient care is provided in Figure 4. The relevant data are derived from Table 9 for the two years 2013 and 2012. The figure shows the deviation of growth of spending on inpatient care by disease from national average as percent. For example, in Austria expenditures for endocrine and skin diseases decreased relatively as compared to the national average. Expenditures for diseases on eye and factors influencing health status and contact with health services increased relatively more than the national average. There is not a uniform reduction or increase of expenditures by diseases across countries. Expenditures for respiratory diseases, e.g. increased relatively more than the national average in Austria, Czech Republic, Germany, and Greece, while they decreased in Bulgaria and Slovenia.

Figure 4: Deviation of growth rate of spending on inpatient care by disease from national average, 2012/2013
(%)

ICD 10	Description	AT	BG	CZ	DE	GR	SI
I	Infectious	-1.1	-15.6	-3.7	3.1	-0.2	-2.7
II	Neoplasms	2.1	1.9	-0.8	-1.2	0.1	4.1
III	Blood	1.6	-1.4	0.1	1.5	-0.7	1.3
IV	Endocrine	-5.1	-0.5	1.4	0.4	0.1	-1.1
V	Mental	-1.0	39.5	-0.6	0.9	6.0	-2.0
VI	Nervous	1.5	4.8	-1.1	1.5	4.5	8.4
VII	Eye	3.6	4.8	-2.0	-1.4	2.0	-2.0
VIII	Ear	1.0	3.0	3.5	0.5	0.8	17.5
IX	Circulatory	-0.6	0.3	-3.1	-1.8	0.0	-4.5
X	Respiratory	2.7	-1.9	5.8	6.9	0.4	-0.1
XI	Digestive	0.8	-0.5	-0.7	1.7	0.9	-9.8
XII	Skin	-6.6	0.8	-3.3	3.0	2.0	-10.9
XIII	Musculoskeletal	-1.4	10.4	0.3	-3.6	-2.0	11.2
XIV	Genitourinary	-0.5	-1.3	2.2	-1.0	-4.9	-0.9
XV	Pregnancy	-1.3	-3.9	1.3	0.7	0.8	10.1
XVI	Perinatal	1.7	-19.2	4.3	-0.1	-5.9	-30.8
XVII	Congenital	-2.1	-0.8	-0.8	-1.5	2.4	-10.3
XVIII	Symptoms	1.5	3.0	-9.6	1.5	0.3	2.9
XIX	Injury	-1.3	0.0	1.0	-0.1	0.6	-0.7
XX	External	0.0	-0.1	0.0	0.0	-0.3	0.0
XXI	Factors	6.9	-12.8	11.0	0.3	0.8	11.4
XXII	Special	:	:	:	:	:	:

Ann.: Please note that the national growth rate for the health care activity *j* varies across countries. The deviation $w_{dj} - w_j$ between the growth of the disease specific expenditures w_{dj} and the growth on average w_j allows comparing the structural change of the disease expenditure across countries.
(:) not available

Pharmaceuticals

This subsection will add further information on variation by disease by describing health expenditures on pharmaceuticals. Many countries do not have accurate outpatient medication data by disease. On the other hand all MS classify pharmaceutical expenditures by the Anatomical-Therapeutic-Chemical Classification System (ATC) which divides drugs into different groups according to the organ system on which they act and/or their therapeutic, pharmacological and chemical characteristics[13]. One main challenge in estimating pharmaceutical expenditure by disease is being able to derive an allocation key which links this expenditure classified by ATC codes to specific disease categories. While many countries have the necessary data on expenditures in the pharmaceutical sector, they lack the appropriate utilization key, or an appropriate mapping from ATC to ICD code that is required to allocate the expenditures by disease. Without such data, several options are available:

- Derive a general, or average, mapping by developing a consensus based on a detailed ATC structure.
- Derive a general, or average, mapping based on the national samples of prescriptions.
- Derive a general, or average, mapping based on the data that is currently collected by IMS.
- Use the country-specific data that IMS collects in the 24 OECD countries. Under this option there further exists the option of using IMS data on expenditures or the available national data.

[13] ATC codification is recommended by the WHO 2011.

The HEDIC Manual discusses the transition from ATC to ICD with their results and pros and cons. It should be noted that the results below are the first results of the application of these transition tables. Further investigation is needed to fully explain the variation between disease classes and countries because differences in, which drugs are authorized for which indications, whether they are reimbursed, and by which financing agencies, all need to be taken into account.

