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Please cite this paper as:

Koechlin, F. *et al.* (2014), "Comparing Hospital and Health Prices and Volumes Internationally: Results of a Eurostat/ OECD Project", *OECD Health Working Papers*, No. 75, OECD Publishing.
http://dx.doi.org/10.1787/5jxznwrj32mp-en



OECD Health Working Papers No. 75

Comparing Hospital and Health Prices and Volumes Internationally

RESULTS OF A EUROSTAT/OECD PROJECT

Francette Koechlin, Paul Konijn, Luca Lorenzoni, Paul Schreyer

JEL Classification: C43, I10, M41

OECD

eurostat EUROPEAN COMMISSION

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

26-Aug-2014

English text only

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Health Working Papers

OECD Health Working Paper No. 75

COMPARING HOSPITAL AND HEALTH PRICES AND VOLUMES INTERNATIONALLY: RESULTS OF A EUROSTAT/OECD PROJECT

Francette Koechlin(1), Paul Konijn(2), Luca Lorenzoni(3) and Paul Schreyer(1)

JEL classification: C43, I10, M41

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ACKNOWLEDGEMENTS

This work has only been possible with the co-operation of country experts who participated in five rounds of pilot data collection, helped defining common specifications and made significant efforts to provide national data in line with the common specifications.

The OECD is also grateful to Eurostat who has supported the project on health PPPs institutionally and financially.

The authors wish to thank Alina-Maria Preda from Eurostat, and Roberto Astolfi, Sophie Bournot and Kees van Gool from the OECD for their help with this work.

The authors gratefully acknowledge all these contributions but remain responsible for any errors in compiling or interpreting the results.

EXECUTIVE SUMMARY

Health services account for a large and increasing share of production and expenditure in OECD and Eurostat countries but there are also noticeable differences between countries in expenditure per capita. Whether such differences are due to more services being consumed or whether they reflect differences in the price of services is a question of significant policy relevance. Yet, cross-country comparisons of health services have typically not disentangled these effects.

This paper presents the results of a joint effort between OECD and Eurostat in developing price comparisons for health goods and services. The main novel feature is the collection of comparable and output-based prices for hospital services that can then be applied to matching national accounts expenditure data so as to derive consistent price and volume comparisons of health products. The data is novel in that it reflects "quasi prices" (negotiated or administrative prices or tariffs) of the output of hospital services, instead of prices of inputs such as wages of medical personnel. The new methodology moves away from the traditional input perspective, thereby relaxing the assumption that hospital productivity is the same across countries.

The results presented may have important consequences for how health expenditure are analysed in the future. Health and hospital-specific price comparisons turn out to be quite different from the comparisons based on the input method or on economy-wide price ratios and consequently lead to different conclusions about the volume of health services consumed per person.

The price level of health services in high income countries tends to be higher than under the old methodology, while the opposite is true for a large part of low income countries. As a consequence, consumption of health services per capita falls for the Nordic countries (except Finland) as well as Switzerland, Luxembourg, Spain and Austria, while per capita indices turn out to be higher for a number of countries such as Lithuania, Slovakia, Romania and Hungary.

By end 2013, the new methodology has become an integral part of the Eurostat/OECD Purchasing Power Parity comparison.

RÉSUMÉ

Les services de santé représentent une part importante et croissante de la production et des dépenses dans les pays de l'OCDE et d'Eurostat, mais des différences notables apparaissent au regard des dépenses par habitant. Savoir si de telles différences sont dues aux quantités des services consommés ou si celles-ci reflètent des différences dans le prix des services est une question fondamentale pour mener des politiques pertinentes. Jusqu'à présent, les comparaisons internationales des services de santé n'ont pourtant pas permis de distinguer ces effets.

Ce document présent les résultats d'un effort conjoint entre l'OCDE et Eurostat dans le développement de comparaisons de prix pour les biens et services de santé. Le caractère novateur de cette étude est la collecte de prix comparables pour les services hospitaliers, prix qui peuvent être ensuite appliqués aux dépenses de comptabilité nationale correspondantes pour obtenir des comparaisons cohérentes de prix et de volume des produits de santé. Les données sont inédites car elles reflètent les "quasi-prix" (prix négociés ou réglementés ou tarifs) de la production des services hospitaliers, au lieu des prix des facteurs de production (« input ») tels que les salaires du personnel médical. La nouvelle méthodologie s'écarte de la perspective traditionnelle basée sur les facteurs de production, s'éloignant ainsi de l'hypothèse que la productivité des hôpitaux est la même dans tous les pays.

Les résultats présentés peuvent avoir des conséquences importantes sur la façon dont les dépenses de santé seront analysées dans l'avenir. Les comparaisons de prix spécifiques du secteur hospitalier et de la santé s'avèrent être très différentes des comparaisons basées sur les facteurs de production ou sur les niveaux de prix de l'ensemble de l'économie. Elles conduisent, par conséquent, à d'autres conclusions sur le volume des services de santé consommés par personne.

Le prix des services de santé dans les pays à revenus élevés tend à être plus élevé avec la nouvelle méthode, alors que l'inverse est vrai pour une grande partie des pays à faibles revenus. Par conséquent, avec la nouvelle méthode, la consommation de services de santé par habitant diminue dans les pays nordiques (à l'exception de la Finlande) ainsi qu'en Suisse, au Luxembourg, en Espagne et en Autriche alors que les indices par habitant se révèlent être plus élevés pour un certain nombre de pays tels que la Lituanie, la Slovaquie, la Roumanie et la Hongrie.

Fin 2013, la nouvelle approche est devenue une partie intégrante de la comparaison des parités de pouvoir d'achat Eurostat-OCDE.

INTRODUCTION

1. Health expenditures account for a sizeable share of Gross Domestic Product (GDP) in the European Union and OECD Member Countries. When expenditures go up, policy-makers and citizens are interested to find out whether a rise in expenditures signals that people consume more health goods and services or whether health goods and services have become more expensive. The same question is of interest in comparisons between countries: are higher per-capita health expenditures in country A compared to country B the result of higher prices or more health goods and services consumed in country A compared to country B? To answer this question, information on the relative prices of health goods and services is required.

2. In international comparisons, the relative prices for a particular product or product group are called Purchasing Power Parities (PPPs). PPPs are used to convert expenditure on product groups or GDP of the countries being compared to a common currency at a uniform price level. Eurostat and OECD have calculated PPPs for GDP and some 50 product groups, including health, on a regular and timely basis since the early 1980s.

3. Frequently, PPPs at the level of total GDP rather than health-specific PPPs have been used for converting health expenditures to a common unit for international comparisons (e.g. OECD 2013). Using GDP PPPs has been criticised in the literature (Gerdtham and Jönnson, 1991; Kavanos and Mossialos, 1999; Melberg 2011). The primary reason is that GDP PPPs do not take account of the relative price levels of health goods and services compared with other goods and services in the economy. For example, in Australia, in the ten years between 2001 and 2011 growth in health prices was nearly double the growth in the overall consumer price index (ABS, 2011). Similarly, in the United States between 1984 and 2009, medical inflation has exceeded annual overall inflation for every year except 1998 (Newman and Davis, 2010). There are a variety of reasons why growth in health prices exceeds general prices, including rising administrative costs, higher prices for health-related technologies and low productivity. This is likely to be true in many countries, implying that GDP PPPs do not accurately reflect the prices of health goods and services relative to other non-health related goods and services in the economy.

4. One may wonder why economy-wide PPPs were used to convert health expenditures if health-specific PPPs were available. However, the traditional health-specific PPPs are based on input methods, typically by comparing salaries of medical and non-medical staff across countries. Comparing the prices of inputs (the services of staff) is not the same as comparing outputs (the medical services actually delivered) unless the unrealistic assumption holds that productivity of staff is equal across countries.

5. Neither the health-specific but input-based PPPs nor the economy-wide PPPs thus appear to be reliable measures for comparing prices and volumes of health services and, consequently, researchers have proposed various ways of deriving output-based, health-specific PPPs. Wordsworth and Ludbrook (2005) produced technology-specific PPPs based on hospital outputs, rather than inputs. For purposes of an economic evaluation, they compared the cost-effectiveness of dialysis across ten renal centres in eight countries. They found that choice of currency conversion measure can significantly influence the results and interpretation of economic evaluations.

6. The HealthBasket Project[1] extended the work by Wordsworth and Ludbrook and collected primary cost and resource data for ten episodes of care, collected across 47 participating hospitals in nine countries. In each hospital a sample of patients was identified and cost data retrieved. The project found widespread variations in the cost per episode across countries, which were explained by: (i) variation in wage rates; (ii) variation in treatment patterns; and (iii) variation in resources used per episode. The HealthBasket Project made a number of important contributions. It produced more refined conversion factors than general GDP PPPs but, as highlighted by the authors, the main drawback of the approach was that it relied on a primary data collection which was expensive to obtain. Furthermore, it did not collect information on the expenditure on different types of services. This restricts the use of the data to developing episode-specific PPPs rather than hospital-wide PPPs.

7. This paper presents the results of a joint effort between OECD National Accounts and Health divisions and Eurostat in developing output-based PPPs for health goods and services. The main novel feature is the collection of comparable prices for hospital services that can then be applied to matching national accounts expenditure data so as to derive consistent price and volume comparisons of health products. The project started in 2007, with five annual rounds of pilot data collection, each round improving on the previous one and extending the country coverage. The growing number of countries that have implemented activity-based hospital payment systems increased the availability and accuracy of the necessary hospital services data over time. The new output-based methodology was implemented by Eurostat and OECD for the official calculation of PPPs at the end of 2013.

8. The results presented in this paper add considerable value to the understanding of health expenditures and may have important consequences for the way future studies are analysed and reported. Through various methodological innovations we could make the analysis less restrictive than several other studies in terms of the assumptions required or the need for separate primary data collections. Overall, having health and hospital-specific PPPs (rather than broader GDP PPPs) removes the need to assume that the relative prices between health and hospital products and other goods and services in the economy are the same across countries. Further, the move from input to output-based hospital PPPs relaxes the assumption that hospital productivity is the same across countries.

9. Part I of the paper lays out the methodology and reports on the results for general hospitals. Part II discusses the results for the overall health sector.

1 For full details and results of the project refer to the special issues of the following journals: European Journal of Health Economics, Vol 6, Supplement 1, 2005; Health Care Management Science, Vol 9, 2006; and Health Economics, Vol 17, Issue S1, 2008.

PART I: PPPS FOR HOSPITALS

10. Price levels of hospital services are a natural departure point for the comparison of prices and volumes of health products more broadly: they constitute an important part of total health expenditure and are a good way for laying out the OECD/Eurostat methodology of collecting quasi-prices and expenditures that are required for the PPP calculation. This part of the paper therefore provides an overview of the methodology for hospital services, details of the data sources and samples, and the main results of the study on general hospitals.

1.1 PPP survey on hospital prices

Output-based methodology for hospitals: main features

11. The key methodological aspect of this work is the derivation of output-based, as opposed to input-based hospital PPPs. The following summary of the methodology is based on Koechlin *et al.*, 2010; Lorenzoni and Pearson, 2011; and European Union/OECD, 2012 where more detail is provided. In general, three main problems have to be addressed in the measurement of PPPs. The first is to identify products that are comparable across countries. This can be complicated because products are not identical, because there are differences in quality or because products simply do not exist in all countries. The second issue is to ensure representativeness of products: whatever price is compared, it has to be the price of a product that is widely and typically purchased in each country. The third issue arises when there is a product, but no meaningful market price for comparison. Issues one and two arise in the comparison of all prices, issue three arises in the comparison of products that are produced and delivered outside markets. In many countries, health services count among these products.

12. Previous calculations of PPPs for hospital services have therefore often been based on prices paid for inputs (such as doctor or nurses wages), rather than the prices paid for hospital outputs. This approach is unsatisfactory. The input-based approach assumes that health care productivity is uniform across countries implying that countries are all equal in their ability to convert inputs to outputs.

13. The alternative is to adopt an output-based approach. This entails the implementation of a price survey covering hospital services. Designing such a survey requires:

- The identification and definition of hospital outputs that can be measured across countries; and
- The estimation of the "prices" for these hospital outputs, accounting for the fact that in many countries no easily observable market price will exist for hospital services.

14. The approach here takes advantage of routinely collected administrative information through secondary databases[2] to estimate 'quasi-prices' (see below for further explanations) for a representative set of health products. In so doing, it has the advantages of larger sample size, greater external data validity

2 Secondary, or administrative, datasets contain coded data that describe services provided by healthcare providers. They are usually available through health administrations and national insurance funds for the purposes of reimbursement and health financing.

(i.e. generalisability) and limited costs of collecting data as compared to the alternative, a specific primary data collection effort that would have to be undertaken.

Identifying and defining hospital outputs: case types

15. For practical reasons, the definition of output of health services is restricted to complete treatments delivered by a single provider which, in this case, are hospitals[3]. A hospital output is called a case type and refers to a hospital service that is similar from a clinical perspective and in terms of its consumption of resources. Two categories of case types are distinguished: medical and surgical. The medical case types specified refer only to inpatient services whereas the surgical case types are further divided between those that require hospitalisation and those that can be performed on an outpatient (day care) basis. The inclusion of outpatient cases reflects the project's intention to take into account changes in medical practice over time.

16. The international use of the International Classification of Disease (ICD) codes is a key enabling factor in collecting data across countries. For each product, a descriptive definition is given first. Then the ICD-10 codes for diagnoses and ICD-9-CM codes for procedures that identify the case type are provided. Finally, rules and criteria for inclusion/exclusion are reported. The case types identified for inclusion in the PPP studies have been selected on the basis that they were common procedures or diagnoses and account for a significant percentage of hospital expenditure. In addition, selected surgical case types had to be procedures that would be the principal procedure within one hospitalisation and medical case types had to be for medical conditions that were clearly identifiable.

17. With the advent of output-based hospital funding, it has become feasible to define similar case types across countries. Numerous countries have adopted case-mix type systems to purchase hospital products, but these have developed on a national basis resulting in substantial differences between countries' classification systems. The OECD undertook a review of secondary datasets to investigate the feasibility of identifying sufficiently similar product types across countries. The review concluded that whilst most countries had Diagnosis Related Groups (DRG)-type systems in place, the international comparability of product classification systems is limited. This implies that careful mapping between the codes used in different national systems is required in order to get comparable information (Lorenzoni and Pearson, 2011).

18. Twenty-one surgical and seven medical case types were selected for the study. Medical case types are defined as those where no operating room procedure are performed. In addition, separate outpatient data was provided for four surgical case types[4], giving us access to data on 32 different products. Case type specifications are presented in Annex 3. In a further effort to maximise cross-country comparability, only 'standard' hospitalisations for each case type are included in the data collection. This meant excluding hospitalisations where (i) the standard profile of care was not followed due to death or transfer to another facility; and (ii) the length of stay[5] was greater than 1.5 standard deviations away from the national case type mean. Restricting the sample in this way decreases the within case type variation, and improves the clinical comparability. The list of case types have been refined and updated as part of the pilot phases of the project.

3 In reality, treatments are often delivered by a combination of providers, e.g., a general practitioner, a medical specialist, a hospital, etc.

4 Arthroscopic excision of meniscus of knee, cataract surgery, ligation and stripping of varicose veins - lower limb and tonsillectomy and/or adenoidectomy.

5 The number of days an inpatient spends in hospital. It is calculated in different ways for different purposes. The most common involves subtracting the discharge date from the admission date.

Estimating quasi-prices for hospital case types

19. To represent "value" of goods and services, prices should be observed from transactions in open and competitive markets. Primarily this means that prices should correspond to the value that informed consumers, making choices in open and competitive markets, attach to different commodities. Such price observations are not always readily available in the health care sector where non-market producers are often present.

