South Africa's private hospital prices, compared internationally?

prepared for

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Executive summary

In 2015, the health division of the Organisation for Economic Co-operation and Development (OECD) and the South African country office of the World Health Organization (WHO) published a paper on a comparison of South African private sector hospital prices and hospital price levels in selected OECD countries as OECD Health Working Paper No. 85 (Lorenzoni & Roubal, 2015). The Working Paper concludes that private hospital services are less affordable in South Africa than in the OECD comparator countries. The paper is referenced in the South African government's White Paper on National Health Insurance (NHI) (Department of Health, 2015) and was submitted to the Competition Commission in the context of the market inquiry into the private healthcare sector for presentation on 17 February 2016.

Argumentative weaknesses and methodological flaws of *OECD HWP 85* have not received much attention. In this light, this report constitutes a critical assessment of *OECD HWP 85* with the intention of contributing constructively to a rational discourse.

The *HWP* is based on previous work by OECD economists comparing hospital prices across OECD countries. The reference study (Koechlin et al., 2014) applies the Eurostat-OECD PPP Programme's methodology that was developed for the comparison of international prices for product groups as diverse as housing, construction, education and health.

The *HWP* attempts to connect a range of topics. South Africa's uniqueness is illustrated by the country's expenditure share of voluntary health insurance as a percentage of total health expenditure, which is the highest within a diverse set of comparator countries. While a comparison between the health expenditure per medical scheme beneficiary and per capita health expenditure in South Africa's public sector alone would have sufficed to demonstrate the situation that calls for reform, the *HWP* embarks on a comparison across systems that is characterised by numerous imprecisions.

Section 2 of this report presents a summary of *OECD HWP 85*. An initial set of critical points is addressed. Lack of appropriate contextualisation is an observation that affects different aspects of the *HWP*. Repeatedly, claims do not take into account the realities of different health systems and allusions to South Africa's outlier role become mere speculation. This point relates to the discussion of utilisation and potential price drivers, but also to the topic of medical inflation. Yet, alleged South African peculiarities can be observed elsewhere. Medical inflation, for example, regularly outpaces overall economic inflation in many countries, including Australia, Canada, Germany, the United Kingdom, and the United States. Reasons are manifold and include high prices of inputs into hospital service provision.

Section 3 provides a brief overview of the South African private sector in order to illuminate the context within which private sector hospital prices are determined. Medical schemes and administrators have significant countervailing market power in price negotiation with private hospitals. This is evident in the level of concentration in the administrator market and the cost management mechanisms available to (and used by) medical schemes and administrators.

The *OECD HWP*'s core contribution lies in the comparative analysis of hospital price levels. The analysis of hospital price indices for the OECD sample is based on data regularly collected by the OECD for these purposes, as presented in an earlier OECD study; the South African data set was drawn from a full set of claims data provided by medical schemes, representing nearly 60% of the total number of medical scheme beneficiaries. The *HWP* derives international hospital price indices on the basis of output prices calculated for 7 medical case types, 21 surgical inpatient case types and 4 surgical outpatient case types. Previous work by the OECD has allowed insight into countries' different modes of delivering

health services. Such international comparisons also lay the groundwork for further analysis of inputs and input prices, the degree of regulation, states of health system development, and different medical cultures. Yet the tools, including conversion measures, need to be chosen extremely carefully, as their choice may have dramatic impacts on the results. The selection of conversion measures for the inclusion of South Africa is critical; the *HWP* does not clearly spell out the implications of this selection, such as which PPP concept is applied, or the impact of substantial exchange rate fluctuation.

The international comparison of output prices of hospital cases is fraught with methodological issues with regard to the choice of prices and price indices, many of which have been addressed by previous OECD publications. The comparison of South African private sector prices with prices from an OECD sample provides for further pitfalls. The *HWP* is unfortunately largely silent on these limitations.

Lack of affordability is a key argument of the *OECD HWP*, although the concept is not explicitly defined there. Affordability of healthcare is addressed in Section 4 of this report. The *OECD HWP* draws conclusions on affordability from the comparison of a country's hospital price levels to GDP price levels and GDP per capita. The *HWP* bases a generalised claim of lack of affordability on the level of private sector hospital prices in comparison to general prices of consumption goods and per capita GDP. This is a hasty conclusion. South Africa's economic reality is characterised by stark income inequalities reflected in a Gini coefficient of 63.4%. Independent of the issue of the undesirable dichotomy of the South African health system, the private health sector currently serves only that part of the population which is roughly identical with medical schemes beneficiaries. This report shows that matching the prices of the subgroup of private hospitals with the average income (approximated by average consumption expenditure) of the private sector clientele, puts South African private hospital prices right on the international sample's trajectory. This report is very sceptical of such an approach altogether, however, as—according to common practice—any consideration of affordability should focus on financial protection rather than on service prices.

There are significant differences between health systems. These differences should not serve as a pretext to condemn international comparisons; they should rather be used to attempt explanations of why key health system variables differ between countries. In contrast to other OECD studies, *OECD HWP 85* is silent on this, and therefore misses the opportunity to appropriately discuss the findings. Comparisons of utilisation and average length of stay have always provided for important discourse around international differences in medical practice. The questions posed by the *HWP* as to whether relative utilisation rates or comparative ALOS impact on price levels are spurious.

OECD HWP 85 compares prices in the private hospital sector in South Africa with—public and private —hospital prices in 20 OECD countries, but fails to disclose fundamental measures that determine the validity of the price comparisons carried out. One such fundamental measure is the coefficient of variation: If prices within one case type vary to a great degree, it is not possible to make valid statements concerning differences in price levels.

In order to validate the *OECD HWP*'s findings, this report (in Section 6) analyses two samples compiled using the OECD authors' specifications for all inpatient case types: a South African sample of all Mediclinic inpatient cases fulfilling the specifications in 2013 (83,777 cases) and a DRG-based sample for Germany (2013). For 24 out of 28 case types in the South African sample, coefficients of variation range far above the critical value specified in the OECD-Eurostat methodological guidelines; this is also the case for 13 out of 28 case types in the German sample. There is a significant correlation (R^2 = 0.53528) between coefficient of variation (indicating variability within the case types) and reported difference in

price level. These findings raise serious doubts concerning the validity of the price comparisons carried out in *OECD HWP 85*.

There are marked differences in the sample structure between the OECD authors' sample for South Africa and the OECD sample for the comparator countries: While in the sample for South Africa, only three case types—M06 (normal delivery), M07 (pneumonia) and S02 (Caesarean section)—account for 57.5% of all sample cases, these make up only 32.5% of all cases in the OECD sample. Excluding these three major groups, there still remain substantial differences in the share of case types between the two samples. Especially highly underrepresented case types, e.g. S06 (discectomy) and S13 (PTCA) show dramatic differences in price levels as reported in *OECD HWP 85*: + 52.6 % and + 39.3%, respectively. To check for differences in complexity of case types, this report compares case mix indices (CMIs) calculated from the Mediclinic sample to CMIs in the German sample. Almost all outliers in price level differences reported in *OECD HWP 85* also show marked differences in CMI. For S06 (discectomy) for example, the reported difference in price level is + 52.6%. The CMI for the South African (Mediclinic) sample is 3.489, whereas the German CMI is only 2.251. For one apparent exception from this trend—M01 (acute myocardial infarction)—there are strong indications for a higher CMI in the OECD authors' sample for South Africa due to restrictive selection criteria.

The findings of this report raise doubts about the validity of the *OECD HWP*'s comparison. Yet to what extent the differences between the South African private hospital cases and the comparator countries are due to structural differences of the hospital sectors under investigation or to flaws in the adaptation of selection procedures, cannot be said at this point.

This report describes further technical points of criticism, such as imprecise presentation of quantitative information and the fact that the *HWP* presents at least four different country samples for the different sections, e.g. only seven out of the twenty OECD countries used for benchmarking of prices are included in the selection of 11 OECD countries used for benchmarking of utilisation rates.

The *OECD HWP*'s discussion section recommends "price control". This comes across as a simplistic piece of advice and constitutes a non-sequitur in the context of the paper's analysis. The paper could have provided a proper analysis of the economy of South Africa's private hospital sector and made appropriate recommendations for a future regulatory framework.

In criticising the lack of prudence of the *OECD HWP*, this report is not intended to downplay the pressing reform towards a more equitable and efficient health system needed for all South Africans.

1 Introduction

Expenditure increases in South Africa's private healthcare sector constitute the main starting point for the Competition Commission's inquiry into the private healthcare sector. Medical schemes' real claims expenditure per beneficiary per annum has increased significantly over the last twenty years. A key focus of the inquiry therefore lies on the providers of healthcare goods and services. The Competition Commission suspects that a lack of competition within the private sector has led to inefficiencies that are reflected in unnecessarily high prices. The Commission initiated the inquiry "because it has reason to believe that there are features of the sector that prevent, distort or restrict competition" (Republic of South Africa, 2013).

In a press statement issued by the Commission on 16 April 2014 (Competition Commission, 2014), the potential sources of "harm to the competition" included:

- Market power including market concentration;
- Barriers to entry and expansion;
- Imperfect information;
- Regulatory framework; and
- Vertical relationships.

Private sector health spending in South Africa currently (fiscal year 2015/16) amounts to 49.6% of total health spending (Department of Health, 2015). At 4.2% of GDP, this is not far from the GDP share of 'mining and quarrying' (4.9%), one of the dominating industry sectors in a country that is the world's biggest producer of gold and platinum. Part of the strength of the private health sector derives from the weak design of the public sector and the perceived decline in quality there. The public sector has traditionally had a 'public health' focus, e.g. accentuating communicable diseases; it has also been pro-poor with income earners having to pay an income-based fee for hospital services and a token fee for primary care services. The expenditure by medical schemes for public sector services has decreased dramatically over the last 25 years and is now negligible. The plight of the public sector has provided the background for a blossoming private sector—and the dichotomisation of the system.

Private healthcare providers account for 37% of all general practitioners in the country, 59% of specialists, and 38% of nurses. 28% of hospital beds are held by private hospitals (Econex, 2013). The figures reflect the fact that service delivery mechanisms differ dramatically between the public and private sectors. The private sector is generally regarded to be "hospicentric". In addition, the hospital sector is subject to scrutiny due to the level of market concentration (see Section 2.2). The Competition Commission's market inquiry therefore places an emphasis on the role of the hospital sector.

The health division of the Organisation for Economic Co-operation and Development (OECD) and the South African country office of the World Health Organization (WHO) submitted selected materials to the Competition Commission, including *OECD Health HWP (HWP) No. 85* (Lorenzoni & Roubal, 2015). They presented their findings on South African hospital prices to the panel for the market inquiry on 17 February 2016. The results of the *HWP* have been termed "explosive" and political repercussions are expected, as Health Minister Aaron Motsoaledi stated that the study proved the market was broken (Risner, 2016).

In the discussions, no argumentative weaknesses or methodological flaws of the *HWP* have received much attention. Mediclinic has asked Scenarium to conduct a critical assessment of the document with the intention of contributing constructively to a rational discourse.

2 Critical review of OECD Health Working Paper No. 85

2.1 Summary[1]

OECD HWP 85 (Lorenzoni & Roubal, 2015) was compiled as a contribution to the Competition Commission's Inquiry.[2] An extension of a previous OECD activity on international prices of hospital services (Koechlin et al., 2014), this paper's objective is to compare prices for inpatient care across different countries, including South Africa. The price comparison is based on differentiated cases.

The paper introduces the subject by describing the uniqueness of the South African health system. The respective section of the paper highlights the fact that private insurance takes on a key role in the financing of health in South Africa: Private voluntary health insurance accounts for 41.8% of total health spending. This figure is compared with data on insurance coverage from OECD countries in order to illustrate South Africa's uniqueness. The analysis broadens to capture the whole private sector, including private hospitals and medical specialists. The significance of the private sector for the development of public provision of health services is highlighted. For example, the fact is emphasised that the private sector is more attractive to medical specialists than the public sector. South Africa is said to lack measures of price control that exist in OECD countries.

A comprehensive section is dedicated to the paper's methodology. Case data, i.e. case-specific data reflecting resource requirements for inpatient treatment at South African hospitals, were categorised taking into account both their medical similarity and their resource absorption. Prices of these cases were defined as the amounts paid to healthcare providers from risk pools, medical savings accounts and out of pocket. Data on length of stay and price for 28 case types under study were thus collected, outliers were excluded from the set of 561,959 inpatient cases provided by a few large South African medical schemes representing 59.4% of the total number of medical scheme beneficiaries in the country. Comparator data from 20 OECD countries were drawn from the OECD-Eurostat hospitals PPP survey.

A key feature of the OECD study's approach is the conversion of the so-called quasi-prices by means of purchasing power parities (PPP). This is based on the approach that has become the standard as applied by Eurostat and the OECD from 2013 onwards.

The *OECD HWP* presents selected descriptive statistics for the South African sample of cases from 2011 to 2013. Admission figures by case type are presented in Table 3 of the *OECD HWP* in absolute terms. Table 4 shows that the absolute increase in cases is largely due to changes in membership. Ideally, the demographic characteristics of changes in the sample could have been highlighted, as they might have explained the shifts between some case categories. The average length of stay and changes over the reporting period are presented for medical case types and inpatient surgical cases in Tables 5 and 6, the average percentage changes in Figure 3.

The authors present absolute output prices drawn from the South African sample as average prices per case category and year. Annual price increases are reported as an average of 6.8% from 2011 to 2012, and 6.2% from 2012 to 2013. These exceed general inflation based on the CPI by 1.2 percentage points and 0.5 percentage points, respectively.

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[1] References to sections, figures and tables in this Summary refer to OECD Health Working Paper No. 85 (Lorenzoni & Roubal, 2015) unless otherwise indicated.

[2] The paper is also referred to in the NHI White Paper in order to substantiate the claim that "[South African] private hospitals are least affordable when compared to OECD countries even for individuals of higher levels of income" (Department of Health, 2015, p. 13).

The core section of the *OECD HWP* compares the price levels of hospital services in South Africa to price levels of OECD countries. In an initial comparison of price levels, OECD averages (20 selected countries out of the OECD's 34) are taken as a benchmark (index=100). South African GDP prices, i.e. national price levels calculated across all categories of goods and services that make up the GDP, are significantly lower than the OECD average—53% of the average OECD level in 2013. Prices for inpatient medical services in South Africa as represented by seven case types are lower than OECD average (at 75% in 2013), and prices for surgical services are higher (at 105% in 2013). The weighted average output price across all case types amounts to 94% of the OECD equivalent. South African hospital prices are nearly double the average of the seven poorer OECD countries in the sample (Table 9). There is a positive correlation between GDP and hospital prices within the subset of OECD countries.

Two diagrams (Figures 5 and 6 in the *OECD HWP*) explore the relationship of per-capita GDP and hospital prices for the selected 20 OECD countries and the South African private hospitals. Figure 5 suggests a positive correlation between per capita GDP and hospital price levels. Hungarian hospital prices are lowest, while the country also features the lowest GDP per capita among the OECD countries included in the sample. Hospital prices are highest in Switzerland and Norway. South African private sector hospital prices range only slightly below hospital price levels in Spain and the United Kingdom, while South Africa's GDP per capita is little over a third of that of Spain. South African private sector prices are significantly higher than those in Portugal and former Semashko systems. A bar chart diagram depicting deviations of hospital price levels from the mean by country ranked according to GDP price levels is presented in Figure 6. Against the expectation that South Africa as the country with the lowest GDP price level should also feature low hospital prices, private sector hospital prices are only a few percentage points below the 20-country average.

A comparison of average prices for the specific case types between the OECD 20-country averages and that of the South African sample, assumedly in 2013 EUR PPP, shows varying results (Tables 10-12): Within the selected medical case types, the reported deviation ranges from a South African price 40.4% above the 20-country average for the treatment of acute myocardial infarction to a price 58.2% below the average price in comparator countries for the treatment of pneumonia. Among inpatient surgical cases, the South African average price of a discectomy is significantly higher than OECD average at a reported price difference of 52.6%. Price differences for outpatient surgical cases range between a reported positive price difference of 39.6% and a negative price difference, signalling lower prices in South Africa, of -28.7%.

The *OECD HWP* compares non-adjusted hospital utilisation rates across the three years of the sample. An age-adjusted comparison of utilisation rates for hysterectomy and knee replacement between South Africa and 11 selected OECD comparator countries shows the position of South Africa within the range of comparators: The country ranks in the top third in its utilisation rates for hysterectomy (Figure 8 of the *HWP*) and takes on a central position in utilisation of hospital services for knee replacement (Figure 9).

The *OECD HWP* also presents a comparison of average length of stay (ALOS) between South Africa and the average of the selected OECD countries. The South African ALOS ranges below that in the benchmark countries for all case types, medical and surgical.

In the section concluding the *HWP*'s results, costs of medical and surgical cases are presented by claim category, namely as cost shares of hospital, pathology, radiology, specialist/family practitioner, and other, as reflected in medical schemes claims data. The relative shares are presented for three years. Hospital costs make up the largest share within the overall costs aggregated for all cases in the sample; their share varies between 43.9% in 2011 and 41.7% in 2013 for medical case types, and between 50.5% in 2011 and 48.6% in 2013 for surgical case types. The observed minor shifts over the three-year observation period do not allow the establishment of a trend. The costs to medical schemes are also presented for single case types.

In a concluding discussion, *OECD HWP 85* reiterates the key message that South African private sector hospital prices on average violate the observed correlation of the selected OECD countries' prices for hospital services and their per capita GDP. The discussion further states that private hospital services in South Africa can be considered unaffordable as the difference between indexed hospital price levels and "economy-wide price levels"—GDP-based comparative price levels [CPL]—is extremely large as compared to the selected OECD countries. The *HWP* further highlights that the increase in hospital prices over the observation period exceeds general inflation. It further points out comparatively high admission rates and values for ALOS that consistently range below those of international comparators. It is argued that, given the relative magnitude of health expenditures in the private sector, there exist spill-over effects that jeopardise the efficiency of services provision in the public sector, such as resulting problems of staff retention in public sector hospitals that compete with the private sector for qualified specialists. The report concludes by suggesting "efforts to control prices".

2.2 Critical points

Regardless of any potential flaws regarding the setting of prices for goods and services in South Africa's private health system, the report suffers from a number of weaknesses in terms of its methodological approach, presentation and argument. The critical points presented in this subsection shall guide the discussion in this paper's subsequent chapters.

2.2.1 Measures for comparison

The *OECD HWP*'s approach is based on previous work by OECD economists to compare hospital prices across a set of OECD countries. Within the Eurostat-OECD PPP Programme, a full methodology has been developed that is applied in the context of comparing international prices for product groups as diverse as housing, construction, education and health. The objective and motivation of the OECD's on-going work on comparing hospital output prices is the generation of hospital-specific PPPs in line with the overarching methodology. As OECD health economists state (Koechlin et al., 2014, p. 9): "[H]aving [both] 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." The line of argument in *OECD HWP 85* deviates from the original intent that underlies the toolkit, i.e. the development of output-based PPP. Detailed hospital price comparisons are a valuable undertaking, as the findings may allow further insight into countries' different modes of delivering health services, differences in inputs and input prices, the degree of regulation, states of health system development, and different medical cultures. Yet the tools, including conversion measures, need to be chosen extremely carefully, as their choice may have dramatic impacts on the results (e.g. Wordsworth & Ludbrook, 2005). The selection of conversion measures for the inclusion of South Africa is critical and the implications of the choice need to be clearly spelt out in any analysis.

2.2.2 South Africa as an outlier

The *OECD HWP*'s introductory section characterises the South African health system as an outlier. Indeed, there are many aspects that support the claim of uniqueness. As most health systems are unique, however, this claim is not very helpful. At best, it jeopardises the achievement of the *OECD HWP*'s own objective to present a meaningful comparison of hospital prices. The context that could have been outlined in this introductory chapter of the report is that of a dichotomised system, associated with extreme inequities, as is broadly acknowledged. These inequities relate to access to services and quality of care. The existence of a strong private sector in the country constitutes an attribute of the South African health system; it is not the cause of inequities. There are many factors that have contributed

to the current structure and state of the health system: historical, political and socio-economic. Some factors are highlighted in Chapter 3 of this report.

2.2.3 Voluntary private health insurance

The *OECD HWP*'s section 2 has a strong focus on private health insurance. The roles and characteristics of private insurance within national health systems contribute to each system's uniqueness. The spectrum of potential objects of insurance is enormous. Classifying private health insurance to allow qualitative comparisons across types of private coverage (e.g. primary, supplementary, and complementary) and countries is problematic; comparisons are most likely more complex than the comparison of hospital outputs. Section 5.3 of this paper takes a more detailed look at this issue and the presentation of respective data in *OECD HWP 85*.

2.2.4 Health systems, history and economy

The design of health systems is a product of a country's socio-economic history. The OECD has an interesting history of expansion from its original European core. The sample of countries selected for hospital price comparisons is rather diverse. It may not surprise that – with the exception of Finland (which for other reasons joined the OECD a little later) – all countries with an above-average hospital price level are among the OECD founding members and the four countries with the lowest hospital prices are Central European countries that joined after the political revolutions of 1989. History and socio-economic context have a strong influence on the efficiency and quality of health service delivery, also on price levels, as will be discussed further in Chapter 5 of this report.

Within the comparator countries, there are dramatic differences across different relevant variables (utilisation, prices, ALOS). There are countries significantly below and above the averages. There is no reason for postulating that South African private hospitals should be at the average or close to it regarding the variables under investigation. The explicit and implicit claims made in this regard in the *OECD HWP* are critically discussed in Sections 5.1 and 5.2 of this report.

2.2.5 "Price drivers"

OECD HWP 85 speculates about "price drivers". The discussion is non-conclusive. Volumes do not seem to explain prices.[3] A section of the *HWP* is dedicated to linking average length of stay (ALOS) to price. The authors calculate the price per day and, unsurprisingly, find that, given South Africa's low medical and surgical ALOS, the relative position in the ranking of prices per day is different from that of overall output prices. OECD HWP No. 75 (Koechlin et al., 2014) already established that there was no correlation between hospital price levels and overall ALOS.[4]

It is unfortunate that the *HWP* does not undertake further effort to identify any underlying "price drivers" of hospital care that may be located outside of the health sector.

[3] Further, the presentation of information in Figure 10 does not reveal the determinants of utilisation increase. Given that medical scheme membership has increased by 12% over the observation period (whereby it is not clear whether the report means "members", as stated, or beneficiaries, which would be the relevant variable), it would be interesting to understand the socio-demographic changes in the medical scheme population. Age- and sex-adjustment of the data would have been appropriate. Further, certain "catch-up effects" within the new population of beneficiaries may be reflected in the figures, particularly when it comes to selective interventions such as hip- or knee replacement.

[4] There may be many explanatory factors for low ALOS in South Africa, including variation in treatment patterns (e.g. Busse et al., 2008). There are countries within the OECD sample with comparably low ALOS: Iceland's ALOS for medical cases is reported at 2.5 days, the ALOS for surgical cases 2.5 days (Koechlin et al., 2014).

2.2.6 Output prices and medical inflation

Had the *OECD HWP 85* undertaken a comparison of medical inflation at the international level, observed price increases in the South African private health sector could have been put into perspective. Medical inflation has consistently exceeded annual overall inflation in many countries for many years (as the earlier *OECD HWP No. 75* acknowledges). For example, the all groups CPI in Australia has increased by 1.3% from March 2015 to March 2016; over the same time period Australian health prices increased by 4.6%: a difference of 3.3 percentage points (Australian Bureau of Statistics, 2016). In Germany, inflation of hospital prices exceeded that of CPI by nearly 1.5 percentage points in 2015 and by little over 2.0 percentage points in 2016, which is still clearly above the values reported for the observation period in South Africa.

> Medical inflation regularly outpaces overall economic inflation in many countries, including Australia, Canada, Germany, the United Kingdom, and the United States. Reasons are manifold and include high prices of inputs into hospital service provision.

2.2.7 Presentation

The *HWP*'s line of argument is not laid out explicitly. Concepts that are critical for the conclusions presented, such as the concept of affordability, are not properly defined. Other themes that do not contribute to a coherent presentation, such as the digression discussing forms of private health insurance in OECD countries (some of which are not even part of the countries selected as comparators), are presented in an unusual format (Table 1). The fact that comparator countries change over the different sections is rather problematic.[5] Aspects with a relevance to the conclusions of the exercise are discussed in more detail in the subsequent sections of this paper.[6]

[5] Without further explanation, the selection of comparator countries in OECD Health Working Paper No. 85 varies between
- A selection of 30 out of 34 OECD countries (without Iceland, Norway, the Slovak Republic and Turkey) plus Brazil, China and India in Section 2, Figure 1;
- A different selection of 24 OECD countries in Section 2, Table 1 (missing some, but now including Iceland and Turkey);
- Yet a different selection of 20 OECD countries for the comparison of hospital prices in Sections 7, 8 and 9; and
- Another different selection of 11 OECD countries for comparing selected utilisation data in Section 10.

The countries selected for the calculation of OECD averages of length of stay (ALOS) are not referenced.