Table 12: Expenditure on pharmaceuticals by diseases as percentage of allocated pharmaceutical expenditure in 2013
(%)

ICD 10	Description	CZ	DE	EL	LV	LT([1])([2])	HU	NL([2])	SI
I	Infectious	2.7	3.3	2.4	6.7	3.4	3.2	2.6	2.8
II	Neoplasms	6.3	17.5	19.7	15.0	11.3	13.7	5.6	10.6
III	Blood	0.2	2.5	1.0	2.3	2.2	4.7	0.6	2.3
IV	Endocrine	13.5	10.2	18.6	21.5	7.4	17.7	10.7	8.0
V	Mental	8.1	10.5	10.2	3.7	6.9	9.8	4.0	9.5
VI	Nervous	5.7	8.7	4.2	7.6	5.6	8.0	20.6	6.5
VII	Eye	1.8	2.0	0.9	3.0	6.8	1.3	:	1.8
VIII	Ear	0.3	0.1	0.1	0.0	1.3	0.1	:	0.3
IX	Circulatory	28.0	18.8	19.5	19.7	28.2	14.9	11.2	26.1
X	Respiratory	11.0	9.7	7.2	6.0	7.4	10.2	10.4	7.2
XI	Digestive	5.2	5.3	4.9	0.4	2.7	3.3	4.1	4.5
XII	Skin	1.0	2.3	0.6	0.3	1.8	0.8	3.7	2.7
XIII	Musculoskeletal	4.9	4.9	4.4	3.7	4.3	3.5	10.3	8.6
XIV	Genitourinary	4.5	3.4	2.9	5.3	3.3	1.4	6.6	5.7
XV	Pregnancy	0.1	0.0	0.0	0.0	1.3	0.0	0.3	0.2
XVI	Perinatal	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0
XVII	Congenital	0.0	0.0	0.0	0.2	1.0	0.3	0.1	0.0
XVIII	Symptoms	0.0	0.0	0.0	0.0	1.8	2.0	8.5	0.0
XIX	Injury	0.0	0.7	0.0	0.1	1.1	0.1	0.6	1.0
XX	External	0.0	0.0	0.0	0.0	0.0	0.0	:	0.0
XXI	Factors	1.8	0.1	3.6	4.5	0.0	4.7	:	2.4
XXII	Special	0.0	0.0	0.0	0.0	1.8	0.1	:	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Not allocated	4.7	0.0	0.0	0.0	0.0	0.0	11.4	0.0

([1]) 2014 instead of 2013
([2]) not only pharmaceuticals but including other medical goods
(:) not available

The rather low percentages of pharmaceutical expenditures for neoplasms in the case of Czech Republic and the Netherlands probably reflect differences in reimbursement mechanisms, because some costs may be hidden in hospital or ambulatory care.

In the case of Czech Republic, the “4.7 percent not allocated” contains expenditure on antibiotics, so chapters 1, 10, 14 may actually slightly increase. In the case of Netherlands 11.4 percent could be not allocated.

Prescription patterns may vary across countries for various reasons including, drug availability, clinical and prescribing guidelines, and cultural influences. In addition, there may be large variations over time for some pharmaceuticals – for example, this becomes apparent in examining the Netherlands time series.

A further insight into the structure of pharmaceutical spending is given by Figure 5. The relevant data are derived from Table 12 for the two consecutive years 2012 and 2013.

The growth of pharmaceutical spending is influenced by several factors. The economic crisis has had a significant effect on this expenditure in many European countries. Regulation has slowed down growth in pharmaceutical spending in many European countries in recent years. Price reductions and a growing share of the generic market have even contributed to negative spending rates.

Figure 5: Deviation of growth of pharmaceutical spending from national average, 2012/2013
(%)

ICD 10	Description	CZ	DE	GR	SI
I	Infectious	14.2	-0.9	-2.5	6.5
II	Neoplasms	-12.6	4.8	-6.3	7.5
III	Blood	7.0	9.2	16.9	2.3
IV	Endocrine	-0.7	-1.1	12.8	0.8
V	Mental	-13.6	-4.1	-4.7	-6.5
VI	Nervous	2.3	-0.2	-7.8	-2.4
VII	Eye	1.7	5.6	-1.9	-1.9
VIII	Ear	-4.3	-4.1	25.4	-7.7
IX	Circulatory	-4.0	-2.0	2.5	-0.3
X	Respiratory	-1.7	0.3	2.2	-1.2
XI	Digestive	-10.5	-0.9	0.0	-4.5
XII	Skin	-3.1	2.2	-46.0	7.9
XIII	Musculoskeletal	-9.8	-0.7	-8.5	3.1
XIV	Genitourinary	-5.6	-2.5	9.2	-1.7
XV	Pregnancy	3.3	-0.9	:	:
XVI	Perinatal	:	:	:	:
XVII	Congenital	:	-0.4	:	:
XVIII	Symptoms	:	-0.4	:	:
XIX	Injury	:	-4.8	-8.2	16.6
XX	External	:	:	:	:
XXI	Factors	-15.3	-1.0	2.6	-7.8
XXII	Special	:	:	:	:

Ann.: Please note that the national growth rate for the health care activity *j* varies across countries. The deviation $w_{dj} - w_j$ between the growth of the disease specific expenditures w_{dj} and the growth on average w_j allows comparing the structural change of the disease expenditure across countries.
(:) not available

Figure 5 shows the deviation of growth of spending on pharmaceutical spending by disease from national average as percent. For example, in Czech Republic expenditures for neoplasms and mental diseases decreased relatively less as compared to the national average, while spending on drugs for infectious diseases increased relatively more than the national average. In the four countries, which could provide these data, only in the case blood diseases one could observe a uniform increase across countries.