20. When goods or services are supplied by a non-market producer the prices charged to consumers are significantly below the price that a market producer would charge. In some cases, the price may even be zero. It would make no sense to compare such prices charged to patients or consumers across countries as they reflect administrative decisions and not the value of products. In such cases, measurement can be based on costs per unit of case type or *quasi-prices*. They are those (unobserved) 'prices' that emulate a competitive situation where prices equal average costs per product. Unit costs can be treated *as if they were prices* (Diewert 2011 and 2012; Schreyer 2012). We use the term 'quasi-prices' in recognition that those values are frequently not observed in open and competitive market transactions and are imputed to approximate what a market price might have been, if there were a market (Evans 2013).

21. How then are quasi-prices derived? Alongside the introduction of activity-based funding mechanisms in many OECD countries, systems have been put in place to approximate the monetary value of services provided by hospitals. These provide, in theory, an indication of the purchasers' willingness-to-pay (usually government or insurer) and the providers' willingness-to-accept these values as the price for hospital services.

22. The hospital PPP survey collects data on the average quasi-prices for the selected case types. Quasi-prices are normally extracted from administrative databases maintained for the purposes of reimbursement and health financing. The quasi-price can be a negotiated price or an administered price; where the former refers to prices that have been established through negotiations between purchasers (third party payers) and providers of hospital services; and the latter reflect the average costs of the service provided. In either case, it is important that they cover the same types of costs across all participating countries reflecting the direct costs as well as the capital costs and overhead costs relating to the production of health services. The cost items to be included are listed in Annex 1 - Table 1.

23. Quasi-prices can be available at hospitalization (case) level or at category/DRG-like level. If data are available at case level, a mean quasi-price by case type has been estimated by simply taking the average quasi-price of the "typical" cases[6] selected through codes and rules identified for each case type. If data are available at category level, the correspondence between case types and DRG-like categories has been reviewed to decide whether the DRG definition matches the case type definition. The decision was made on the basis of an agreed threshold of at least 80 %[7] of cases within each DRG for which the selected case type-specific diagnosis and/or procedure codes could be assigned. As a consequence, only a subset of the case types might be included in the analysis.

6 "Typical" cases are those who have undergone a normal and expected course of treatment. Atypical and long stay cases excluded in the calculations refer to cases for which the "standard" profile of care is not followed because of death, sign-out, or transfer to other facilities and cases with a number of days of stay higher than 1 ½ standard deviations from the country case type-specific mean

7 The threshold was chosen by experts on the basis of their experience with analyzing casemix data.

Data sources and sample

24. The 2013 data collection gathered 2011[8] data on hospital activity and quasi-prices for a basket of 32 hospital products, using a standardized questionnaire. Out of the 37 European countries participating in Eurostat's regular PPP program, thirty-one countries participated in the 2013 survey: Austria, Belgium, Bulgaria, Croatia, Cyprus[9] [10], Czech Republic, Denmark, Estonia, Finland, France, the former Yugoslav Republic of Macedonia (FYROM), Germany, Hungary, Iceland, Ireland, Italy, Lithuania, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland[11] and the United Kingdom[12]. Annex 1 - Table 2 lists participating countries as well as details of the sampling frame used by each country.

25. Six out of the 37 countries did not participate in the 2013 survey: Albania, Bosnia and Herzegovina, Greece, Montenegro, Serbia and Turkey. For those countries an input based approach was used in the calculations. This was the case also for Cyprus as the number of cases reported was low.

26. The number of hospitals and cases in the study varied across countries (Annex 1 - Table 2). At one end, five countries cover the entire hospital population. At the lower end, France covers less than 6%. The relatively low percentage of sample hospitals for France is due to the sampling approach to cost collection in use: the values estimated from a sample of hospitals are grossed up to the entire population using activity and financial statistics to produce national estimates.

27. Countries reported a good coverage of hospitals for this study. Besides, there is evidence that the representativeness of the sample increases over time as DRG-based payment systems are refined. Hence, the increased use of DRG-based systems for hospital financing in several countries (e.g. Switzerland) should contribute to improve comparability further in the future.

28. In terms of number of cases, all countries covered at least 12.9% of cases discharged from sample hospitals, while several cover more – for instance, Portugal covered 28.8% of total cases in the sample hospital (Annex 1 - Table 2). The percentage of expenditure related to sample cases varied from 12.3% in Germany to 30% in Portugal (Annex 1 - Table 2). On average, 18.2% of total cases and 18.5% of total expenditure was covered by the basket of services in the sample hospitals in 2011.

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8 Data were collected for three years 2010, 2011, 2012 but it was decided to present only results for the year 2011 in this document as data were missing for some countries for 2010 and were still preliminary for some countries for 2012.

9 Footnote by Turkey: the information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

10 Footnote by all the European Union Member States of the OECD and the European Union: the Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus."

11 Switzerland collected hospital data for 2011 on a voluntary basis. Only since 2012 it is mandatory for hospitals to provide data according to the Swiss DRG tariff system. This new calculation system is still under development.

12 England only.

Adjustments to the quasi-prices to ensure better comparability

29. Countries share many common features in the collection of data used for measuring the costs of hospital products that form the basis of the quasi-prices, but there are also some important differences that need to be accounted for. It is clear that the cost accounting systems used by the countries will not be harmonized (Tan *et al.,* 2011), but the results should be comparable.

30. In 2013, a metadata survey asked countries to provide information on costing methods. The survey sought information on costing principles and inclusions such as the compensation of employees, capital consumption[13], intermediate inputs, and taxes on production, as well as costs relating to health services directly and overhead costs. The survey also collected information on items that should have been excluded such as expenditure on "research and development in health" and "education and training of health personnel", as well as income derived from treating private patients in public hospitals or from non-patient care activities.

31. The results of the cost metadata questionnaire showed that several countries exclude consumption of fixed capital (CFC) from their cost calculation. To account for those differences, 4.8% was added to prices for consumption of fixed capital for the following countries: Bulgaria, Croatia, Denmark, Germany, Hungary, Ireland, Latvia, Lithuania, Norway and Switzerland. Countries were identified on the basis of the results of the 2013 hospital PPP metadata questionnaire. The add-on figure was estimated on the basis of National accounts data from the German Statistical Office[14].

32. Moreover, prices were decreased by 1.26% to account for the inclusion of research and development expenditure in the prices reported by the following nine countries: Bulgaria, Denmark, Estonia, FYROM, Malta, the Netherlands, Portugal, Romania and Spain. Countries were identified on the basis of the results of the metadata questionnaire. This figure was estimated on the basis of the System of Health Accounts (SHA) (OECD, Eurostat, WHO 2011) expenditure data on research and development in health. Finally, prices were decreased by 1.18% to account for the inclusion of training and education expenditure in the prices reported by the following nine countries: Bulgaria, Denmark, Estonia, Ireland, Malta, the Netherlands, Portugal, Romania and Spain. Countries were identified on the basis of the results of the metadata questionnaire. This figure was estimated on the basis of SHA expenditure data on training and education in health.

Validation process

33. The data validation process started at the end of August 2013 and consisted of three steps. Firstly, data were compared across countries over time[15] by case type. Variables included in this step were number of cases, average length of stay and quasi-price by case type. Secondly, price level indices over time and across countries were compared. This included medical inpatient, surgical inpatient and surgical outpatient/day surgery clusters. Finally, the so-called 'Quaranta editing procedure' (European Union/OECD 2012, pages 357-367) was used to identify outliers by case type and by country.

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13 The loss of the value of the capital goods due to their normal wear and tear or obsolescence is called "consumption of fixed capital" or "capital consumption". Capital consumption is an imputed, not an actual cost. In other words it is a non-cash expense. Capital consumption is added to all other production costs to indirectly estimate the value of the non-market production. The indirect measure is an approximation required to overcome the lack of economically significant prices for the non-market sector.

14 To break CFC down at hospital level, the total output figures of hospitals as a share of the whole ISIC 86 were used.

15 For those countries for which 2010, 2011 and 2012 data were available.

34. In each phase, clarifications were sought from countries if the value of a variable seemed to be not plausible and/or inconsistent over time or as compared to other countries. The validation process included the review of the raw data that countries used to feed the survey tables, the analysis of the mapping from local coding and classification systems to case types and an assessment of whether countries interpreted the survey guidelines correctly.

PPP calculations and price level indices

35. The PPP survey also collects data on the number of cases recorded for each case type. Multiplying the average quasi-prices by the corresponding case numbers provides each case type with a value. These case type values can be summed across case types to give a total value for all case types with which the individual case type values can be converted into percentage shares. The percentage shares are used as weights when calculating PPPs for hospital services[16].

36. PPPs for hospital services were first compiled for the 30 countries which could report quasi-prices and weights according to the agreed methodology and PPPs for the seven remaining countries were estimated according to the input approach. The methodology used to calculate PPPs can be found in Chapter 7 of the Eurostat-OECD PPP Manual.

37. PPPs were then used to derive price level indices (PLIs). PLIs are the ratios of PPPs to exchange rates. The average PLI of the group of 28 EU Member States was calculated as the weighted average of the PLIs of the different countries (with total expenditure on hospitals as weights). This average was then set to equal 100 and each country's PLI expressed in relation to it. PLIs provide a measure of the difference in price levels between countries by indicating – for a given category or aggregate – the number of units of the common currency needed to buy the same volume of the category or aggregate. In our example, there is no common currency as such and results should be interpreted looking at the relative positions of countries rather than looking at absolute levels. Price levels depend on exchange rates and maybe subject to large variations in line with exchange rates swings and should there be interpreted with caution

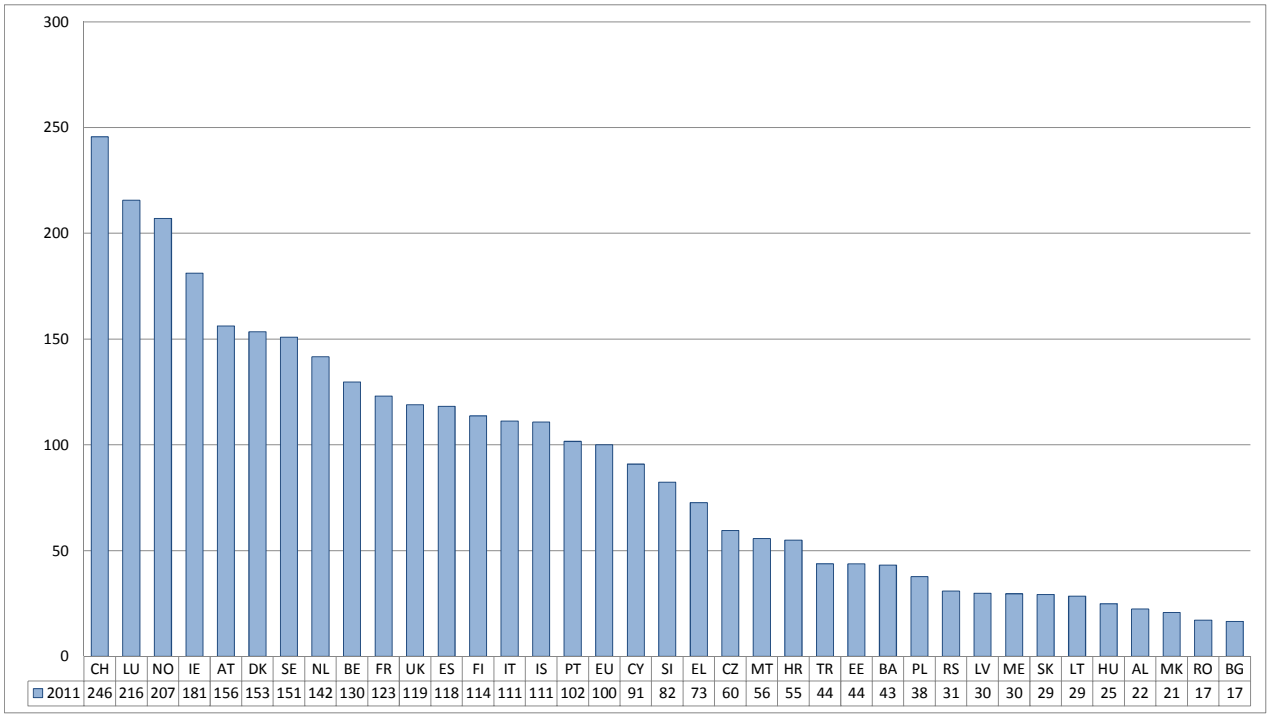
1.2 Main results: price level indices for hospital services[17]

38. As shown in Figure 1, price level indices for hospital services vary widely across countries. Bulgaria and Romania have price levels that are 17% of the average EU price level, whereas in Switzerland hospital services are priced at 246% of the EU average, a range of nearly 1 to 15. Broadly, three clusters of countries can be identified: fourteen mainly Central and Eastern Europe (CEE) countries and Western-Balkan countries with PLIs below 50, sixteen countries with PLIs between 50 and 150 and seven countries with PLIs above 150.

16 It should be noted that those weights are based on the sample of case types, not the population that this sample is supposed to represent.

17 The results for Germany will be included in a next version of this paper, after further review.

Figure 1. Price level indices for hospital services, 2011, EU28=100



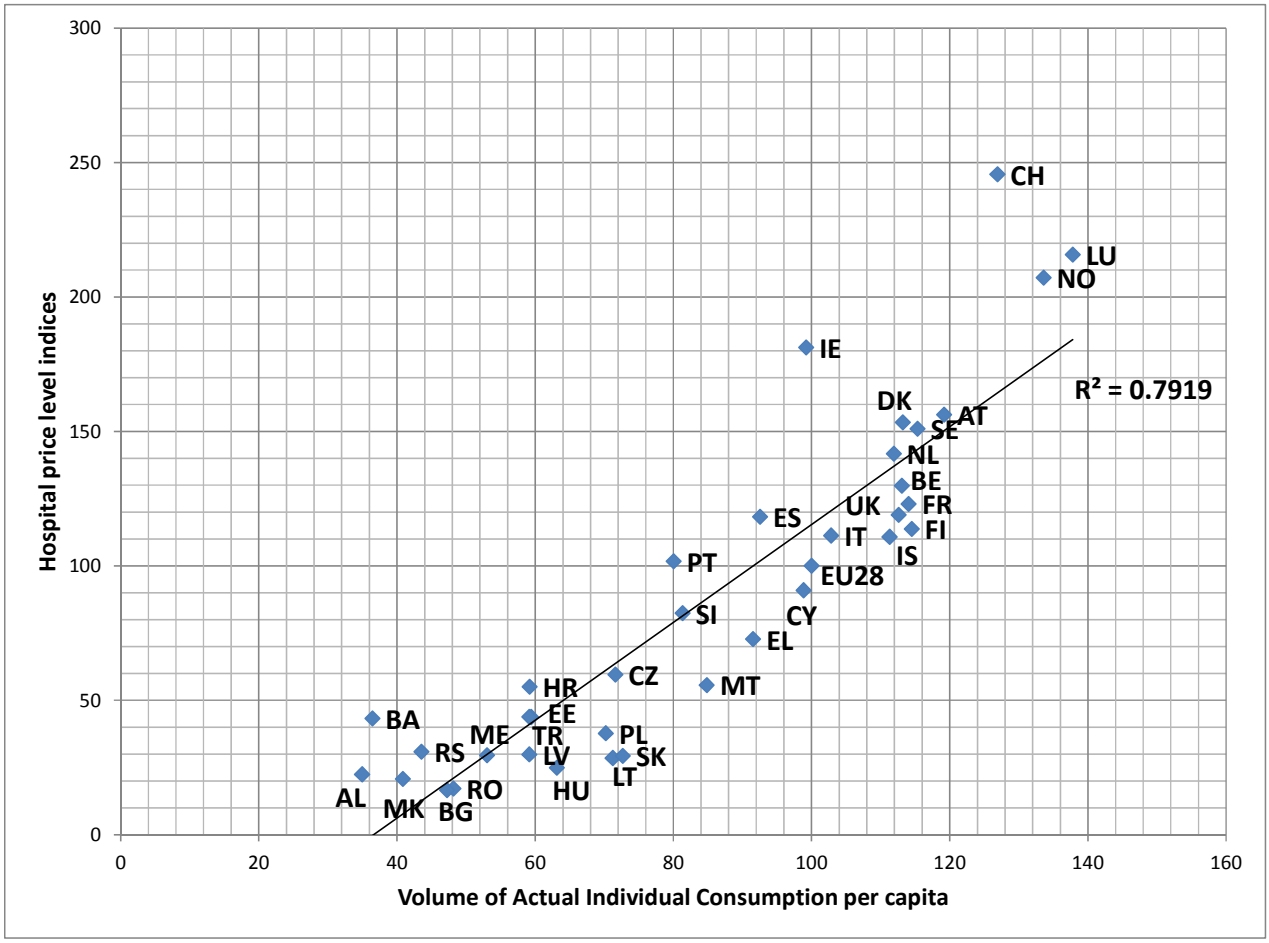
Source: 2013 Eurostat/OECD Hospitals PPPs Survey

39. Price levels tend to correlate with income levels: richer countries have generally higher price levels than poorer countries. This correlation is stronger for services (non-tradable) than for goods (tradable). Figure 2 displays the price levels for hospitals plotted against the index of real per capita expenditure on total actual individual consumption (AIC), which corresponds to household consumption adjusted for social transfers in kind, that is the health, education or housing services provided by government for free or at low cost. There is indeed a strong correlation: higher levels of AIC correspond to higher price levels for hospitals, in line with expectations. Nonetheless, the low price levels observed in some countries deserve further analysis. We will start by exploring the effect of differences in the average length of stay across countries on the price levels.