[6] There are smaller flaws in the presentation of data in OECD Health Working Paper No. 85 that should have been caught during proof reading and editing before the presentation to the South African Competition Commission. These include—but are not limited to—incorrect references to "percentage points" rather than "per cent" on p. 20 (paragraph 43) and the rather unusual percentages presented in Tables 10 to 12 (the common way of presenting the differences would have been to relate the South African price to the OECD price (South Africa/OECD-1).

3 History and overview of private sector pricing in South Africa

3.1 Background

Before a coordinated public health system was established in 1919, medical schemes evolved from occupational health insurance in the mining industry that started as far back as 1889. Regulation of these medical schemes by the government was done for the first time in 1956. Up until 1984, medical schemes were non-competing occupational funds sponsored by employers or industry, and primarily reimbursed the expenses of private health professionals and hospital services located in the public sector. As is the case now, public sector hospital health services were available to all the citizens of the country. However, patients were subject to a fee arrangement that required higher income earners to pay fees, while indigent patients received free services (Department of Health, 2002)[7]. Medical scheme membership was particularly useful for those above the tax threshold in avoiding catastrophic health expenditure associated with the fees in public hospitals and from private specialists. Benefits and provider fee-for-service (FFS) tariffs were regulated applying a highly contested scale of benefits prepared by the Representative Association of Medical Schemes (RAMS)[8].

The setting of medical fees was always a source of conflict between medical schemes and the medical profession. The Medical Association often objected to the fees that were set, as well as to the arbitration mechanism. This resulted in many doctors opting out of the tariff system. Those health professionals accepting the RAMS tariffs remained "contracted in" to the tariff system and were guaranteed full reimbursement by law, providing an incentive to remain contracted in. Those who opted out of the tariff system set their own tariffs, resulting in possible delays in full fee settlement as the schemes did not guarantee full payment and did not pay health providers directly. This emerging challenge was seen to be detrimental to the doctor-patient relationship. Subsequently, the government intervened by setting up a Remuneration Committee in 1969. Leading to a series of amendments on the structure of engagements between medical schemes, the medical profession and patients, it culminated in the Amendment Act, No. 59 of 1984; allowing any professional or supplier of a service to determine their own tariffs through respective statutory control bodies (van den Heever, 2012; Department of Health, 2002).

From the early 1980s, the private hospital market started to grow. This coincided with a period marked by international sanctions against South Africa, a slow-down in the economic growth rate, a reduction in the tax-based financing of the public health sector and a subsequent decline in the quality of hospital services in the public sector. This resulted in medical scheme members shifting from the use of hospital services in the public sector to hospital services in the private sector. Literature on the subject indicates that the shift of treatment from public to private hospitals resulted in increased costs of hospital services for medical schemes. Possible factors identified as reasons for this increase include the full cost recovery price (inclusive of VAT[9]) charged by private hospitals and the additional margins for profit, both of which do not apply to public hospital services (van den Heever, 2012). Other factors that have been listed in the policy discourse as contributors to increases in medical

[7] From 2000, the Department of Health implemented a Uniform Patient Fee Schedule (UPFS) rate. The UPFS set varying levels of subsidisation according to four income levels. Those in the highest income bracket paid the full UPFS rate. Those in the lowest income level received hospital services free of charge, while those in the two income brackets in between were partially subsidised. In addition, where there is a third party payer (such as a medical scheme or government department), the full UPFS rate applied, irrespective of income level of the patient (McLeod, 2011).

[8] RAMS was a private association representing all medical schemes.

[9] Private hospital bills include a VAT (Value Added Tax) component; the current VAT rate in South Africa is 14%.

scheme costs of hospital services include: changes to the regulatory environment[10] (McLeod, 2009), a lack of integration of healthcare, an increase in hospital utilisation (intensity and frequency) and an increase in prices (National Department of Health, 2011; Hospital Association of South Africa, 2008). Since then, the question of costs and prices in the private hospital sector has remained a major issue in the country's health policy space. This shift to the use of private hospitals by medical scheme members was the beginning of a distinct private sub-system that has endured to date – with financing, pooling, purchasing and provision of health services almost entirely accomplished by the private sector.

Since the early 1980s, the medical scheme and private hospital markets have changed significantly. While some medical schemes have remained occupational schemes linked to a particular employer (restricted schemes), other medical schemes that are open to membership from different employers (known as open schemes) have proliferated. In addition, from the early 1980s, medical scheme administrators who were contracted by occupational medical schemes to manage their day-to-day operations developed sufficient expertise in health insurance to expand into commercial insurance models independent of employers. They naturally evolved into competing amongst themselves to manage the daily operations of medical schemes. Private hospitals have evolved from mainly doctor-owned institutions to a dominance of corporate-owned hospitals in the current dispensation (van den Heever, 2012).

Until 1993, RAMS had the statutory authority to publish the official price list for all medical schemes. This status was removed in the 1993 amendment to the Medical Schemes Act, after which they could only publish a recommended schedule of benefits. Schemes did not have to adhere to the prices and could negotiate separate tariffs with service providers if they wished. It was nearly impossible for medical schemes to individually negotiate with all providers for the many health services covered. This was especially challenging for negotiations with doctors and specialists because of their sheer numbers. Negotiations with hospitals would have been much less challenging, as they were few in number. Consequently the RAMS schedule of fees became uniform throughout the market. In response, private hospital groups and medical professionals set their fees according to their own processes. Hospital-set tariffs did not differ from RAMS tariffs, as the two associations negotiated common reference prices to which all parties adhered. However, provider fees set by the South African Medical Association (SAMA) on behalf of general practitioners and specialists were often higher than the RAMS tariffs, and so medical scheme members were "balance billed"[11] the difference for the services of these health professionals. Following the abolishment of the statutory tariffs published by RAMS, in terms of the 1993 amendment of the Medical Schemes Act, the Hospital Association of South Africa (HASA) applied for and received permission from the competition authorities at the time to set its own "reference price" (Department of Health, 2010). Essentially, RAMS negotiated tariff changes with providers on behalf of medical schemes, HASA negotiated tariff changes with medical schemes on behalf of private hospitals, and SAMA negotiated tariff increases on behalf of health professionals. RAMS has since transitioned to become the Board of Healthcare Funders (BHF), and currently does not represent all medical schemes[12].

[10] The association between changes in the regulatory environment and subsequent impact on the cost of hospital services to medical schemes is discussed in more detail in a later section.

[11] Balanced billing refers to the billing of the medical scheme member for the difference between what the scheme pays to the provider and what the provider charged. In some cases, providers require the scheme member to settle his/her full bill directly with the provider, and then claim the expense (or part) from the medical scheme.

[12] BHF represents 66 of the 83 medical schemes. Medical schemes affiliated with BHF cover around 30% of total medical scheme beneficiaries (calculated from the list of members in BHF website and number of beneficiaries in each scheme as reported in the Council for Medical Schemes Annual Report 2014/15).

In 2004, the Competition Commission ruled that this centralised approach to tariff negotiation (referred to as "collective bargaining") was collusive in nature with anti-competitive outcomes. The Commission ruled that the practice of price setting by representative organisations went against horizontal practices that are prohibited in the Competition Act of 1998. The Competition Act prohibits direct or indirect fixing of a purchase or selling price or any other trading condition by firms or association of firms in a horizontal relationship (Competition Commission, 1998; Competition Commission, 2004). This ruling created a significant logistical challenge. By implication, each medical scheme now had to negotiate reimbursement tariffs with every individual health provider. Some stakeholders in the health sector have commented that the Commission's decision has had the effect of weakening medical schemes bargaining power with private hospitals (Halse et al., 2012).

To address this logistical problem, the Council for Medical Schemes (CMS)[13] established an interim reference tariff schedule, the National Health Reference Price List (NHRPL). Price schedules under the NHRPL were not determined by negotiation but instead were determined based on cost analysis and were published on an annual basis. However, medical service providers could still deviate from NHRPL values and charge more—which they did (Department of Health, 2010).

The NHRPL process was ultimately handed over to the Department of Health, and henceforth became the Reference Price List (RPL). Although providers (including private hospital groups) participated and contributed significantly to the RPL process, there were concerns from health providers around the absence of a clear process and methodology for determining the RPL. In 2007, RPL regulations were promulgated. However in 2010, the RPL was set aside based on a court ruling that found that the Department of Health had failed to comply with the correct process for the promulgation of the regulations relating to the obtainment of information and the process of determination and publication of RPL (HASA vs Minister of Health, 2010).

Later in 2010, the Department of Health published a discussion document on price determination in the private sector to stimulate discussions amongst stakeholders and the eventual establishment of a healthcare price determination authority (Department of Health, 2010). This process has not been concluded, and currently, individual private hospitals negotiate tariff increases with each medical scheme or representative administrator on an annual basis.

3.2 Key players in the private hospital sector

3.2.1 Medical schemes

The number of medical schemes has been declining in recent years mainly due to the amalgamation of some medical schemes. Currently, there are 83 medical schemes in operation - 23 open and 60 closed schemes, compared to 131[14] in 2005. At the end of 2014, the number of medical scheme beneficiaries was 8.81 million (approximately 17% of the population) with a consistent growth in membership over the years. In 2005, there were 6.84 million beneficiaries. The individual medical schemes vary in size with a few large and many smaller ones. The five largest medical schemes cover approximately 65% of all medical scheme beneficiaries (Council for Medical Schemes, 2015). They are set up as not-for profit entities. However, most medical schemes make use of 'for-profit' administrators for their day-to day operations and in negotiating tariffs with health care providers.

[13] The CMS is a statutory body established by the Medical Schemes Act (Act 131 of 1998) with the primary function of regulating medical schemes.

[14] 47 open schemes and 84 closed schemes.

3.2.2 Administrators/case management organisations

Administrators are profit making firms that provide medical schemes with operational support around negotiating tariffs and reimbursement mechanisms, collecting claims on behalf of medical schemes, case management and in the establishment of provider networks. In 2014, only five out of the 83 medical schemes were self-administered. The market share of medical scheme administrators in terms of number of beneficiaries covered is presented below. The three largest scheme administrators represent approximately 75% of medical scheme members (Council for Medical Schemes, 2015).

Administrator	**Beneficiary**	**Market size**
Discovery Health (Pty) Ltd	32.92%	32.92%
Medscheme Holding (Pty) Ltd	12.01%	42.56%
Metropolitan Health Corporate (Pty) Ltd	9.63%	
Other Administrators	11.26%	11.26%
Self-Administered Medical Schemes	7.96%	7.96%
Momentum Medical Scheme Administrators	3.47%	3.47%
V Med Administrators (Pty) Ltd	1.84%	1.84%
Medical Scheme		
GEMS[15]	*20.92%*	
Total beneficiaries	100%	100%

Table 1: Market shares of administrators (Source: Council for Medical Schemes Annual Report 2014/2015)

3.2.3 Council for Medical Schemes (CMS)

The CMS is a statutory body established by the Medical Schemes Act (Act 131 of 1998). The CMS is a regulator of medical schemes with the overriding objective of protecting the interests of medical scheme members. Other functions include

1. The control and coordination of medical schemes in a manner that is complementary to the national health policy;
2. The investigation of complaints and settlement of disputes in relation to the affairs of medical schemes as provided for in the Medical Schemes Act;
3. The collection and dissemination of information about private health care (Pearmain, 2000).

3.2.4 Brokers

Open medical schemes can make use of brokers to sign up members. Brokers act as agents for medical schemes to recruit members for the schemes in return for a commission, which is usually around 2% of gross contribution income.

[15] Administration for Government Employees Medical Scheme (GEMS) is shared by Medscheme Holding and Metropolitan Health.

3.2.5 Medical specialists

Specialists are secondary care providers and operate in hospitals and clinics. They determine and oversee the treatment of patients in hospitals. All specialists are required to register with the Health Professions Council of South Africa (HPCSA). Based on the ethical rules of HPCSA, specialists cannot be employed by private hospitals. Specialists usually lease consultation rooms within a private hospital, but can operate in more than one hospital. Specialist bills are independent of bills charged by private hospitals. Assessments of human resource requirements in South Africa indicate a severe shortage of specialists in the health system (Econex, 2009).

3.2.6 Ancillary services

Services such as radiology, pathology, physiotherapy, occupational therapy, and dietician practices are also independent from hospitals. These practices also work in hospitals by renting space. Their services are provided based on the referral of the specialist. Hospitals do not have control over their fees and their operations.

3.3 Prices and costs in the private hospital sector

Since medical scheme members started to predominantly use private hospital services, the cost of hospital services to medical schemes has remained a concern within this sub-sector.

As mentioned previously, various factors have been identified as contributing to the overall increase in expenditure on hospital services. While some are directly related to the pricing process, others are about the structure of the market, relationships between key stakeholders, and the policy and regulatory environment. Some of these factors that are deemed to impact on the pricing and cost of hospital services are briefly discussed below:

3.3.1 Market concentration and market power

The private hospital sector is dominated by four hospital groups[16] that account for over 85% of private hospital beds in the country (Econex, 2011). With 83 registered schemes, covering nearly nine million lives (Council for Medical Schemes, 2015), the market has often been categorized as an oligopolistic market, with price setting abilities attributed to hospitals. However, in most instances, medical scheme administrators, not medical schemes themselves, negotiate tariffs with hospitals. In recent years, the administrator and medical scheme market has become increasingly concentrated (Econex, 2014). Currently, the three largest administrators account for approximately 75% of the medical schemes market in terms of lives covered (Council for Medical Schemes, 2015). Also, medical schemes and administrators use a variety of mechanisms to manage hospital costs (Council for Medical Schemes, 2015; Econex, 2014). These include:

- Hospital and doctor networks to channel their members to lower-cost health professionals and hospitals;
- Contracting with managed care companies for managing utilisation;
- Use of alternative reimbursement levels that shift more financial risk on hospitals;
- Adjusting benefit plans and using deductibles/co-payments to manage the use of care;
- Providing general practitioners and specialists with incentives to move patients to lower levels of care in order to reduce hospital costs.

[16] Netcare, Life, Mediclinic and National Hospital Network.

Based on levels of concentration and cost management mechanisms available to schemes and administrators, it appears that they have significant countervailing market power in price/reimbursement negotiation with private hospitals.

> Medical schemes and administrators have significant countervailing market power in price negotiation with private hospitals. This is evident in the level of concentration in the administrator market and the cost management mechanisms available to (and used by) medical schemes and administrators.

3.3.2 Regulatory environment for medical schemes

Some of the regulations governing the operations of the medical schemes may be contributing to the growth in medical scheme expenditure on hospitals. The Medical Schemes Act of 1998[17] introduced:

- Open enrolment, i.e. no one may be declined membership of an open medical scheme, irrespective of their age or state of health;
- Community rating, i.e. scheme contribution rates are not to differ based on a person's age or state of health (as opposed to risk-rated contributions); and
- Prescribed minimum benefits (PMBs)—a list of 270 diagnosis and treatment pairs that all medical scheme options must cover in full without co-payment from the scheme member.

At the time these regulations were introduced, two other regulatory pillars were being considered: Mandatory membership for certain income categories and a risk equalisation fund. However, these concepts were dropped and later fully discarded.

Open enrolment and community rating meant that any member of the population could join and leave a medical scheme at any time, and their contribution would not be based on their individual risk profile. This creates an incentive for anti-selection—joining medical schemes when the need for health care is higher and leaving when the need for care is low. In addition, it works against the principle of cross-subsidisation from the young and healthy to the older and riskier members. Although mechanisms such as late-joiner penalties and waiting periods[18] exist, research indicates that there is evidence of significant levels of anti-selection in the medical schemes environment. The distribution of medical scheme members shows that young, working-age people have a higher tendency not to join medical schemes compared to the older, working-age and retired people. Also, there is a common phenomenon for women of child-bearing age to join medical schemes to have children, and to leave if the child is healthy (McLeod, 2009). Anti-selection has the effect of increasing the general risk profile of medical scheme members, increasing utilisation of health care services per person (both by intensity and frequency), and therefore increasing the contribution per member over time. Higher contributions for medical scheme membership create additional incentives for anti-selection.

Since the introduction of PMBs, medical schemes have been compelled to cover the full costs of diagnosis and treatment pairs that are mostly provided as hospital services. The implication has been that co-payments (either for utilisation management or as a result of

[17] Regulations in terms of the Medical Schemes Act, 1998 (ACT NO. 131 of 1998). These regulations took effect in 2000. The Medical Schemes Act is instituted by the Department of Health. All regulations and conditions outlined in the Act are therefore direct regulations provided by the Government of South Africa.

[18] Waiting periods could be general or specific to a health condition.

reduced real benefits) are disproportionately more applicable to non-hospital services. This on its own has the effect of increasing the proportion of medical scheme expenditure on hospital services, even if utilisation and price increases for all health services categories were the same.

3.3.3 Regulatory environment for health providers

The Health Professions Council of South Africa (HPCSA) has ethical and professional rules that place certain prohibitions on the relationship between private hospitals and registered medical professionals. [19] Hospitals do not employ doctors (or have an ownership interests in professional practices), pathologists, radiologists, physiotherapists, occupational therapists or dieticians. Registered professionals also cannot share fees with private hospitals. This means that a large proportion of the overall fees for overall hospital-based services is not charged by private hospitals themselves, nor do private hospitals have any major influence in the determination of these prices. Fees charged by radiologists, pathologists, specialists, etc., are set independently of hospitals and can vary among types of specialist service providers. Importantly, the use of ancillary services such as radiologists, pathologists, dieticians, etc., is based on instruction from the referring doctor.

An additional point of interest is that since 2004, private hospitals apply a Net Acquisition Price (NAP) model to both pharmaceuticals and surgical consumables. This means that the price that hospitals pay for pharmaceuticals and surgical consumables is the same price that is billed to the patient or medical scheme. Previously, hospitals marked up the sale of pharmaceuticals and surgical consumables to subsidise ward, theatre and equipment. The switch to the NAP model has increased the degree of transparency in the negotiation of prices of hospital services (Hospital Association of South Africa, 2008). Indications from Mediclinic's billing accounts indicate that pharmacy accounts for approximately 27% of hospital bills (Mediclinic, 2016).

3.3.4 Characteristics of the public sector

The quality of care in the public sector has been a concern in recent years. A review of the South African health system in the late 2000s pointed to challenges such as a general lack of accountability, shortage of health personnel, lack of managerial capacity, and insufficient decentralisation of managerial authority (Development Bank of South Africa, 2008). The decline in the quality of care in the public sector has had two similar but distinct effects. One of the effects has been on bargaining power between medical schemes and hospitals: The subsequent low regard for public hospitals makes them unattractive for medical scheme members and removes any leverage that medical schemes could otherwise exercise over private hospitals (van den Heever, 2012). The second effect is the inelastic demand for medical scheme membership (Okorafor, 2012). Despite the consistent and significant annual increase in scheme contributions, the number of medical scheme members has continued to grow, albeit at a slower rate in recent years. This sends the wrong signal to the market as far as cost management is concerned. Another relevant issue is that of medical scheme members utilising public hospitals: It is often the case that the public hospital does not bill the medical scheme for the service.

[19] Ethical Rule of Conduct for Practitioners Registered Under the Health Professions Act, 1974.

3.4 Summary

This section of the report has provided an overview of the private hospital sector, including the relationships, structures and regulations that impact on eventual cost and price of private hospital care. Key points are:

i. The current process for determining hospital reimbursement tariffs is largely a consequence of the Competition Commission ruling against collective bargaining in 2004 and the subsequent failure to establish appropriate reference prices.

ii. The regulatory environment for medical schemes has created incentives for behaviours that shape utilisation within the medical scheme environment. PMBs give emphasis to hospital services, which has the effect of increasing expenditure that is accounted for by hospitals.

iii. The private hospital market and the administrator market are similarly concentrated. Considering the options available to schemes and administrators to manage costs, they have significant countervailing market power in tariff bargaining with private hospitals. However, the decline in the quality of care in public sector hospitals removes additional leverage that medical schemes and administrators could have had in tariff bargaining by channelling their members to an alternative source of hospital care besides private hospitals.

iv. In the medical scheme environment, claims for hospital services originate from a number of independent providers, of which the hospital is one. Each of these providers acts and bills independently. HPCSA ethical rules have had the effect of limiting the coordination and integration of care for hospital services, therefore introducing inefficiencies in the delivery of care to the patient.

v. Hospital bills to medical schemes consist of a “ward, theatre and equipment” component and a pharmacy component. The pharmacy component is billed at cost to the hospital without a mark-up; the pharmacy component accounts for around 27% of the total hospital bill.

4 Comparison of affordability of health services based on countries' GDP

4.1 Interpreting GDP

The comparison of living standards across countries is extremely difficult methodologically. Over time, different concepts have been developed for different sectors and different aspects of life. Gross Domestic Product (GDP) captures the gross values added of all institutional units engaged in production within a country and is also often regarded as an indicator of living standards as it correlated to consumption opportunities (Mankiw & Taylor, 2014). However, GDP is value-neutral as it does not just capture "desirable growth": For example, GDP increases if many people fall ill and receive expensive hospital care. Limitations of the concept of GDP are manifold and it is widely recognised that GDP is neither an adequate means of measuring quality of life or economic welfare, nor is it an appropriate concept to assess national progress (Stiglitz et al., 2010; Gordon & Glenn, 2012). The limitations are also acknowledged in the Eurostat-OECD Methodological Manual (Eurostat, 2012).

Recognising some of the limitations of GDP is important for the discussion of hospital price comparisons between the South African private hospital sector and the hospital sectors of different countries. In particular,

- GDP—even when PPP-adjusted—does not take into account differences in the quality of goods;
- GDP does not take into account externalities, e.g. the exploitation of resources may lead to undesirable consequences regarding their availability for alternative use or to negative effects on livelihoods;
- GDP does not encapsulate sustainability, e.g. an overuse of the health system may contribute to GDP but overstretch resources such that levels of service provision cannot be maintained in the longer term;
- The concept does not capture the non-monetary, informal economy; and, most importantly,
- The concept does not reflect the distribution of income and wealth.

In the context of hospital price comparisons as presented in the respective *OECD HWPs*, GDP is used within the concept of GDP-based PPP and for ranking and comparing countries in terms of their GDP per capita.

GDP is a meaningful indicator of the level of economic activity in a country and in comparison to other countries, even though the calculation of GDP varies between countries (There is a uniform approach for OECD countries). However, it is not an accurate measure of material well-being, as would be reflected the consumption of individual goods and services by resident households. GDP also covers collective services provided to the community by government, capital goods and net exports (Eurostat, 2012).[20]

4.2 Income distribution

Income distribution is a key concept when discussing the affordability of goods and services. The Gini coefficient expresses the statistical dispersion of income levels within the economy.

[20] An affinity for GDP in South Africa's political and social debate was identified previously (Fioramonti, 2013).

Figure 1 shows the position of countries based on the levels of Gross National Income (GNI) per capita[21] and the respective countries' Gini coefficients.

South Africa is among the world's countries with the least equal distribution of income and features a Gini coefficient of 63.4%. At the same time, the South African GNI per capita is very low at 12,530 USD PPP per capita. The OECD comparator countries selected for the OECD study are characterised by significantly higher GNI per capita: At 23,350 USD PPP, the GNI per capita of Hungary, the poorest country from the sample, is nearly double that of South Africa, and the level of inequality, as measured by the Gini index, is significantly lower in Hungary (30.6%).

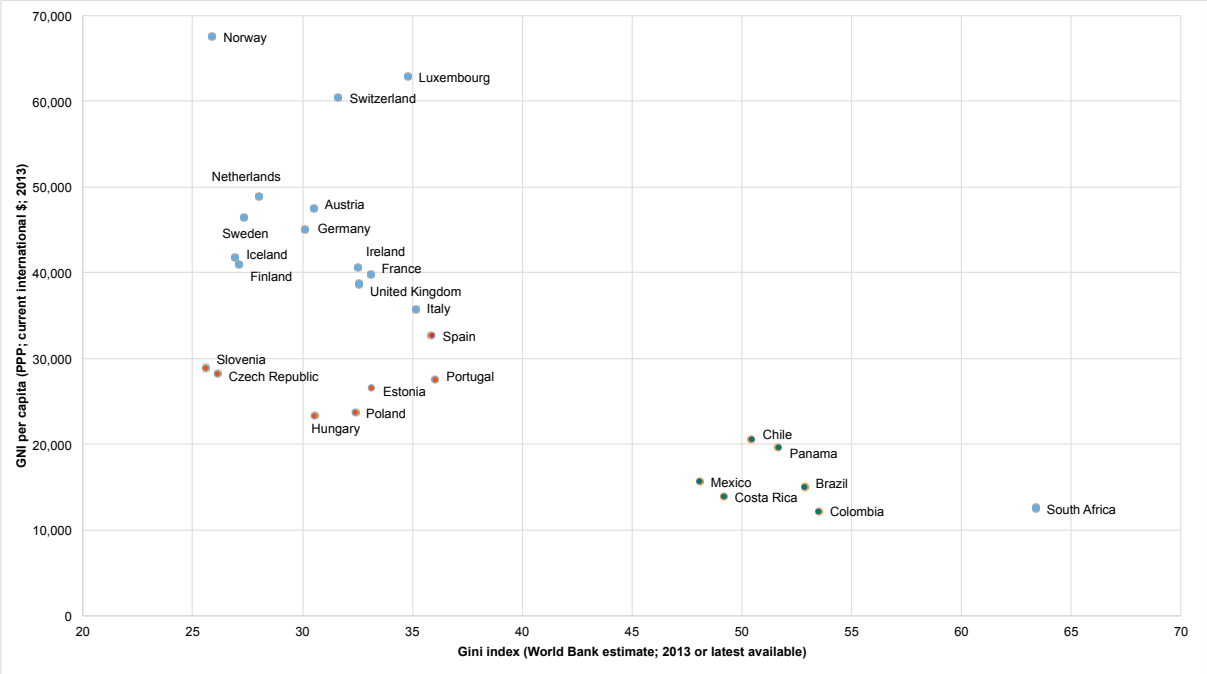

Figure 1: GNI per capita and Gini index for selected countries (2013) (Source: World Bank, International Comparison Program database.)