A significant proportion of total pharmaceutical spending is covered by private sources, notably household spending on Over-the-Counter medicines. Detailed information linking private out-of-pocket spending to disease, age and gender categories is limited. In some countries, the pharmaceutical market is characterized by a high number of new products. Both new products and changes in the prescribing patterns contribute to variations in consumption by age groups.

Table 13: Volume of pharmaceuticals in 2013
(%)

ICD 10	Description	CZ	DE	LV	LT(1)	HU	SI
	Units	package	DDD	prescription	prescription	prescription	DDD
I	Infectious	1.0	0.5	0.3	0.2	1.3	1.6
II	Neoplasms	3.9	1.5	1.9	2.0	0.8	4.7
III	Blood	0.7	1.6	0.0	0.3	0.7	0.6
IV	Endocrine	7.5	14.8	14.4	8.4	13.0	3.7
V	Mental	8.6	5.2	4.8	7.4	5.5	9.4
VI	Nervous	3.6	2.7	3.0	4.2	2.4	2.1
VII	Eye	2.5	1.9	3.6	4.1	1.5	4.0
VIII	Ear	0.5	0.1	0.0	0.2	0.5	0.7
IX	Circulatory	37.4	47.5	58.8	56.4	41.0	30.3
X	Respiratory	7.9	5.2	5.2	8.4	9.6	8.1
XI	Digestive	5.2	7.7	0.5	1.0	5.7	7.0
XII	Skin	2.9	1.6	0.4	0.9	2.7	4.4
XIII	Musculoskeletal	7.2	5.3	2.3	3.1	7.9	8.0
XIV	Genitourinary	3.4	4.1	2.0	2.4	2.3	8.4
XV	Pregnancy	0.3	0.0	0.0	0.0	0.1	0.3
XVI	Perinatal	0.0	0.0	0.0	0.0	0.1	0.0
XVII	Congenital	0.0	0.1	0.0	0.0	0.0	0.0
XVIII	Symptoms	0.0	0.0	0.0	0.1	2.5	0.0
XIX	Injury	0.0	0.2	0.1	0.0	0.6	4.5
XX	External	0.0	0.0	0.0	0.0	0.1	0.0
XXI	Factors	0.3	0.0	2.6	0.8	1.7	2.1
XXII	Special	7.2	0.0	0.0	0.0	0.3	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0

(1) 2014 instead of 2013; not only pharmaceuticals but including other medical goods.

Two of six countries use DDD as the volume unit for the allocation of pharmaceuticals by disease (Germany and Slovenia). The Czech Republic uses packages, and Hungary, Latvia and Lithuania use prescriptions, as the volume unit. Table 13 shows clearly the importance of pharmaceuticals for the treatment of circulatory diseases.

The relative unit cost in Table 14 is derived from Table 12 and from Table 13. The relative unit cost is calculated by dividing pharmaceutical expenditures by volumes and standardization on the national average. As compared to these national averages, Table 14 shows a broad variation of pharmaceutical prices, presumably strongly influenced by the organisational structures of the health system.

Further insight may be gained by comparing chapters within the prescribed medicines, and the distribution of pharmaceuticals by age and sex.

Table 14: Relative unit cost of pharmaceuticals in 2013
(country average = 100)

ICD 10	Description	CZ	DE	LV	LT(1)	HU	SI
		package	DDD	prescription	prescription	prescription	DDD
I	Infectious	281.3	639.6	2 334.0	1 134.0	253.5	169.6
II	Neoplasms	161.0	1 141.6	807.4	724.0	1 814.4	224.7
III	Blood	36.5	150.5	24 722.2	1 385.0	721.2	356.4
IV	Endocrine	181.6	68.9	149.3	129.0	136.5	218.4
V	Mental	94.3	201.1	76.7	104.0	180.4	101.4
VI	Nervous	158.2	326.9	248.3	179.0	331.7	313.3
VII	Eye	70.0	104.4	83.0	85.0	88.4	45.1
VIII	Ear	64.4	201.1	18.7	23.0	18.1	38.9
IX	Circulatory	74.9	39.7	33.6	58.0	36.3	86.2
X	Respiratory	138.4	186.8	114.5	85.0	106.0	88.4
XI	Digestive	99.9	68.6	75.9	68.0	59.0	64.8
XII	Skin	33.7	144.5	63.7	62.0	28.4	60.4
XIII	Musculoskeletal	68.0	92.4	156.5	73.0	44.1	107.0
XIV	Genitourinary	130.7	82.4	265.1	103.0	61.0	67.8
XV	Pregnancy	35.9	66.3	232.3	127.0	41.7	47.6
XVI	Perinatal	:	:	:	76.0	89.6	:
XVII	Congenital	:	59.1	9 868.7	1 353.0	758.1	:
XVIII	Symptoms	14.5	73.6	:	51.0	79.7	:
XIX	Injury	:	376.1	121.7	32.0	22.6	21.4
XX	External	:	:	:	51.0	23.3	0.0
XXI	Factors	663.0	349.7	171.9	168.0	275.6	112.9
XXII	Special	0.0	:	88.3	393.0	41.0	0.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0