40. One of the key reasons for the careful selection of case types has been to reduce the potential heterogeneity in products across countries. In a bid to increase homogeneity even further, countries were asked to restrict their sample of hospitalisations to standard profiles of care and a length of stay no greater than 1.5 standard deviations away from the case type mean. Even with these restrictions, it is possible that cross-country heterogeneity in any specific case type remains. One potential source of unobserved heterogeneity may be complexity of cases[18] which, in turn, could result in higher average resource use and costs.

18 Complexity of cases refers to a set of interrelated but distinct patient attributes – including severity of illness, prognosis, treatment difficulty, need for intervention and resource intensity – that are not captured by the case types definitions.

Figure 2. Comparison of price level indices for hospital services and volume of Actual Individual Consumption per capita, 2011, EU28=100

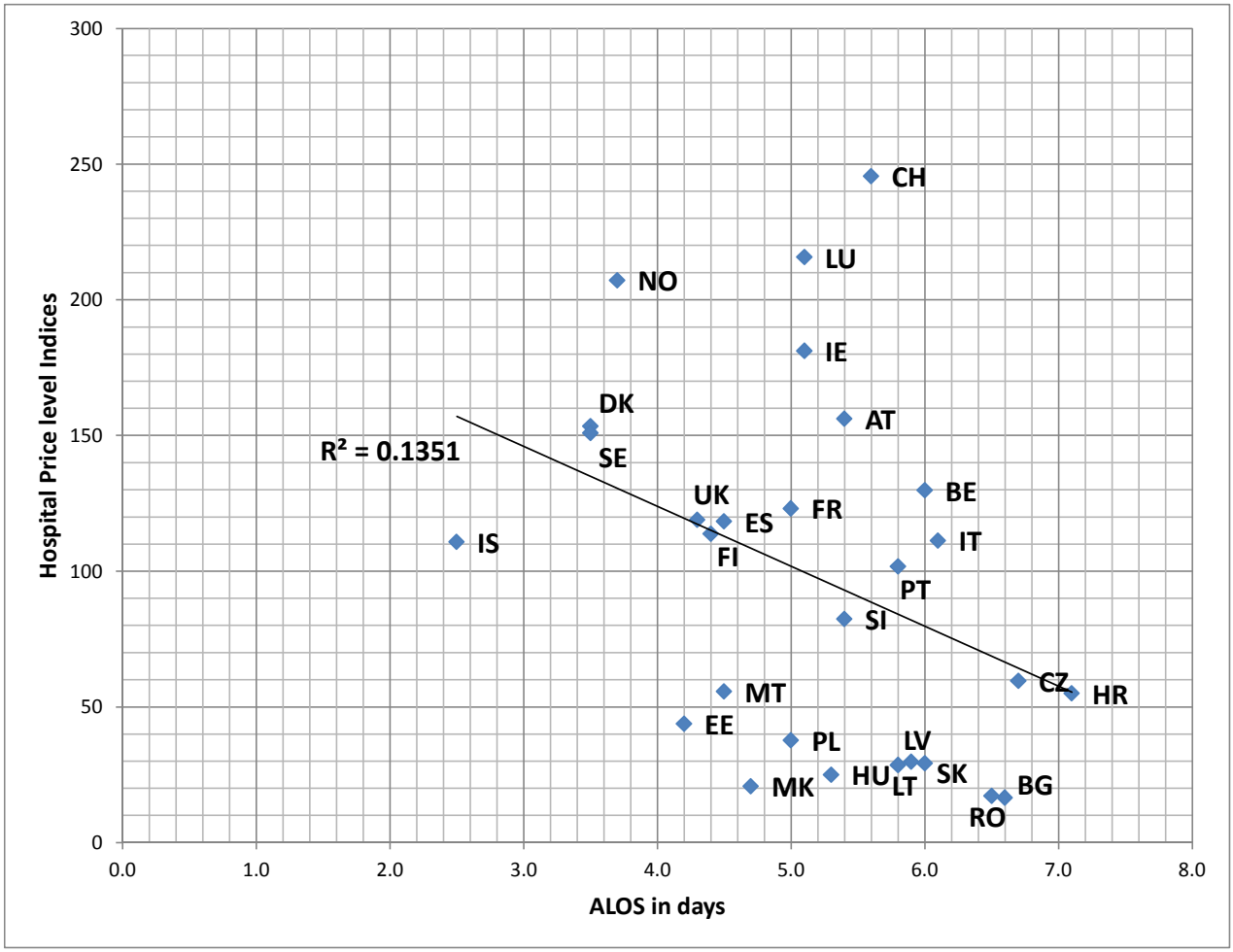


Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

Cross-country and case type variation in average length of stay

41. Can the observed price differences be related to differences in average length of stay (ALOS)? Overall, ALOS was 5.3 days and ranged from 2.5 in Iceland to 7.1 in Croatia (Annex 1 – Table 3). There is some evidence of systematic variation in ALOS with Nordic countries reporting ALOS at the lower end of the distribution whereas CEE countries tend to report higher than average ALOS. Figure 3 plots the average ALOS against the price levels for hospitals. There appears to be practically no correlation between overall average ALOS and price levels, implying that the observed differences in prices for hospital services cannot be explained by systematic differences in ALOS across countries.

Figure 3. Comparison of price level indices for hospital services and average length of stay (ALOS), 2011, EU28=100



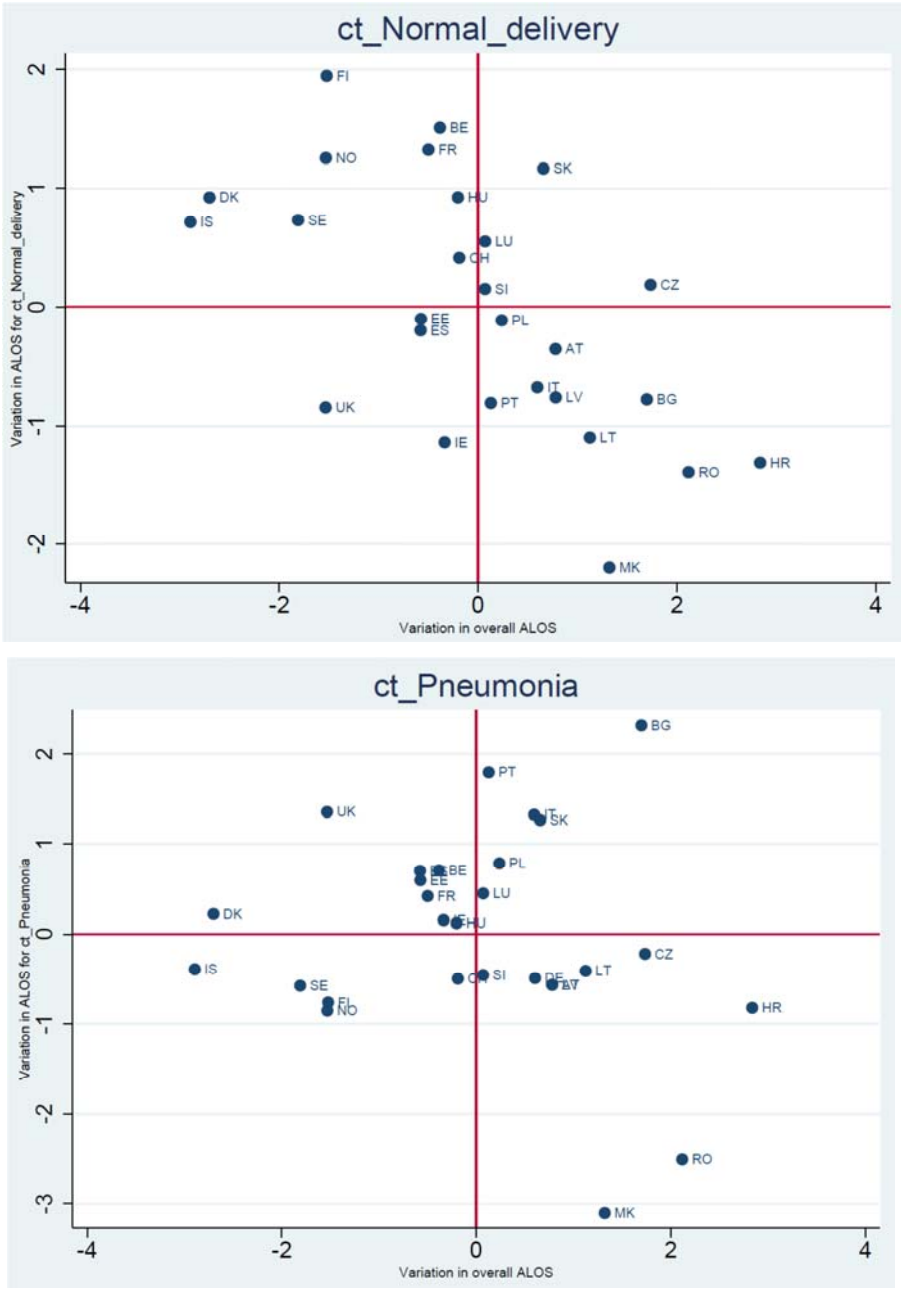
Source: 2013 Eurostat/OECD Hospitals PPPs Survey

42. Average length of stay not just reflects patient complexity but is also associated with a number of systematic factors, such as the payment mechanism and incentives in place for hospital administrators. Hence, we examined the ALOS across all countries and inpatient case types (Annex 1 – Table 4) in a multilevel model analysis[19]. This allowed us to identify the cross-country systematic effect in ALOS for each individual case type.

43. Figure 4 shows the results for two medical case types, normal delivery and pneumonia. The horizontal line is an estimation of the systematic variation in ALOS across countries. Those countries to the right of the vertical line are those that systematically report a higher ALOS across all case types whereas those to the left report lower ALOS. Note that the relative position of countries along the horizontal axis remains unchanged across all case type graphs. The vertical position for a country indicates the degree of variation in ALOS for an individual case type, after accounting for the systematic variation. Countries above the horizontal line report higher ALOS for a specific case type, after accounting for their systematic variation in ALOS.

19 Multilevel modelling (MLM) is a frequently used econometric technique to analyse hierarchical data structures. In our case, the case types represent the lower level hierarchy which are nested in the higher, country level hierarchical structure. The technique is used to identify the between and within country variation in ALOS. For further information on MLM see Snijders and Bosker (2011).

Figure 4. Variation in average length of stay (ALOS) by country: Normal delivery and Pneumonia

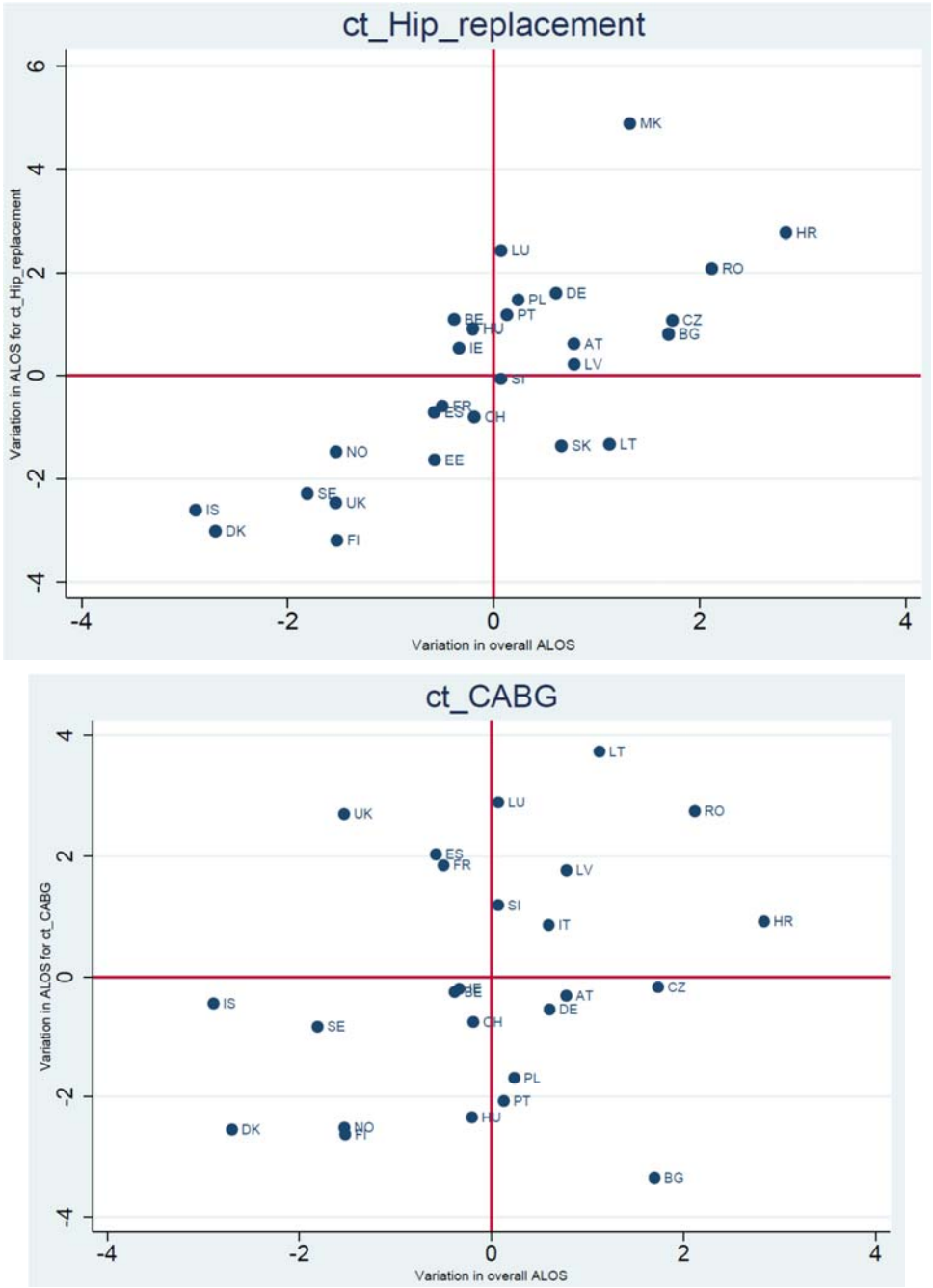


Source: 2013 Eurostat/OECD Hospitals PPPs Survey

44. Of the total variation in ALOS, 43% is due to these systematic country effects. Nevertheless, the graph also reveals that some variation in ALOS persists after accounting for these systematic differences. For example, ALOS in Slovakia (SK) is higher overall but in addition is higher than average for normal delivery. On the other hand, Nordic countries already have a low ALOS across all products and even lower ALOS for pneumonia.