It is important to understand what the differences in economic activity and in income distribution mean for the comparison of health systems. Comparing averages is fraught with conceptual and methodological pitfalls. Section 5.1 reflects on the choice of comparator countries for price comparisons in the health sector.

4.3 Using PPP

Purchasing power parities (PPP) are a concept used to convert expenditure on specified groups of goods between countries to a common currency. Purchasing power parities are used in different contexts, as the approach can either indicate whether a currency is over or undervalued, or—more importantly in this context—the concept can be used to compare price levels of product groups. The Eurostat-OECD Methodological Manual (Eurostat, 2012, p. 37) suggests that spatial comparisons of GDP, volume comparisons of the component expenditures of GDP, and spatial comparisons of price levels (at the level of GDP or analytical categories) are the primary uses of the concept. PPPs can be calculated on the basis of the economy as a whole, "at GDP level", for sectors of the economy, and for

[21] GNI is used for convenience of drawing data from a single source. The concept of GNI differs from GDP, as it relates to the ownership of means of production (rather than their location). OECD Health Working Paper No. 85 acknowledges that a contributor to the study (Insight, 2014) suggested GNI as superior to GDP to address the affordability objective but dismisses this without further discussion (Lorenzoni & Roubal, 2015, p. 16, para 36).

particular product groups. The appropriate choice of PPP definition for any specific price comparison is not straightforward. Eurostat and the OECD have developed a coherent methodological approach that is based on both economic theory and the consideration of practical limitations (Eurostat, 2012).

In general, economy-wide PPPs are problematic in hospital price comparisons, as they do not take into account relative price levels of health goods and services on the one hand and all other goods and services on the other (Kavanos & Mossialos, 1999). The OECD approach to the comparison of hospital prices uses the PPP concept in establishing indices at the country level, as described in more detail in a working paper by Koechlin and colleagues (2014). Here, price benchmarks are derived from a sample of OECD countries. Price indices are calculated using the Eurostat-OECD method as reflected in the Eurostat-OECD Methodological Manual (Eurostat, 2012). This involves the calculation of output prices or "quasi prices", the definition of surgical and medical case types as "products" (selected by diagnosis code, procedure codes, and possibly further selection rules), and the calculation and application of weights. The use of output prices rather than input prices for international comparison is considered superior because, inter alia, the use of input prices implies comparable productivity in the countries being compared.[22] Still, even when comparing output prices, the products compared are probably far from the homogenous ideal the method would require. This point is partly addressed by a step that constitutes an element of the Eurostat-OECD approach: the Quaranta editing procedure (Eurostat, 2012, Appendix 4). This serves to validate the prices collected for price comparison. Quaranta editing is an iterative process that first flags prices after exchange rate conversion ("XR indices") and PPP indices for specific products as outliers if the fall outside the range 80 (4/5) to 125 (5/4). The process also considers dispersion among PPP indices at three levels (1. for a product; 2. among a country's PPP indices; and 3. among all PPP indices irrespective of product or country). Should any variation coefficient lie above 33%, there is an apparent inconsistency and validation is required.

OECD HWP 85 resorts to an economy-wide approach in considering the consumer price index (CPI) "as a proxy for affordability" (p. 21, Fn. 20), and in comparing the South African GDP with that of the average of the OECD sample on the basis of USD PPP. Economy-wide PPPs are commonly calculated from a sample selected from the whole range of final goods and services that comprise GDP (Eurostat, 2012). GDP is commonly estimated using national annual purchasers' prices of actual market transactions.

Regarding the economy-wide approach, caveats apply that should have been highlighted as limitations in *OECD HWP 85*. When implicitly dealing with comparative price levels, such as in Section 7 of the *HWP*, the implications should be made obvious. Comparative price level (CPL) indices are the ratios of purchasing power parities to market exchange rates. At the level of GDP, CPLs provide a measure of the differences in the general price levels of countries and are measured as an index. The CPL varies significantly with the exchange rate. In 2011, South Africa's CPL (62) was higher than that of the OECD countries Poland (59), Mexico (59), Hungary (59) and Turkey (56) (Source: OECD, n.d.). In 2013, on the other hand, South Africa was found at the bottom of the table: The exchange rate had fallen from an annual average of 7.22 ZAR/USD in 2011 to an annual average of 9.63 ZAR/USD in 2013. The exchange rate is also relevant when it comes to the consideration of hospital price levels. Output prices are not independent of input goods nor services (Wordsworth & Ludbrook, 2005). A considerable share of costs faced by hospitals is dependent on the exchange rate, as hospital technology is imported, as is a significant percentage of pharmaceuticals and consumables.

[22] The approach has been adopted as an integral part of Eurostat/OECD PPP comparisons after extensive piloting (Koechlin et al., 2010).

Overall, regarding the choice of output prices as the basis for international comparison, the *HWP* should have acknowledged that it is rather heroic to assume that the quality of the product (case) is identical across countries. A problem in undertaking this exercise is the unobserved heterogeneity of cases across countries. The severity of the underlying illness and associated resource intensity may differ significantly. There are countries—Germany may serve as an example—that have always tended more towards treating patients as inpatients in hospitals as compared to other countries.[23]

Further, the sale of medical goods and services does not only involve different providers but the transaction may also involve two or more buyers or payers with each paying a share of the total price. Capturing "full market prices" for case categories is challenging. The full market price is defined as the "total price paid to the provider of the good or service" (Eurostat, 2012, p. 155). As pointed out, the total price may be paid by different purchasers, e.g. the patient via out-of-pocket payments (such as co-payments), government and third-party payers (medical schemes). The full market price may also comprise services rendered by different service-providing entities, e.g. medical specialists, providers of pathology services and providers of hospital services. The latter is also the case in South Africa.

Appropriately capturing "quasi prices" across different systems and constellations within systems is an extremely complex tactic, which may be appropriate for an explorative paper but not necessarily constitute a sound basis for policy decisions. Whether quasi prices are negotiated prices or administrative prices, it is important that the costs they cover are the same for all participating countries.[24]

> The international comparison of output prices of hospital cases is fraught with methodological issues with regard to the choice of prices and price indices, many of which have been addressed by previous OECD publications. The comparison of South African private sector prices with prices from an OECD sample provides for further pitfalls.

4.4 Affordability

Affordability constitutes one of the dimensions of access to healthcare (McIntyre et al., 2009). Ensuring the affordability of health services is therefore a key objective of health and social policy. Health systems need to be organised such that everyone can access needed health services without risking economic hardship.

OECD HWP 85 does not define the term affordability in the main body of the text but implies that a certain type of healthcare, here: hospital inpatient services, is unaffordable if its relative international price level exceeds the relative international price level of the GDP as a

[23] The limitations resulting from the impossibility of capturing severity levels have been acknowledged in the Working Paper (Lorenzoni & Roubal, 2015, p. 13 Fn). An international comparison of severity levels within the case groups would be rather instructive, as treatment cultures differ significantly between countries, e.g. cases of a certain severity would be treated as inpatients in some countries but not hospitalised in other countries, and in some case groups resource requirements differ significantly with the degree of severity. Given the availability of high quality outpatient treatment by specialists whose offices are located at the hospital grounds, the cost sharing component for inpatient treatment and the associated assumption that inpatient cases in certain case categories may be on average more severe in South Africa than in other countries, suggest an extremely cautious interpretation of findings.

[24] For more on health system differences, cf. Section 5.2.

whole. This is a slightly manipulative notion; There are plenty of methodological and practical arguments against this.

Finally, in its Annex 3, the *HWP* contains a definition of affordability, based on the concept of catastrophic expenditure (e.g. McIntyre et al., 2006), the wording borrowed from Niëns and colleagues (Niëns et al., 2012): "The price of a commodity is deemed unaffordable when it exceeds a certain proportion of a household's or economy's resources" (Lorenzoni & Roubal, 2015, p. 64). Niëns and team never mention the term economy but they do build a solid case for demonstrating the measurement of affordability at the micro level by defining catastrophic expenditure as a share of a household's resources, and by applying a "macro method", demonstrating how the need to buy certain pharmaceuticals would drive individuals from low income deciles below alternative poverty lines. This is not new and is appropriate where individuals in need are required to pay out of pocket for health services: The study cited in *OECD HWP 85* focuses on the costs of generic glibenclamide (an antidiabetic drug) to cash-paying poor households.

The comparison of private sector hospital prices and GDP (PPP) per capita is precarious. Apart from the above criticism of using GDP per capita as an approximation of households' ability to pay[25] and the implications of imposing a linear distribution of per capita income, the presentation by Lorenzoni and Roubal fails to discuss both the socio-economic status of the current addressees of private sector services as well as the existence of a large public sector with public hospitals offering subsidised health services to a majority of the population.

The much-discussed dichotomy of the South African health system reflects the plight of social and economic policy over many years. This dichotomy is deeply rooted in the dramatic inequality of wealth and income. The fact that a private health sector has developed independently of the public health sector in the form of a separate system for the better-off has been made possible by the socio-economic divide (and the country's failure to successfully address this) and by lack of effective health system regulation. Notwithstanding the unattractiveness of the dichotomous South African health system in the light of the government's aim to move towards universal health coverage and in awareness of the inequities of the system, it is the reality that the currently existing private system addresses a sub-population that is recruited largely from the formal economy with beneficiaries concentrated in the upper income groups.

As nearly all patients in South African private sector hospitals are beneficiaries of medical schemes, the best approximation as to the distribution of private sector hospital patients across income groups would be achieved by determining the distribution of medical scheme members across consumption deciles. This is shown in Figure 2.

[25] The authors use household final consumption in a complementary brief, a last-minute submission to the Competition Commission on 17 February 2016 (WHO/OECD, 2016).

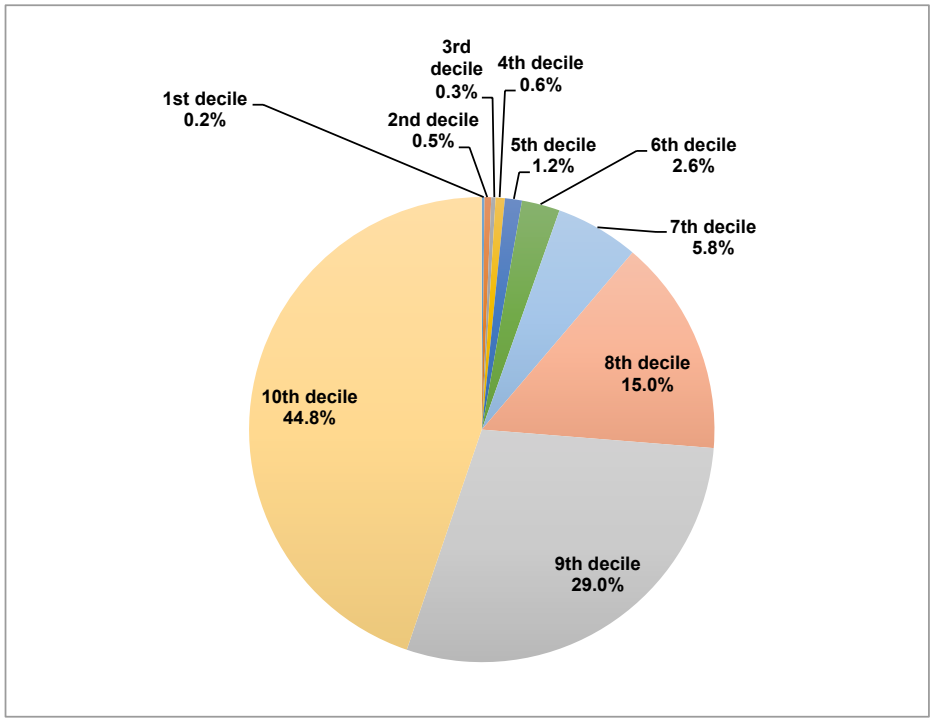

Figure 2: Distribution of medical scheme member across consumption deciles, 2010/2011 (Source: Income and Expenditure Survey, 2010-2011.[26])

In *OECD HWP 85*, the authors present a biased picture of South African private sector prices by connecting South African private sector price levels with GDP per capita (PPP). As the authors can show a correlation between price levels for hospital services and per capita GDP for the selected OECD countries, the scatter plot presents South Africa as an outlier (Lorenzoni & Roubal, 2015, p. 25 [Figure 5]).

The authors may have realised the disingenuousness of the original presentation when they provided an additional diagram for presentation to the Competition Commission on 17 February 2016. Figure 2 of their three-page brief (WHO/OECD, 2016) shows a similar diagram that depicts household consumption expenditure—rather than GDP per capita—on the x-axis and hospital comparative price level on the y-axis. For the selected OECD countries, the scatter plot shows a pattern similar to the corresponding diagram; South Africa is now additionally depicted by its four highest income deciles. The plot shows that only one decile is located to the right of the imaginative trend line, implying that for all the others hospital services may not be “affordable”.

This is still slightly manipulative. For all OECD countries presented, the dots depicted in the diagram are based on averages, which means that—as long as the hospital services included in price level calculations serve 100% of the population—half of the population finds itself to the right of the dot and half of the population to the left. The authors could have considered depicting the point representing private sector prices and private sector clients: Figure 3 depicts hospital comparative price levels and household consumption expenditure per capita for the OECD country sample and the South African medical scheme population. The scatter plot shows South Africa in line with the trend.

[26] The analysis in this section uses the latest available South African Income and Expenditure Survey (IES) 2010-2011. The IES is a household survey that is routinely conducted by Statistics South Africa every five years. The IES 2010-2011 was conducted between September 2010 and August 2011. Sample realisation was 27,665 households.

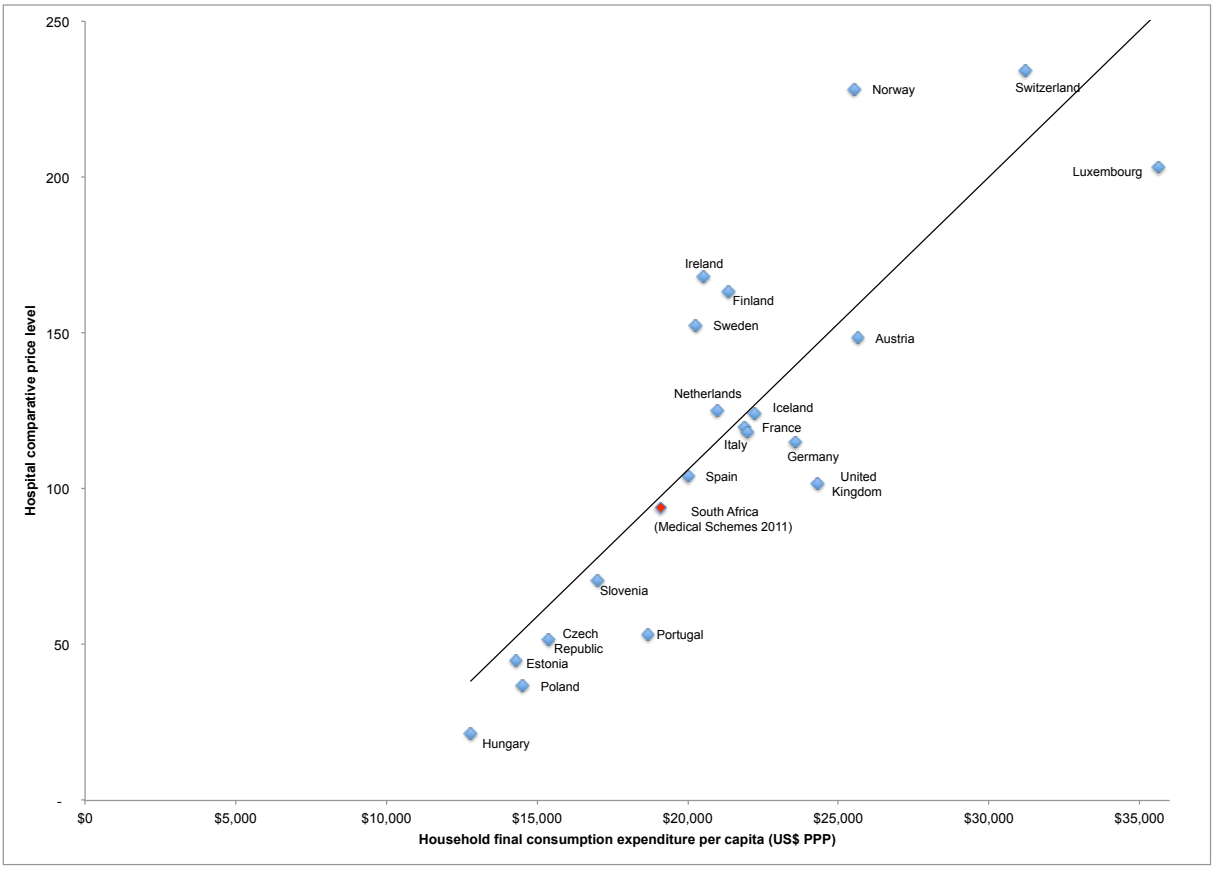

Figure 3: Hospital comparative price levels and household consumption expenditure per capita. (Sources: OECD.Stat; StatsSA, Income and Expenditure Survey 2010/2011.)

The presentation of Figure 3 (along with Lorenzoni and Roubal's presentations) is problematic, as it suggests that it somehow deals with affordability. Quasi prices of hospital services do not tell us much about the financial burden that the patient in need of hospital services may be confronted with. This depends very much on the degree to which financial health protection is realised within the country's health system, i.e. the degree of risk-related and income-related cross-subsidisation. Within the South African private sector, there is partial risk equalisation within the medical scheme population, as medical schemes are tied to open enrolment and community rating. Quasi prices of hospital services also do not tell us much about the economic position of suppliers of hospital services, e.g. regarding their profit-making potential.

> Affordability is ill-defined in OECD Working Paper No. 85. The analysis does not take into account existing mechanisms of financial protection. The Working Paper's approach of presenting calculated price levels in relation to economic well-being is suboptimal. However, when this approach is applied for argument's sake, the consideration of average household consumption expenditure of medical scheme members as an approximation of the socio-economic status of the clientele of private hospital in South Africa shows: South African private sector hospital prices lie along the same trajectory as those of the selected OECD comparator countries.

5 On the selection of comparator countries

5.1 Economy and economic history

A comparison of different health systems is challenging considering their different historical backgrounds as well as current set-up and dynamics. Health systems develop before the background of a country's (political) economy and its historical and cultural context. This is not meant to imply that comparisons between health systems should not be conducted.[27] Rather, it would be desirable that more investigators took differences in health and social systems more seriously when embarking on comparisons of certain aspects of systems, such as prices, co-payments or benefit packages.

There are very obvious aspects related to economic context and politico-economic history that should be taken into account when embarking on price comparisons. Prices of some systems turn out to be suboptimal comparators if systems are running deficits, i.e. prices are not cost-covering. There is some evidence that this is the case in one or the other country whose health system can still be considered in the process of transformation from a former Semashko model to a social health insurance system. This applies to five out of the six countries with the lowest assigned price levels in *OECD HWP 85*. Through the 1990s, Central and Eastern European countries have struggled to embark on their transition projects in the light of an economic downturn that meant increasing unemployment, inflation, low salaries, tax evasion and large informal sectors. Countries hardly managed to maintain the healthcare coverage levels they had under communism. Universal access has meant access to largely relatively poor-quality health services. Health systems are still facing a prolonged transition phase (Tambor et al., 2013).

Even though the Czech health financing and insurance system, for example, guarantees almost universal and equal access, it has suffered from significant deficits since the start of the implementation of social health insurance (Nemec et al., 2013). The Czech Republic introduced social health insurance in 1992; the country shifted to the classification as a high-income country in 2006 (Vilcu & Mathauer, 2016).

Informal payments that have been a common feature across Eastern and Central European health systems before the revolutions of 1989 still play a role in some countries. These have been described, for example, for Hungary where almost half of hospital patients pay informal charges of 130 EUR on average, even though co-payments were introduced in 2007 and abolished one year later in 2008 as a result of a public referendum (Baji et al., 2010; Baji et al., 2015), and for Poland where informal payments serve to financially support underfunded or indebted hospitals, even if they are estimated to have amounted to only 2% of total OOP expenditure in 2006 and 1.5% in 2009 (Sagan et al., 2011).

The characterisation of the health systems of the Central European countries in the OECD sample as systems in transition also means that—apart from imperfections in financing—the quality of hospital services provision and hospital governance may not be quite in line with that of other EU countries (Sowa, 2016). 73% of Polish respondents of a Eurobarometer survey of 2013 believe that it is "likely" that patients could be harmed by hospital care in their country (an increase of 4 percentage points over 2009) (European Commission, 2014).

[27] On the occasion of the Competition Commission hearings, acknowledging methodological challenges of comparing health systems, Francesca Colombo, Head of the Health Division at OECD, made a point to highlight that it was not just South Africa being difficult to compare to an otherwise more or less homogenous sample of OECD countries, but that within the sample there were large differentials (Risner, 2016).

There are arguments that make five of the seven countries of *OECD HWP 85*'s "second comparison group" appear suboptimal, e.g. if prices are not cost-covering. These arguments should have been acknowledged as possible limitations.

5.2 Health system typologies

It is certainly beyond the scope of this paper to discuss the characteristics of health systems in detail. Yet it is important to highlight that a discussion of affordability of hospital services must include a discussion of the financial burden that actually accrues to patients once they utilise these services.

In some of the countries, out-of-pocket expenditure (OOP) as a share of total health expenditure (THE) is quite high: In Hungary, the share of OOP of THE amounts to 28.3% (2012); in Estonia 18.2% (2012); in Poland 22.7% (2012); and in Portugal 27.3% (2011) (OECD, 2014). In Estonia and Hungary lower income quintiles face a particularly heavy burden of OOP (Vilcu & Mathauer, 2016)

In some countries, co-payments apply for inpatient services. In Estonia, for example, there is a co-payment of up to 2.50 EUR per day for up to 10 days per episode of illness; further co-payments apply for above-standard accommodation and for certain specific services (Lai et al., 2013). In Germany, the co-payment amounts to 10.00 EUR per day for up to 10 days per episode of illness. There are further charges for above-standard rooms (single or double rooms) of 40 to 60 EUR per day. Selection of preferred doctor (chief/head physician) is also billed extra. These extra services that would regularly be covered by private insurance (full or supplementary). The average mark-up for these "private" choices amounts to 20-25% on top of the basic DRG-based service price.

5.3 Voluntary private health insurance

Voluntary private insurance frequently leads to heated discussions, even among health systems experts. Private health insurance can take many shapes and is therefore still poorly understood by researchers and policy makers (as already pointed out ten years ago by Sekhri & Savedoff, 2005). In order to take out the ideology bias: "Private", as defined in a 2004 OECD publication (Colombo & Tapay, 2004), can be distinguished from public insurance on the basis of the source of funds. While all money ultimately comes from household or employer income, it is channelled through the state—via general tax or social insurance contributions—in public insurance programmes, and paid directly to the risk-pooling entity in private insurance. Private and public characterise the type of management. Private insurance can be for-profit or not-for-profit. Enrolment in private or public insurance can be voluntary or mandatory. Within a health system, the role of private health insurance can be

- Substitutive (or duplicate), i.e. private insurance provides coverage that would otherwise be available from the state;
- Complementary, i.e. it provides coverage for services excluded or not fully covered by public insurance; or
- Supplementary, i.e. in principle it covers the same range of services as public insurance but aims to increase provider choice or the level of inpatient amenities.

In most health systems, we find competing approaches to health insurance, and different permutations exist. *OECD HWP 85* reflects some of the options in its Table 1 entitled

"Population covered by private health insurance" (Lorenzoni & Roubal, 2015, p. 11).[28] This table lacks meaning: The information contained cannot be interpreted, as the aggregation of data and reduction of descriptions to summative labels covers up complexity.