(1) 2014 instead of 2013; not only pharmaceuticals but including other medical goods.
(:) not available

Outlook

Pharmaceutical expenditure covers spending on prescription medicines used in ambulatory care, and self-medication which latter is often referred to as over-the-counter products. Not included are the costs of medicines used in hospitals as these are captured in estimates of inpatient spending. Obviously pharmaceuticals are an essential part of treatment patterns for most disease groups. Work to develop further the methodology for classifying pharmaceutical expenditure is ongoing and is a key aspect of developing the methodology for compiling disease accounts.

Chapter summary

- The HPDS compilations show major similarities in the share of expenditure on pharmaceuticals and inpatient care by diseases among countries. The challenge is to distinguish between absolute differences in expenditure on diseases in different countries as result morbidity and organisation of the health care systems on the one hand, and those differences which are results of coding practices and compilation procedures.
- Data from the HPDS are presented for inpatient care by disease, in terms of expenditure, volume and unit costs, and approaches to forecasting the future development of these costs. Possible reasons for variation between countries in inpatient expenditure for specific disease groups are discussed. These may include demographic structure and disease patterns, institutional arrangements (e.g. the extent to which day surgery is used) and clinical

guidelines for treating different diseases.

- All MS classify pharmaceutical expenditures by the Anatomical-Therapeutic-Chemical Classification System (ATC) which divides drugs into different groups according to the organ system on which they act and/or their therapeutic, pharmacological and chemical characteristics.
- While many countries have the necessary data on expenditures in the pharmaceutical sector, they lack the appropriate utilization key, or an appropriate mapping from ATC to ICD code that is required to allocate the expenditures by disease. Four methods are proposed which countries may use in the absence of such a utilisation key.
- Further work is needed to check the inter-country validity of bridging tables.
- In interpreting inter-country differences in pharmaceutical spend by disease, differences in, which drugs are authorized for which indications, whether they are reimbursed, and by which financing agencies, all need to be taken into account.
- Data from the HPDS are presented on expenditure on pharmaceuticals by disease as a percentage of total pharmaceutical expenditure in 2013; and on the volume and unit cost of pharmaceuticals by disease.
- Change in the level of pharmaceutical expenditure by disease between 2012 and 2013 is presented for the Czech Republic, Germany, Greece, and Slovenia.
- Outlook: Work to develop further the methodology for classifying pharmaceutical expenditure is ongoing and is a key aspect of developing the methodology for compiling disease accounts.

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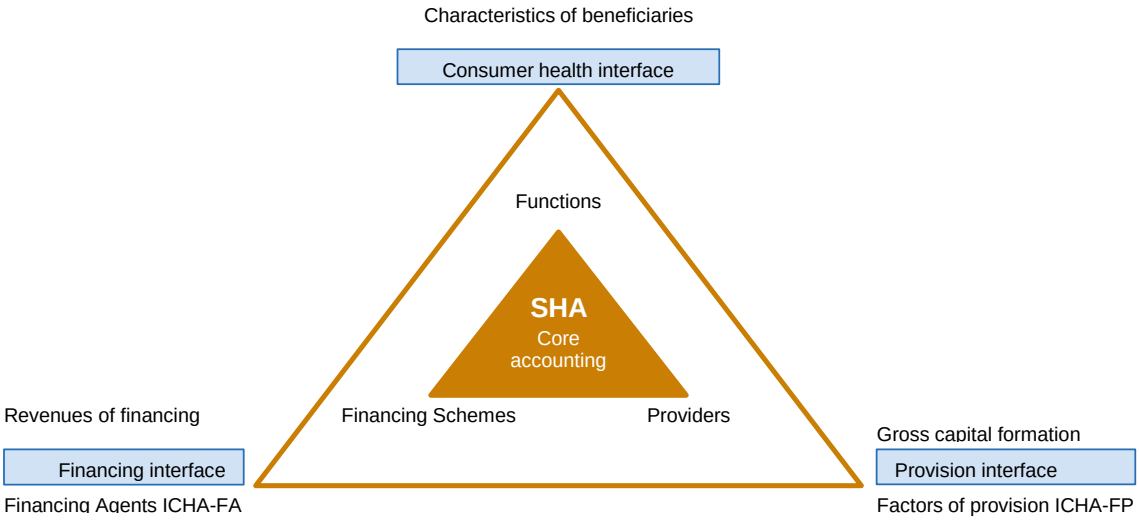
7 Developing the statistical system of HEDIC

Dimensions of the HEDIC statistical system

HEDIC requires data from sources provided by various statistical organisations, in general in the public domain of a country. As has been shown in earlier chapters, HEDIC provides additional information for comparing health expenditure. As described in the SHA 2011 manual, accounting of health expenditures by disease expands the consumer interface, as shown in Figure 6 below. The HEDIC project has concentrated on several important aspects of these accounts. The efficiency and operability of HEDIC depends very much on the successful integration of the additional dimensions of health expenditures by age, sex and disease in the SHA compilation process.