45. Figure 5 shows the same results for two surgical case types - hip replacement and coronary artery bypass graft (CABG). For both case types, Romania (RO) and Croatia (HR) display considerable higher ALOS. For CABG there is greater spread in ALOS across all countries, with those that systematically report lower ALOS also tending to report lower ALOS for CABG.

Figure 5. Variation in average length of stay (ALOS) by country: Hip replacement and coronary artery bypass graft (CABG)



Source: 2013 Eurostat/OECD Hospitals PPPs Survey

46. The fact that a large part of variation is accounted for by cross-country differences provides some indication that these come as a result of systematic differences between countries in the way that hospital

services are provided (in particular different practices concerning the length of a hospital stay), rather than factors that are associated with individual case types. Nevertheless, the analysis points towards some specific variations for individual case types. It will be worthwhile to continue monitoring these and, in the case of large outliers, investigate potential reasons for the observed variation.

Activity-based hospital payments, informal payments and deficits

47. Some of the results reported in this paper require further interpretation and analysis as there is the possibility of systematic under- or over-valuation of quasi-prices for some of the lower income, primarily CEE, countries. We explore three potential sources of systematic under- or over-valuation of quasi-prices in these countries; stage of implementation of activity-based hospital payments; informal payments and co-payments; and deficits.

Implementation of activity-based hospital payments

48. The countries with low hospital price levels are geographically CEE countries and historically countries of the former Eastern bloc. Starting in the 1990s, reforms in these countries have focused on decentralisation and moved away from hospital centred systems. Overall change has been slow due to many factors including cultural values and institutional settings. The centralised and bureaucratic model of health planning was based on a top-down approach to policy and planning that may have left limited flexibility for health financing reform, especially at the hospital level (Healy *et al.,* 2002). According to Healy (2002), there was an assumption that "one size fits all" in a collectivized society, with very few concessions to local circumstances.

49. Most CEE countries that have supplied data for this study have undergone (or are undergoing) major restructuring to their health care systems, including the implementation of output based pricing and the introduction of DRG systems. CEE countries are at different phases in DRG use (see Annex 2 for a description of recent reforms in a number of CEE countries). For instance, in 2010, Bulgaria began to consider adopting a DRG system and Bosnia and Herzegovina, Latvia, Lithuania and Serbia have piloted DRGs. Hungary, on the other hand, implemented DRG-based systems in 1993, much earlier than most other CEE countries in this study (Gaal *et al.,* 2011).

50. Experience from early adopters in other parts of the world has shown that DRG-based systems require new information infrastructures, diagnosing, coding and financing arrangements. Such systems are often completed in a stepwise approach, take several years to implement and require considerable refinements and modifications in the follow-up years. Generally, systems are piloted first in a limited set of hospitals for a limited set of diagnosis. In the first instance, DRG systems are often used in a "shadow billing" capacity, while traditional payment mechanisms remain in place.

51. The immediate period following DRG implementation is often marked by substantial changes. Over time, the required infrastructure and data systems mature and the administrative workforce is educated and trained. Furthermore, it takes time for the institutional changes to occur and respond to the new payment system. This introduces the possibility that in the early years following DRG implementation, the data drawn from DRG systems may be volatile. Nevertheless, data quality will improve over time as DRG systems become fully embedded in these health care systems.

Informal and patient co-payments

52. In some countries the consumption of health care goods and services is often related to informal payments, so-called "envelope payments" or "under-the-table payments"[20]. Regardless of whether these payments relate to normal or additional services provided to patients, or represent a patient's additional gratitude to the physician, these extra unrecorded payments increase the incomes of health care providers on one side and add to the financial burdens of the consumer on the other side (OECD, Eurostat, WHO 2011). Informal payments are becoming an increasingly urgent and debated issue, especially in developing and transitional countries (Chereches *et al*., 2013). For the purposes of the PPP study, informal payments are of concern because they represent costs that may not be reflected in the data on quasi-prices. Informal payments are often unobserved and are thus under-reported in official data collections upon which the PPP study relies. Countries with high levels of informal payments are therefore at risk of systematic under-reporting of quasi-prices.

53. There are various reasons why informal payments may arise. In a number of CEE countries, physicians' wages are relatively low and in many instances health worker salaries have decreased in real terms in the post-transition period. Recent experiences also suggest that some salaried staff face delays in receiving their wages (Rechel and McKee, 2009). In this context, informal payments provide additional revenue to health care workers and/or institutions.

54. Informal payments may also have the effect of creating incentives for higher throughput. Even with a DRG system, physicians are still salaried employees of the state thereby having little incentive to improve efficiency by increasing the number of cases. However, in a system with informal payments additional revenue for physicians can be gained by treating more cases. This scenario creates the possibility of simultaneously observing health systems with high throughput and low salaries for health workers which, in turn, are reflected in the officially low price levels.

55. Given their nature, it is often difficult to obtain accurate data on the size of informal payments. A 2010 survey of health care consumers in the targeted countries reveals that in Lithuania, Romania and Hungary almost half of hospitalised patients made informal payments. In Bulgaria around 50% paid only formal charges (European Policy Brief 2011). In Hungary, the amount of informal payments adds a significant expense for patients as it equals 13.7% of the average monthly salary (Baji *et al.,* 2012). In Bulgaria, the size of informal payments was estimated to be equal to 3.6% of public expenditure on health and 47.1% of all out-of-pocket payments (Atasanova *et al.,* 2013).

56. In some instances, even official patient co-payments may not always be captured by administrative data collections, thereby leading to under-reporting of quasi-prices. The co-payments within some social health insurance systems are paid directly to health care providers, and applied to all levels of medical services, except emergency care. In Bulgaria, for example, patients face a complex system of co-payments (as well as informal payments as described above). The co-payment size for hospital services equals 2% of the minimum monthly wage in the country per day for the first 10 days of hospital stay. It is not always clear that even such official co-payments are observed in the administrative cost data.

57. The available evidence shows that in some countries informal payments occur frequently and can be large. This suggests that in some instances the quasi-prices reported in some health systems highly under-represent the actual costs of health care. In principle, it would be possible to make adjustments to the

20 Households' out-of-pocket expenditure by definition includes cost-sharing and informal payments (both in cash and kind). Under the SHA framework, informal payments are considered as out-of-pocket-payments and reported under HF.3.1. Of note that only formal cost-sharing is reported under HF.3.2 (Cost sharing with third party payers).

quasi-prices to reflect informal payments. In practice, however, there are question marks around the method and size of this adjustment. In addition, the issue of informal payments may also affect the accuracy of SHA and SNA data.

Hospital deficits

58. The presence of financial deficits indicate that the revenue received by hospitals do not cover their total costs. This, in turn, may be a sign that the prices received by hospitals through the DRG-based payment system are too low. There is some evidence of deficits in some CEE countries. The Hungarian Insurance Fund operates at a deficit and has experienced consistent gaps between expenditure and revenue since the implementation of DRGs. This figure has been as high as 23.8% of total health expenditure (or 1.7% of GDP), although for 2010 the overspending has reduced to 4.8% of health expenditure (0.3% of GDP) (Gaal *et al.,* 2011). Romania's health system also appears to be experiencing deficit, but it is foreseen that the needed infrastructure improvement to make DRGs fully operational will require additional cost. In Slovakia, the health care system experienced growing deficits prior to the health reforms introduced during 2003 and 2006. However, the transformation of health insurance funds into health insurance companies has stabilized the sector in terms of financing, with companies forced to become more prudent and effective at utilizing their own resources. After the transformation period, no new debt has been created (Szalay *et al.,* 2011). The health care system in Slovenia has not accumulated a deficit since 2004 due to a strict adherence to an agreed framework adopted when the Health Insurance Institute of Slovenia borrowed against the treasury to gain solvency before EU accession.

59. Deficits have been a relatively common feature in a number of health care systems, including some CEE countries. The presence of deficits may indicate that quasi-prices are intentionally set by payers at a lower level than full cost of production. If this is the case, then there is a possibility of under-valuation of quasi-prices. . At the same time, there is clear evidence that many countries have substantially reduced the size of their health care deficits as well as the number of countries in which deficits exist. While the presence of deficits may require careful interpretation and monitoring in future PPP results, there are signs that this issue is being resolved.

Limitations of the study

60. The comparison of product types across countries assumes that these services are delivered with the same level of quality. This is a strong assumption but it should be noted that it is also implicit in other PPP comparisons. Also, the methodology at hand has been designed to minimise biases through quality differences by only comparing hospital products with the same or very similar characteristics. In this way, stratification keeps quality constant if the products included in a particular stratum are relatively homogeneous (Atkinson, 2005).

61. Nevertheless, further work may be required to control for potential quality differences. Future methodological work could, in the first instance, improve product homogeneity by adding further criteria to the product selection process. For instance, it is feasible to add the type of surgery (laparotomic versus laparoscopic surgery) for hospital products such as appendectomy, cholecystectomy and abdominal and vaginal hysterectomy. This would entail regular monitoring of hospital products, particularly when different technologies become available. Over the longer term, methodological advancement could occur by augmenting the analysis with an explicit quality adjustment based – as an example - on post-treatment survival, life expectancy and waiting times (Castelli *et al.,* 2007; Deveci, 2011) and patient-reported outcome measures (NHS Information Centre, 2011; Gutacker *et al.* (2011).

62. The increased use of DRG-based systems for hospital financing should contribute to improving comparability further in the future. Moreover, the representativity of the hospital sample should increase

over time as DRG-based payment systems are refined. Finally, where the quasi-prices are actually used to pay for hospital services, both payers and suppliers of hospital products have a strong incentive to ensure that the quasi-price measures reflect the opportunity costs of providing and purchasing hospital services.

63. The case type definitions do not take into account the "severity" of the hospitalization case as proxied through secondary diagnoses and/or age. The main reasons for that being the way severity is measured and in coding practices among countries[21]. This means that severity is not a selection criterion for the case types identified for this study, and all the hospitalization cases that match the case type definitions should be included independently of their severity level.

21 The completeness of hospital coding, represented by the mean number of secondary diagnoses, can differ across countries in terms of who is responsible for code assignment, strength, and scope of incentives for coding, implementation of coding guidelines, and data storage limitations.

PART II: PPPS FOR TOTAL HEALTH EXPENDITURES

64. To obtain PPPs for total health care, PPPs for hospital services need to be combined with PPPs for other health care goods and services – pharmaceutical products, outpatient services, etc. It is important to note that the method used to calculate PPPs for total health described in this paper changed from the previous method. This was driven by not only a shift from an input-based to an output-based approach for hospital services, but also by a change in the classification of health expenditure, in the data sources for the weights of the different expenditure categories and in the calculation approach (see paragraphs 66-71 below). In part II of this paper, we will label "input" as the previous method, while "output" will refer to the new method now being used.

65. It is important to note that hospitals are the key health care institutions in all OECD health systems. On average, OECD countries spend approximately 36% of overall health care expenditure on hospital services. Thus the results presented in this part are highly dependent and correlated to the hospitals' results presented and discussed in Part I of this document. Some of the differences between the "output" and the "input" method results presented here may be explained by a change in the method for calculating prices for hospital services, even if it is difficult to disentangle the effects of the other changes – that is classification of health expenditure, data sources for weights and the calculation approach – on the results.

2.1 Data and methods for calculating PPPs for total health

The classification for health expenditure

66. The classification of health expenditure and a related set of weights to be used in the calculation of the output-based health PPPs combine information from the System of Health Accounts (SHA) with the standard national accounts expenditure aggregates for health.

67. The classification (see Annex 1 - Table 5) is based on the classifications of providers and of functions that are used in the SHA[22]. The first four items include all services provided by hospitals, as a whole and broken down into their three major classes (general, mental and speciality hospitals). We excluded long term care home services provided by hospitals as those services are for the most part included in social protection expenditure in SNA. The same approach is used for the fifth category, services provided by nursing and residential care facilities, for which long term home care services have also been excluded. Goods and services provided by the remaining two categories of the provider classification (i.e. "Providers of ambulatory health care" and "Retail sale and other providers of medical goods") have been broken down into the main categories of the functional classification. These include out-patient medical, dental and paramedical services, as well as pharmaceutical products, other medical products, and therapeutic appliances and equipment. Annex 1 – Table 6 reports the correspondence between the SHA classification codes and the PPP expenditure categories.

Calculation of the weights of the different categories

68. The relative weight of each of the items included in the classification was calculated using the SHA data which are reported annually by the large majority of OECD and European countries. For this exercise, data refers to 2010 and 2011 as reported in the 2013 OECD-Eurostat-WHO joint SHA data

22 Annex 1 – Table 5 is based on the SHA 1.0 classifications. Note that the new SHA 2011 (OECD, Eurostat, WHO 2011) presents minor changes to the provider and functional classifications.

collection. The relative weights represent the share of health expenditure of each item in total expenditure on personal health care (excluding long term home care). Imputations were made for those countries for which the implementation of SHA has not been completed yet. Results for 2011 are presented in Annex 1 - Table 5, where shadowed rows identify the countries for which SHA data were not available and therefore imputed[23].

Calculation of health PPPs

69. The PPPs for health have been calculated using the shares for the 10 categories of expenditures as weights and the PPPs calculated for each category as described in Annex 1 - Table 7. For mental health and substance abuse hospitals as well as for speciality hospitals it was decided to use the same PPP as for general hospital services as the breakdown from SHA between different type of hospitals is not always available and accurate. For nursing and residential care facilities, PPPs are currently calculated on the basis of prices for medical hospital services per day of stay. This is a proxy that needs to be improved upon.

70. For the six categories of outpatient services and medical goods, PPPs were used that are calculated on the basis of regular PPP price surveys on those goods and services.

71. For the six countries which did not participate in the hospital price survey, we used the PPP for "hospital services" coming from the traditional input approach PPP calculations for the three categories relating to hospital services and the PPPs for social protection for nursing and residential care facilities.