For example, the table shows that 32% of the German population is covered by private health insurance that can be characterised as "primary" or "complementary". The share of private primary (full) health insurance is 10.9% (2014) (PKV, 2015). However, about half of this group resembles civil servants and their dependents who are covered directly by the German government for 50% of their claims. This group's contributions to private insurance are considerably lower than any other member's because only part of their risk has to be covered by insurance. In the other half of private insurance members, there are those who have used the opportunity to opt out of social health insurance as a result of their income exceeding the social insurance threshold or of their self-employed status; yet there is also a certain share of the population who are mandatorily privately insured, as they fall in one or the other exemption category and cannot choose the social health insurance option because they have not previously been a social health insurance member. The rest of the group of privately insured will mainly be people who are otherwise social health insurance beneficiaries but choose additional benefits from a private insurer, such as complementary dental care insurance, overseas travel insurance, supplementary hospital care insurance for superior amenities, or additional sickness allowances.

The table also shows Switzerland with a share of 29.5% of the population taking out private supplementary insurance. The table overlooks the very large share of compulsory private health insurance. Swiss residents have to obtain compulsory health insurance from a list of authorised health insurance companies, many of which are private.

This raises the issue of classifying insurance as mandatory or voluntary. While *OECD HWP 85* in its (inadequately labelled) Figure 1 and the subsequent text states that 41.8% of health expenditure is channelled through voluntary health insurance, the presentation may be somewhat misleading: For example, in industries with affiliated closed schemes, scheme membership usually comes with the employment contract—44% of medical scheme members are in closed schemes. Many employees of larger organisations are offered to join the group contracts that exists with a specific medical scheme; medical scheme membership becomes part of the contractual arrangement with the employer. Further, there are about 1.2 million government employees in South Africa. In 2014, there were approximately 687,000 members of the Government Employees Medical Scheme (GEMS). Noting that some government officials are also members of other closed schemes such as POLMED (for the South African police force) or PARMED (for parliamentarians), the coverage among South African government employees is rather high. GEMS membership is highly subsidised and has come as an additional benefit to many government employees.

Not only is it therefore difficult to pin down the characteristics of private insurance as voluntary in different countries and contexts, it is also difficult to define what should count as insurance. Looking at Figure 1 of the *OECD HWP* again, it becomes obvious that not all arrangements covered by the separate bars is insurance in a narrow sense. For example, most expenditure that is classified as voluntary private health insurance in the bar representing Hungary is individual medical savings accounts without any pooling across individuals beyond the family (Gaál et al., 2011).

[28] Table 1 of the Working Paper and the corresponding text (paragraph 16) are directly copied from earlier OECD Health Working Paper No. 70 (Kumar et al., 2014). This has been a missed opportunity for improvement of the presentation and the correction of the misrepresentation of the German private health insurance context.

There are significant differences between health systems. These differences should not serve as a pretext to condemn international comparisons; they should rather be used to attempt explanations of why key health system variables differ between countries. In contrast to other OECD studies, *OECD HWP 85* is completely silent on this, and therefore misses the opportunity to appropriately discuss the findings.

6 On the selection of case types (patient categories) for "price" comparison

For a valid international comparison of hospital price levels on the basis of PPPs the authors of the OECD Health Working Paper on health related PPPs identified three major problems: comparability of products, representativeness of products and the existence of market prices (Koechlin et al., 2014). The following section will focus on the first two problems with regards to PPPs: comparability of products and representativeness of products.

6.1 Comparability of products

For the PPP-based comparison of inpatient hospital price levels OECD and Eurostat identified 28 case types - seven medical inpatient case types and 21 surgical inpatient case types. Case types are defined by certain inclusion and exclusion criteria on the level of principal diagnoses and principal and secondary procedures (Annex 2 of HWP No. 85). The comparison of inpatient hospital price levels for these 28 case types for private hospitals in South Africa and public and private hospitals in 20 OECD countries leads the authors of the OECD Health Working Paper No. 85 to the conclusion that "private hospital prices in South Africa are on par with prices in countries with much higher GDP levels – including the United Kingdom, Germany, and France" (Lorenzoni & Roubal, 2015).

As a result of price comparisons in one sector, i.e. hospital services, one would expect a specific country to range above, on par, or below the price level of comparator countries. Looking at the results of price comparisons on the case type level, one of the first things to notice is the striking range in price-differences detected. Taking South Africa as a basis, for 2013 they range from +40.4% for M01 Acute myocardial infarction to -58.2% for M07 (pneumonia) for medical case types and +52.6% for S06 (discectomy) to -46.1% for S21 (tonsillectomy and/or adenoidectomy) for surgical case types (Lorenzoni & Roubal, 2015). Therefore, price levels differ significantly from the OECD average, both below and above, in the medical and the surgical case type categories.

OECD HWP 75 compares prices in the private hospital sector in South Africa with – public and private – hospital prices in 20 OECD countries, but fails to disclose fundamental measures that determine the validity of the price comparisons carried out. One such fundamental measure is the coefficient of variation: if prices within one case type vary to a great degree, it is not possible to make valid statements concerning differences in price levels. As an arbitrary value for the critical level for coefficients of variation OECD and Eurostat set a value of 33%. The OECD-Eurostat experts state that this value is supported by experience and that it should be applied consistently (Eurostat, 2012, Annex IV, Section IV.3).

We investigated two samples with all the case types discussed in OECD HWP 75 and calculated the relevant coefficients of variation, with the following results:

1. A case-specific Mediclinic sample for South Africa (83,777 cases for 2013) depicts critical values in coefficients of variation (> 33 %) for 24 out of 28 case types.
2. A DRG-based sample for Germany (486,959 cases for 2013) shows critical values in coefficients of variation (> 33 %) for 13 out of 28 case types, with a significant correlation (R^2 = 0.53528) between coefficient of variation and reported difference in price level.

These findings raise serious doubts concerning the validity of the price comparisons carried out in OECD HWP 75.

> Product (case type)-level variation coefficients show values that indicate low reliability of the calculated price indices and shed justifiable doubt on the price comparisons in *OECD HWP 85*.

6.1.1 The problem of variance

The problem of comparability of products is closely related with variance: The *Eurostat-OECD Methodological Manual on Purchasing Power Parities* distinguishes three different variation coefficients[29] - basic heading variation coefficients, country variation coefficients and product variation coefficients (OECD/Eurostat, 2012). Since forming case types from cases with related procedures and/or diagnoses runs analogous to forming basic headings,[30] they should "cover, at least in principle, relatively homogenous groups of products with more or less uniform price levels" (OECD/Eurostat, 2012, p. 359, Fn. 7). By investigating case type variation coefficients for each case type, we investigate basic heading variation coefficients. This means evaluating the homogeneity of prices within each case type. For DRG-based systems, where there is a uniform price for each DRG, the basic heading variation coefficient is relevant. In a health system without fixed prices, the product variation coefficient measuring dispersion of prices for the same product (e.g. a specific combination of procedures within a case type) would also be relevant. The *Methodological Manual* states for the product variation coefficient that "the higher the coefficient's value, the less uniform are the product's price levels and the more suspect is the product's comparability and the accuracy of its pricing across countries" (OECD/Eurostat, 2012, p. 365). They set the critical level for all three variation coefficients at 33%. Although "the choice of critical value is arbitrary, but supported by experience" (OECD/Eurostat, 2012, p. 358), we will for fault of validated values, use this value to highlight critical levels of dispersion.

Since no measures of dispersion for the case types are disclosed in the OECD Working Paper No. 85, we analysed two different samples: (1) a case specific sample provided by Mediclinic for 2011 to 2013, the same period investigated in the working paper, with price data on the hospital services charged by Mediclinic, and (2) the cost calculation sample from German hospitals on a DRG specific level.

[29] Variations coefficients are calculated dividing standard deviations in prices by average prices.

[30] The OECD Methodological Manual on Purchasing Power Parities explains basic headings by using rice as an example: the basic heading "rice" will comprise seven different types of rice such as "long-grain rice, parboiled" etc.

6.1.2 Variance in the Mediclinic sample

To investigate the problem of within-case type variance on a case specific level, we used a Mediclinic sample, covering 245,291 inpatient cases: 80,470 in 2011, 81,044 in 2012 and 83,777 in 2013. The sample was generated by applying the case type descriptions and filter criteria of the OECD Health Working Paper No. 85 to distinguish the different case types (Table 4). Taking case type M01 Acute myocardial infarction as an example, we first identified all cases with a primary diagnosis code from the case description (Table 2) which resulted in 4,091 cases in 2013 (Table 3).

ICD Code	Primary diagnosis description
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
I21.8	Subsequent myocardial infarction of other sites
I21.9	Subsequent myocardial infarction of unspecified site

Table 2: Primary diagnoses for M01 Acute myocardial infarction

As exclusion criteria, we then applied operating room procedures (CPT procedure codes 10000 – 69990) and invasive treatments included in S13 PTCA and S05 Coronary artery bypass graft. This reduced the number of cases to 2,719 cases (Table 3).

Category	2011	2012	2013
ALOS	2.91	2.95	3.16
SD_ALOS	3.82	3.89	3.93
APRICE	21,194	23,160	24,483
SD_PRICE	16,110	19,905	19,784
Var_Coeff	76.0%	85.9%	80.8%
Cases Case description	3,043	3,398	4,091
Cases exclusion/inclusion criteria	2,027	2,242	2,719
Cases after Quaranta editing procedure	1,886	2,116	2,515

Table 3: M01 Acute myocardial infarction, case type characteristics (Source: Mediclinic sample, own calculations)

In a further step, we applied the Quaranta editing procedure (OECD/Eurostat, 2012) – a procedure introduced by OECD/Eurostat to harmonize PPPs across countries – to exclude outliers in length of stay (LOS). This resulted in excluding all cases with a difference in LOS of more than 1.5 standard deviations from average LOS (ALOS). The procedure will be explained by taking the example M01 Acute myocardial infarction: For case type M01 ALOS

in 2013 was 3.16 days with a standard deviation from ALOS (SD_ALOS) of 3.93 days. As a consequence all cases with LOS > 9 days (3.16 + (3.93 * 1.5) = 9.06) were excluded from the sample, reducing the number of M01 cases in the sample to 2,515 cases.

The application of the Quaranta editing procedure to the Mediclinic sample led to a reduction in cases considered of 8.1% for all case types, with a remaining number of 245,291 cases. Since only the prices charged by Mediclinic were available, we calculated the average price excluding the price components charged by other service providers, e.g. “specialists”, “pathology” and “radiology”.

Calculating variation coefficients for the inpatient case types in the Mediclinic sample, we get variation coefficients ranging between 24.6% and 167.0% (Table 4). Only three out of the 21 surgical case types fall below the critical level of 33% and only one of the seven medical case types is below that threshold. These results have to be interpreted with caution, since for some case types (S06, S07, and S13) the number of cases considered is small (< 50), but even for high volume case types like M07 Pneumonia the coefficient of variation is 73.5%.

For 18 out of 21 surgical case types and 6 out of 7 medical case types the variation coefficient of prices in the Mediclinic sample exceeds the critical level of 33%.

Case type category	Code	Case type	Cases (2013)	ALOS (2013)	Std_dev ALOS	Average price (2013, in Rand)	Std_dev price	Coefficient of variation
Medical case types	M01	Acute myocardial infarction	2,515	3.16	3.93	24,483	19,784	80.8%
	M02	Angina pectoris	5,396	1.69	1.99	19,635	12,312	62.7%
	M03	Cholelitiasis	279	2.75	2.41	6,941	11,593	167.0%
	M04	Heart failure	3,598	5.05	4.53	17,391	17,728	101.9%
	M05	Malignant neoplasm	688	5.28	5.45	13,024	12,612	96.8%
	M06	Normal delivery	6,984	1.75	0.70	13,637	4,435	32.5%
	M07	Pneumonia	20,964	4.61	3.41	12,747	9,374	73.5%
Surgical case types	S01	Appendectomy	3,168	2.53	1.75	17,587	6,539	37.2%
	S02	Caesarian section	21,720	2.86	0.71	22,596	5,554	24.6%
	S03	Cholecystectomy	3,528	2.53	2.60	27,189	12,755	46.9%
	S04	Colorectal resection	207	7.66	4.35	76,028	63,633	83.7%
	S05	Coronary artery bypass graft	126	8.54	3.58	156,371	141,091	90.2%
	S06	Discectomy	33	2.74	0.98	63,749	48,245	75.7%
	S07	Endarterectomy	36	4.34	3.05	51,137	39,307	76.9%
	S08	Hip replacement: total and partial	2,404	6.72	3.85	87,645	73,148	83.5%
	S09	Hysterectomy	3,903	3.04	1.19	22,821	8,185	35.9%
	S10	Knee replacement	2,573	5.75	2.53	88,445	73,472	83.1%
	S11	Mastectomy	475	3.17	2.36	23,725	9,577	40.4%
	S12	Open prostatectomy	142	5.19	2.13	52,104	39,634	76.1%
	S13	PTCA	25	1.63	1.47	74,576	60,279	80.8%
	S14	Peripheral vascular bypass	84	6.90	4.73	75,789	64,633	85.3%
	S15	Inguinal hernia repair	1,620	1.28	0.87	19,576	8,711	44.5%
	S16	Thyroidectomy	762	1.92	1.59	23,710	9,672	40.8%
	S17	Transurethral resection of prostate	316	3.04	2.29	20,813	6,455	31.0%
	S18	Arthroscopic excision of meniscus of knee	387	1.20	0.83	16,127	3,948	24.5%
	S19	Lens and cataract procedures	68	1.89	1.91	16,724	7,345	43.9%
	S20	Ligation and stripping of varicose veins	442	1.36	1.12	18,174	6,626	36.5%
	S21	Tonsillectomy and/or adenoidectomy	1,334	1.30	1.17	9,270	8,629	93.1%

Table 4: Case type characteristics and coefficient of variation for the Mediclinic sample, 2013 (Source: Mediclinic sample, own calculations)

Comment: Cases for S19 are substantially lower than in the OECD sample for South Africa, because day cases were not considered.

6.1.3 Variance in the German DRG sample

The German DRG system covers the whole spectrum of inpatient treatment and is unique in publishing a great variety of DRG-specific data. We used this data to form the G-DRG sample for the 28 case types defined. In the German DRG system, case weights for DRGs in year *t* are calculated on the basis of case-specific cost-data in year *t-2* from approximately 200 hospitals. The results of these cost-calculations are published in a so-called "DRG Browser" that contains number of cases, primary diagnoses, procedures, average length of stay and cost components for each DRG (InEK, 2014). For the DRG system 2015, a total of 252 hospitals delivered cost-calculation data for 2013 comprising over 4.4m cases (21% of all cases). These cases were "priced" at 2013 DRG catalogue prices with a total number of 1,142 DRGs.

Since the cost calculation data is available on category level only, we could not filter case-specifically. We therefore had to select "typical" cases through codes and rules identified for each case type, an approach proposed by OECD/Eurostat (OECD/Eurostat, 2013). Since there is no primary procedure code defined, the number of "cases" for the surgical case types is derived from the number of procedures documented in each DRG and thus may be overestimated.[31]

Taking the case type definitions for Germany,[32] we first identified all DRGs with the number of primary diagnoses or procedures included. We then singled out DRGs that did not match the case type definition (e.g. primary diagnoses for medical case types that are grouped in a DRG from the surgical partition or in a DRG that requires by definition an OR procedure). Appendix 1 depicts a list of all excluded DRGs for each of the twenty-eight case types. In this comparison – by taking DRG catalogue prices – we assume that all cases considered falling within the same DRG are inliers, calculated with +/- 2 standard deviations in ALOS (InEK, 2013) and are remunerated at a uniform price. Therefore, this can be considered a conservative approach.[33]

[31] A problem that was also addressed by the authors of OECD Health Working Paper 75 (Koechlin et al., 2014).

[32] For surgical case types there are specifications for German procedure codes listed in OECD Health Statistics 2015. Definitions, Sources and Methods.

[33] In reality, prices may vary due to LOS, application of blood transfusions, or high priced medical equipment and drugs that are reimbursed in addition to DRG case weight. The approach may be considered conservative, because calculating standard deviations from means will lead to smaller standard deviations than from individual cases.

Case type category	Code	Case type	Cases (2013)	Average price (2013, in Euro)	Std_dev	Coefficient of variation	Price difference in OECD HWP 85	CMI
Medical case type	M01	Acute myocardial infarction	9,330	5,865	7,211	123%	40.4%	1.957
	M02	Angina pectoris	18,290	1,571	1,444	92%	23.2%	0.659
	M03	Cholelitiasis	3,499	2,032	1,790	88%	-38.5%	0.656
	M04	Heart failure	50,875	3,054	1,465	48%	-14.0%	0.998
	M05	Malignant neoplasm	18,858	2,061	962	47%	-8.8%	0.745
	M06	Normal delivery	16,705	1,597	99	6%	1.8%	0.550
	M07	Pneumonia	43,838	2,792	2,452	88%	-58.2%	0.931
Surgical case type	S01	Appendectomy	19,195	2,903	1,154	40%	-40.1%	0.981
	S02	Caesarian section	8,109	2,569	154	6%	-18.0%	0.849
	S03	Cholecystectomy	21,503	3,407	3,031	89%	16.5%	1.136
	S04	Colorectal resection	7,469	8,001	4,485	56%	16.7%	2.808
	S05	Coronary artery bypass graft	14,922	13,576	1,858	14%	38.0%	4.552
	S06	Discectomy	17,829	5,520	3,962	72%	52.6%	2.251
	S07	Endarterectomy	8,203	4,855	1,856	38%	18.6%	1.636
	S08	Hip replacement: total and partial	28,634	7,233	1,081	15%	32.9%	2.423
	S09	Hysterectomy	6,181	3,598	864	24%	-21.2%	1.238
	S10	Knee replacement	21,000	7,368	1,124	15%	31.0%	2.474
	S11	Mastectomy	19,359	4,038	1,177	29%	-22.6%	1.354
	S12	Open prostatectomy	6,160	6,642	975	15%	16.8%	2.416
	S13	PTCA	71,598	4,513	3,531	78%	39.3%	1.525
	S14	Peripheral vascular bypass	2,456	8,578	2,291	27%	-0.2%	2.990
	S15	Inguinal hernia repair	13,070	2,460	564	23%	6.3%	0.821
	S16	Thyroidectomy	11,533	3,827	415	11%	-10.3%	1.137
	S17	Transurethral resection of prostate	10,157	3,147	457	15%	5.6%	1.067
	S18	Arthroscopic excision of meniscus of knee	8,719	2,288	614	27%	22.2%	0.767
	S19	Lens and cataract procedures	10,838	1,993	612	31%	5.7%	0.665
	S20	Ligation and stripping of varicose veins	2,760	2,411	268	11%	15.9%	0.786
	S21	Tonsillectomy and/or adenoidectomy	15,869	2,369	1,414	60%	-46.1%	0.795

Table 5: Case type characteristics and coefficient of variation for the G-DRG sample, 2013 (Source: OECD Health WP 85; G-DRG Report-Browser V2013/2015; own calculations)

Comment: Number of cases for surgical case types may be overestimated, since no primary procedures are coded.

Just as in the Mediclinic Sample (Table 4), the seven medical case types show in all but one (M06 Normal delivery) case type variation coefficients that lie far beyond the critical level of 33%. Even high volume case types such as M04 Heart failure (coefficient of variation 48%) and M07 Pneumonia (coefficient of variation 88%) are far from homogeneous in price. For surgical case types the picture is less pronounced, but still a third of the case types depict coefficients of variations beyond the critical level, with very pronounced levels of > 50% in five of seven critical surgical case types.

It is interesting to note that high coefficients of variation in most case types coincided with big differences in price levels reported in the OECD Health Working Paper No. 85 (Table 3). Diagram 1 shows how absolute price differences correlate with coefficients of variation for medical (red dots) and surgical (blue dots) case types. The correlation coefficient R^2 = 0,53528 shows a significant correlation[34] between these two variables, indicating that within case type variability may be connected with reporting of price level differences.

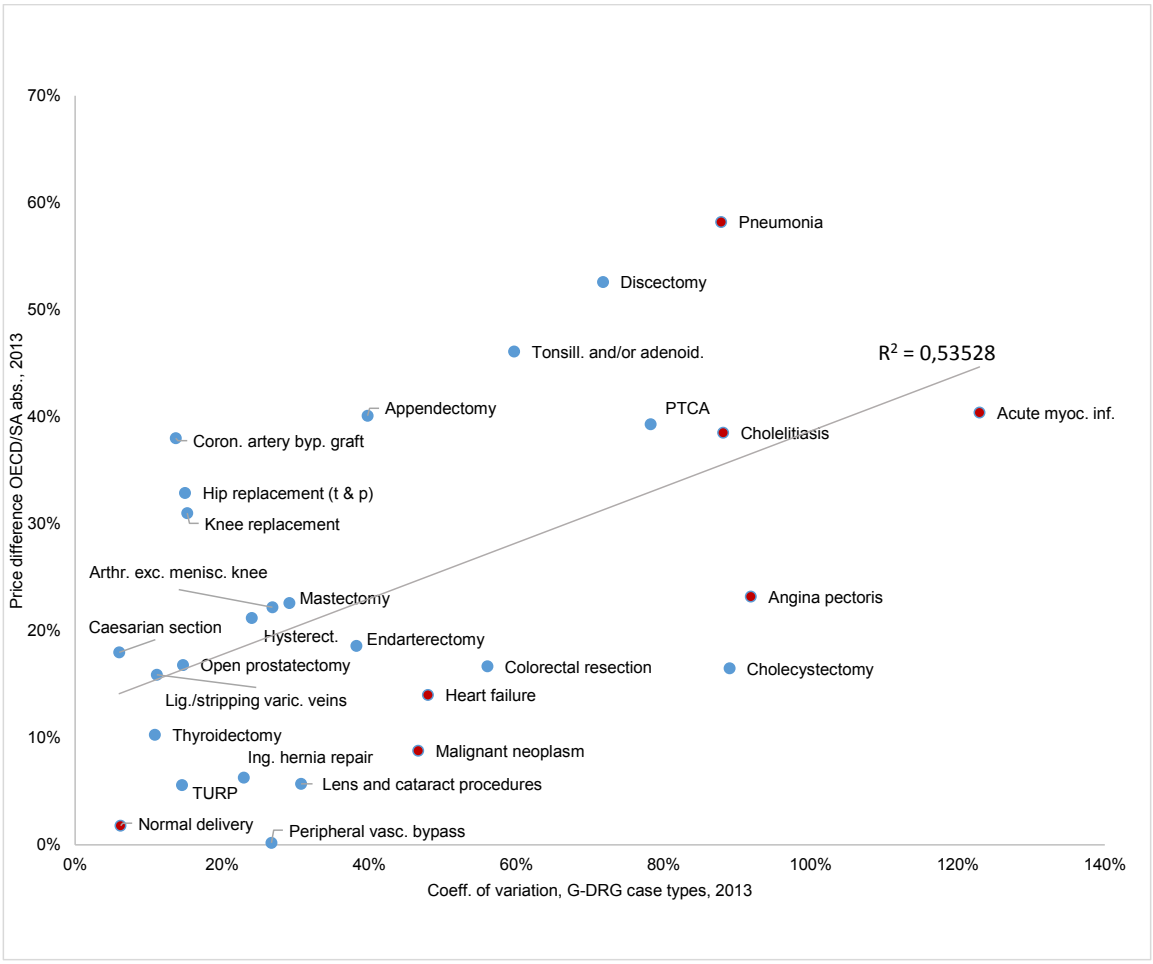

Figure 4: Absolute price differences (South African sample) and coefficient of variation G-DRG sample, 2013 (Source: OECD Health Working Paper 85; DRG Report-Browser V2013/2015; own calculations)

[34] Significant at a level of p ≤ 1%.

Within the German sample, the variation coefficient of prices exceeds the critical level of 33% in a third of the 21 surgical case types; only one of the seven medical case types features a variation coefficient below that threshold. Five out of seven critical surgical case types show a very pronounced coefficient of variation of > 50%. There is a highly significant correlation between absolute price differences detected in *OECD HWP 85* and coefficients of variation in the G-DRG sample.

6.2 Representativeness of case types and complexity of cases

To draw valid conclusions for price levels of inpatient hospital services, the cases studied should also be representative for hospital services as a whole. Looking at the share of cases considered in the 28 inpatient case types in all the inpatient cases, the representativeness for hospital services in total is covered. In terms of representativeness for hospital services in total the original OECD study on PPP for hospital services reported 18.2% of total cases covered by the sample for all countries and 12.4% of total cases for Germany in 2011 (Koechlin et al., 2014). An important question in this respect is, if the shares of case types in the sample are comparable.

There are very marked differences in the sample structure between the OECD sample for South Africa and the OECD sample for the comparator countries: while in the sample for South Africa, only three case types – M06 Normal delivery, M07 Pneumonia and S02 Caesarean section – account for 57.5% of all sample cases, these make up only 32.5% of all cases in the OECD sample. Excluding these three major groups, there still remain substantial differences in the share of case types between the two samples (Table 7). Especially highly underrepresented case types, e.g. S06 Discectomy and S13 PTCA did show big differences in price levels as reported in *OECD HWP 85* (Lorenzoni & Roubal, 2015), + 52.6 % and + 39.3% respectively. A chi square test shows no significant association between observed and expected frequencies in the OECD sample for South Africa (Appendix 2).