Figure 6: Interfaces of the accounting framework of SHA 2011



Source: SHA 2011.

Each of the three core dimensions (functions, provision, and financing) of SHA provides interfaces to further breakdowns or dimensions. The interface related to the consumer is different in nature from the other two interfaces. The aim of developing the consumer health interface is to provide more detailed information on health care expenditure in relation to the uses and beneficiaries of the health care system. The distribution of health care expenditure by patient characteristics (e.g. age, sex, socioeconomic status or diseases/condition of beneficiaries), population morbidity (incidence or prevalence of diseases), and its burden both in monetary and non-monetary terms, can give health care policy makers important information for re-designing health care priorities and re-allocating available resources. While information derived from the consumer health interface can be used as an input to priority setting, the information from either the financial or the provision interfaces gives insights into the type and level of resources available. Accordingly, information on the revenues of

the financing schemes, on health care exports and imports (external trade), on the cost of inputs used in health care provision or, importantly, information on capital formation, education, training, and research in the health sector, can provide further support to decisions on changes in the allocation of health care sector resources.

In this chapter we discuss whether HEDIC would also improve the compilation and comparison of the three core tables of SHA. It is suggested that HEDIC has the potential to improve the international comparability of health expenditures among MS. It fulfils the important requirement of enabling age-gender standardization of health expenditures.

Comparability

Including information on expenditure by disease, age and gender in SHA has the potential to improve the international comparability of SHA, by improving the three core tables of SHA, for the following reasons:

- Countries will interrogate their data sources more thoroughly in order to compile these additional dimensions, thereby leading to improvements in the quality of the SHA compilations, and, in some cases, an increase in the number of data sources used[14].
- We will gain a better understanding of different levels of spending by function, if we know the age profile of the users of services in different countries. For example there are some important inter-country differences in the age of users of long-term care.

Standardization

Why is standardization necessary? The level of health expenditure varies considerably by age as we have shown in chapter 0. Standardization seeks to provide numbers and comparisons that minimize the influence of age. The *direct method of standardization* applies the same set of weights to the age-specific expenditures. The age-adjusted expenditure rate is therefore independent of differences in the age distribution of two countries. In direct standardization, the country provides the expenditure profiles and the European standard population (see Eurostat 2013) provides the weights. In *indirect standardization*, the European average provides the profiles and the country population provides the weights.

Age standardization is one of the key methods to control for different age distributions among populations or over time. Without knowledge of expenditures by age of each country, only indirect standardisation of health expenditures per capita is possible using the European standard profile. Preliminary compilations of age-standardized health expenditures show considerable shifts in the standardised expenditures as compared to the non-standardized expenditures. The interpretation of these figures needs further discussion.

Data needs

The distribution of expenditure items by disease requires the use of information from different data

[14] For example one central statistical agency commented that working on HEDIC has: improved the co-operation with its main data provider, a health insurance fund; enabled a better overview of the HC-HP correlation; improved its understanding of the background of the health care system; helped the clarification of several methodological issues (mainly concerning the HP classification); and resulted in the last 2-3 years in increasing interest from policy makers and private experts in both SHA and expenditure on diseases.

sources. Any distribution used in compiling HEDIC will inevitably be based on the ICD system, as it serves as a unique reference point for international classification to which almost all other international and national classifications are mapped (or can potentially be mapped). All EU Member States support the use of ICD in coding health service data.

For reporting and comparative purposes, an international classification must provide a level of aggregation that is both feasible in a wide range of countries and useful from a policy perspective. This report shows that despite some differences in coding practices, health care records with diagnoses based on ICD 10 can serve for the compilation of HEDIC. Aggregate data on population groups by disease, age, sex, and type of health care activity are sufficient for the compilation.

Summary of progress made in estimating expenditure by disease

HEDIC has explored the possibility of compilation of health expenditures by disease and conditions in a sample of MS with very different data structures in a close link to SHA 2011. In contrast to previous studies, HEDIC abstained from a standardized multidimensional approach, thereby giving countries more flexibility to adapt the method to the national data environment.

For more countries than hitherto, HEDIC can show costs of diseases by ICD-chapters.

HEDIC has compiled health expenditure profiles by age and sex which allow better projections of future health expenditure.

HEDIC has split health expenditure values of inpatient care and pharmaceuticals into volumes and prices. A close link to non-expenditure statistics has been established.