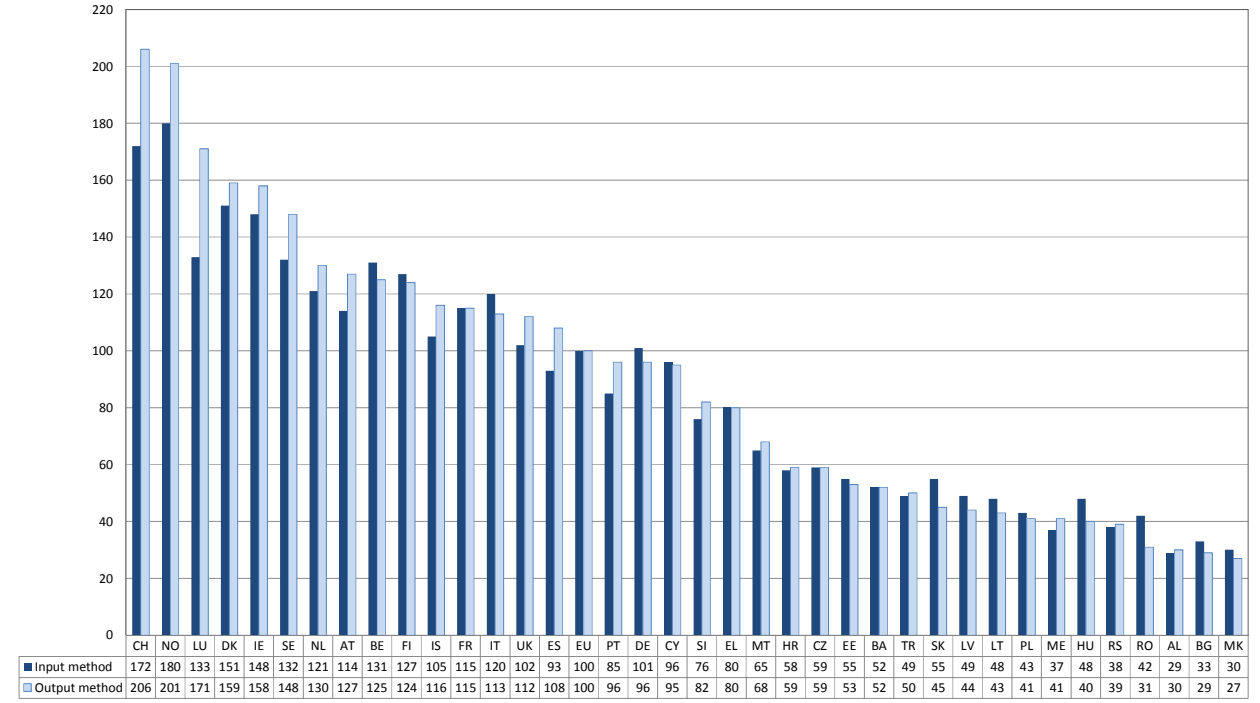
2.2 Main results for health

72. Figure 6[24] shows the PLIs for the overall health sector, including hospitals, outpatient services, pharmaceuticals, medical goods and therapeutic appliances. A comparison of PLIs calculated on the basis of the output-based methodology and the input-based methodology is reported. We observe a larger spread of the output-based results as compared to the input-based ones: from 27 in the former Yugoslav Republic of Macedonia to 206 in Switzerland.

23 Imputations were performed for those countries not reporting SHA. To do that, we first identified homogeneous groups of health systems for countries reporting SHA questionnaire, then assign those countries not reporting SHA to one of those groups and lastly impute the missing values. The identification of homogeneous groups was derived from the analysis proposed by Joumard and colleagues in 2010, where OECD countries were clustered into 5 groups, primarily on the basis of their institutional characteristics. Within each group, an average value of each expenditure component has been computed on the basis of the available information. Those average values have then been imputed to the countries without SHA data within each group.

24 Note that this figure reports the results for 37 countries, including Albania, Bosnia and Herzegovina, Greece, Malta, Montenegro, Serbia and Turkey. As no hospital output data is available for these seven countries, an input-based method is used, as explained above.

Figure 6. Comparison of price level indices for health, output-based and input-based method, 2011, EU28=100

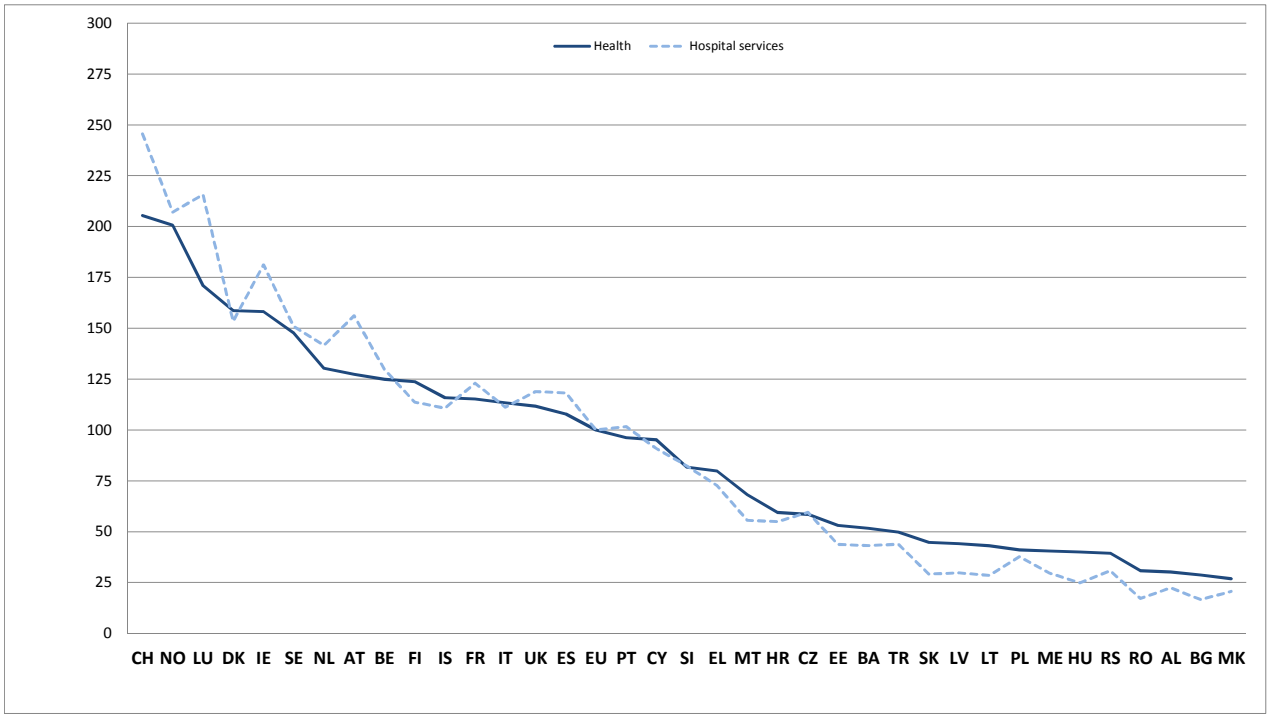


	CH	NO	LU	DK	IE	SE	NL	AT	BE	FI	IS	FR	IT	UK	ES	EU	PT	DE	CY	SI	EL	MT	HR	CZ	EE	BA	TR	SK	LV	LT	PL	ME	HU	RS	RO	AL	BG	MK
Input method	172	180	133	151	148	132	121	114	131	127	105	115	120	102	93	100	85	101	96	76	80	65	58	59	55	52	49	55	49	48	43	37	48	38	42	29	33	30
Output method	206	201	171	159	158	148	130	127	125	124	116	115	113	112	108	100	96	96	95	82	80	68	59	59	53	52	50	45	44	43	41	41	40	39	31	30	29	27

Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

73. The spread of health PLIs is less pronounced than that of hospital PLIs reported in part I of this paper, as shown in Figure 7. This is in line with expectations because total health includes also health products, such as pharmaceuticals and therapeutic appliances which are tradable. By dividing total health expenditures (as reported in the national accounts) with their respective PPPs as calculated above, a measure of real (i.e. price level adjusted) expenditures, or volume, is obtained. To compare those volumes across countries, they are further divided by the population of each country and indexed to the average volume per capita of the EU28.

Figure 7. Comparison of price level indices for hospital services and health, 2011, EU28=100

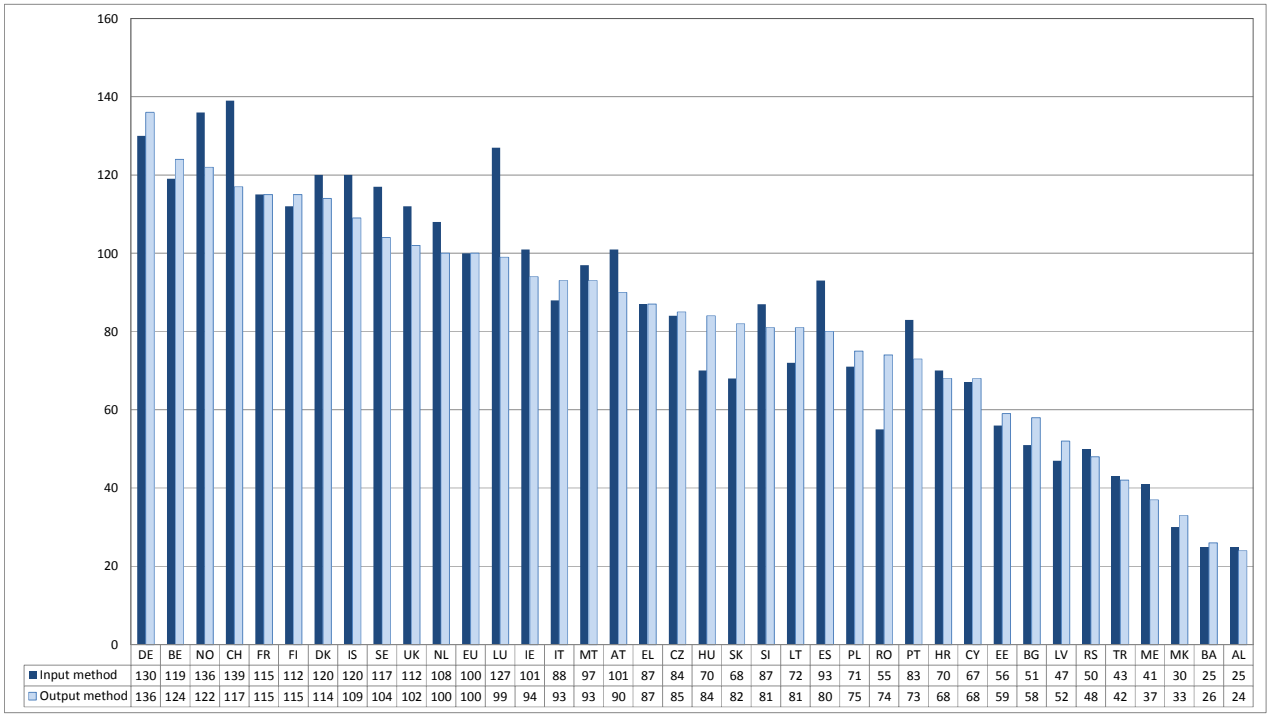


Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

74. Per capita volume indices for the year 2011 for health as a whole compiled using the new method are compared with the, previously published, input-based results in Figure 8. This figure shows that per capita volume indices for health compiled with the output-based methodology vary from 24 in Albania to 136 in Germany. The output-based methodology appears to reduce the per capita volume indices for the Nordic countries (except Finland) as well as Switzerland, Luxembourg, Spain and Austria. On the other hand, per capita volume indices are higher with the new methodology for a number of CEE countries, including Lithuania, Slovakia, Romania and Hungary. This is due to both the change of methodology for the calculation of PPPs for hospital services, to the change of structure and data sources for the weights, and the new methodology for the calculation of PPPs for total health expenditures. It is difficult to disentangle the different effects.

75. It is worth noting that the impact of the new method on broad macro-economic aggregates is limited. Differences in per capita volumes do not exceed 3 points, whether Actual Individual Consumption (AIC) or GDP is considered. Country rankings stay almost unchanged.

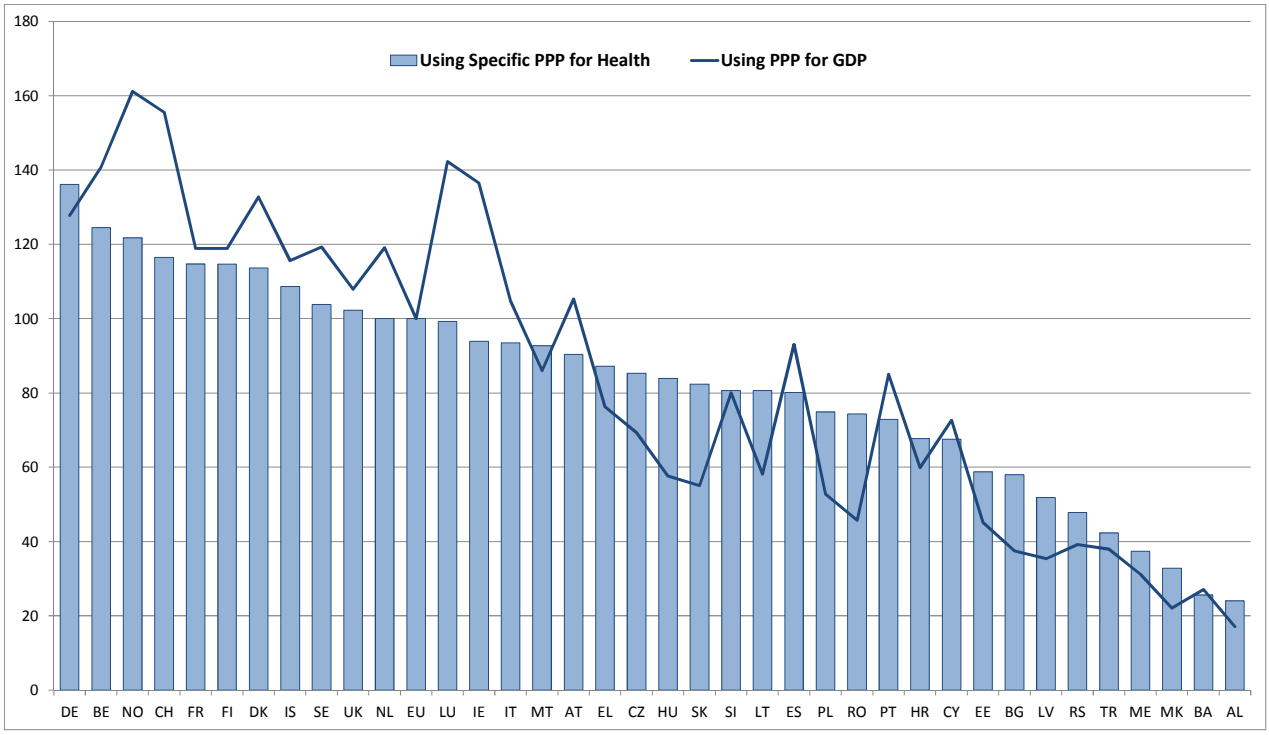
Figure 8. Comparison of per capita volume indices for health, output-based and input-based method, 2011, EU28=100



	DE	BE	NO	CH	FR	FI	DK	IS	SE	UK	NL	EU	LU	IE	IT	MT	AT	EL	CZ	HU	SK	SI	LT	ES	PL	RO	PT	HR	CY	EE	BG	LV	RS	TR	ME	MK	BA	AL
Input method	130	119	136	139	115	112	120	120	117	112	108	100	127	101	88	97	101	87	84	70	68	87	72	93	71	55	83	70	67	56	51	47	50	43	41	30	25	25
Output method	136	124	122	117	115	115	114	109	104	102	100	100	99	94	93	93	90	87	85	84	82	81	81	80	75	74	73	68	68	59	58	52	48	42	37	33	26	24

Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

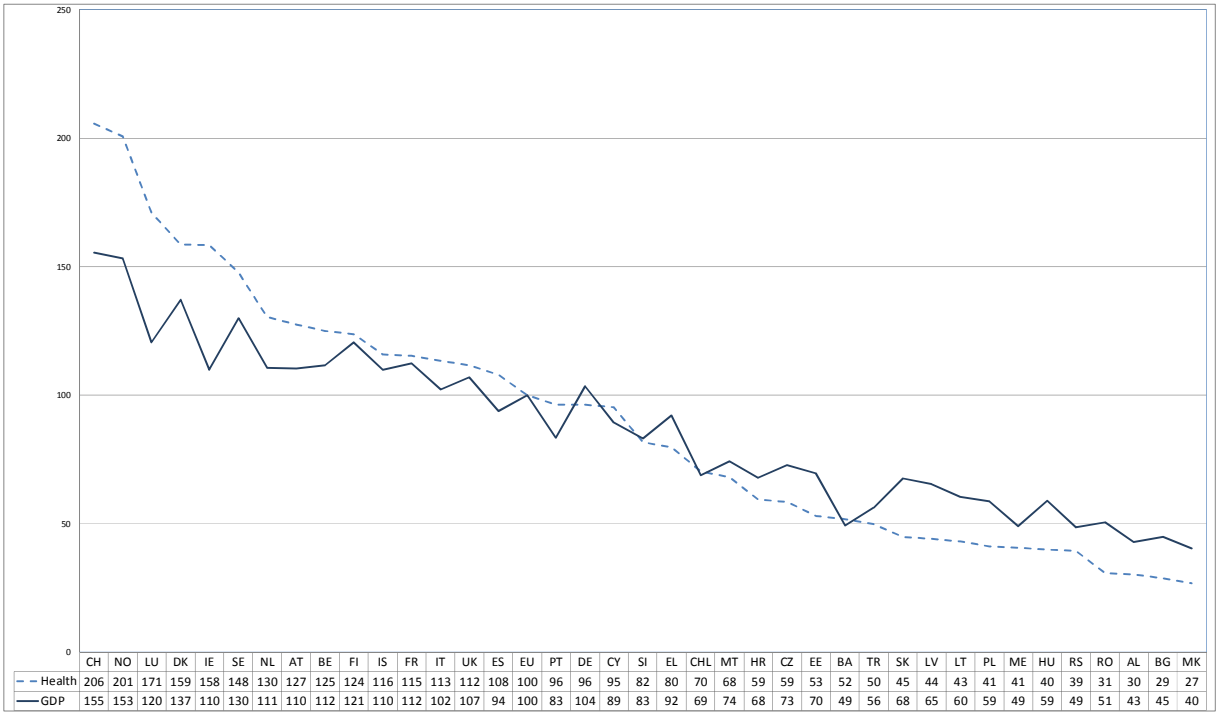
Figure 9. Comparison of per capita volume indices for health, PPP for GDP and PPP for health, 2011, EU28=100



Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

76. Figure 9 shows the differences in the per capita volume of health if we use the health-specific PLIs instead of the economy-wide GDP PPP. It appears that per capita volume indices are more equal across countries when health-specific PPPs are used. This can be explained by the fact that price level indices for health vary more across countries than price level indices for GDP as shown in Figure 10.

Figure 10. Comparison of price level indices for gross domestic product and health, 2011, EU28=100



	CH	NO	LU	DK	IE	SE	NL	AT	BE	FI	IS	FR	IT	UK	ES	EU	PT	DE	CY	SI	EL	CHL	MT	HR	CZ	EE	BA	TR	SK	LV	LT	PL	ME	HU	RS	RO	AL	BG	MK
Health	206	201	171	159	158	148	130	127	125	124	116	115	113	112	108	100	96	96	95	82	80	70	68	59	59	53	52	50	45	44	43	41	41	40	39	31	30	29	27
GDP	155	153	120	137	110	130	111	110	112	121	110	112	102	107	94	100	83	104	89	83	92	69	74	68	73	70	49	56	68	65	60	59	49	59	49	51	43	45	40

Source: 2013 Eurostat/OECD Hospitals PPPs Survey; OECD Purchasing Power Parities Statistics 2013

CONCLUSIONS

77. The new output-based methodology developed for calculating hospital and health PPPs appears to be sound and reliable. It increases the price level of health products in high income countries, while the opposite is true for a large part of lower income countries. The new output-based methodology reduces the per capita volume of health services for the Nordic countries (except Finland) as well as Switzerland, Luxembourg, Spain and Austria. On the other hand, per capita volume indices are higher with the new methodology for a number of CEE countries, including Lithuania, Slovakia, Romania and Hungary.

78. Improvements to the methodology are needed in particular for nursing and residential care facilities, for which the PPPs are currently calculated on the basis of prices for medical hospital services per day of stay. Work is already on-going in this area. Moreover, the increased use of DRG-based systems for hospital financing should contribute to improving comparability further in the future.

79. The small impact at the macro-economic level in no way reduces the importance of the new set of health PPPs for analyses of the health sector. In particular, we find that in wealthier countries, the price level index for GDP tends to be lower than the new health PLI results while in lower income countries the opposite phenomenon can be observed (see Figure 8). In other words, relative prices for health services tend to increase with rising income levels, confirming similar observations in the literature. The direction that the new health prices take is therefore plausible.

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ANNEX 1: TABLES

Table 1. Cost covered by quasi-prices

Overhead costs	Medical infrastructure	Laundry
		Sterilization
		Patient transport within the hospital
		Food service to patients
		Other (includes patient transport outside the hospital, staff transport, transportation of samples/blood)
	Non-medical infrastructure	Administrative staff
		Cleaning
		Security
		Gardening
		Desk officers
		Telephone
		Printing and stationery
		Rent
		Taxes
		Energy
		Water
		Waste disposal
		IT/IS services
		Building maintenance
		Equipment maintenance
Capital costs[1]		Consumption of fixed capital
Direct costs	Compensation of employees	Medical staff
		Nursing staff
		Technical staff
		Administrative staff
	Goods and services	Medical and surgical equipment[2]
		Laboratory equipment[2]
		Disposables (including medical and surgical supplies)
		Drugs
		Medical gases
		Dressings
		Prosthesis

[1] Capital costs should also cover research and development (R&D) but as countries have difficulty determining the cost of this item, R&D is not included in the quasi prices reported.

[2] Includes small tools - that is goods that may be used repeatedly or continuously in production over many years but may nevertheless be small, inexpensive and used to perform relatively simple operations

Table 2. Sample by country. General and specialised hospitals

Country	*No. sample hospitals*	*% total hospitals*	*% total cases*	*% total expenditure*
Austria	129		13.6	
Belgium	109	100		
Bulgaria	253	80.8		
Croatia	30	100		
Cyprus	1			
Czech Republic	189	100	15.8	17.4
Denmark	35	85.4		
England				
Estonia	12	50		
Finland	8	17	16.4	18.4
France	73	5.4		
FYROM	12	20.7	20.2	32
Germany	1601	92.2	12.4	12.3
Hungary	71	53.8		
Iceland	1		24.2	17.6
Ireland	13	22.8	13.3	14.6
Italy	571	44.3	17.2	16
Latvia	39	55.7		
Lithuania	77	100	18.6	20.5
Luxembourg	6	100		
Malta	1			
Netherlands	163	42.6		
Norway[25]	29		12.9	15.5
Poland	970	88.8		
Portugal	44	83	28.8	30
Romania	107	23.7	21.7	24.5
Slovakia				
Slovenia	22	88	15.6	19.3
Spain	488	88.8	26.3	19.6
Sweden	62	65.9	18.1	16.8
Switzerland	69	38.3	17.1	16.7

25 In Norway, hospitals are organized as trusts which consist of one up to several hospitals.

Table 3. Average length of stay by country and by type of product

	ALOS (days)		
Country	*Medical*	*Surgical*	*Total*
Croatia	7.2	6.9	7.1
Czech Republic	6.7	6.7	6.7
Bulgaria	7.5	5.3	6.6
Romania	6.4	6.5	6.5
Italy	6.5	5.7	6.1
Slovakia	6.7	5.2	6.0
Belgium	7.0	5.5	6.0
Latvia	5.1	6.8	5.9
Lithuania	6.6	5.1	5.8
Germany	7.3	5.3	5.8
Portugal	7.3	4.9	5.8
Switzerland	6.0	5.4	5.6
Austria	5.4	5.5	5.4
Slovenia	5.4	5.3	5.4
Hungary	6.0	4.9	5.3
Luxembourg	5.9	4.6	5.1
Ireland	5.3	5.0	5.1
Poland	5.6	4.6	5.0
France	5.3	4.7	5.0
FYROM	3.4	5.5	4.7
Spain	4.7	4.3	4.5
Malta	4.3	4.7	4.5
Finland	4.7	4.3	4.4
United Kingdom	4.8	3.8	4.3
Estonia	5.0	3.7	4.2
Norway	3.6	4.0	3.7
Denmark	4.3	2.6	3.5
Sweden	3.4	3.8	3.5
Iceland	2.5	2.5	2.5
Total	*5.8*	*5.0*	*5.3*

Table 4. Number of cases and average length of stay by case type

Code	*Case type*	*Number of cases*	*% of cases*	*ALOS (days)*
S04	Colorectal resection	129,744	1.1	13.1
S05	Coronary artery bypass graft	73,882	0.6	12.3
S14	Peripheral vascular bypass	40,260	0.3	11.3
S08	Hip replacement: total and partial	509,887	4.2	9.3
S10	Knee replacement	387,872	3.2	8.5
S12	Open prostatectomy	123,165	1.0	8.2
M07	Pneumonia	1,237,583	10.3	7.9
M04	Heart failure	1,144,204	9.5	7.6
M01	Acute myocardial infarction	279,057	2.3	6.2
S07	Endarterectomy: vessels of head and neck	65,622	0.5	5.9
S09	Hysterectomy: abdominal and vaginal	401,754	3.3	5.7
S11	Mastectomy	95,708	0.8	5.5
M05	Malignant neoplasm of bronchus and lung	328,866	2.7	5.2
S02	Caesarean section	1,136,693	9.4	5.2
S17	Transurethral resection of prostate (TURP)	229,398	1.9	5.2
S06	Discectomy	148,370	1.2	5.1
M03	Cholelitiasis	229,213	1.9	5.0
S13	Percutaneous transluminal coronary angioplasty (PTCA)	462,983	3.8	4.4
S03	Cholecystectomy	666,212	5.5	4.2
S01	Appendectomy	435,927	3.6	3.9
M02	Angina pectoris	380,012	3.2	3.8
S16	Thyroidectomy	242,788	2.0	3.6
M06	Normal delivery	1,547,793	12.8	3.4
S21I	Tonsillectomy and/or adenoidectomy	370,396	3.1	2.6
S15	Repair of inguinal hernia	572,317	4.7	2.3
S20I	Ligation and stripping of varicose veins - lower limb	210,698	1.7	2.0
S18I	Arthroscopic excision of meniscus of knee	97,882	0.8	2.0
S19I	Cataract surgery	503,472	4.2	1.9
	Total	*12,051,760*	*100*	*5.3*

Table 5. SHA-based weights by category and by country, 2011

Countries	Hospital services	General	Mental	Speciality (other then mental health and substance abuse hospitals)	Nursing and residential care facilities	Out-patient medical services	Out-patient dental services	Out-patient paramedical services	Pharmaceutical products	Other medical products	Therapeutic appliances and equipment
AU	0.45	0.42	-	0.03	0.10	0.16	0.06	0.03	0.14	0.00	0.05
BE	0.37	0.31	0.05	0.01	0.15	0.21	0.04	0.04	0.18	0.00	0.02
CZ	0.47	0.42	0.02	0.03	0.02	0.17	0.06	0.06	0.18	0.01	0.03
DK	0.56	0.51	0.05	-	0.14	0.10	0.06	0.02	0.08	0.01	0.04
EE	0.49	0.47	0.00	0.03	0.03	0.10	0.07	0.05	0.22	0.01	0.02
FI	0.39	0.39	0.00	-	0.08	0.25	0.07	0.02	0.15	0.00	0.03
FR	0.40	0.36	0.04	-	0.07	0.17	0.05	0.06	0.18	0.01	0.05
DE	0.35	0.32	-	0.03	0.09	0.20	0.09	0.05	0.17	0.00	0.06
EL	0.41	0.36	0.02	0.04	0.01	0.21	-	0.05	0.30	-	0.02
HU	0.32	0.29	0.00	0.03	0.03	0.18	0.03	0.04	0.36	0.01	0.03
IS	0.37	0.36	-	0.00	0.13	0.23	0.06	0.02	0.13	0.03	0.02
IE	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
IT	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
LU	0.39	0.33	0.02	0.03	0.18	0.20	0.06	0.04	0.09	0.01	0.03
NL	0.39	0.29	0.09	0.02	0.23	0.14	0.04	0.02	0.12	-	0.05
NO	0.45	0.36	0.09	-	0.22	0.12	0.06	0.01	0.08	0.00	0.05
PL	0.38	0.34	0.02	0.02	0.02	0.20	0.06	0.05	0.26	0.00	0.02
PT	0.41	0.40	0.01	-	0.02	0.27	-	0.06	0.20	-	0.04
SK	0.28	0.27	0.01	0.00	-	0.17	0.05	0.09	0.31	-	0.10
SI	0.46	0.36	0.02	0.08	0.06	0.14	0.06	0.02	0.20	0.02	0.04
ES	0.45	0.42	0.01	0.02	0.07	0.17	0.06	0.02	0.18	0.01	0.03
SE	0.57	0.57	-	-	-	0.16	0.09	-	0.13	0.01	0.04
CH	0.40	0.31	0.04	0.06	0.19	0.18	0.07	0.04	0.10	-	0.02
TR	0.47	0.47	-	0.00	0.07	0.20	0.08	0.01	0.13	0.02	0.03
UK	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
CY	0.49	0.35	0.02	0.11	0.01	0.20	0.05	0.08	0.15	0.00	0.02
LV	0.37	0.29	0.04	0.05	0.06	0.17	0.03	0.04	0.28	0.00	0.04
LT	0.41	0.35	0.01	0.05	0.02	0.15	0.06	0.04	0.11	0.17	0.03
RO	0.41	0.31	0.02	0.09	0.03	0.09	0.03	0.05	0.38	0.00	0.01
BG	0.44	0.32	0.00	0.11	0.00	0.08	0.05	0.04	0.38	-	0.02
ML	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
HR	0.45	0.40	0.02	0.03	-	0.10	0.07	0.05	0.28	0.03	0.02
MK	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
BA	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
ME	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
RS	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
AL	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02

Table 6. Mapping between SHA functional and provider classifications and PPPs expenditure categories

SHA functional classification	*SHA provider classification*	*PPP Expenditure category*
Personal care HC.1-HC.5 (excluding HC3.3)	Hospitals (HP1)	Hospital services
Personal care HC.1-HC.5 (excluding HC3.3)	General hospitals (HP1.1)	General
Personal care HC.1-HC.5 (excluding HC3.3)	Mental health and substance abuse hospitals (HP1.2)	Mental
Personal care HC.1-HC.5 (excluding HC3.3)	Speciality (other then mental health and substance abuse hospitals) (HP1.3)	Speciality (other then mental health and substance abuse hospitals)
Personal care HC.1-HC.5 (excluding HC3.3)	Nursing and residential care facilities (HP2)	Nursing and residential care facilities
Out-patient medical services (HC1-3 excluding HC1.3.2	Total expenditure HP.3-HP.4	Out-patient medical services
Out-patient dental services (HC1.3.2)	Total expenditure HP.3-HP.4	Out-patient dental services
Out-patient paramedical services (HC4)	Total expenditure HP.3-HP.4	Out-patient paramedical services
Pharmaceutical products (HC5.1.1+HC5.1.2)	Total expenditure HP.3-HP.4	Pharmaceutical products
Other medical non-durables (HC5.1.3)	Providers of ambulatory health care (HP3) +Retail sale and other providers of medical goods (HP4)	Other medical products
Therapeutic appliances and other medical durables (HC5.2)	Providers of ambulatory health care (HP3)+Retail sale and other providers of medical goods (HP4)	Therapeutic appliances and equipment