To check for differences in complexity of case types we compared case mix indices (CMIs) calculated from the Mediclinic sample to CMIs in the G-DRG sample (Table 8). Almost all the outliers in price level differences reported in *OECD HWP 85* also show marked differences in CMI, e.g. S06 Discectomy: reported difference in price level + 52.6%, CMI Mediclinic sample (3.489) vs. CMI G-DRG sample (2.251). For one apparent exception from this trend – M01 Acute myocardial infarction – there are strong indications for a higher CMI in the OECD sample for South Africa due to restrictive selection criteria.

In addition to the concerns expressed due variance within case types, the pronounced differences in frequencies of case types between the OECD sample for South Africa and the OECD sample for 2011 in *OECD HWP 75* (Koechlin et al., 2014) plus the strong indications for differences in complexity of case types make valid price comparisons for private hospitals in South Africa on the basis of PPP highly questionable.

Substantial differences in the sample structures regarding shares and complexity of case types between the OECD comparator countries and the South African sample raise further questions about their comparability. Even after excluding the effect of the pronounced preference for Caesarean section in private hospitals in South Africa, there is no significant association between the OECD Sample for South Africa and the sample of OECD comparator countries. The surgical case types discectomy and PTCA illustrate these differences well: With shares in the sample for South Africa that are less than a tenth of the share in the comparator sample they are at the same time identified as the most prominent outliers in hospital prices in *OECD HWP 85*.

To check for potential shortcomings in case composition/case selection - again the OECD Health Working Paper No. 85 does not disclose a case type specific comparison of number of cases in the South African sample with the sample of the comparator countries - we look at the 2011 figures reported in the *OECD Health Working Paper No. 75* (Koechlin et al., 2014) and compare them to the sample composition for 2013 – the year that price comparisons are based on - depicted in *OECD HWP 85*. The shares of normal delivery (Case type M06) and Caesarean section (Case type S02) in South Africa differ substantially from the shares in other countries, with lower shares for normal delivery and very much higher shares for Caesarean section. Both case types (M06 and S02) together comprise almost a third of all cases in the sample for South Africa compared to 22.2% in the OECD sample and thus are highly overrepresented (Table 6).

The same holds true for case type M07 Pneumonia that accounts for 26.4% of all cases compared to 10.3% in the OECD sample. A Chi-square test to see, in how far observed and expected frequencies[35] matched in the OECD sample for South Africa showed no significant association (Appendix 2), even though we pooled case types M06 Normal delivery and S02 Caesarean section to exclude the effect of the pronounced preference for Caesarean section in South Africa.

[35] Expected frequencies are calculated by multiplying the number of cases in the OECD sample for South Africa with the share of the respective case type in the OECD sample for the comparator countries.

Code	Case type	OECD sample South Africa		OECD sample HWP 75	
		inp. cases	share	inp. cases	share
M01	Acute myocardial infarction	1,668	0.9%	279,057	2.3%
M02	Angina pectoris	9,581	4.9%	380,012	3.2%
M03	Cholelitiasis	725	0.4%	229,213	1.9%
M04	Heart failure	8,344	4.3%	1,144,204	9.5%
M05	Malignant neoplasm	837	0.4%	328,866	2.7%
M06	Normal delivery	15,231	7.8%	1,547,793	12.8%
M07	Pneumonia	51,783	26.4%	1,237,583	10.3%
S01	Appendectomy	6,129	3.1%	435,927	3.6%
S02	Caesarian section	45,571	23.3%	1,136,693	9.4%
S03	Cholecystectomy	6,674	3.4%	666,212	5.5%
S04	Colorectal resection	340	0.2%	129,744	1.1%
S05	Coronary artery bypass graft	490	0.3%	73,882	0.6%
S06	Discectomy	206	0.1%	148,370	1.2%
S07	Endarterectomy	145	0.1%	65,622	0.5%
S08	Hip replacement: total and partial	3,396	1.7%	509,887	4.2%
S09	Hysterectomy	7,353	3.8%	401,754	3.3%
S10	Knee replacement	4,455	2.3%	387,872	3.2%
S11	Mastectomy	961	0.5%	95,708	0.8%
S12	Open prostatectomy	307	0.2%	123,165	1.0%
S13	PTCA	418	0.2%	462,983	3.8%
S14	Peripheral vascular bypass	170	0.1%	40,260	0.3%
S15	Inguinal hernia repair	3,531	1.8%	572,317	4.7%
S16	Thyroidectomy	1,241	0.6%	242,788	2.0%
S17	Transurethral resection of prostate	875	0.4%	229,398	1.9%
S18	Arthroscopic excision of meniscus of knee	1,002	0.5%	97,882	0.8%
S19	Lens and cataract procedures	13,058	6.7%	503,472	4.2%
S20	Ligation and stripping of varicose veins	1,080	0.6%	210,698	1.7%
S21	Tonsillectomy and/or adenoidectomy	10,362	5.3%	370,396	3.1%
Total cases		195,933	100.0%	12,051,758	100.0%

Table 6: Composition of South African sample (2013) compared to OECD sample (2011) (Source: OECD Health Working Paper 85; OECD Health Working Paper 75)

In order to detect differences in the other case types more clearly (Table 7), all three highly overrepresented and high volume case types – M06, M07 and S02 - are excluded in the following calculation of case compositions. Differences in case composition may indicate (1) differences in care delivery (due to differences in epidemiology and/or treatment standards) or (2) differences in selection criteria (due to coding practice or criteria formulation/application). Among medical case types almost all are disproportionate to the OECD sample: while a disproportionately high share of M02 Angina pectoris cases is included, all the other medical case types are highly underrepresented: in absolute terms the number of expected cases, especially for high volume case types like M01 Acute myocardial infarction and M04 Heart failure, would be substantially higher. For case type M01 Acute myocardial infarction the Mediclinic sample (applying the selection criteria for M01 for South Africa of Annex 2, *OECD HWP 85*, the general selection criteria of Annex 3, *OECD Health WP 75,* and the Quaranta editing procedure) showed a higher absolute number of cases (Table 4) than the OECD sample for South Africa. This may indicate differences in case selection and may be connected to differences in severity of cases selected (this will be discussed in further detail below).

Code	Case type	OECD sample South Africa		OECD sample HWP 75	
		inp. cases	share	inp. cases	share
M01	Acute myocardial infarction	1,668	2.0%	279,057	3.4%
M02	Angina pectoris	9,581	11.5%	380,012	4.7%
M03	Cholelitiasis	725	0.9%	229,213	2.8%
M04	Heart failure	8,344	10.0%	1,144,204	14.1%
M05	Malignant neoplasm	837	1.0%	328,866	4.0%
M06	*Normal delivery*	*15,231*		*1,547,793*	
M07	*Pneumonia*	*51,783*		*1,237,583*	
S01	Appendectomy	6,129	7.4%	435,927	5.4%
S02	*Caesarian section*	*45,571*		*1,136,693*	
S03	Cholecystectomy	6,674	8.0%	666,212	8.2%
S04	Colorectal resection	340	0.4%	129,744	1.6%
S05	Coronary artery bypass graft	490	0.6%	73,882	0.9%
S06	Discectomy	206	0.2%	148,370	1.8%
S07	Endarterectomy	145	0.2%	65,622	0.8%
S08	Hip replacement: total and partial	3,396	4.1%	509,887	6.3%
S09	Hysterectomy	7,353	8.8%	401,754	4.9%
S10	Knee replacement	4,455	5.3%	387,872	4.8%
S11	Mastectomy	961	1.2%	95,708	1.2%
S12	Open prostatectomy	307	0.4%	123,165	1.5%
S13	PTCA	418	0.5%	462,983	5.7%
S14	Peripheral vascular bypass	170	0.2%	40,260	0.5%
S15	Inguinal hernia repair	3,531	4.2%	572,317	7.0%
S16	Thyroidectomy	1,241	1.5%	242,788	3.0%
S17	Transurethral resection of prostate	875	1.0%	229,398	2.8%
S18	Arthroscopic excision of meniscus of knee	1,002	1.2%	97,882	1.2%
S19	Lens and cataract procedures	13,058	15.7%	503,472	6.2%
S20	Ligation and stripping of varicose veins	1,080	1.3%	210,698	2.6%
S21	Tonsillectomy and/or adenoidectomy	10,362	12.4%	370,396	4.6%
Total cases (excluding M06, M07 and S02)		83,348	100.0%	8,129,689	100.0%

Table 7: Composition of South African sample (2013) compared to OECD sample (2011), excluding M06, M07 and S02 (Source: OECD Health Working Paper 85; OECD Health Working Paper 75)

For the surgical case types there is also a very distinct difference in case type composition between the South African sample and the OECD sample. While S03 Cholecystectomy (8.0% vs. 8.2%) is at par with the OECD sample, there are two case types overrepresented in the South African sample – S19 Lens and cataract procedures (15.7% vs. 6.2%) and S21 Tonsillectomy and/or adenoidectomy (12.4% vs. 4.6%)[36] -, and most of the other surgical case types are highly underrepresented. Most pronounced differences show S13 PTCA (0.5% vs. 5.7%) and S06 Discectomy (0.2% vs. 1.8%), again the case types from the group of surgical case types that report the highest price differences (+39.3% for S13 and + 52.6% for S06) in *OECD HWP 85* (Lorenzoni & Roubal, 2015).

[36] The exclusion of day surgery cases seems to have been handled differently from the specifications of OECD Health WP 75. The Mediclinic sample suggests that some of the day cases were counted as ambulatory/day surgery and others as inpatient. This is also supported by the fact that ALOS for S19 in the South African sample are 1.0 in all three years reported.

Large differences in the share of cases within the samples compared may point to differences in the complexity of cases included in the sample, which constitutes another potential limitation to comparability. As the authors of *OECD HWP 75* pointed out, higher complexity of cases "could result in higher average resource use and costs" (Koechlin et al., 2014).[37] For the Mediclinic sample a relative internal caseweight was reported for each case and the G-DRG sample comprises caseweights for all DRGs considered. To make these two variables roughly comparable, we "rebased" the internal Mediclinic CMI to the level of the CMI of the G-DRG sample – 1.417 (Table 8).

Case type category	Code	Case type	Cases G-DRG (2013)	CMI G-DRG (2013)	Cases Mediclinic sample (2013)	CMI Mediclinic sample*	Price difference in OECD HWP 85
Medical case type	M01	Acute myocardial infarction	9,330	1.957	2,515	1.900	40.4%
	M02	Angina pectoris	18,290	0.659	5,396	0.971	23.2%
	M03	Cholelitiasis	3,499	0.656	279	0.865	-38.5%
	M04	Heart failure	50,875	0.998	3,598	1.382	-14.0%
	M05	Malignant neoplasm	18,858	0.745	688	3.916	-8.8%
	M06	Normal delivery	16,705	0.550	6,984	0.706	1.8%
	M07	Pneumonia	43,838	0.931	20,964	0.844	-58.2%
Surgical case type	S01	Appendectomy	19,195	0.981	3,168	1.245	-40.1%
	S02	Caesarian section	8,109	0.849	21,720	1.207	-18.0%
	S03	Cholecystectomy	21,503	1.136	3,528	2.270	16.5%
	S04	Colorectal resection	7,469	2.808	207	4.611	16.7%
	S05	Coronary artery bypass graft	14,922	4.552	126	8.708	38.0%
	S06	Discectomy	17,829	2.251	33	3.489	52.6%
	S07	Endarterectomy	8,203	1.636	36	3.024	18.6%
	S08	Hip replacement: total and partial	28,634	2.423	2,404	5.168	32.9%
	S09	Hysterectomy	6,181	1.238	3,903	1.206	-21.2%
	S10	Knee replacement	21,000	2.474	2,573	4.744	31.0%
	S11	Mastectomy	19,359	1.354	475	1.457	-22.6%
	S12	Open prostatectomy	6,160	2.416	142	3.001	16.8%
	S13	PTCA	71,598	1.525	25	5.433	39.3%
	S14	Peripheral vascular bypass	2,456	2.990	84	3.800	-0.2%
	S15	Inguinal hernia repair	13,070	0.821	1,620	2.373	6.3%
	S16	Thyroidectomy	11,533	1.137	762	1.426	-10.3%
	S17	Transurethral resection of prostate	10,157	1.067	316	1.156	5.6%
	S18	Arthroscopic excision of meniscus of knee	8,719	0.767	387	0.857	22.2%
	S19	Lens and cataract procedures	10,838	0.665	68	1.095	5.7%
	S20	Ligation and stripping of varicose veins	2,760	0.786	442	0.944	15.9%
	S21	Tonsillectomy and/or adenoidectomy	15,869	0.795	1,334	0.512	-46.1%
	Sum of sample cases, CMI		486,959	1.417	83,777	1.417	

* CMI for the Mediclinic sample was "rebased" to the overall CMI for the G-DRG sample

Table 8: Complexity of cases in the G-DRG sample as compared to the Mediclinic sample, 2013 (Source: OECD Health Working Paper 85; DRG Report-Browser V2013/2015; Mediclinic sample; own calculations)

If we look at the outliers among the case types concerning price difference reported in OECD HWP 85 – highlighted in blue in table 7 -, all the surgical case types with considerably higher price levels also depict considerably higher CMIs. Both S06 Discectomy (3.489) and S13 PTCA (5.433) show CMIs for the Mediclinic sample that are > 50 % higher than the

[37] While *Koechlin et al.* explicitly point out this potential limitation, Lorenzoni & Roubal merely state, that "severity" is not a selection criterion.

respective CMIs in the G-DRG sample. The same holds true for the most prominent outlier on the other end of the range – S21 Tonsillectomy and/or adenoidectomy – with a reported price level difference of -46.1 %. Here the CMI in the Mediclinic sample (0.844) is 35.5 % below the CMI in the G-DRG sample (0.931).

For the medical case types in the case of M07 Pneumonia (reported price difference of -58.2 %) the same relation can be observed, with a CMI in the Mediclinic sample (0.844) that is 9.3 % below the G-DRG sample CMI (0.931). One apparently remarkable exception from this trend can be observed for case type M01 Acute myocardial infarction: here a lower CMI (-2.9 %) seems to go along with a higher price level (+40.4 %). Two reasons speak against this exception: (1) As shown before (Table 7), the inclusion of cases in the OECD sample for South Africa was very restrictive, leading to a strong underrepresentation of M01 cases as compared to the OECD sample and the application of selection criteria on the Mediclinic sample. This restrictive selection may be connected with the inclusion of more severe cases and accordingly a higher CMI. (2) If we take the average price for "hospital" services for M01 from the Mediclinic sample (24,483 Rand, Table 4) and take the share of "hospital" in all price components from OECD HWP 75 of approx. 45 % (Lorenzoni & Roubal, 2015) we do get a substantially lower price for M01.[38] This also points to higher complexity of cases for M01 in the OECD sample for South Africa.

Hence, there is sufficient reason to suspect, that differences in the complexity of cases play a decisive role in determining differences in price levels. As far as conclusions about effect sizes are concerned, results have to be interpreted with due caution, since they lean on comparable but not identical data.

> Higher complexity of cases can account for higher prices due to higher costs/utilisation of resources. Comparing the complexity of cases in the Mediclinic sample with the G-DRG sample show pronounced differences in case mix indices (CMI) for those case types with pronounced price differences in *OECD HWP 85*. Coronary artery bypass grafting (CABG) may serve as an illustrative example for differences in medical culture reflected in differences in case frequency and CMI. A stricter indication of CABG would yield less, but more severe cases.

6.3 Conclusion

Taking a closer look at comparability and representativeness of products, e.g. case types, as two central aspects for evaluating the validity of the PPP approach employed in the OECD Health Working Paper No. 85 for the comparison of price levels in private hospitals in South Africa with those in public and private hospitals in selected OECD countries, we were able to detect several very critical aspects. Comparability of case types appears to be limited by very high rates of dispersion as measured in coefficients of variation: the vast majority of case types – both in the Mediclinic sample and the German DRG sample – showed coefficients of

[38] Approximating the overall price of M01 cases in the Mediclinic sample by applying shares of the "hospital" price component between 45 % and 52 % [for less complex cases of the same case type with similar LOS a higher share of "hospital" may be expected], we get prices in the OECD sample for South Africa, that are between 18 % and 37 % above the approximated prices in the Mediclinic sample.

variation way beyond the critical value of 33%. Representativeness is also highly questionable due to the large difference in representation of case types and the complexity of cases selected – to what extent this is due to structural differences of the hospital sectors under investigation or to flaws in the adaptation of selection procedures cannot be said at this point.

Price level comparisons on the basis of the case type specific PPPs, as presented in the OECD Health Working Paper No. 85, appear to be highly speculative without a presentation and most probably thorough revision of central aspects defining the validity of the instrument of hospital specific PPPs.

7 Remark on the legitimacy of conclusions

The conclusions of *OECD HWP 85* are presented in the document's last section entitled 'Discussion'. The discussion brings in a range of claims that touch on topics that were presented in more detail in previous OECD Working Papers, such as implications of the type of hospital ownership in OECD countries. The findings from the analysis underlying the Working Paper are twofold: Firstly, the statistical analysis appears to lack a layer of testing the validity of the concept, as the presentation is eclectic and lacks important statistical information, including coefficients of variation. Secondly, the presentation lacks qualitative depth, such that a proper understanding of hospital pricing in South Africa cannot be conveyed.

Most of the aspects covered in the nine concluding paragraphs are discussed in the above chapters. The last paragraph of the *HWP* stands out. It contains strong claims that cannot legitimately be deduced from the material presented in the Working Paper.

The first claim is the "spill over" argument: Private sector prices make it difficult for the public sector to retain specialists. This argument ignores the fact that competition for specialists is not limited to the spheres of the public and private healthcare service sectors in South Africa. The competitive market for medical specialists is not even limited to the public and private sectors of healthcare provision but it comprises other industries, including the pharmaceutical industry, and—in a globalised world—international markets for healthcare services and health products. There are many well-known factors beyond income that pose problems for the retention of specialists in the South African public sector that require urgent attention.

The second claim is that the study suggests price controls "while ensuring accessibility and quality".[39] Conceding that "price control" may not even be meant literally (which would still be negligent given the exposed role of the *HWP* in South African health policy matters), the findings do not suggest much apart from providing further illustration of the health system dichotomy. The careless presentation of non-sequiturs could be counterproductive and once more obstruct the path towards a rational engagement with information that might be able to guide future reform and effective regulation of South Africa's health system.

[39] Capacity constraints regarding the effective introduction of price controls have become obvious in the past, as illustrated in Chapter 2 of this report.

8 Outlook

The health system constitutes an area of the South African economy that reflects the country's inequality of living standards. There appears to be an underlying assumption to the WHO-OECD's argument that the private sector may be causal. Yet the structure of the health sector is merely a reflection of the socio-economic reality of the country as a whole. Reducing the socio-economic divide requires comprehensive reforms built around good governance principles across all sectors of the economy. In the health sector, reform can only mean that a reasonable vision for a health system be developed that overcomes the current dichotomy. Any rational approach will highlight the need for risk pooling and risk equalisation in order to encourage income- and risk-related cross-subsidies.

Most likely, the solution does not lie in downgrading the provision of quality health services by imposing rigid instruments such as price controls. Rather, mechanisms should be developed that encourage collaboration between the current private and public health sectors. It is a rather naïve idea to have population groups' income levels determine hospital prices. The question is less about linking hospital prices to patient income; it is about linking hospital prices to acceptable quality. In parallel, the question is who pays and how can financing be arranged in order to ensure that every single person in need has access to quality care. Naturally, these discussions go far beyond the scope of *OECD HWP 85*.

In the short term, prices will certainly remain an important topic, and policy-makers will continue to home in on private sector providers as long as there is no perception that the determination of prices is transparent to the relevant stakeholders. Within the private sector, both providers and funders understand that the regulatory environment needs to change and that the first and foremost target variable is going to be the price.

It will be important to ensure that the Competition Commission is equipped with balanced information based on rigorous analysis. It will further be important to demonstrate the value that private healthcare providers add: their contribution to the economy, their impact as a location factor in South Africa, their capacity to effectively work towards the reduction of inequalities, and their potential to share valuable knowledge in the management and provision of quality healthcare.

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Appendix 1: Case types for the German DRG sample 2013

Note: The DRG descriptions in this Appendix are simplified translations of G-DRG descriptions of the 2013 G-DRG catalogue and do not claim completeness.

S01 Appendectomy (surgical)

The following OPS procedures were used to identify S01 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S01	47.0, 47.1	Appendectomy	5-470; 5-471; 5-479.1
S01	47.01, 47.11	Laparoscopic appendectomy	5-470.1; 5-471.1

And admissions must have a primary diagnosis of diseases of appendix (K35-K38). Revision of DRG data reduced the number of cases considered from 22,265 to 19,195 cases. The following DRGs were excluded:

Code	DRG	Description	Cases
S01	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	10
S01	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	39
S01	A01B	Liver transplantation with rejection of transplanted organ	8
S01	A02Z	Kidney and pancreas transplantation	21
S01	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	7
S01	A11E	Artificial respiration > 249 h with complex OR procedure, without complex intensive care treatment	9
S01	A13B	Artificial respiration > 95 h with very complex OR procedure	11
S01	A13D	Artificial respiration > 95 h with complex OR procedure	17
S01	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	37
S01	A17B	Kidney transplantation	5
S01	A36B	Complex intensive care treatment with rejection of transplanted organ	6
S01	G01Z	Evisceration of the smaller pelvis	7
S01	G02A	Intestinal surgery, cases of malformation, age < 2	111
S01	G02B	Intestinal surgery, cases of malformation, age > 1	157
S01	G03A	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum with highly complex procedure	5
S01	G03B	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, with complex intevention	4
S01	G03C	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, without complex intevention	12
S01	G04A	Adhaesiolysis on the peritoneum, age < 4 years or extremely severe complications	7
S01	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	175
S01	G08A	Complex reconstruction of the abdominal wall, age > 0 years with catastrophic CC	6
S01	G10Z	Certain interventions of hepatobiliary system,	32
S01	G14Z	Geriatric rehabilitative complex treatment with certain OR procedure, diseases of digestive system	33
S01	G16A	Complex resection of rectum with surgery of liver metastases, with complicating procedures	6
S01	G16B	Complex resection of rectum with surgery of liver metastases, without complicating procedures	91
S01	G17A	Other resection of rectum with malignant neoplasm	257
S01	G17B	Other resection of rectum without malignant neoplasm	66
S01	G18A	Certain interventions on small or large intestines, with highly complex intervention	64
S01	G18B	Certain interventions on small or large intestines, with very complex intervention	202
S01	G18C	Certain interventions on small or large intestines, with complex intervention	219
S01	G19B	Other interventions on stomach, esophagus and duadenum without complicating constellation, with complex intervention	24

Code	DRG	Description	Cases
S01	G21A	Complex divided adhesions of peritoneum, age > 3 and < 16, with very severy CC	78
S01	G21B	Complex divided adhesions of peritoneum, age > 3 and < 16, without very severe	196
S01	G33Z	Multiline complex OR procedure, diseases of digestive organs	7
S01	G35Z	Complex vacuum therapy for diseases of digestive organs	17
S01	G36B	Intensive care treatment for diseases of digestive organs (less complex)	8
S01	G37Z	Multivisceral intervention for diseases of digestive organs	20
S01	G38Z	Complicating constellation for post OR procedure, diseases of digestive organs	11
S01	H01B	Surgery on pancreas and liver with major intervention or radiation therapy, without complex intervention or complex intensive care treatment	18
S01	H07B	Cholezystectomy without highly complex circumstances	6
S01	H08B	Laparoscopic Cholezystectomy without very complex diagnosis	9
S01	H09A	Interventions on pancreas and liver and portosystemic shunt operations, under highly complex circumstances, with certain interventions on liver, pancreas and bile ducts	5
S01	H09B	Interventions on pancreas and liver and portosystemic shunt operations, under highly complex circumstances, with certain interventions on liver, pancreas and bile ducts for malignant neoplasm	5
S01	H12A	Other interventions on hepatobiliary system, under highly complex circumstances or complex intervention	4
S01	I27A	Interventions on soft tissue with certain diagnosis and certain intervention or catastrophic CC	4
S01	L02A	Surgical implantation of a shunt for peritoneal dialysis , age < 10 years	6
S01	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	160
S01	L10Z	Recontruction of the bladder or continent pouch after malignant neoplasm surgery	106
S01	L13A	Kidney-, ureter- or large bladder-interventions, with malignant neoplasm, age > 18	5
S01	L33Z	Multiline complex OR procedures or high-cost implant, diseases of urinary system	9
S01	L37Z	Multivisceral intervention for diseases of urinary system	24
S01	L38Z	Complicating constellation with other operative intervention, diseases of the urinary system	5
S01	M01B	Major surgical intervention on a male patients the pelvic organs without extremely severe complicating conditions	19
S01	M37Z	Major surgical intervention on the intestines or the urinary bladder due to disorders of the male sexual organs	5
S01	N01B	Evisceration of female pelvis and radical vulvectomy with highly severe CC	98
S01	N01C	Evisceration of female pelvis and radical vulvectomy with severe CC	98
S01	N01D	Evisceration of female pelvis and radical vulvectomy without severe CC	80
S01	N02A	Intervention on the uterus and adnexes due to malignant neoplasm on the ovaries and adnexes, with extremely severe CC	36
S01	N02B	Intervention on the uterus and adnexes due to malignant neoplasm on the ovaries and adnexes, with severe CC	30
S01	N02C	Intervention on the uterus and adnexes due to malignant neoplasm on the ovaries and adnexes, without severe CC	89
S01	N04Z	Hysterectomy except for malignant neoplasm, severe CC or complex intervention	5
S01	N05A	Ovariectomies and complex interventions on the tubae uterinae except for malignant neoplasm, with severe CC	7
S01	N05B	Ovariectomies and complex interventions on the tubae uterinae except for malignant neoplasm, without severe CC	45
S01	N07Z	Other interventions on uterus and adnexes except for malignant neoplasm, with complex diagnosis	110
S01	N08Z	Endoscopic interventions on female sexual organs	292
S01	N11B	Other surgical procedures on female sexual organs with severe CC or CC	4