Practical considerations in compiling HEDIC

While the HEDIC study has demonstrated the general feasibility of collecting data on expenditure by age, sex and disease, any decision to collect such data routinely must also take into account the resources available for doing so within countries, and countries' current intentions and plans for continuing to work in this area. Countries supplying data to the HEDIC project were asked to describe their current plans for work on disease accounts, and to estimate the resources they would need in terms of Full Time Equivalent (FTE) appropriately qualified person(s) working in the organisation with principle responsibility for compiling disease accounts. Twelve of the fourteen the countries who have submitted data for HEDIC stated that they plan to continue work on disease accounts. Estimates of the resources needed for regular compilation of disease accounts in the organisation responsible for this work ranged from 0.25 to 1.9 FTEs. This range reflects the current state of development of disease accounts in different countries, and the level of detail. Two countries in the group will produce disease for disease groupings which are much more detailed than the ICD chapter level.

Other considerations include:

- Possible legal obstacles. Is a new regulation/amendment to the existing regulation on supply of SHA data needed? It is suggested that should a decision be taken to compile disease accounts routinely, the most practical approach would be to amend the existing regulation for supply of SHA 2011 data, at the point at which this regulation is scheduled to be reviewed. Data for purposes of compiling the HEDIC Pilot Data Set have been supplied on the basis of "gentlemen's agreements" between the institutions which collectively hold the data needed to compile HEDIC.
- Capacity to process HEDIC data within Eurostat.

- The importance of maintaining momentum and expertise following the end of the current HEDIC project.

Productivity loss

Indirect cost can be seen as the loss in production/value added as a result of adverse health outcomes. This may be as a result of death, illness or time spent undergoing treatment. The importance of including productivity costs in economic evaluations of treatments has been widely discussed (Krol 2012), and is strongly recommended for certain diseases. Its importance in the case of depression was emphasized by WHO 2003.

Productivity losses vary by population groups. Treatments mainly targeting diseases affecting the elderly are not likely to generate much productivity savings, while interventions that have a strong effect on the productivity of the working population may produce productivity costs that reflect a large part of total disease costs.

The ESS collects already such indicators as “injuries at work” as regular indicator of ECHI. A next step could check the integration of this indicator in the HEDIC accounts.

Outlook

HEDIC has added both characteristics of population groups, and price and volumes, to the standard three-dimensional cube of SHA. Chapter 10 of the SHA 2011 edition introduces the compilation of health expenditure by diseases, as an illustrative example of how SHA data can be used in conjunction with other data sources to further develop health accounts, in this case the allocation of current health expenditure for specific analyses according to classifications of characteristics of individuals. Breakdowns of expenditure by individual characteristics are intended to provide policy-related information on variations in spending between population groups that are differentiated by their characteristics. It is important to note that such data on inequalities in spending do not, by themselves, imply any unfairness in the distribution of expenditure on health between men and women, between different age groups, but merely report current resource allocations, and act as one of the inputs for analysis. It would be fruitful to ask Policy Directorates in the European Commission for their likely use of data generated by disease accounts.

HEDIC enriches the three-dimensional cube of SHA not only by providing information about population groups, but also by the measurement of changes in price and volume within the SHA framework (see Chapter 13 of the SHA 2011 edition). Statistics on volumes are part of the non-health expenditure framework. Volumes and values can be presented by population groups. It is obvious that the close connection between values and volumes is important for understanding differences in spending on sex-specific care such as pregnancy, on disease, and also differences in age-specific allocation of expenditure.

In further developing the HEDIC statistical system these links to non-expenditure statistics should be given special attention.

Chapter summary

- This chapter provides an overview of the dimensions of the HEDIC statistical system.
- Within the accounting framework of SHA 2011, HEDIC expands the information we have about the consumer health interface, as opposed to the provision interface or the provider interface, by expanding information on the beneficiaries of health care. This additional information is useful for policy makers tasked with re-ordering priorities and reallocating

resources.

- The interrogation of data sources needed to compile HEDIC has the potential to improve the quality of these sources for compilation of the core tables, and may expand the number of sources used.
- Detailed understanding of the age profile of service users in different countries will improve our interpretation of inter-country differences in spending by function. For example there is considerable inter-country variation in the age of users of long-term care.
- HEDIC enables age-sex standardisation of health expenditures.
- Countries actively participating in HEDIC described their plans for future development of disease accounts with only two stating that they have no plans to do so.
- Outlook: In further developing the HEDIC statistical system, policy makers need to be explicitly consulted about their likely use of disease accounts data. Links to non-expenditure statistics should be given special attention.

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8 Conclusions

Potential of HEDIC

Fourteen European Member States delivered data for the HEDIC Pilot Data Set, but in different detail and years covered. There are many reasons for these variations which reflect the legal, technical and financial barriers to compiling HEDIC.

Analysis of this data has demonstrated the general feasibility of estimating health expenditures by disease, age and sex in a wide range of national settings and data contexts; and has shown that it has the potential to provide a large amount of information for the analysis of epidemiological and demographic characteristics of health resource allocation in the European health system. It is clear that the analysis presented in this paper could be extended considerably based on the information provided to date; and to a much greater extent with the addition of further years and countries.

By combining data on expenditure by age, sex and disease with that used to produce e.g. indicators compiled for ECHI, or the indicators which will be developed during Eurostat's work to develop morbidity statistics, the utility of these indicators for resource allocation, and assessing the sustainability of health systems, will be enhanced.