HC3.3: Long-term nursing care: home care

Table 7. PPPs used in the calculation of health PPPs by health expenditure category

Category	*Method used to calculate PPP*
General hospitals	Output approach – Hospital services
Mental health and substance abuse hospitals	Output approach – Hospital services
Speciality hospitals	Output approach – Hospital services
Nursing and residential care facilities	PPPs for medical hospital services per day
Outpatient medical services	Out-patient medical services (PPP health survey)
Outpatient dental services	Dental services (PPP health survey)
Outpatient paramedical services	Paramedical services (PPP health survey
Pharmaceutical products	Pharmaceutical products (PPP health survey)
Other medical goods	Other medical products (PPP health survey)
Therapeutic appliances	Therapeutic appliances (PPP health survey)

ANNEX 2: OUTPUT BASED PRICING REFORMS
SUMMARY OF EXPERIENCES IN SELECTED CEE COUNTRIES

80. Bulgaria has been undergoing reforms since 2000, evolving from a state run to a complex mostly single payer national health insurance system, encompassing a mix of public and private, centralized and decentralized features (World Bank, 2013). Hospitals are funded retrospectively case-based via an aggregated version of DRGs, called Clinical Care Pathways (CCPs), capped by a global budget target. CCP (reimbursement) values and volumes are negotiated via an annual National Health Services Agreement by representatives of the physicians', dentists' unions, and the National Health Insurance Fund. Price information is under negotiation, based on real costs and available funding in the NHIF budget (Dimova *et al.*, 2011). Hungary nationally implemented a DRG-based system in 1993. Consistent with experiences elsewhere, the introduction of DRGs in Hungary has seen a reduction in ALOS similar to other Western European countries (Gaal *et al.,* 2011). More data would be necessary to see whether hospital prices have increased or decreased since 1993. In Hungary, the DRG system has been used to allocate total national hospital budget rather than as a fixed payment scheme (Kroneman *et al.,* 2001). Where other countries generally fix a price to be reimbursed for a specific DRG code at all hospitals, the Hungarian system allows a hospital to be allocated a larger share of the resources based on output. Hospitals can compete with one another by increasing output to gain a larger share of a fixed budget. The increased output through this type of competition further reduces price per case.

81. Latvia introduced a global budget payment system for hospitals in 2010. Budgets are allocated according to contracted volumes, and tariffs are set according to the national average cost per patient. Budget ceilings are set at 95% (90% for university hospitals) of the preceding year's budget. Overruns of the contracted volume budget are not reimbursed, but budgets can be decreased during a one-year budgetary period if volume targets are not met (Mathauer *et al.,* 2012).

82. Romania's imported a DRG system in 2007 (Radu *et al.,* 2010) but there have been a number of issues regarding its adoption as a payment tool. There has been reported resistance among medical staff once they became aware of the implications and lower than expected payment rates (Mathauer *et al.,* 2012). The lack of a completely embedded system has led to incorrect patient coding and, in turn, inaccurate data. Further, the centrally run nature of the Romanian health care system and lack of competition may impede accurate valuation of input prices. As result, output prices may not accurately reflect the real costs of care (Haraga *et al.,* 2009). The degree of uncertainty around costs data is also affected by the lack of costing exercises in Romania.

83. Slovakia has aimed to decentralise and privatise key aspects of their health care system, placing greater responsibility on the individual. Since 2003, prices in Slovakian hospitals for inpatient care have been determined by negotiation between insurers and providers. However, average prices between state-owned and non-state owned hospitals vary by between 30% - 104%, with even greater variation if certain quality criteria are included. In the outpatient sector prices are uniform (Szalay *et al.,* 2011). This systematic price heterogeneity provides some cause for concern about the ability to calculate underlying cost structures and quasi-prices.

84. According to an IMF report, the Slovak health system has inefficiencies that occur mostly in the process of transforming intermediate health resources into health outcomes (Verhoeven *et al.,* 2007). The IMF study outlines two reasons for this. First, the system retains many of its old features, still reflecting many of its pre- and early transition hospital structures and workforce practices. Second, relatively low

prices for labour and other inputs for health services has led to a situation that despite its low spending levels, real resources in the health sector are relatively high (Verhoeven *et al.,* 2007). Slovakia does not currently employ a DRG system but they have recently purchased (in 2012) the German version for future adaptation and implementation.

85. Slovenia has had a DRG system in place since 2003 (purchased and adapted from the Australian system). The DRG system is operated at the secondary and tertiary care levels, bringing their payment system in line with many other European countries. Remuneration of health care providers is reportedly dependent on completed work, or the number of individuals treated. Private practitioners are paid according to this method and work for the Health Insurance Institute of Slovenia (HIIS) is on a contractual basis. The HIIS is a public non-profit entity responsible for administering and financing hospital services among other services and infrastructure at the national level. The situation is different in public health services (Albreht *et al.,* 2009). Salary levels for public sector health providers were low prior to the reforms beginning in the 1990's but are now negotiated between trade unions and the Ministry of Health.

ANNEX 3: CASE TYPES DEFINITIONS

Medical case types

M01, Acute Myocardial Infarction

Case type description	This case type relates to either newly diagnosed myocardial infarction or episode of care following the initial episode where the patient is admitted for further observation, evaluation or treatment for a myocardial infarction that has received initial treatment, but occurred less than 4 weeks ago. It includes: Coronary (artery) embolism, occlusion, rupture, thrombosis; Infarction of myocardium, atrium or ventricle; Rupture of myocardium, atrium or ventricle; and ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction.
ICD-10 codes	I21.0, Acute transmural myocardial infarction of anterior wall I21.1, Acute transmural myocardial infarction of inferior wall I21.2, Acute transmural myocardial infarction of other sites I21.3, Acute transmural myocardial infarction of unspecified site I21.4, Acute subendocardial myocardial infarction I21.9, Acute myocardial infarction, unspecified I22.0, Subsequent myocardial infarction of anterior wall I22.1, Subsequent myocardial infarction of inferior wall I22.8, Subsequent myocardial infarction of other sites I22.9, Subsequent myocardial infarction of unspecified site
Rules	No operating room procedure is performed
Inclusion	Invasive treatments: 36.04, Intracoronary artery thrombolytic infusion 36.06, Insertion of drug-eluting coronary artery stents 36.07, Insertion of non drug-eluting coronary artery stents 37.21, Right heart catheterization 37.22, Left heart catheterization 37.23, Combined heart catheterization 37.26, Catheter based invasive electrophysiologic testing 37.61, Implant of pulsation balloon 88.52, Angiocardiography of right heart structures 88.53, Angiocardiography of left heart structures 88.54, Combined right and left heart angiocardiography 88.55, Coronary arteriography using a single catheter 88.56, Coronary arteriography using two catheters 88.57, Other and unspecified coronary arteriography 88.58, Negative-contrast cardiac roentgenography
Exclusion	00.66, Percutaneous transluminal coronary angioplasty [PTCA] (see S13) 36.1_, Bypass anastomosis for heart revascularization (see S05)

M02, Angina pectoris

Case type description	This case type includes both stable and unstable angina (Prinzmetal's angina included). Angina is a condition in which the heart doesn't get enough blood flow and oxygen Stable angina is chest pain or discomfort that typically occurs with activity or stress. The pain usually begins slowly and gets worse over the next few minutes before going away. It quickly goes away with medication or rest, but may happen again with additional activity or stress. Unstable angina occurs at rest with an increasingly severe pattern. It could prelude a heart attack.
ICD-10 codes	I20.0, Unstable angina I20.1, Angina pectoris with documented spasm I20.8, Other forms of angina pectoris I20.9, Angina pectoris, unspecified
Rules	No operating room procedure is performed
Inclusion	Invasive treatments: 36.04, Intracoronary artery thrombolytic infusion 36.06, Insertion of drug-eluting coronary artery stents 36.07, Insertion of non drug-eluting coronary artery stents 37.21, Right heart catheterization 37.22, Left heart catheterization 37.23, Combined heart catheterization 37.26, Catheter based invasive electrophysiologic testing 88.52, Angiocardiography of right heart structures 88.53, Angiocardiography of left heart structures 88.54, Combined right and left heart angiocardiography 88.55, Coronary arteriography using a single catheter 88.56, Coronary arteriography using two catheters 88.57, Other and unspecified coronary arteriography 88.58, Negative-contrast cardiac roentgenography
Exclusion	00.66, Percutaneous transluminal coronary angioplasty [PTCA] (see S13) 36.1_, Bypass anastomosis for heart revascularization (see S05)

M03, Cholelitiasis

Case type description	This case type identifies cases with presence or formation of gallstones in the gallbladder or bile ducts. This can cause severe upper right abdominal (right hypochondrial) pain, potentially radiating to the right shoulder, as a result of blocked bile flow.
ICD-10 codes	K80.0, Calculus of gallbladder with acute cholecystitis K80.1, Calculus of gallbladder with other cholecystitis K80.2, Calculus of gallbladder without cholecystitis K80.3, Calculus of bile duct with cholangitis K80.4, Calculus of bile duct with cholecystitis K80.5, Calculus of bile duct without cholangitis or cholecystitis K80.8, Other cholelithiasis
Rules	No operating room procedure is performed.
Inclusion	
Exclusion	

M04, Heart failure

Case type description	*Heart failure occurs when the heart cannot pump enough blood to meet the body's needs, and it typically develops after other conditions have weakened or damaged the heart. The chronic variant tends to develop slowly over time. However, patients may also experience a sudden onset of symptoms, which is known as acute heart failure. Congestive heart failure is defined as blood backing up into the liver, abdomen, lower extremities, and lungs.*
ICD-10 codes	I50.0, Congestive heart failure I50.1, Left ventricular failure I50.9, Heart failure, unspecified
Rules	No operating room procedure is performed.
Inclusion	
Exclusion	Hypertensive heart failure (I11.0) Rheumatic heart failure (I09.9)

M05, Malignant neoplasm of bronchus and lung

Case type description	Primary malignant neoplasm arising from the cells of the bronchus, or lung
ICD-10 codes	C34.0, Malignant neoplasm of bronchus and lung - Main bronchus C34.1, Malignant neoplasm of bronchus and lung - Upper lobe, bronchus or lung C34.2, Malignant neoplasm of bronchus and lung - Middle lobe, bronchus or lung C34.3, Malignant neoplasm of bronchus and lung - Lower lobe, bronchus or lung C34.8, Malignant neoplasm of bronchus and lung - Overlapping lesion of bronchus and lung C34.9, Malignant neoplasm of bronchus and lung, unspecified
Rules	No operating room procedure is performed.
Inclusion	
Exclusion	Carcinoma in situ of bronchus and lung (D02.2)

M06, Normal delivery

Case type description	Delivery requiring minimal or no assistance, with or without episiotomy, without fetal manipulation [e.g., rotation version] or instrumentation [forceps] of a spontaneous, cephalic, vaginal, full-term, single, live-born infant
ICD-10 codes	O80.0, Spontaneous vertex delivery O80.1, Spontaneous breech delivery O80.8, Other single spontaneous delivery O80.9, Single spontaneous delivery, unspecified
Rules	No operating room procedure is performed
Inclusion	
Exclusion	

M07 Pneumonia

Case type description	Inflammation of one or both lungs, in which the air sacs (alveoli) become filled with liquid, which severely decreases the gas exchange with blood. It is often caused by bacterial (especially pneumococcal) or viral infection.
ICD-10 codes	J12.0, Adenoviral pneumonia J12.1, Respiratory syncytial virus pneumonia J12.2, Parainfluenza virus pneumonia J12.8, Other viral pneumonia J12.9, Viral pneumonia, unspecified J13, Pneumonia due to Streptococcus pneumoniae J14, Pneumonia due to Haemophilus influenzae J15.0, Pneumonia due to Klebsiella pneumoniae J15.1, Pneumonia due to Pseudomonas J15.2, Pneumonia due to staphylococcus J15.3, Pneumonia due to streptococcus, group B J15.4, Pneumonia due to other streptococci J15.5, Pneumonia due to Escherichia coli J15.6, Pneumonia due to other aerobic Gram-negative bacteria J15.7, Pneumonia due to Mycoplasma pneumoniae J15.8, Other bacterial pneumonia J15.9, Bacterial pneumonia, unspecified J16.0, Chlamydial pneumonia J16.8, Pneumonia due to other specified infectious organisms J18.0, Bronchopneumonia, unspecified J18.1, Lobar pneumonia, unspecified J18.2, Hypostatic pneumonia, unspecified J18.8, Other pneumonia, organism unspecified J18.9, Pneumonia, unspecified
Rules	No operating room procedure is performed
Inclusion	
Exclusion	Rheumatic pneumonia (I00) Pneumonia in diseases classified elsewhere (J17)

Surgical case types

S01 Appendectomy

Case type description	Procedure to surgically remove appendix through laparoscopic intervention or traditional (open) appendectomy.
ICD-9-CM codes	47.01, Laparoscopic appendectomy 47.09, Other appendectomy 47.11, Laparoscopic incidental appendectomy 47.19, Other incidental appendectomy
Rules	Principal diagnosis of diseases of appendix (K35-K38)
Inclusion	Incidental appendectomy
Exclusion	

S02 Caesarean section

Case type description	Procedure where a baby is delivered by cutting through the front wall of the abdomen to open the womb. It can be performed as a planned procedure, where the medical need for the operation becomes apparent during pregnancy; an emergency procedure, where a situation arises during labour that calls for urgent delivery of the baby; or an elective procedure, on the basis of personal choice rather than as a result of medical risk
ICD-9-CM codes	74.0, Classical cesarean section 74.1, Low cervical cesarean section 74.2, Extraperitoneal cesarean section 74.4, Cesarean section of other specified type 74.99, Other cesarean section of unspecified type
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S03 Cholecystectomy

Case type description	Cholecystectomy is here defined as the surgical removal of the gallbladder or of a part of the gallbladder. These interventions can be employed for treating a number of diseases including symptomatic gallstones or neoplasm. It is the most common method for treating symptomatic gallstones. Surgical options include the standard procedure, called laparoscopic cholecystectomy, and an older more invasive procedure, called open cholecystectomy.
ICD-9-CM codes	51.21, Other partial cholecystectomy 51.22, Cholecystectomy 51.23, Laparoscopic cholecystectomy 51.24, Laparoscopic partial cholecystectomy
Rules	Principal diagnosis of cholelitiasis (K80), cholecystitis (K81) or other diseases of gallbladder (K82)
Inclusion	Partial colecistectomy
Exclusion	

S04 Colorectal resection

Case type description	A colorectal resection is a surgery to remove a section of the large intestine. It is done to remove injured or diseased parts of the colon and/or the rectum.
ICD-9-CM codes	17.31, Laparoscopic multiple segmental resection of large intestine 17.32, Laparoscopic cecetomy 17.33 Laparoscopic right hemicolectomy 17.34, Laparoscopic resection of transverse colon 17.35, Laparoscopic left hemicolectomy 17.36, Laparoscopic sigmoidectomy 17.39, Other laparoscopic partial excision of large intestine 45.71, Open and other multiple segmental resection of large intestine 45.72, Open and other cecectomy 45.73, Open and other right hemicolectomy 45.74, Open and other resection of transverse colon 45.75, Open and other left hemicolectomy 45.76, Open and other sigmoidectomy 45.79, Other and unspecified partial excision of large intestine 45.81, Laparoscopic total intra-abdominal colectomy 45.82, Open total intra-abdominal colectomy 45.83, Open and unspecified total intra-abdominal colectomy 48.40, Pull-through resection of rectum, not otherwise specified 48.41, Soave submucosal resection of rectum 48.42, Laparoscopic pull-through resection of rectum 48.43, Open pull-through resection of rectum 48.49, Other pull-through resection of rectum 48.50, Abdominoperineal resection of rectum, not otherwise specified 48.51, Laparoscopic abdominoperineal resection of the rectum 48.52, Open abdominoperineal resection of rectum 48.59, Other abdominoperineal resection of the rectum 48.61, Transsacral rectosigmoidectomy 48.62, Anterior resection of rectum with synchronous colostomy 48.63, Other anterior resection of rectum 48.64, Posterior resection of rectum 48.65, Duhamel resection of rectum 48.69, Other resection of rectum
Rules	Principal diagnosis of malignant neoplasm of colon (C18), of rectosigmoid junction (C19) or of rectum (C20)
Inclusion	
Exclusion	