Code	DRG	Description	Cases
S01	N21Z	Hysterectomy except for malignant neoplasm without extermely severe CC or complex intervention	30
S01	N23Z	Other reconstructive interventions on female sexual organs	10
S01	N33Z	Multiple complex surgical procedures for diseases or disorders of female sexual organs	13
S01	N34Z	Major interventions on intestines or urinary bladder for diseases or disorders of female sexual organs	57
S01	N38Z	Complicating constellation with other operative intervention, diseases or disorders of female sexual organs	22
S01	O05B	Other surgical procedures during pregnancy, without complex OR procedure	30
S01	R02Z	Major OR-prozedues with extremely severe CC, with complex OR-prozedure for hematological or solid neoplasms	4
S01	R12B	Other hematological and solid neoplasms with major OR-procedures without extremely severe CC, with complex OR-procedure	11
S01	P06A	Newborn, weight at admission > 2499 g with significant OR-procedure or artificial respiration > 95 hours with multiple severe problems, with artificial respiration > 120 hours	4
S01	P06B	Newborn, weight at admission > 2499 g with significant OR-procedure or artificial respiration > 95 hours with multiple severe problems, without artificial respiration > 120 hours	6
S01	T01A	OR-Procedure for infectious and parasitic diseases with complex procedure or complicating procedures or after organ transplantation	13
S01	T01B	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures excepting after organ transplantation	24

S02 Caesarian section (surgical)

The following OPS procedures were used to identify S02 admissions:

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S02	74.0	Classical cesarean section	5-740.0
S02	74.1	Low cervical cesarean section	5-741.0
S02	74.2	Extraperitoneal cesarean section	5-749.10
S02	74.4	Cesarean section of other specified type	
S02	74.99	Other cesarean section of unspecified type	

Revision of DRG data reduced the number of cases considered from 8,430 to 8,109 cases. The following DRGs were excluded:

Code	DRG	Description	Cases
S02	O01A	Sectio caesarea with multiple complicating diagnoses, up to 25th week of	30
S02	O01B	Sectio caesarea with multiple complicating diagnoses, 25th to 33rd week of pregnancy or with complicating diagnosis up to 25th week of pregnancy	47
S02	O01C	Sectio caesarea with several complicating diagnoses, 26th to 33rd week of pregnancy or without complicating factors	244

S03 Cholecystectomy (surgical)

The following OPS procedures were used to identify S03 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S03	51.22; 51.23	Cholecystectomy	5-511
S03	51.23	Laparoscopic cholecystectomy	5-511.1; 5-511

Revision of DRG data reduced the number of cases considered from 27,761 to 21,503 cases. The following DRGs were excluded:

Code	DRG	Description	Cases
S03	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	17
S03	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	147
S03	A06A	Artificial respiration > 1799 h with complex intensive care treatment	5
S03	A07A	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with highly complex OR procedure	9
S03	A07B	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure or multiple trauma	6
S03	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	17
S03	A09A	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and highly complex OR procedure , age < 16 years	12
S03	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	72
S03	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	29
S03	A09D	Artificial respiration > 499 h without complex OR procedure , without multiple trauma, age > 15 years	9
S03	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	36
S03	A11C	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with complicating OR procedure and age < 16 years	9
S03	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	23
S03	A13B	Artificial respiration > 95 h with very complex OR procedure	43
S03	A13C	Artificial respiration > 95 h without complex OR procedure, with certain OR procedure and complicating constellation	20
S03	A13D	Artificial respiration > 95 h with complex OR procedure	26
S03	A13F	Artificial respiration > 95 h without certain OR procedure, age > 15 years	4
S03	F08B	Reconstructive vascular procedures, without complicating constellation, with catastrophic CC, with complex multiple-level surgery	4
S03	G02A	Intestinal surgery, cases of malformation, age < 2	54
S03	G02B	Intestinal surgery, cases of malformation, age > 1	164
S03	G03A	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum with highly complex procedure	182
S03	G03B	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, with complex intevention	34
S03	G03C	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, without complex intevention	502
S03	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	98
S03	G08B	Complex reconstruction of the abdominal wall, age > 0 years without catastrophic	8
S03	G10Z	Certain interventions of hepatobiliary system,	96
S03	G12A	Other OR procedures on digestive organs with complex OR procedure	5
S03	G12B	Other OR procedures on digestive organs with moderately complex OR procedure, LOS > 1 day	8
S03	G16A	Complex resection of rectum with surgery of liver metastases, with complicating procedures	23
S03	G16B	Complex resection of rectum with surgery of liver metastases, without complicating procedures	65
S03	G17A	Other resection of rectum with malignant neoplasm	62
S03	G17B	Other resection of rectum without malignant neoplasm	12
S03	G18A	Certain interventions on small or large intestines, with highly complex intervention	61
S03	G18B	Certain interventions on small or large intestines, with very complex intervention	209
S03	G18C	Certain interventions on small or large intestines, with complex intervention	36

Code	DRG	Description	Cases
S03	G19A	Other interventions on stomach, esophagus and duadenum with complicating constellation	26
S03	G19B	Other interventions on stomach, esophagus and duadenum without complicating constellation, with complex intervention	73
S03	G19C	Other interventions on stomach, esophagus and duadenum without complicating constellation, without complex intervention	34
S03	G21B	Complex divided adhesions of peritoneum, age > 3 and < 16, without very severe CC	25
S03	G22B	Appendectomy or laparoscopic adhaesiolysis in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 9 years	4
S03	G22C	Appendectomy or laparoscopic adhaesiolysis in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 15 years	5
S03	G33Z	Multiline complex OR procedure, diseases of digestive organs	40
S03	G36A	Intensive care treatment for diseases of digestive organs (highly complex)	14
S03	G36B	Intensive care treatment for diseases of digestive organs (less complex)	22
S03	G37Z	Multivisceral intervention for diseases of digestive organs	75
S03	G38Z	Complicating constellation for post OR procedure, diseases of digestive organs	49
S03	H01A	Surgery on pancreas and liver with major intervention or radiation therapy, with complex intervention or complex intensive care treatment	344
S03	H01B	Surgery on pancreas and liver with major intervention or radiation therapy, without complex intervention or complex intensive care treatment	1,039
S03	H02A	Major biliary tract procedures with malignant neoplasm	97
S03	H02B	Major biliary tract procedures without malignant neoplasm	172
S03	H05Z	Laporotomy and moderately complex procedures on biliary tract	392
S03	H06A	Other hepatobiliary and pancreas OR procedures with certain procedure and complex diagnosis	87
S03	H09A	Interventions on pancreas and liver and portosystemic shunt operations, under highly complex circumstances, with certain interventions on liver, pancreas and bile ducts	262
S03	H09B	Interventions on pancreas and liver and portosystemic shunt operations, under highly complex circumstances, with certain interventions on liver, pancreas and bile ducts for malignant neoplasm	284
S03	H09C	Interventions on pancreas and liver and portosystemic shunt operations, without highly complex circumstances, without certain interventions on liver, pancreas and bile ducts (exception: malignant neoplasm)	126
S03	H12A	Other interventions on hepatobiliary system, under highly complex circumstances or complex intervention	98
S03	H38Z	Complicating constellation with certain OR procedure, diseases and disorders of hepatobiliary system and pancreas	27
S03	H41A	ERCP procedures with catastrophic CC	93
S03	K04A	Major surgical procedures with adipositas and complex procedure	30
S03	K14Z	Adrenal gland OR procedures, except malignant neoplasm and extensive lymphadenectomy	4
S03	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	10
S03	N01B	Evisceration of female pelvis and radical vulvectomy with highly severe CC	22
S03	N01C	Evisceration of female pelvis and radical vulvectomy with severe CC	7
S03	N34Z	Major interventions on intestines or urinary bladder for diseases or disorders of female sexual organs	10
S03	N38Z	Complicating constellation with other operative intervention, diseases or disorders of female sexual organs	6

Code	DRG	Description	Cases
S03	O05B	Other surgical procedures during pregnancy, without complex OR procedure	7
S03	Q02A	Different OR procedures, blood and immune system disorders, with highly complex CC	4
S03	Q02C	Different OR procedures, blood and immune system disorders, without highly complex CC	6
S03	R02Z	Major OR-prozedues with extremely severe CC, with complex OR-prozedure for hematological or solid neoplasms	10
S03	R12B	Other hematological and solid neoplasms with major OR-procedures without extremely severe CC, with complex OR-procedure	8
S03	T01A	OR-Procedure for infectious and parasitic diseases with complex procedure or complicating procedures or after organ transplantation	24
S03	T01B	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures excepting after organ transplantation	90
S03	T01C	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures and except after organ transplantation	5
S03	R01A	Lymphoma and leucemia with major OR-procedures, with extremely severe CC, with complex OR-procedure	4

S04 Colorectal resection (surgical)

The following OPS procedures were used to identify S04 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S04	45.7; 45.8	Colectomy	5-455; 5-456; 5-458
S04	No specific code	Laparoscopic colectomy	5-455.*5 .*6; 5-456.*5 .*6 .*7; 5-458.*5 .*6

And admissions must have primary diagnosis of malignant neoplasm of colon (C18), of rectosigmoid junction (C19) or of rectum (C20).

Revision of DRG data reduced the number of cases considered from 12,722 to 7,469 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S04	G02A	Intestinal surgery, cases of malformation, age < 2	937
S04	G02B	Intestinal surgery, cases of malformation, age > 1	2,360
S04	G03B	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, with complex intevention	7
S04	G03C	Major malignant neoplasm surgery on the stomach, oesophagus or duodenum without highly complex procedure, without complex intevention	19
S04	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	458
S04	G07C	Appendectomy or laparoscopic adhaesiolysis in case of peritonitis with highly complex or complex conditions or small intervention on small and large intestines	6
S04	G08A	Complex reconstruction of the abdominal wall, age > 0 years with catastrophic CC	8
S04	G10Z	Certain interventions of hepatobiliary system,	189
S04	G16A	Complex resection of rectum with surgery of liver metastases, with complicating procedures	20
S04	G16B	Complex resection of rectum with surgery of liver metastases, without complicating procedures	602
S04	G17A	Other resection of rectum with malignant neoplasm	190
S04	G17B	Other resection of rectum without malignant neoplasm	137
S04	G21B	Complex divided adhesions of peritoneum, age > 3 and < 16, without very severe	7
S04	G22B	Appendectomy or laparoscopic adhaesiolysis in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 9 years	9
S04	G33Z	Multiline complex OR procedure, diseases of digestive organs	26
S04	G35Z	Complex vacuum therapy for diseases of digestive organs	73
S04	G37Z	Multivisceral intervention for diseases of digestive organs	139
S04	G38Z	Complicating constellation for post OR procedure, diseases of digestive organs	66

S05 Coronary artery bypass graft (surgical)

The following OPS procedures were used to identify S05 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S05	36.1	Coronary artery bypass graft	5-361; 5-362; 5-363.4

Revision of DRG data reduced the number of cases considered from 19,123 to 14,922 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S05	A06A	Artificial respiration > 1799 h with complex intensive care treatment	4
S05	A07B	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure or multiple trauma	6
S05	A09A	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and highly complex OR procedure , age < 16 years	9
S05	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	215
S05	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	49
S05	A11A	Artificial respiration > 249 h or > 95 h with complicating constellation, age < 16	14
S05	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	173
S05	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	192
S05	A13A	Artificial respiration > 95 h with highly complex OR procedure or complex OR procedure and complex intensive care treatment	21
S05	A13B	Artificial respiration > 95 h with very complex OR procedure	81
S05	A13D	Artificial respiration > 95 h with complex OR procedure	196
S05	F03A	Cardiac valve procedures with CPB pump with complicating constellation	186
S05	F03B	Cardiac valve procedures with CPB pump without complicating constellation, with triple surgery or age < 1 year	108
S05	F03C	Cardiac valve procedures with CPB pump without complicating constellation, age > 0 years, with complex procedure	718
S05	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	1,414
S05	F03F	Cardiac valve procedures with CPB pump without complicating constellation, age > 15 years, without complex procedure	8
S05	F06A	Coronar bypass surgery with multiline complex OR procedures, with complicating constellation	41
S05	F06B	Coronar bypass surgery with multiline complex OR procedures, without complicating constellation	190
S05	F36A	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > 1176/1380	23
S05	F36B	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > 588/828	35
S05	F36C	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > -/828, without OR procedure	518

S06 Discectomy (surgical)

The following OPS procedures were used to identify S06 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S06	80.50; 80.51; 80.59	Discectomy	5-831.0--5-831.5 .x

Revision of DRG data reduced the number of cases considered from 18,103 to 17,829 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S06	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	6
S06	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	10
S06	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	18
S06	A13D	Artificial respiration > 95 h with complex OR procedure	10
S06	B03Z	Operating procedures on the spine or spinal chord due to para- / tetraplegy or malignant neoplasm or complicated cerebral paralysis, muscle dystrophy, n opathy with extreme complications	15
S06	B18Z	Surgery on the spine or spinal chord without major complications	40
S06	B61A	Miscellaneous acute diseases and injuries of the bone marrow with complex procedures, < 14 days., transferred	23
S06	I02A	Large-area tissue /skin transplantation, except on the hands, with complicating constellation, under extremely complicating conditions and with complex OR procedure	5
S06	I26Z	Complex intensive care treatment, > 588/522 score	22
S06	I27C	Interventions on soft tissue without certain diagnosis and certain intervention, without catastrophic CC	4
S06	I34Z	Complex treatment for early rehabilitation in geriatric medicine	17
S06	I98Z	Complex vacuum treatment, diseases and disorders of the musculoskeletal	4
S06	W01B	Multiple trauma with artificial respiration > 72h or other surgery with complex vacuum treatment	5
S06	W01C	Multiple trauma with artificial respiration > 72h or other surgery without complex vacuum treatment	19
S06	W02A	Hip, femur & lower limb procedures for multple trauma with complex or severe CC	11
S06	W02B	Hip, femur & lower limb procedures for multple trauma without complex or severe	27
S06	W36Z	Complex intensive care treatment in cases of multiple trauma	4

S07 Endarterectomy (surgical)

The following OPS procedures were used to identify S07 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S07	38.12	Carotid endarterectomy	5-381.0

Revision of DRG data reduced the number of cases considered from 9,591 to 8,203 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S07	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	42
S07	B03Z	Operating procedures on the spine or spinal chord due to para- / tetraplegy or malignant neoplasm or complicated cerebral paralysis, muscle dystrophy, n opathy with extreme complications	16
S07	B07Z	Interventions on peripheal nerves, brain nerves and otherparts of the nervous system withcatastrophic CC or complicating diagnosis,	57
S07	B12Z	Implantation of an artificial pacemakerfor diseases and disorders of the nervous system	23
S07	B17C	Interventions on peripheal nerves, brain nerves and otherparts of the nervous system without complicating diagnosis, age < 19 years or with catastrophic CC age > 15 years	104

Code	DRG	Description	Cases
S07	B39A	Neurological complex treatment of stroke with certain OR procedure, > 72h with complex surgery or complex constellation	8
S07	B39B	Neurological complex treatment of stroke with certain OR procedure, < 72h with complex surgery or >72h without complex surgery, without complex constellation	598
S07	B39C	Neurological complex treatment of stroke with certain OR procedure, < 72h without complex surgery, without complex constellation	453
S07	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	4
S07	F03F	Cardiac valve procedures with CPB pump without complicating constellation, age > 15 years, without complex procedure	13
S07	F05Z	Coronar bypass surgery with invasive cardiologic diagnostics or other complicated cardio-vascular surgery	11
S07	F06C	Coronar bypass surgery without multiline complex OR procedures, with complicating constellation, with invasive cardiologic diagnostics	47
S07	F28A	Amputation with additional vascular surgery, with catastrophic or severe CC	12

S08 Hip replacement (surgical)

The following OPS procedures were used to identify S08 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S08	81.51--81.53	Hip replacement	5-820; 5-821.1--5-821.6 .f .g .j
S08	00.70--00.77; 81.53 (2006)	Secondary hip replacement	5-821.1--5-821.6 .f .g .j

Revision of DRG data reduced the number of cases considered from 32,064 to 28,634 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S08	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	14
S08	901C	Extensive OR procedure unrelated to primary diagnosis with complex OR	125
S08	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	4
S08	A11E	Artificial respiration > 249 h with complex OR procedure, without complex intensive care treatment	9
S08	A13C	Artificial respiration > 95 h without complex OR procedure, with certain OR procedure and complicating constellation	4
S08	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	25
S08	B39B	Neurological complex treatment of stroke with certain OR procedure, < 72h with complex surgery or >72h without complex surgery, without complex constellation	5
S08	G14Z	Geriatric rehabilitative complex treatment with certain OR procedure, diseases of digestive system	4
S08	I01Z	Both-sided surgery or multple major surgery on the jonts of the lower extremities with complex diagnose	529
S08	I02C	Large-area tissue /skin transplantation, except on the hands, with complicating constellation, without extremely complicating conditions and without complex OR procedure	23
S08	I05A	Othe major joint replacement or replacement of the hip without complicating diagnose but exteremely complicating circumstances	799
S08	I05B	Othe major joint replacement	6
S08	I08B	Other hip and femur procedures, with complex multiple surgery, with catastrophic	168
S08	I08C	Other hip and femur procedures, with certain procedures on hip fracture, without catastrophic CC	116
S08	I08D	Other hip and femur procedures, with multiple surgery or with catastrophic CC	222

Code	DRG	Description	Cases
S08	I09C	Other spine procedures, without complex surgery, with certain complex spine procedure	4
S08	I12A	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with catastrophic CC	11
S08	I26Z	Complex intensive care treatment, > 588/522 score	39
S08	I27B	Interventions on soft tissue without certain diagnosis, with certain intervention or catastrophic CC	136
S08	I34Z	Complex treatment for early rehabilitation in geriatric medicine	989
S08	I36Z	Bilateral implantation or switch of endoprothesis of hip and knee	57
S08	I95Z	Implantation of a tumor endoprothesis	50
S08	I98Z	Complex vacuum treatment, diseases and disorders of the musculoskeletal	21
S08	K09A	Other endocrine, nutritional and metabolic OR procedures with highly complex procedure	7
S08	L33Z	Multiline complex OR procedures or high-cost implant, diseases of urinary system	4
S08	R03Z	Lymphoma and leucemia with other OR-procedures, with extremely severe CC	5
S08	T01A	OR-Procedure for infectious and parasitic diseases with complex procedure or complicating procedures or after organ transplantation	11
S08	W01C	Multiple trauma with artificial respiration > 72h or other surgery without complex vacuum treatment	4
S08	W02A	Hip, femur & lower limb procedures for multple trauma with complex or severe CC	5
S08	W02B	Hip, femur & lower limb procedures for multple trauma without complex or severe	34

S09 Hysterectomy (surgical)

The following OPS procedures were used to identify S09 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S09	68.3–68.7; 68.9	Hysterectomy	5-682; 5-683; 5-685

Revision of DRG data reduced the number of cases considered from 8,303 to 6,181 cases. The following DRGs were excluded:

Code	DRG	Description	Cases
S09	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	4
S09	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	16
S09	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	4
S09	A13B	Artificial respiration > 95 h with very complex OR procedure	4
S09	A13D	Artificial respiration > 95 h with complex OR procedure	7
S09	G02B	Intestinal surgery, cases of malformation, age > 1	6
S09	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	9
S09	G10Z	Certain interventions of hepatobiliary system,	6
S09	G12B	Other OR procedures on digestive organs with moderately complex OR procedure, LOS > 1 day	4
S09	G16A	Complex resection of rectum with surgery of liver metastases, with complicating procedures	5
S09	G16B	Complex resection of rectum with surgery of liver metastases, without complicating procedures	31
S09	G17A	Other resection of rectum with malignant neoplasm	34
S09	G17B	Other resection of rectum without malignant neoplasm	4
S09	G18A	Certain interventions on small or large intestines, with highly complex intervention	11
S09	G37Z	Multivisceral intervention for diseases of digestive organs	26
S09	G38Z	Complicating constellation for post OR procedure, diseases of digestive organs	10
S09	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	24
S09	L06B	Small interventions on the urinary bladder, without highly complex circumstances	5
S09	L10Z	Recontruction of the bladder or continent pouch after malignant neoplasm surgery	4
S09	L37Z	Multivisceral intervention for diseases of urinary system	9
S09	N01B	Evisceration of female pelvis and radical vulvectomy with highly severe CC	192
S09	N01C	Evisceration of female pelvis and radical vulvectomy with severe CC	282
S09	N01D	Evisceration of female pelvis and radical vulvectomy without severe CC	250
S09	N02A	Intervention on the uterus and adnexes due to malignant neoplasm on the ovaries and adnexes, with extremely severe CC	127
S09	N02B	Intervention on the uterus and adnexes due to malignant neoplasm on the ovaries and adnexes, with severe CC	174
S09	N05A	Ovariectomies and complex interventions on the tubae uterinae except for malignant neoplasm, with severe CC	6
S09	N06Z	Complex reconstructive interventions on femalesexual organs	167
S09	N33Z	Multiple complex surgical procedures for diseases or disorders of female sexual organs	14
S09	N34Z	Major interventions on intestines or urinary bladder for diseases or disorders of female sexual organs	125
S09	N38Z	Complicating constellation with other operative intervention, diseases or disorders of female sexual organs	52
S09	O04A	Post partum or post abortion with OR procedure or certain mamma surgery	5

S10 Knee replacement (surgical)

The following OPS procedures were used to identify S10 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S10	81.54	Total knee replacement	5.822.0--5-822.4 .6 .7 .9 .a .b .d.e .f; 5-823.1--5-823.4 .b .f .h

Revision of DRG data reduced the number of cases considered from 21,523 to 21,000 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S10	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	9
S10	I01Z	Both-sided surgery or multple major surgery on the jonts of the lower extremities with complex diagnose	154
S10	I02A	Large-area tissue /skin transplantation, except on the hands, with complicating constellation, under extremely complicating conditions and with complex OR procedure	4
S10	I02B	Large-area tissue /skin transplantation, except on the hands, with complicating constellation, under extremely complicating conditions or with complex OR	5
S10	I03A	Hip replacement with catastrophic CC	5
S10	I03B	Hip replacement without catastrophic CC	107
S10	I08B	Other hip and femur procedures, with complex multiple surgery, with catastrophic	4
S10	I08D	Other hip and femur procedures, with multiple surgery or with catastrophic CC	4
S10	I12A	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with catastrophic CC	12
S10	I12B	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with severe CC with revision of knee	11
S10	I34Z	Complex treatment for early rehabilitation in geriatric medicine	100
S10	I36Z	Bilateral implantation or switch of endoprothesis of hip and knee	32
S10	I95Z	Implantation of a tumor endoprothesis	61
S10	I98Z	Complex vacuum treatment, diseases and disorders of the musculoskeletal	6
S10	T01A	OR-Procedure for infectious and parasitic diseases with complex procedure or complicating procedures or after organ transplantation	4

S11 Mastectomy (surgical)

The following OPS procedures were used to identify S11 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S11	85.33–85.36; 85.4	Total mastectomy	5-872; 5-874; 5-877

Revision of DRG data reduced the number of cases considered from 21,042 to 19,359 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S11	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	7
S11	902Z	Non-extensive OR procedure unrelated to primary diagnosis	5
S11	J01Z	Microvascular tissue transfer, malignant neoplasm of skin, subcutaneous tissue and mamma	47
S11	J06Z	Mastectomy with implantation of prothesis and plastic surgery with malignant neoplasm	976
S11	J08B	Other skin transplantation or debriment without complex procedure, with catastrophic CC	5
S11	J08C	Other skin transplantation or debriment without complex procedure, without catastrophic CC	7
S11	J10B	Plastic surgery on skin, subcutaneous tissue and mamma except of malignant neoplasm	19
S11	J16B	Radiation therapy with OR procedure on diseases and disorders of skin, subcutaneous tissue and mamma	549
S11	J24A	Mamma surgery except of malignant neoplasm with extensive surgery, with prothesis implantation	19
S11	J26Z	Plastic reconstruction of Mamma with complex skin transplantation	23
S11	R13Z	Other hematological and solid neoplasms with certain OR-procedures without extremely severe CC,	7
S11	T01C	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures and except after organ transplantation	5
S11	X06B	Other surgery on other injuries without very complex CC, age > 65 years	10
S11	X06C	Other surgery on other injuries without very complex CC, age < 66 years	4