Including information on expenditure by disease, age and gender in the regular SHA compilation and data collection has the potential to improve the international comparability of SHA, by improving the three core tables of SHA. For example:

- Countries would need to interrogate their data sources more thoroughly in order to compile these additional dimensions, thereby leading to improvements in the quality of the SHA compilations, and, in some cases, an increase in the number of data sources used.
- We would gain a better understanding of different levels of spending by function, if we have a detailed understanding of the age profile of the users of services in different countries. For example there are some important inter-country differences in the age of users of long-term care.

We will be better placed to understand disease-specific cost-drivers, if we have information on expenditure by disease and age, preferably at a more detailed level than the ICD-chapters[15]. For example, combining information on trends in pharmaceutical costs by disease, and demographic information, is one example of how data on expenditure by age, gender and disease can help to improve the accuracy of health expenditure forecasts[16].

[15] This can contribute to the debate on several issues like the organization of health care coverage and the fiscal sustainability of health systems.

[16] However it should be noted that forecasting the distribution of new medicines by disease is rather difficult because innovations are complex and require long periods of development and implementation (see Toumi, Rémuzat 2012).

Focus of future work

Areas to focus on in future work (in terms of their relative importance in current expenditure and difficulty of measurement to date) include:

- Expanding HEDIC estimates to a lower level of aggregation than the ICD-chapters, enabling investigation of major diseases within chapters, such as lung, breast and colorectal cancer, dementia, depression and mental handicap; stroke vs heart failure, low back pain vs musculoskeletal diseases; asthma/COPD,
- Extending the time series and harmonising with the current SHA data collection
- Bringing other EU countries not currently actively participating in HEDIC into the process of costing illness,
- Comparing European HEDIC data with data being produced by WHO and OECD ongoing work on cost of illness for countries outside Europe,
- Developing guidelines for the process of handling the large volumes of data which disease accounts produce[17],
- Exploring the potential of incorporating HEDIC data in existing indicators such as those compiled for ECHI.

Areas where it may be interesting to expand the HEDIC methodology include

- exploring the potential of using large blended data sets, as in the work done by the US Bureau of Economic Analysis, to account for spending on disease treatments, and develop disease-based price indices,
- further work on using Health Interview Survey data to classify health care expenditure,
- further examination of reproductive health accounts,
- refining the analysis of pharmaceutical expenditure below the level of ICD 10 Chapters,
- extending work on indirect costs, recognising the complexity of valuing lost productivity due to morbidity and mortality.

Incorporation into regular SHA data collection

In order to identify the next practical steps to be taken in order to continue the work of HEDIC, it will be necessary to assess the feasibility and desirability of working towards the general aim of routine collection from all European MS, of data on total current health expenditure allocated to the six dimensions of function, activity, finance, age, sex and disease.

The HEDIC approach is in line with Eurostat's ongoing approach to the modernization of social statistics in that it would meet users' needs in a comprehensive way; would build on existing Eurostat public health statistics, in particular those on expenditure and non-monetary health care and causes of death, and also on morbidity data currently under development and will make better use of different data sources. A key next step in assessing the continuation of HEDIC, will be to assess user

[17] Adding dimensions of age, sex and disease to the SHA dimensions of function, finance and activity will generate a minimum of over 12000 cells in to which each expenditure item could be classified in such a database. The Health Accounts Production Tool (HAPT) developed by WHO is one approach to building and managing such a database. Considerable experience of using this tool is now available in WHO countries working on health accounts, and may be of interest in the production of SHA-based disease accounts in future.

demand for information from disease accounts and to establish priorities.

Chapter summary

- The HEDIC study has demonstrated the general feasibility of estimating expenditures by disease, age and gender in a wide range of national settings and data contexts. HEDIC information has the potential to provide a huge platform for the analysis of epidemiological and demographic characteristics of resource allocation in the European health system.
- It is suggested that HEDIC has the potential to improve comparability of the three core tables of SHA and to help us better understand disease-specific cost drivers.
- Proposals are made for extending the coverage of HEDIC in its present form (including more countries, extending the time series) and for developing the HEDIC methodology further.
- In order to work out what to do next to continue the work of HEDIC, it will be necessary to assess the feasibility and desirability of working towards the general aim of routine collection from all European MS, of data on total current health expenditure allocated to the six dimensions of function, activity, finance, age, sex and disease.This should include adding information on these dimensions to existing indicators such as those collected under ECHI; and those which will be developed under Eurostat's work to develop morbidity indicators.

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9 Annexes

Glossary

Defined Daily Dose (DDD): is the assumed average maintenance dose per day for a drug used for its main indication in adults. DDDs are assigned to each active ingredient(s) in a given therapeutic class by international expert consensus. DDDs can be aggregated within and across therapeutic classes of the Anatomic-Therapeutic Classification (ATC).