S05 Coronary artery bypass graft

Case type description	A surgical procedure used to divert blood around narrow or clogged arteries (blood vessels). This improves blood flow and oxygen supply to the heart. CABG involves taking a blood vessel from another part of the body, usually the chest or leg, to use as a graft. The grafts replace any hardened or narrowed arteries in the heart.
ICD-9-CM codes	36.10, Aortocoronary bypass for heart revascularization, not otherwise specified 36.11, (Aorto)coronary bypass of one coronary artery 36.12, (Aorto)coronary bypass of two coronary arteries 36.13, (Aorto)coronary bypass of three coronary arteries 36.14, (Aorto)coronary bypass of four or more coronary arteries 36.15, Single internal mammary-coronary artery bypass 36.16, Double internal mammary-coronary artery bypass 36.17, Abdominal - coronary artery bypass 36.19, Other bypass anastomosis for heart revascularization
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S06 Discectomy

Case type description	A discectomy is a surgical procedure in which the central portion of an intervertebral disc, the nucleus pulposus, which is causing pain by stressing the spinal cord or radiating nerves, is removed.
ICD-9-CM codes	80.50, Excision or destruction of intervertebral disc, unspecified 80.51 , Excision of intervertebral disc 80.59, Other destruction of intervertebral disc
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S07 Endarterectomy: vessels of head and neck

Case type description	Endarterectomy is a surgical procedure to remove the atheromatous plaque material, or blockage, in the lining of an artery constricted by the buildup of deposits. It is carried out by separating the plaque from the arterial wall. The procedure is widely used on the carotid artery of the neck as a way to reduce the risk of stroke.
ICD-9-CM codes	38.11 Endarterectomy intracranial vessels 38.12 Endarterectomy other vessels of head and neck
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S08 Hip replacement: total and partial

Case type description	Hip replacement surgery provides a long term solution for worn or damaged hip joints which can cause severe pain and loss of mobility. The operation replaces both the natural socket (the acetabulum) and the rounded natural ball at the head of the thigh-bone (femur) with artificial parts (prosthetics). This item includes revision and partial replacement.
ICD-9-CM codes	00.70, Revision of hip replacement, both acetabular and femoral components 00.71, Revision of hip replacement, acetabular component 00.72, Revision of hip replacement, femoral component 00.73, Revision of hip replacement, acetabular liner and/or femoral head only 81.51, Total hip replacement 81.52, Partial hip replacement 81.53, Revision of hip replacement, not otherwise specified
Rules	Any principal diagnosis code
Inclusion	Revision of hip replacement
Exclusion	

S09 Hysterectomy: abdominal and vaginal

Case type description	A procedure where the womb (uterus) or a part of the womb is surgically removed. Hysterectomies are performed to treat conditions that affect the female reproductive system, such as non cancerous tumors (fibroids) and types of cancer.
ICD-9-CM codes	68.31, Laparoscopic supracervical hysterectomy [LSH] 68.39, Other and unspecified subtotal abdominal hysterectomy 68.41, Laparoscopic total abdominal hysterectomy 68.49, Other and unspecified total abdominal hysterectomy 68.51, Laparoscopically assisted vaginal hysterectomy (LAVH) 68.59, Other and unspecified vaginal hysterectomy 68.61, Laparoscopic radical abdominal hysterectomy 68.69, Other and unspecified radical abdominal hysterectomy 68.71, Laparoscopic radical vaginal hysterectomy [LRVH] 68.79, Other and unspecified radical vaginal hysterectomy 68.9, Other and unspecified hysterectomy
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S10 Knee replacement

Case type description	In knee replacement surgery (arthroplasty) a damaged, worn or diseased knee is replaced with an artificial joint. Knee replacement is a routine operation for knee pain when the knee joint has been severely damaged as, for instance, by severe arthritis. There are two main types of knee surgery, depending on the condition of the knee: total knee replacement and half (partial) knee replacement. Both are included in the case type definition
ICD-9-CM codes	00.80, Revision of knee replacement, total (all components) 00.81, Revision of knee replacement, tibial component 00.82, Revision of knee replacement, femoral component 00.83, Revision of knee replacement, patellar component 00.84, Revision of total knee replacement, tibial insert (liner) 81.54, Total knee replacement 81.55, Revision of knee replacement, not otherwise specified
Rules	Any principal diagnosis code
Inclusion	Revision of knee replacement
Exclusion	

S11 Mastectomy

Case type description	A mastectomy is an operation to remove the whole breast, usually because it has been affected by cancer. There are four types of mastectomy: Simple mastectomy (the removal of all the breast tissue and most of the skin covering it; lymph nodes are preserved); Subcutaneous mastectomy (the removal of all the breast tissue, but leaving most of the skin covering it); Radical mastectomy (the removal of all the breast tissue, axillary lymph nodes, skin and pectoral muscles included); modified radical mastectomy (similar to the radical mastectomy, except that the large muscle behind the breast is left in place). Only simple and radical mastectomy should be included.
ICD-9-CM codes	85.41, Unilateral simple mastectomy 85.42, Bilateral simple mastectomy 85.43, Unilateral extended simple mastectomy 85.44, Bilateral extended simple mastectomy 85.45, Unilateral radical mastectomy 85.46, Bilateral radical mastectomy 85.47, Unilateral extended radical mastectomy 85.48, Bilateral extended radical mastectomy
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S12 Open prostatectomy

Case type description	Open Prostatectomy is a surgical procedure involving a skin incision and removal of all or part of the prostate. This procedure is usually performed when abnormalities of the prostate, such as a tumor, or an enlargement of the gland itself, restrict the normal flow of urine along the urethra.
ICD-9-CM codes	60.3, Suprapubic prostatectomy 60.4, Retropubic prostatectomy 60.5, Radical prostatectomy 60.62, Perineal prostatectomy 60.69, Other prostatectomy
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S13 Percutaneous transluminal coronary angioplasty (PTCA)

Case type description	A procedure in which a small balloon at the tip of the catheter is inserted near the blocked or narrowed area of the coronary artery. When the balloon is inflated, the plaque or blockage is compressed against the artery walls and the diameter of the blood vessel is widened (dilated) to increase blood flow to the heart.
ICD-9-CM codes	00.66, Percutaneous transluminal coronary angioplasty [PTCA]
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S14 Peripheral vascular bypass

Case type description	A peripheral vascular bypass is the surgical rerouting of blood flow around an obstructed artery that supplies blood to the extremities. This surgery is performed when the buildup of fatty deposits (plaque) in an artery has blocked the normal flow of blood that carries oxygen and nutrients to the extremities. Bypass surgery reroutes blood from above the obstructed portion of an artery to another vessel below the obstruction. A bypass surgery is named for the artery that will be bypassed and the arteries that will receive the rerouted blood. The three common peripheral vascular bypass surgeries are: Aortobifemoral bypass surgery, which reroutes blood from the abdominal aorta to the two femoral arteries in the groin; Femoropopliteal bypass (fem-pop bypass) surgery, which reroutes blood from the femoral artery to the popliteal arteries above or below the knee; and Femorotibial bypass surgery, which reroutes blood between the femoral artery and the tibial artery.
ICD-9-CM codes	39.25, Aorta-iliac-femoral bypass 39.29, Other (peripheral) vascular shunt or bypass
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S15 Repair of inguinal hernia

Case type description	Inguinal hernia repair, also known as herniorrhaphy, is the surgical correction of an inguinal hernia. An inguinal hernia is the protrusion of abdominal-cavity contents (usually a part of the bowel) through an opening of the abdominal wall in the groin area between the abdomen and the thigh. The surgery may be a standard open procedure through an incision large enough to access the hernia or a laparoscopic procedure performed through tiny incisions, using an instrument with a camera attached (laparoscope) and a video monitor to guide the repair
ICD-9-CM codes	17.11, Laparoscopic repair of direct inguinal hernia wih graft or prosthesis 17.12, Laparoscopic repair of indirect inguinal hernia with graft or prosthesis 17.13, Laparoscopic repair of inguinal hernia with graft or prosthesis, not otherwise specified 17.21, Laparoscopic bilateral repair of direct inguinal hernia wih graft or prosthesis 17.22, Laparoscopic bilateral repair of indirect inguinal hernia with graft or prosthesis 17.23, Laparoscopic bilateral repair of inguinal hernia, one direct one indirect, with graft or prosthesis 17.24, Laparoscopic bilateral repair of inguinal hernia with graft or prosthesis, not otherwise specified 53.00, Unilateral repair of inguinal hernia, not otherwise specified 53.01, Other and open repair of direct inguinal hernia 53.02 ,Other and open repair of indirect inguinal hernia 53.03, Other and open repair of direct inguinal hernia with graft or prosthesis 53.04, Other and open repair of indirect inguinal hernia with graft or prosthesis 53.05, Repair of inguinal hernia with graft or prosthesis, not otherwise specified 53.10, Bilateral repair of inguinal hernia, not otherwise specified 53.11, Other and open bilateral repair of direct inguinal hernia 53.12, Other and open bilateral repair of indirect inguinal hernia 53.13, Other and open bilateral repair of inguinal hernia, one direct and one indirect 53.14, Other and open bilateral repair of direct inguinal hernia with graft or prosthesis 53.15, Other and open bilateral repair of indirect inguinal hernia with graft or prosthesis 53.16, Other and open bilateral repair of inguinal hernia, one direct and one indirect, with graft or prosthesis 53.17, Bilateral inguinal hernia repair with graft or prosthesis, not otherwise specified
Rules	Principal diagnosis of inguinal hernia (K40)
Inclusion	
Exclusion	

S16 Thyroidectomy

Case type description	A thyroidectomy is an operation that involves the surgical removal of all or part of the thyroid gland. Surgeons often perform a thyroidectomy when a patient has thyroid cancer or some other condition of the thyroid gland (such as hyperthryroidism). Less extreme variants of thyroidectomy include hemithyroidectomy" (or "unilateral lobectomy") -- removing only half of the thyroid , and isthmectomy - removing the band of tissue (or isthmus) connecting the two lobes of the thyroid
ICD-9-CM codes	06.2, Unilateral thyroid lobectomy 06.31, Excision of lesion of thyroid 06.39, Other thyroidectomy 06.4, Complete thyroidectomy 06.50, Substernal thyroidectomy, not otherwise specified 06.51, Partial substernal thyroidectomy 06.52, Complete substernal thyroidectomy 06.6, Excision of lingual thyroid
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S17 Transurethral resection of prostate

Case type description	Transurethral resection of the prostate (also known as TURP) is a urological operation. It is used to treat benign prostatic hyperplasia (BPH). It is performed by visualising the prostate through the urethra and removing tissue by thermotherapy or dissection. This procedure is done with spinal or general anesthetic. A large triple lumen catheter is inserted through the urethra to irrigate and drain the bladder after the surgical procedure is complete.
ICD-9-CM codes	60.21, Transurethral (ultrasound) guided laser induced prostatectomy (TULIP) 60.29, Other transurethral prostatectomy 60.96, Transurethral destruction of prostate tissue by microwave thermotherapy 60.97, Other transurethral destruction of prostate tissue by other thermotherapy
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S18 Arthroscopic excision of meniscus of knee (Inpatient and Outpatient)

Case type description	Knee arthroscopic surgery is a procedure performed through small incisions in the skin to repair injuries to tissues such as ligaments, cartilage, or bone within the knee joint area. The surgery is conducted with the aid of an arthroscope, a very small instrument guided by a lighted scope attached to a television monitor. Arthroscopic surgeries range from minor procedures such as flushing or smoothing out bone surfaces or tissue fragments (lavage and debridement) associated with osteoarthritis, to the realignment of a dislocated knee and ligament grafting surgeries
ICD-9-CM codes	80.26, Arthroscopy, knee + 80.6, Excision of semilunar cartilage of knee
Rules	Any principal diagnosis code. The two codes should be reported at the same time for the same case
Inclusion	
Exclusion	

S19 Lens and cataract procedures (Inpatient and Outpatient)

Case type description	Extracapsular cataract extraction is a category of eye surgery in which the lens of the eye is removed while the elastic capsule that covers the lens is left partially intact to allow implantation of an intraocular lens. This approach is contrasted with intracapsular cataract extraction, an older procedure in which the surgeon removed the complete lens within its capsule and left the eye aphakic (without a lens)
ICD-9-CM codes	13.11, Intracapsular extraction of lens by temporal inferior route 13.19, Other intracapsular extraction of lens 13.2, Extracapsular extraction of lens by linear extraction technique 13.3, Extracapsular extraction of lens by simple aspiration (and irrigation) technique 13.41, Phacoemulsification and aspiration of cataract 13.42, Mechanical phacofragmentation and aspiration of cataract by posterior route 13.43, Mechanical phacofragmentation and other aspiration of cataract 13.51, Extracapsular extraction of lens by temporal inferior route 13.59, Other extracapsular extraction of lens 13.64, Discission of secondary membrane [after cataract] 13.65, Excision of secondary membrane [after cataract] Capsulectomy 13.66, Mechanical fragmentation of secondary membrane [after cataract] 13.69, Other cataract extraction 13.70, Insertion of pseudophakos, not otherwise specified 13.71, Insertion of intraocular lens prosthesis at time of cataract extraction, one-stage 13.72, Secondary insertion of intraocular lens prosthesis 13.8, Removal of implanted lens 13.90, Operation on lens, not elsewhere classified 13.91, Implantation of intraocular telescope prosthesis
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S20 Ligation and stripping of varicose veins – lower limb (Inpatient and Outpatient)

Case type description	Vein ligation and stripping is a surgical approach to the treatment of varicose veins. It is also sometimes called phlebectomy. Ligation refers to the surgical tying off of veins in the leg, while stripping refers to the removal of the veins through incisions in the groin area or behind the knee. If some of the valves in the vein are healthy, the weak portion of the vein can be closed off by ligation. If the entire vein is weak, it is closed off and pulled downward and out through an incision made below it. Tying and removal of the greater saphenous vein is done to reduce the pressure of blood flowing backward through this large vein into the smaller veins that feed into it.
ICD-9-CM codes	38.59, Ligation and stripping of varicose veins, lower limb veins
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

S21 Tonsillectomy and/or adenoidectomy (Inpatient and Outpatient)

Case type description	Tonsillectomy is a surgical procedure to remove the tonsils. The tonsils are part of the lymphatic system, which is responsible for fighting infection. An adenoidectomy is the surgical removal of the adenoids—small lumps of tissue that lies in the back of the throat behind the nose.
ICD-9-CM codes	28.2, Tonsillectomy without adenoidectomy 28.3, Tonsillectomy with adenoidectomy 28.4, Excision of tonsil tag 28.6, Adenoidectomy without tonsillectomy
Rules	Any principal diagnosis code
Inclusion	
Exclusion	

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