S12 Open prostatectomy (surgical)

The following OPS procedures were used to identify S12 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S12	60.3--60.6	Open prostatectomy (excludes transurethral)	5-603; 5-604

Revision of DRG data reduced the number of cases considered from 6,224 to 6,160 cases. The following DRGs were excluded:

Code	DRG	Description	Cases
S12	G16B	Complex resection of rectum with surgery of liver metastases, without complicating procedures	10
S12	G37Z	Multivisceral intervention for diseases of digestive organs	4
S12	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	4
S12	L04B	Surgery on kidney, urether or major surgery on the urinary bladder without malignant neoplasm and extreme complications, age > 2 years	12
S12	L37Z	Multivisceral intervention for diseases of urinary system	23
S12	M37Z	Major surgical intervention on the intestines or the urinary bladder due to disorders of the male sexual organs	11

S13 PTCA (surgical)

The following OPS procedures were used to identify S13 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S13	00.66 (2006)	Transluminal coronary angioplasty	8-837.0 .1 .k .m .n .p .q .u .v .w

Revision of DRG data reduced the number of cases considered from 75,556 to 71,598 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S13	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	14
S13	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	820
S13	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	16
S13	A09A	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and highly complex OR procedure , age < 16 years	4
S13	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	88
S13	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	45
S13	A11A	Artificial respiration > 249 h or > 95 h with complicating constellation, age < 16	5
S13	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	100
S13	A13A	Artificial respiration > 95 h with highly complex OR procedure or complex OR procedure and complex intensive care treatment	6
S13	A13B	Artificial respiration > 95 h with very complex OR procedure	16
S13	A13D	Artificial respiration > 95 h with complex OR procedure	94
S13	A60C	Rejection of transplanted organ, > 1 day	26
S13	A60D	Rejection of transplanted organ, 1 day	15
S13	A66Z	Evaluation before other organ transplantation	4
S13	A69Z	Evaluation before organ transplantation, without inclusion in waiting list	12
S13	B07Z	Interventions on peripheal nerves, brain nerves and otherparts of the nervous system withcatastrophic CC or complicating diagnosis,	8
S13	B12Z	Implantation of an artificial pacemakerfor diseases and disorders of the nervous system	291
S13	E05A	Major surgery on the thorax, with interventions on thorax deformation or with catastrophic CC	5
S13	E36Z	Complex intensive care treatment, diseases of the respiratory organs	5
S13	F01A	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, with additional heart or vascular surgery	177

Code	DRG	Description	Cases
S13	F01B	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, with additional heart or vascular surgery	197
S13	F01D	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, with additional heart or vascular surgery	270
S13	F02B	Secondary implantation cardioverter / defibrillator (AICD), single-chamber	4
S13	F03C	Cardiac valve procedures with CPB pump without complicating constellation, age > 0 years, with complex procedure	14
S13	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	8
S13	F05Z	Coronar bypass surgery with invasive cardiologic diagnostics or other complicated cardio-vascular surgery	25
S13	F06B	Coronar bypass surgery with multiline complex OR procedures, without complicating constellation	7
S13	F06D	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics	143
S13	F06E	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics, with intraoperative ablation	87
S13	F08B	Reconstructive vascular procedures, without complicating constellation, with catastrophic CC, with complex multiple-level surgery	19
S13	F08C	Reconstructive vascular procedures, without complicating constellation, with catastrophic CC, with complex surgery	14
S13	F08E	Reconstructive vascular procedures, without complicating constellation, without catastrophic CC, without complex surgery	5
S13	F09B	Other cardiothoracic procedures without CPB pump, without complicating constellation, age > 15 years, with catastrophic CC	134
S13	F09C	Other cardiothoracic procedures without CPB pump, without complicating constellation, age > 15 years, without catastrophic CC	37
S13	F12A	Implantation of pacemaker, three-chamber system, with catastrophic CC	16
S13	F12D	Implantation of pacemaker, two-chamber system, age > 15 years, with complex surgery	637
S13	F12F	Implantation of pacemaker, single-chamber system, with invasive cardiologic diagnostics	102
S13	F13A	Amputation, upper limb and toe for circulatory disorders, with catastrophic CC	6
S13	F14A	Complex or multiple vascular procedures without major vascular procedures with catastrophic CC	13
S13	F14B	Complex or multiple vascular procedures without major vascular procedures without catastrophic CC	4
S13	F98A	Complex minimally invasive cardiac valve procedures with highly complex procedure or complex diagnosis or age < 16 years	22
S13	F98B	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, with very complex procedure	257
S13	F98C	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, without very complex procedure	14
S13	G02B	Intestinal surgery, cases of malformation, age > 1	4
S13	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	7
S13	H12A	Other interventions on hepatobiliary system, under highly complex circumstances or complex intervention	4
S13	I08B	Other hip and femur procedures, with complex multiple surgery, with catastrophic	4
S13	I26Z	Complex intensive care treatment, > 588/522 score	4
S13	I27B	Interventions on soft tissue without certain diagnosis, with certain intervention or catastrophic CC	4
S13	I44A	Implantation of bicondylar endoprothesis or other endoprothesis implantation/revision of knee, with catastrophic CC	8

Code	DRG	Description	Cases
S13	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	6
S13	L09A	Other surgery, diseases of urinary organs, with dialysis shunt, acute or chronic kidney failure	11
S13	Q02A	Different OR procedures, blood and immune system disorders, with highly complex CC	19
S13	Q02C	Different OR procedures, blood and immune system disorders, without highly complex CC	4
S13	R03Z	Lymphoma and leucemia with other OR-procedures, with extremely severe CC	6
S13	S01Z	HIV-Disease with OR-procedure	16
S13	T01A	OR-Procedure for infectious and parasitic diseases with complex procedure or complicating procedures or after organ transplantation	10
S13	T01B	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures excepting after organ transplantation	60
S13	Z01B	OR procedures in other circumstances that require untilisation of the health system	5

S14 Peripheral vascular bypass (surgical)

The following OPS procedures were used to identify S14 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S14	39.29 (part of)	Femoropopliteal bypass	5-393.52 .53 .54

Revision of DRG data reduced the number of cases considered from 2,575 to 2,456 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S14	F21A	Other OR procedures for circulatory disorders, with highly complex surgery	16
S14	F28A	Amputation with additional vascular surgery, with catastrophic or severe CC	95
S14	F36C	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > -/828, without OR procedure	4
S14	K09B	Other endocrine, nutritional and metabolic OR procedures without highly complex procedure, with complex procedure	4

S15 Inguinal hernia repair (surgical)

The following OPS procedures were used to identify S15 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S15	53.0; 53.1	Repair of inguinal hernia	5-530

And primary diagnosis of inguinal hernia (K40).

Revision of DRG data reduced the number of cases considered from 14,499 to 13,070 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S15	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	24
S15	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	4
S15	B17D	Interventions on peripheal nerves, brain nerves and otherparts of the nervous system without complicating diagnosis, age > 18 years, with moderately complex	5
S15	F21B	Other OR procedures for circulatory disorders, without highly complex surgery, with complex surgery	16
S15	G02A	Intestinal surgery, cases of malformation, age < 2	21
S15	G02B	Intestinal surgery, cases of malformation, age > 1	4
S15	G04B	Adhaesiolysis on the peritoneum, age > 5 years or extremely severe complications	28
S15	G08B	Complex reconstruction of the abdominal wall, age > 0 years without catastrophic	116
S15	G18B	Certain interventions on small or large intestines, with very complex intervention	21
S15	G18C	Certain interventions on small or large intestines, with complex intervention	70

Code	DRG	Description	Cases
S15	G21B	Complex divided adhesions of peritoneum, age > 3 and < 16, without very severe	61
S15	G22B	Appendectomy or laparoscopic adhaesiolysis in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 9 years	21
S15	G23B	Appendectomy or laparoscopic adhaesiolysis except in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 9 years	395
S15	G23C	Appendectomy or laparoscopic adhaesiolysis except in case of peritonitis or catastrophic or severe CC except malignant neoplasm, age > 13 years	22
S15	H08B	Laparoscopic Cholezystectomy without very complex diagnosis	4
S15	L02B	Surgical implantation of a shunt for peritoneal dialysis, age > 9 years and acute or chronic kidney failure	6
S15	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	7
S15	L10Z	Recontruction of the bladder or continent pouch after malignant neoplasm surgery	5
S15	M01A	Major surgical intervention on a male patients the pelvic organs under extremely severe complicating conditions	4
S15	M01B	Major surgical intervention on a male patients the pelvic organs without extremely severe complicating conditions	99
S15	M03A	Surgical intervention on the penis, age < 6 years	13
S15	M04A	Surgical intervention on the scrotum under extremely complicating conditions	17
S15	M04B	Surgical intervention on the scrotum without extremely complicating conditions, with other surgery, age < 3 years	37
S15	M04C	Surgical intervention on the scrotum without extremely complicating conditions, age < 3 years	153
S15	M04D	Surgical intervention on the scrotum without extremely complicating conditions, without other surgery, age > 2 years	123
S15	P03A	Newborn, weight at admission 1000 - 1499 g with significant OR-procedure or artificial respiration > 95 hours; or with multiple severe problems and artificial respiration > 479 hours	9
S15	P03B	Newborn, weight at admission 1000 - 1499 g with significant OR-procedure or artificial respiration > 95 hours with multiple severe problems and artificial respiration > 120 and < 480 hours	7
S15	P03C	Newborn, weight at admission 1000 - 1499 g with significant OR-procedure or artificial respiration > 95 hours without multiple severe problems or artificial respiration > 120 and < 480 hours	13
S15	P61D	Newborn, weight at admission 600-749 g, without significant OR-procedure	15
S15	P62A	Newborn, weight at admission 750-999 g, with significant OR-procedure	5
S15	P62B	Newborn, weight at admission 750-874 g without significant OR-procedure	13
S15	P62C	Newborn, weight at admission 875-999 g without significant OR-procedure	18
S15	P64Z	Newborn, weight at admission 1250-1499 g without significant OR-procedure, without artificial repiration >95h.	4
S15	P67B	Newborn, weight at admission > 2499 g, without significant OR-procedure or artificial respiration > 95 hours, with severe problem, without hypothermia treatment	22
S15	P67C	Newborn, weight at admission > 2499 g, without significant OR-procedure or artificial respiration > 95 hours, with other problem	47

S16 Thyroidectomy (surgical)

The following OPS procedures were used to identify S16 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S16	06.2-- 06.6	Thyroidectomy	5-061--5-064

Revision of DRG data reduced the number of cases considered from 12,140 to 11,533 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S16	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	20
S16	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	5
S16	A09A	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and highly complex OR procedure , age < 16 years	4
S16	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	4
S16	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	7
S16	A09D	Artificial respiration > 499 h without complex OR procedure , without multiple trauma, age > 15 years	4
S16	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	8
S16	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	10
S16	D24A	Complex plastic surgery and major operations on the head or throat, with catastrophic CC	4
S16	D24B	Complex plastic surgery and major operations on the head or throat, without catastrophic CC	10
S16	D25B	Moderately complex surgery on the head or throat with malignant neoplasm, without catastrophic CC	4
S16	K14Z	Adrenal gland OR procedures, except malignant neoplasm and extensive lymphadenectomy	468
S16	L09C	Other surgery, diseases of urinary organs, without dialysis shunt, age < 2 years or highly complex CC	23
S16	R04A	Other hematological or solid neoplasms with certain OR procedures, with highly complex of complex CC	5
S16	R12B	Other hematological and solid neoplasms with major OR-procedures without extremely severe CC, with complex OR-procedure	14
S16	R13Z	Other hematological and solid neoplasms with certain OR-procedures without extremely severe CC,	17

S17 Transurethral resection of prostate - TURP (surgical)

The following OPS procedures were used to identify S17 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S17	60.2	Transurethral prostatectomy	5-601

Revision of DRG data reduced the number of cases considered from 11,097 to 10,157 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S17	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	67
S17	L03Z	Malignant neoplasm surgery of the kidney, urether or urinary bladder, age < 19 yeasr or with extremely complicated circumstances	10
S17	L06A	Other small interventions on the urinary bladder, under highly complex	9
S17	L06B	Small interventions on the urinary bladder, without highly complex circumstances	10
S17	L18A	Complex transurethral, percutaneous transrenal and other retroperitoneal procedures with catastrophic CC	16

Code	DRG	Description	Cases
S17	L18B	Complex transurethral, percutaneous transrenal and other retroperitoneal procedures without catastrophic CC	22
S17	M03C	Surgical intervention on the penis, age > 17 years	21
S17	M06Z	Other OR procedures on male sexual organs	44
S17	M09A	OR procedures on male sexual organs with malignant neoplasm with highly complex CC	71
S17	M09B	OR procedures on male sexual organs with malignant neoplasm without highly complex CC	644
S17	M37Z	Major surgical intervention on the intestines or the urinary bladder due to disorders of the male sexual organs	5
S17	M38Z	Complicating constellation with surgery, diseases and disorders of male sexual organs	8
S17	T01B	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures excepting after organ transplantation	8
S17	X06B	Other surgery on other injuries without very complex CC, age > 65 years	5

S18 Arthroscopic excision of meniscus of knee (surgical)

The following OPS procedures were used to identify S18 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S18	No specific code	Arthroscopic excision of meniscus of knee	5-812.5 .6

Revision of DRG data reduced the number of cases considered from 9,559 to 8,719 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S18	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	16
S18	902Z	Non-extensive OR procedure unrelated to primary diagnosis	6
S18	B17D	Interventions on peripheal nerves, brain nerves and otherparts of the nervous system without complicating diagnosis, age > 18 years, with moderately complex	4
S18	I08D	Other hip and femur procedures, with multiple surgery or with catastrophic CC	24
S18	I08E	Other hip and femur procedures, with moderately complex surgery, with certain osteotomy, without catastrophic CC	6
S18	I08F	Other hip and femur procedures, with moderately complex surgery, without certain osteotomy, without catastrophic CC	21
S18	I08G	Other hip and femur procedures, without moderately complex surgery, with certain bone transplantation,	39
S18	I08H	Other hip and femur procedures, without moderately complex surgery, without certain bone transplantation,	46
S18	I12A	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with catastrophic CC	25
S18	I12B	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with severe CC with revision of knee	21
S18	I12C	Miscellaneous muculoskeletal procedures for infection/inflammation of bone/joint with severe CC without revision of knee	112
S18	I13B	Humerus, tibia, fibula and ankle procedures with complex multiple procedure	8
S18	I13C	Humerus, tibia, fibula and ankle procedures with certain multiple procedure	43
S18	I13D	Humerus, tibia, fibula and ankle procedures with complex procedure	147
S18	I13E	Humerus, tibia, fibula and ankle procedures with moderately complex procedure	69
S18	I13F	Humerus, tibia, fibula and ankle procedures without moderately complex procedure	34
S18	I16Z	Other shoulder or clavicula procedures	8
S18	I20G	Foot procedures without complex procedures, age > 15 years	4
S18	I21Z	Local excision and removal of internal fixation device of hip, femur and spine	17
S18	I23A	Local excision and removal of internal fixation device except of hip, femur and spine, with complicating procedure on the bone	85

Code	DRG	Description	Cases
S18	I23B	Local excision and removal of internal fixation device except of hip, femur and spine, without complicating procedure on the bone	40
S18	I32G	Wrist and hand procedures without complex or moderately complex procedures	6
S18	I34Z	Complex treatment for early rehabilitation in geriatric medicine	5
S18	I44B	Implantation of bicondylar endoprothesis or other endoprothesis implantation/revision of knee, without catastrophic CC	5
S18	I44C	Miscellaneous endoprothetic surgery on the knee	19
S18	I47B	Revision or replacement of hip joint without complicating diagnosis, without catastrophic CC	7
S18	I59Z	Other humerus, tibia, fibula and ankle procedures or moderately complex procedures on knee	4
S18	T01C	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures and except after organ transplantation	14
S18	X04Z	Other surgery on injuries of lower extremities	5

S19 Lens and cataract procedures (surgical)

The following OPS procedures were used to identify S19 admissions (OECD, 2015):

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S19	13.1--13.8	Cataract surgery	5-142--5-147; 5-149

Revision of DRG data reduced the number of cases considered from 15,600 to 10,838 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S19	902Z	Non-extensive OR procedure unrelated to primary diagnosis	12
S19	C01A	Complex surgery after penetrating eye injury	59
S19	C01B	Other surgery after penetrating eye injury	46
S19	C03A	Surgery on the retina with pars-plana-vitrectomy, with extracapsular extraction of the lens (ECCE)	1,334
S19	C03C	Surgery on the retina with pars-plana-vitrectomy, without extracapsular extraction of the lens (ECCE)	433
S19	C04A	Cornea transplantation with extracapsular extraction of the lens or age < 16 years	460
S19	C04B	Cornea transplantation without extracapsular extraction of the lens or age > 15	25
S19	C06Z	Complex glaucoma surgery	941
S19	C07A	Other interventions for glaucoma with extracapsular extraction of the lens (ECCE)	670
S19	C13Z	Other surgery on the lecrimal gland and tear ducts	5
S19	C15Z	Other surgery on the retina	768
S19	C16Z	Complex eye surgery, age < 6 years	4
S19	K09C	Other endocrine, nutritional and metabolic OR procedures without highly complex procedure, without complex procedure	5

S20 Ligation and stripping of varicous veins (surgical)

The following OPS procedures were used to identify S20 admissions:

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S20	38.59	Ligation and stripping of varicose veins, lower limb veins	5-385.1 .2 .4 .7 .8 .9

Revision of DRG data reduced the number of cases considered from 2,866 to 2,760 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S20	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	18
S20	F21A	Other OR procedures for circulatory disorders, with highly complex surgery	73
S20	F59B	Moderately complex vascular procedures with complex surgery, with catastrophic CC, LOS > 1 day	11
S20	F59D	Moderately complex vascular procedures without complex surgery, age > 15 years or LOS = 1	4

S21 Tonsillectomy and/or adenoidectomy (surgical)

The following OPS procedures were used to identify S21 admissions:

Code	ICD-9 CM	Common surgical procedures	OPS 2013
S21	28.2--28.4	Tonsillectomy	5-281; 5-282

Revision of DRG data reduced the number of cases considered from 16,154 to 15,869 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
S21	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	8
S21	Q02C	Different OR procedures, blood and immune system disorders, without highly complex CC	10
S21	R04A	Other hematological or solid neoplasms with certain OR procedures, with highly complex of complex CC	9
S21	R11B	Lymphoma and leucemia with other OR-procedures, without extremely severe or severe CC	40
S21	R12B	Other hematological and solid neoplasms with major OR-procedures without extremely severe CC, with complex OR-procedure	53
S21	R12C	Other hematological and solid neoplasms with major OR-procedures without extremely severe CC, without complex OR-procedure	11
S21	R13Z	Other hematological and solid neoplasms with certain OR-procedures without extremely severe CC,	45
S21	T01C	OR-Procedure for infectious and parasitic diseases without complex procedure or complicating procedures and except after organ transplantation	101
S21	X06C	Other surgery on other injuries without very complex CC, age < 66 years	8

M01 Acute myocardial infarction (medical, with procedures)

The following ICD diagnosis codes were used to identify M01 admissions:

Code	ICD-10 code	Diagnosis
M01	I21.0	Acute transmural myocardial infarction of anterior wall
M01	I21.1	Acute transmural myocardial infarction of inferior wall
M01	I21.2	Acute transmural myocardial infarction of other sites
M01	I21.3	Acute transmural myocardial infarction of unspecified site
M01	I21.4	Acute subendocardial myocardial infarction
M01	I21.9	Acute myocardial infarction, unspecified
M01	I22.0	Subsequent myocardial infarction of anterior wall
M01	I22.1	Subsequent myocardial infarction of inferior wall
M01	I22.8	Subsequent myocardial infarction of other sites
M01	I22.9	Subsequent myocardial infarction of unspecified site

Exclusion criteria: Other OR procedure is performed and procedures for S13 PTCA and S05 Coronary artery bypass graft. Inclusion criteria: invasive cardiologic diagnostics.

Revision of DRG data reduced the number of cases considered from 30,239 to 9,330 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M01	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	7
M01	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	21
M01	902Z	Non-extensive OR procedure unrelated to primary diagnosis	5
M01	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	4
M01	A09A	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and highly complex OR procedure , age < 16 years	4
M01	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	83
M01	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	28
M01	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	89
M01	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	106
M01	A13A	Artificial respiration > 95 h with highly complex OR procedure or complex OR procedure and complex intensive care treatment	6
M01	A13B	Artificial respiration > 95 h with very complex OR procedure	15
M01	A13C	Artificial respiration > 95 h without complex OR procedure, with certain OR procedure and complicating constellation	4
M01	A13D	Artificial respiration > 95 h with complex OR procedure	59
M01	F01A	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, with additional heart or vascular surgery	31
M01	F01B	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, with additional heart or vascular surgery	43
M01	F01C	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, without additional heart or vascular surgery	15
M01	F01D	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, with additional heart or vascular surgery	61
M01	F01E	Primary implantation cardioverter / defibrillator (AICD), single- or two-chamber stimulation, without additional heart or vascular surgery, with catastrophic CC	36
M01	F01F	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	11
M01	F01G	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	8
M01	F03A	Cardiac valve procedures with CPB pump with complicating constellation	12
M01	F03B	Cardiac valve procedures with CPB pump without complicating constellation, with triple surgery or age < 1 year	7
M01	F03C	Cardiac valve procedures with CPB pump without complicating constellation, age > 0 years, with complex procedure	26
M01	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	63
M01	F05Z	Coronar bypass surgery with invasive cardiologic diagnostics or other complicated cardio-vascular surgery	61
M01	F06B	Coronar bypass surgery with multiline complex OR procedures, without complicating constellation	12
M01	F06C	Coronar bypass surgery without multiline complex OR procedures, with complicating constellation, with invasive cardiologic diagnostics	27
M01	F06D	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics	492
M01	F06F	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, without invasive cardiologic diagnostics	1,451
M01	F07A	Other procedures with CPB pump, age < 1 year	21

Code	DRG	Description	Cases
M01	F07B	Other procedures with CPB pump, age > 0 year, without complicating constellation	173
M01	F09B	Other cardiothoracic procedures without CPB pump, without complicating constellation, age > 15 years, with catastrophic CC	61
M01	F09C	Other cardiothoracic procedures without CPB pump, without complicating constellation, age > 15 years, without catastrophic CC	5
M01	F12A	Implantation of pacemaker, three-chamber system, with catastrophic CC	7
M01	F12D	Implantation of pacemaker, two-chamber system, age > 15 years, with complex surgery	118
M01	F12E	Implantation of pacemaker, two-chamber system, without complex surgery, with catastrophic CC	24
M01	F12F	Implantation of pacemaker, single-chamber system, with invasive cardiologic diagnostics	20
M01	F12G	Implantation of pacemaker, two-chamber system, without complex surgery, without catastrophic CC	18
M01	F12I	Implantation of pacemaker, single-chamber system, witholut invasive cardiologic diagnostics, age > 15 years, without implantation of event recorder	7
M01	F14A	Complex or multiple vascular procedures without major vascular procedures with catastrophic CC	4
M01	F15Z	Percutaneous coronary angioplasty, with complicating constellation or complex diagnosis, age < 16 years	64
M01	F21A	Other OR procedures for circulatory disorders, with highly complex surgery	4
M01	F21B	Other OR procedures for circulatory disorders, without highly complex surgery, with complex surgery	4
M01	F21C	Other OR procedures for circulatory disorders, without highly complex or complex surgery, with certain surgery	13
M01	F24A	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, with catastrophic CC	394
M01	F24B	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, without catastrophic CC	2,712
M01	F36A	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > 1176/1380	15
M01	F49A	Invasive cardiological diagnostics except for acute myocardial infarction, with catastrophic CC, with complex OR procedure	15
M01	F49B	Invasive cardiological diagnostics except for acute myocardial infarction, with catastrophic CC, without complex OR procedure	53
M01	F49D	Invasive cardiological diagnostics except for acute myocardial infarction, without catastrophic CC, age > 14 years, with cardial mapping	507
M01	F52A	Percutaneous coronary angioplasty, with complex diagnosis, with catastrophic CC	1,287
M01	F52B	Percutaneous coronary angioplasty, with complex diagnosis, without catastrophic	12,107
M01	F56A	Percutaneous coronary angioplasty, with highly complex intervention, with catastrophic CC	90
M01	F59A	Moderately complex vascular procedures with catastrophic CC	66
M01	F59B	Moderately complex vascular procedures with complex surgery, with catastrophic CC, LOS > 1 day	5
M01	F59C	Moderately complex vascular procedures with other bilateral surgery, age > 15 years or LOS = 1	6
M01	F59D	Moderately complex vascular procedures without complex surgery, age > 15 years or LOS = 1	5
M01	F98B	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, with very complex procedure	14
M01	S01Z	HIV-Disease with OR-procedure	7

M02 Angina pectoris (medical, with procedures)

The following ICD diagnosis codes were used to identify M02 admissions:

Code	ICD-10 code	Diagnosis
M02	I20.0	Unstable angina
M02	I20.1	Angina pectoris with documented spasm
M02	I20.8	Other forms of angina pectoris
M02	I20.9	Angina pectoris, unspecified

Exclusion criteria: Other OR procedure is performed and procedures for S13 PTCA and S05 Coronary artery bypass graft. Inclusion criteria: invasive cardiologic diagnostics.