Diagnostic Related Groups (DRGs): By means of specially designed software hospital patients are grouped into a certain number of categories based on their main diagnosis, clinical procedure codes, gender, age, and the presence of complications and bi-diagnosis. The grouping procedure starts out by categorising patients Major Diagnostic Categories (MDCs) according to their main diagnosis. Subsequently, separation is made between medical and surgical cases. The resulting DRGs are assumed to be categorised in a way so that each group is homogenous with respect to clinical and economic resource requirements.

Premature retirement is measured as the difference between the official age of retirement and the actual age of retirement. The official age varies by country.

Incidence: Occurrence of an event (e.g, new cases of a disease or injury occurring in a specified time interval). Only burden arising from new diagnoses is captured.

Premature death: Premature mortality, measured in terms of potential years of life lost (PYLL) before the age of 70 years, focuses on deaths among younger age groups of the population. The calculation of PYLL involves adding age-specific deaths occurring at each age and weighting them by the number of remaining unlived years up to a selected age limit, defined here as age 70. For example, a death occurring at five years of age is counted as 65 years of PYLL. The indicator is expressed per 100 000 females and males. In order to relate it to productivity losses it is necessary to adjust these years by probability of workforce participation.

Prevalence: In this study used as 12 month period prevalence as compared to point prevalence. Point prevalence refers to the number of people in a particular health state, or with a particular condition, at a point in time. 12 month period prevalence refers to the number of persons in a particular health state, or with a particular condition during the period of a year.

Risk factor: Any entity that increases the probability or incidence of a condition.

Participating institutions

The institutions listed here participated formally in the contract with Eurostat to carry out the HEDIC project.

Consortium:

IGSS Inspection générale de la sécurité sociale (Luxembourg)

Gesundheit Österreich Forschungs- und Planungs GmbH (GÖ FP) (Austria)

National Statistical Institute (Bulgaria)

Institute of Health Information and Statistics of the Czech Republic

BASYS Beratungsgesellschaft für angewandte Systemforschung mbH (Germany)

National and Kapodistrian University of Athens (UoA) (Greece)

Hungarian Central Statistical Office (HCSO)

Sveikatos Ekonomikos Centras (SEC) (Lithuania)

Central Statistical Bureau of Latvia

Centraal Bureau voor de Statistiek (CBS) (Netherlands)

The National Board of Health and Welfare (Sweden)

Terveyden ja hyvinvoinnin laitos (THL) (Finland)

Subcontractors:

National Institute for Public Health and the Environment (RIVM), Netherlands

Finzdrav d.o.o., Slovenia

Observers:

Hauptverband der österreichischen Sozialversicherungsträger, Austria

Bundesamt für Statistik, Schweiz

Unit of Health Care and Information, Ministry of Health, Spain

Destatis - Federal Statistical Office of Germany

Central Statistical Office, Warsaw

Department of Health, United Kingdom

List of Countries

BG	Bulgaria
CZ	Czech Republic
DE	Germany
EE	Estonia
EL	Greece
ES	Spain
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
NL	the Netherlands
AT	Austria
PL	Poland
SI	Slovenia
FI	Finland
SE	Sweden
UK	United Kingdom
CH	Switzerland

Abbreviations

ACHE	Allocated Current Health Expenditure
AIHE	Allocated Inpatient Health Expenditure
ATC	Anatomical-Therapeutic-Chemical Classification System
BASYS	Applied Systems Research Consulting Corporation Ltd (Beratungsgesellschaft für angewandte Systemforschung)
CEPS	Centre d'Etudes de Populations, de Pauvreté et de Politiques Socio Economiques
CHE	Current Health Expenditure
COI	Cost-of-Illness studies
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Diseases
DDD	Defined Daily Dose
DRGs	Diagnostic Related Groups
EC	European Commission
ECFIN	Directorate-General "Economic and Financial Affairs"
ECDC	European Centre for Disease Prevention and Control

ECHI	European Core Health Indicators
EEA	European Economic Area
EFTA	European Free Trade Association
EHN	European Heart Network
ESS	European Statistical System
EU	European Union
EUR	Euro
Eurostat	Statistical Office of the European Communities
FTE	Full Time Equivalent
GPs	General Practitioners
HE	Health Expenditures
HEDIC	Health Expenditures by Diseases and Conditions
HPDS	HEDIC Pilot Data Set
ICD	International Classification of Diseases
ICHA-FA	Classification of Financing Agents
ICHA-FP	Classification of Factors of Health Care Provision
ICPD	International Conference on Population and Development
IGSS	Inspection Générale de la Sécurité Sociale
IRDES	Institut de Recherche et Documentation en Economie de la Santé
ISHMT	International Short List of Hospital Morbidity Tabulation
LTC	Long-term care
MDCs	Major Diagnostic Categories
MS	Member State
NSA	National Statistical Authorities with responsibility for official health statistics
OECD	Organization for economic co-operation and development
OTC	Over-The-Counter
OUKCL	Oxford University and King's College London
PYLL	Potential Years of Life Lost
PPS	Purchasing Power Standard
RH	Reproductive Health
SHA	System of Health Accounts
WHO	World Health Organisation

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