Revision of DRG data reduced the number of cases considered from 31,771 to 18,290 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M02	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	19
M02	902Z	Non-extensive OR procedure unrelated to primary diagnosis	4
M02	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	18
M02	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	4
M02	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	12
M02	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	21
M02	A13B	Artificial respiration > 95 h with very complex OR procedure	10
M02	A13D	Artificial respiration > 95 h with complex OR procedure	22
M02	F01A	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, with additional heart or vascular surgery	4
M02	F01B	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, with additional heart or vascular surgery	5
M02	F01C	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, without additional heart or vascular surgery	18
M02	F01D	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, with additional heart or vascular surgery	14
M02	F01E	Primary implantation cardioverter / defibrillator (AICD), single- or two-chamber stimulation, without additional heart or vascular surgery, with catastrophic CC	11
M02	F01F	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	17
M02	F01G	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	25
M02	F02A	Secondary implantation cardioverter / defibrillator (AICD), two- or three-chamber stimulation	4
M02	F03A	Cardiac valve procedures with CPB pump with complicating constellation	4
M02	F03C	Cardiac valve procedures with CPB pump without complicating constellation, age > 0 years, with complex procedure	55
M02	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	63
M02	F03F	Cardiac valve procedures with CPB pump without complicating constellation, age > 15 years, without complex procedure	10

Code	DRG	Description	Cases
M02	F05Z	Coronar bypass surgery with invasive cardiologic diagnostics or other complicated cardio-vascular surgery	36
M02	F06A	Coronar bypass surgery with multiline complex OR procedures, with complicating constellation	4
M02	F06B	Coronar bypass surgery with multiline complex OR procedures, without complicating constellation	31
M02	F06C	Coronar bypass surgery without multiline complex OR procedures, with complicating constellation, with invasive cardiologic diagnostics	40
M02	F06D	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics	11
M02	F06E	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics, with intraoperative ablation	635
M02	F06F	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, without invasive cardiologic diagnostics	1,696
M02	F07A	Other procedures with CPB pump, age < 1 year	43
M02	F08D	Reconstructive vascular procedures, without complicating constellation, without catastrophic CC, with complex surgery	4
M02	F12D	Implantation of pacemaker, two-chamber system, age > 15 years, with complex surgery	34
M02	F12E	Implantation of pacemaker, two-chamber system, without complex surgery, with catastrophic CC	5
M02	F12F	Implantation of pacemaker, single-chamber system, with invasive cardiologic diagnostics	33
M02	F12G	Implantation of pacemaker, two-chamber system, without complex surgery, without catastrophic CC	62
M02	F12H	Implantation of pacemaker, single-chamber system, witholut invasive cardiologic diagnostics, age > 15 years, with implantation of event recorder	5
M02	F12I	Implantation of pacemaker, single-chamber system, witholut invasive cardiologic diagnostics, age > 15 years, without implantation of event recorder	4
M02	F15Z	Percutaneous coronary angioplasty, with complicating constellation or complex diagnosis, age < 16 years	5
M02	F21C	Other OR procedures for circulatory disorders, without highly complex or complex surgery, with certain surgery	5
M02	F24A	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, with catastrophic CC	6
M02	F24B	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, without catastrophic CC	227
M02	F52B	Percutaneous coronary angioplasty, with complex diagnosis, without catastrophic	60
M02	F56A	Percutaneous coronary angioplasty, with highly complex intervention, with catastrophic CC	68
M02	F56B	Percutaneous coronary angioplasty, without highly complex intervention, without catastrophic CC	2,186
M02	F58A	Percutaneous coronary angioplasty, with catastrophic CC	174
M02	F58B	Percutaneous coronary angioplasty, without catastrophic CC	7,349
M02	F59A	Moderately complex vascular procedures with catastrophic CC	19
M02	F59B	Moderately complex vascular procedures with complex surgery, with catastrophic CC, LOS > 1 day	27
M02	F59C	Moderately complex vascular procedures with other bilateral surgery, age > 15 years or LOS = 1	19
M02	F59D	Moderately complex vascular procedures without complex surgery, age > 15 years or LOS = 1	43
M02	F98B	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, with very complex procedure	12
M02	S65B	Other diseases with HIV-disease, without highly complex CC	4

M03 Cholelitiasis (medical)

The following ICD diagnosis codes were used to identify M03 admissions:

Code	ICD-10 code	Diagnosis
M03	K80.0	Calculus of gallbladder with acute cholecystitis
M03	K80.1	Calculus of gallbladder with other cholecystitis
M03	K80.2	Calculus of gallbladder without cholecystitis
M03	K80.3	Calculus of bile duct with cholangitis
M03	K80.4	Calculus of bile duct with cholecystitis
M03	K80.5	Calculus of bile duct without cholangitis or cholecystitis
M03	K80.8	Other cholelithiasis

Exclusion criteria: OR procedure is performed.

Revision of DRG data reduced the number of cases considered from 29,158 to 3,499 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M03	H02B	Major biliary tract procedures without malignant neoplasm	118
M03	H05Z	Laporotomy and moderately complex procedures on biliary tract	322
M03	H06A	Other hepatobiliary and pancreas OR procedures with certain procedure and complex diagnosis	29
M03	H06C	Other hepatobiliary and pancreas OR procedures without certain procedure and complex diagnosis	28
M03	H07A	Cholezystectomy under highly complex circumstances	32
M03	H07B	Cholezystectomy without highly complex circumstances	1,389
M03	H08A	Laparoscopic Cholezystectomy with very complex diagnosis	200
M03	H08B	Laparoscopic Cholezystectomy without very complex diagnosis	17,342
M03	H09A	Interventions on pancreas and liver and portosystemic shunt operations, under highly complex circumstances, with certain interventions on liver, pancreas and bile ducts	40
M03	H09C	Interventions on pancreas and liver and portosystemic shunt operations, without highly complex circumstances, without certain interventions on liver, pancreas and bile ducts (exception: malignant neoplasm)	63
M03	H12A	Other interventions on hepatobiliary system, under highly complex circumstances or complex intervention	31
M03	H12B	Other interventions on hepatobiliary system, without highly complex circumstances or complex intervention	16
M03	H36A	Diseases and disorders of hepatobiliary system and pancreas with complex intensive care treatment > 980/828 score	5
M03	H36B	Diseases and disorders of hepatobiliary system and pancreas with complex intensive care treatment > 588/552 and < 981/829 score	20
M03	H41A	ERCP procedures with catastrophic CC	253
M03	H41B	ERCP procedures with severe CC or age < 16 years, with complex procedure	495
M03	H41C	ERCP procedures with severe CC or age < 16 years, without complex procedure	5,276

M04 Heart failure (medical)

The following ICD diagnosis codes were used to identify M04 admissions:

Code	ICD-10 code	Diagnosis
M04	I50.0	Congestive heart failure
M04	I50.1	Left ventricular failure
M04	I50.9	Heart failure, unspecified

Exclusion criteria: OR procedure is performed and Hypertensive heart failure (I11.0), Rheumatic heart failure (I09.9).

Revision of DRG data reduced the number of cases considered from 59,541 to 50,875 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M04	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	39
M04	901C	Extensive OR procedure unrelated to primary diagnosis with complex OR	21
M04	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	126
M04	902Z	Non-extensive OR procedure unrelated to primary diagnosis	67
M04	A05B	Heart transplantation with artificial respiration < 179 hours or age > 15 years	4
M04	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	13
M04	A07E	Artificial respiration > 999 h, without complex OR procedure , without multiple trauma, age > 15 years	6
M04	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	20
M04	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	21
M04	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	31
M04	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	42
M04	A11E	Artificial respiration > 249 h with complex OR procedure, without complex intensive care treatment	18
M04	A13D	Artificial respiration > 95 h with complex OR procedure	6
M04	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	97
M04	A13F	Artificial respiration > 95 h without certain OR procedure, age > 15 years	68
M04	A13G	Artificial respiration > 95 h with certain OR procedure, with catastrophic CC, age > 15 years	99
M04	A13H	Artificial respiration > 95 h with certain OR procedure, without catastrophic CC, age > 15 years	131
M04	A62Z	Evaluation before heart transplantation	26
M04	A69Z	Evaluation before organ transplantation, without inclusion in waiting list	20
M04	F01A	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, with additional heart or vascular surgery	48
M04	F01B	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, with additional heart or vascular surgery	15
M04	F01C	Primary implantation cardioverter / defibrillator (AICD), three-chamber stimulation, without additional heart or vascular surgery	502
M04	F01D	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, with additional heart or vascular surgery	20
M04	F01E	Primary implantation cardioverter / defibrillator (AICD), single- or two-chamber stimulation, without additional heart or vascular surgery, with catastrophic CC	56
M04	F01F	Primary implantation cardioverter / defibrillator (AICD), two-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	108
M04	F01G	Primary implantation cardioverter / defibrillator (AICD), single-chamber stimulation, without additional heart or vascular surgery, without catastrophic CC	331
M04	F03C	Cardiac valve procedures with CPB pump without complicating constellation, age > 0 years, with complex procedure	12
M04	F03E	Cardiac valve procedures with CPB pump without complicating constellation, age > 16 years, with complex procedure	13
M04	F06E	Coronar bypass surgery without multiline complex OR procedures, without complicating constellation, with invasive cardiologic diagnostics, with intraoperative ablation	12
M04	F07A	Other procedures with CPB pump, age < 1 year	19

Code	DRG	Description	Cases
M04	F07B	Other procedures with CPB pump, age > 0 year, without complicating constellation	7
M04	F12A	Implantation of pacemaker, three-chamber system, with catastrophic CC	10
M04	F12B	Implantation of pacemaker, three-chamber system, without catastrophic CC	35
M04	F12D	Implantation of pacemaker, two-chamber system, age > 15 years, with complex surgery	4
M04	F12E	Implantation of pacemaker, two-chamber system, without complex surgery, with catastrophic CC	39
M04	F12F	Implantation of pacemaker, single-chamber system, with invasive cardiologic diagnostics	24
M04	F12G	Implantation of pacemaker, two-chamber system, without complex surgery, without catastrophic CC	64
M04	F12I	Implantation of pacemaker, single-chamber system, witholut invasive cardiologic diagnostics, age > 15 years, without implantation of event recorder	86
M04	F13A	Amputation, upper limb and toe for circulatory disorders, with catastrophic CC	4
M04	F14A	Complex or multiple vascular procedures without major vascular procedures with catastrophic CC	8
M04	F15Z	Percutaneous coronary angioplasty, with complicating constellation or complex diagnosis, age < 16 years	46
M04	F17A	Replacement of pacemaker, multiple-chamber system or age < 16 years	4
M04	F17B	Replacement of pacemaker, single-chamber system, age > 15 years	4
M04	F19A	Other percutaneous transluminal interventions on heart, aorta and lung vessels, with catastrophic CC	9
M04	F19C	Other percutaneous transluminal interventions on heart, aorta and lung vessels, without catastrophic CC	9
M04	F19D	Radio frequency ablation, age > 15 years	13
M04	F21A	Other OR procedures for circulatory disorders, with highly complex surgery	11
M04	F21B	Other OR procedures for circulatory disorders, without highly complex surgery, with complex surgery	33
M04	F21C	Other OR procedures for circulatory disorders, without highly complex or complex surgery, with certain surgery	116
M04	F24A	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, with catastrophic CC	52
M04	F24B	Percutaneous coronary angioplasty, with complex diagnosis and highly complex procedure, age >15 years, without catastrophic CC	123
M04	F27B	Miscellaneous prodedures for diabetes mellitus with complications, with catastrophic CC	8
M04	F27C	Miscellaneous prodedures for diabetes mellitus with complications, without catastrophic CC	4
M04	F28B	Amputation for circulatory disorders except upper limb and toes, with catastrophic or severe CC	9
M04	F36A	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > 1176/1380	8
M04	F36C	Complex intensive care treatment for circulatory diseases and disorders with complicating factors, score > -/828, without OR procedure	65
M04	F43A	Artificial respiration > 24h for circulatory diseases and disorders, age < 6 years	58
M04	F43B	Artificial respiration > 24h for circulatory diseases and disorders, age > 5 years	116
M04	F49A	Invasive cardiological diagnostics except for acute myocardial infarction, with catastrophic CC, with complex OR procedure	26
M04	F49B	Invasive cardiological diagnostics except for acute myocardial infarction, with catastrophic CC, without complex OR procedure	77
M04	F49D	Invasive cardiological diagnostics except for acute myocardial infarction, without catastrophic CC, age > 14 years, with cardial mapping	1,015
M04	F49E	Invasive cardiological diagnostics except for acute myocardial infarction, without catastrophic CC, age > 14 years, without cardial mapping, with complex diagnosis	3,391
M04	F49F	Invasive cardiological diagnostics except for acute myocardial infarction, without catastrophic CC, age > 14 years, without cardial mapping, without complex diagnosis	55
M04	F50B	Ablative measures for tacharrhythmia with complex ablation, without implantation of event recorder	4
M04	F52A	Percutaneous coronary angioplasty, with complex diagnosis, with catastrophic CC	111

Code	DRG	Description	Cases
M04	F52B	Percutaneous coronary angioplasty, with complex diagnosis, without catastrophic	725
M04	F56B	Percutaneous coronary angioplasty, without highly complex intervention, without catastrophic CC	15
M04	F58A	Percutaneous coronary angioplasty, with catastrophic CC	9
M04	F58B	Percutaneous coronary angioplasty, without catastrophic CC	60
M04	F59A	Moderately complex vascular procedures with catastrophic CC	51
M04	F59B	Moderately complex vascular procedures with complex surgery, with catastrophic CC, LOS > 1 day	12
M04	F59C	Moderately complex vascular procedures with other bilateral surgery, age > 15 years or LOS = 1	16
M04	F98B	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, with very complex procedure	36
M04	F98C	Complex minimally invasive cardiac valve procedures without highly complex procedure or complex diagnosis, age > 15 years, without very complex procedure	44

M05 Malignant neoplasm (medical)

The following ICD diagnosis codes were used to identify M05 admissions:

Code	ICD-10 code	Diagnosis
M05	C34.0	Malignant neoplasm of bronchus and lung - Main bronchus
M05	C34.1	Malignant neoplasm of bronchus and lung - Upper lobe, bronchus or lung
M05	C34.2	Malignant neoplasm of bronchus and lung - Middle lobe, bronchus or lung
M05	C34.3	Malignant neoplasm of bronchus and lung - Lower lobe, bronchus or lung
M05	C34.8	Malignant neoplasm of bronchus and lung - Overlapping lesion of bronchus and lung
M05	C34.9	Malignant neoplasm of bronchus and lung, unspecified

Exclusion criteria: OR procedure is performed and carcinoma in situ of bronchus and lung (D02.2).

Revision of DRG data reduced the number of cases considered from 27,338 to 18,858 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M05	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	8
M05	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	111
M05	902Z	Non-extensive OR procedure unrelated to primary diagnosis	5
M05	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	17
M05	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	16
M05	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	11
M05	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	17
M05	A13B	Artificial respiration > 95 h with very complex OR procedure	10
M05	A13D	Artificial respiration > 95 h with complex OR procedure	22
M05	E01A	Both-sided lobectomy, extended resection of the lung and other complex operations on the thorax with complex constellation, highly complex intervention or complex diagnosis	198

Code	DRG	Description	Cases
M05	E01B	Both-sided lobectomy, extended resection of the lung and other complex operations on the thorax, without complex constellation, without highly complex intervention, without complex diagnosis	584
M05	E02B	Other surgery on the respiratory organs, with complex intervention or catastrophic CC, age > 9 years	153
M05	E02C	Other surgery on the respiratory organs, without complex intervention or catastrophic CC, , age > 9 years	2,707
M05	E03Z	Brachytherapy or therapy with free nuclids of respiratory organs, > 1 day LOS	56
M05	E05A	Major surgery on the thorax, with interventions on thorax deformation or with catastrophic CC	490
M05	E05B	Major surgery on the thorax, without interventions on thorax deformation or with catastrophic CC	1,228
M05	E06A	Other lung resection, biopsy on thorarcic organs with catastrophic CC	122
M05	E06B	Other lung resection, biopsy on thorarcic organs without catastrophic CC, age < 16 years	30
M05	E06C	Other lung resection, biopsy on thorarcic organs without catastrophic CC, age > 15 years	449
M05	E08A	Radiation therapy for diseases of the respiratory organs with surgery or artificial respiration > 24 hours	11
M05	E08B	Radiation therapy for diseases of the respiratory organs without surgery or artificial respiration > 24 hours, more than 9 radiation sessions	741
M05	E08C	Radiation therapy for diseases of the respiratory organs without surgery or artificial respiration > 24 hours, less than 10 radiation sessions	1,478
M05	E36Z	Complex intensive care treatment, diseases of the respiratory organs	16

M06 Normal delivery (medical)

The following ICD diagnosis codes were used to identify M06 admissions:

Code	ICD-10 code	Diagnosis
M06	O80.0	Spontaneous vertex delivery
M06	O80.1	Spontaneous breech delivery
M06	O80.8	Other single spontaneous delivery
M06	O80.9	Single spontaneous delivery, unspecified

Exclusion criteria: OR procedure is performed.

Revision of DRG data reduced the number of cases considered from 16,934 to 16,705 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M06	O02B	Vaginal delivery with complicating interventional procedure, after 33rd week of pregnancy	229

M07 Pneumonia (medical)

The following ICD diagnosis codes were used to identify M07 admissions:

Code	ICD-10 code	Diagnosis
M07	J12.0	Adenoviral pneumonia
M07	J12.1	Respiratory syncytial virus pneumonia
M07	J12.2	Parainfluenza virus pneumonia
M07	J12.8	Other viral pneumonia
M07	J12.9	Viral pneumonia, unspecified
M07	J13	Pneumonia due to Streptococcus pneumoniae
M07	J14	Pneumonia due to Haemophilus influenzae
M07	J15.0	Pneumonia due to Klebsiella pneumoniae
M07	J15.1	Pneumonia due to Pseudomonas
M07	J15.2	Pneumonia due to staphylococcus
M07	J15.3	Pneumonia due to streptococcus, group B
M07	J15.4	Pneumonia due to other streptococci
M07	J15.5	Pneumonia due to Escherichia coli
M07	J15.6	Pneumonia due to other aerobic Gram-negative bacteria
M07	J15.7	Pneumonia due to Mycoplasma pneumoniae
M07	J15.8	Other bacterial pneumonia
M07	J15.9	Bacterial pneumonia, unspecified
M07	J16.0	Chlamydial pneumonia
M07	J16.8	Pneumonia due to other specified infectious organisms
M07	J18.0	Bronchopneumonia, unspecified
M07	J18.1	Lobar pneumonia,unspecified
M07	J18.2	Hypostatic pneumonia, unspecified
M07	J18.8	Other pneumonia,organism unspecified
M07	J18.9	Pneumonia, unspecified

Exclusion criteria: OR procedure is performed; Rheumatic pneumonia (I00); Pneumonia in diseases classified elsewhere (J17).

Revision of DRG data reduced the number of cases considered from 47,507 to 43,838 cases.

The following DRGs were excluded:

Code	DRG	Description	Cases
M07	901B	Extensive OR procedure unrelated to primary diagnosis with highly complex OR procedure	21
M07	901D	Extensive OR procedure unrelated to primary diagnosis without highly complex or complex OR procedure	178
M07	902Z	Non-extensive OR procedure unrelated to primary diagnosis	7
M07	A07C	Artificial respiration > 999 h or > 499 h with complex intensive care treatment, with complex OR procedure , without multiple trauma	20
M07	A09B	Artificial respiration > 499 h or > 249 h with highly complex OR procedure , with innate dysplasia or tumor, age < 3 years	12
M07	A09C	Artificial respiration > 499 h or > 249 h with complex intensive care treatment and complex OR procedure or multiple trauma	33
M07	A11B	Artificial respiration > 249 h or > 95 h with complex intensive care treatment, with highly complex OR procedure. Age < 2 years with innate dysplasia	15
M07	A11D	Artificial respiration > 249 h without complex OR procedure, without complex intensive care treatment, age > 15 years	74
M07	A11E	Artificial respiration > 249 h with complex OR procedure, without complex intensive care treatment	32
M07	A13D	Artificial respiration > 95 h with complex OR procedure	5

Code	DRG	Description	Cases
M07	A13E	Artificial respiration > 95 h without complex OR procedure, age < 16 years	79
M07	E02B	Other surgery on the respiratory organs, with complex intervention or catastrophic CC, age > 9 years	13
M07	E02C	Other surgery on the respiratory organs, without complex intervention or catastrophic CC, , age > 9 years	269
M07	E06A	Other lung resection, biopsy on thorarcic organs with catastrophic CC	5
M07	E06C	Other lung resection, biopsy on thorarcic organs without catastrophic CC, age > 15 years	18
M07	E08B	Radiation therapy for diseases of the respiratory organs without surgery or artificial respiration > 24 hours, more than 9 radiation sessions	9
M07	E08C	Radiation therapy for diseases of the respiratory organs without surgery or artificial respiration > 24 hours, less than 10 radiation sessions	58
M07	E36Z	Complex intensive care treatment, diseases of the respiratory organs	324
M07	E40B	Diseases and disorders of the respiratory organs with artificial respiration > 24h, LOS > 2 days, with complex procedure, with catastrophic CC, age > 15 years	298
M07	E40C	Diseases and disorders of the respiratory organs with artificial respiration > 24h, LOS > 2 days, with complex procedure, without catastrophic CC	490
M07	E60B	Zystic Fibrosis (Mucoviscidosis), age > 15 years	4
M07	E77G	Infections and inflammations of the respiratory organs without complex diagnosis, without catastrophic CC or LOS = 1 day, with para-/tetraplegia	436
M07	E77H	Infections and inflammations of the respiratory organs without complex diagnosis, without catastrophic CC or LOS = 1 day, age < 1 year	1,062
M07	P06A	Newborn, weight at admission > 2499 g with significant OR-procedure or artificial respiration > 95 hours with multiple severe problems, with artificial respiration > 120 hours	7
M07	P06C	Newborn, weight at admission > 2499 g with significant OR-procedure or artificial respiration > 95 hours without multiple severe problems, without multiple severe problems	4
M07	P67A	Newborn, weight at admission > 2499 g, without significant OR-procedure or artificial respiration > 95 hours, with multiple severe problems, with hypothermia	43
M07	P67B	Newborn, weight at admission > 2499 g, without significant OR-procedure or artificial respiration > 95 hours, with severe problem, without hypothermia treatment	69
M07	S63B	Infection and HIV-disease without complex diagnosis and without extremely severe CC	84

Appendix 2: Chi square test for observed and expected frequencies in the OECD sample for South Africa

Pearson chi2(26) = 110000			Pr = 0.000	
likelihood-ratio chi2(26) = 110000			Pr = 0.000	
			residuals	
Case type	observed	expected	classic	Pearson
M01	1,668	4,537	-2,869	-42.59
M02	9,581	6,178	3,403	43.29
M03	725	3,726	-3,001	-49.17
M04	8,344	18,602	-10,258	-75.21
M05	837	5,347	-4,510	-61.67
M06/S02	60,802	43,643	17,159	82.13
M07	51,783	20,120	31,663	223.22
S01	6,129	7,087	-958	-11.38
S03	6,674	10,831	-4,157	-39.94
S04	340	2,109	-1,769	-38.52
S05	490	1,201	-711	-20.52
S06	206	2,412	-2,206	-44.92
S07	145	1,067	-922	-28.22
S08	3,396	8,290	-4,894	-53.75
S09	7,353	6,532	821	10.16
S10	4,455	6,306	-1,851	-23.31
S11	961	1,556	-595	-15.08
S12	307	2,002	-1,695	-37.89
S13	418	7,527	-7,109	-81.94
S14	170	655	-485	-18.94
S15	3,531	9,305	-5,774	-59.85
S16	1,241	3,947	-2,706	-43.07
S17	875	3,729	-2,854	-46.74
S18	1,002	1,591	-589	-14.77
S19	13,058	8,185	4,873	53.86
S20	1,080	3,425	-2,345	-40.07
S21	10,362	6,022	4,340	55.93
Sum	195,933	195,933		

Note: Expected frequencies are calculated by multiplying the number of cases in the OECD sample for South Africa with the share of the respective case type in the OECD sample for the comparator countries.