

Applied Health Economics Sweden

**The experience of the DRG-reimbursement
system in the Stockholm county council**

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1. Introduction to the Swedish Health Care System

The Swedish health care system is organized on three levels: national, regional and local. The regional level, through the county councils, together with central government, forms the basis of the health care system. The county councils plan the development and organization of health care according to the needs of their residents. Their planning responsibility also includes health services supplied by other providers, such as private practitioners, clinics and physicians in occupational medicine. Still, private provision is small and make up around 10-15 % of all services (yet, higher in primary health care).

In 2008, Swedish health care expenditure was 9.5% of GDP. Health care expenditure expressed in US\$ PPP per capita was 2678 in 2008, slightly higher than the EU15 average. The Swedish health system has over a longer period been stable and sustainable in terms of cost containment and financing of services. The system is primarily funded through taxation. Both county councils and municipalities have the right to levy proportional income taxes on their respective populations. In addition to taxation revenue, financing of health care services is supplemented by state grants and user charges.

The Swedish health care system was built up and characterized by planning mechanisms and budget reimbursement. The development during the 1990s moved in the direction of planned markets within a publicly funded health system. A number of county councils introduced managed care systems in which specific purchaser functions were established and separated from the provider functions. By 1994, 14 out of 26 county councils had established separate purchasing functions. The organization and working methods of purchasers vary across county councils. Some have focused on promoting public health collaboration with social services and regional insurance offices, whereas others have focused on price and volume negotiations with different providers. Some county councils have introduced one large central council-purchasing organization, while others have introduced purchasing at the local level. The purchasing organizations negotiate with hospitals to establish financial and activity contracts. Almost all hospitals are owned and run by the county councils themselves. There is only one private for-profit acute hospital (in Stockholm). Private clinics exist for non-acute services as elective surgery. Most of them are run as for-profit units.

The contracts between the purchasers and the hospitals are often based on fixed per-case payments, complemented by price or volume ceilings and quality considerations. DRG is the most widespread case system used for reimbursement in short-term somatic care. The application of DRG and other classification systems varies between regions and county councils.

2. The DRG-system

The Diagnosis Related Groups (DRG) classification was originally developed in the U.S. for the product line management of hospitals. The classification was based on the resource use but was first considered for analysis of utilization review and quality assurance. The construction of the system should also meet the objective of clinical coherence. The data required for the construction of the DRGs came from hospital inpatient data where the DRG groups were based on principal diagnosis, comorbidities, surgical procedures, age, sex and discharge status in order to obtain homogenous resource groups. In hospital management systems based on DRG resource consumption was calculated for each DRG group, reflecting average treatment costs in that group (Fetter & Freeman 1986). Applications of DRG tend to vary between countries and hospital care systems (Palmer 1991). DRG has been applied to health care resource allocation, hospital pricing, management, quality control and productivity research. Growing health care expenditures and the move to more efficient hospital production in most countries have been the driving forces behind adoption of the DRG system. Accordingly, the main focus of DRG use has been in resource allocation and as a payment mechanism for inpatient care (Fetter 1992).

Since the 1980s DRG based financing has been applied in the US Medicare system as a hospital pricing system, while in Canada, Australia and some West European countries DRG is used for resource allocation (Kimberly & de Pourville 1993, Mossialos & Grand 1999). The effects of DRG based hospital pricing have been studied widely especially in the USA, and several technical and incentive problems have emerged. Although average length of stay and thus health care costs in the Medicare system initially decreased due to DRG based

pricing, several negative impacts, such as DRG-creep, patient selection and early discharges, have been noted.

During the 1990s, DRG-based hospital financing systems were introduced in the Nordic countries, particularly in Sweden, Norway and Finland. The earliest Nordic DRG applications employed various US DRG classifications adapted to local hospital information systems by the use of special tables for converting the Nordic diagnosis and procedure codes to those in the clinical modification of the 9th revision of the International Classification of Diseases (ICD-9-CM) applied in the USA. In the mid-1990s, the Nordic countries launched a modified DRG system based on the Nordic version of the ICD-10 and a new Nordic classification of surgical procedures introduced in 1996. The current version of the NordDRG applies the Nordic diagnosis and procedure codes but imitates the DRG classification rules in the 12th edition of the DRG classification issued by the US Health Care Financing Administration (HCFA) in 1994. In Sweden, Norway and Finland, where the financing and ownership of hospitals are public, the aim of using DRG based financing is to improve the control of hospital production, increase efficiency and make the reimbursement more transparent.

3. DRG as a reimbursement system in the Stockholm County Council

The decision how to reimburse providers rests with the county councils in Sweden. The use of DRG a payment method has increased during the last 20 years. Today, over 65 per cent of all discharges from Swedish acute somatic care are reimbursed by the NordDRGs as the major payment component. Until the early 1990s the hospitals in the Stockholm County Council (SCC) were reimbursed via a global budgeting. The system was considered as an appropriation-based compensation (Hakansson et al. 1988).

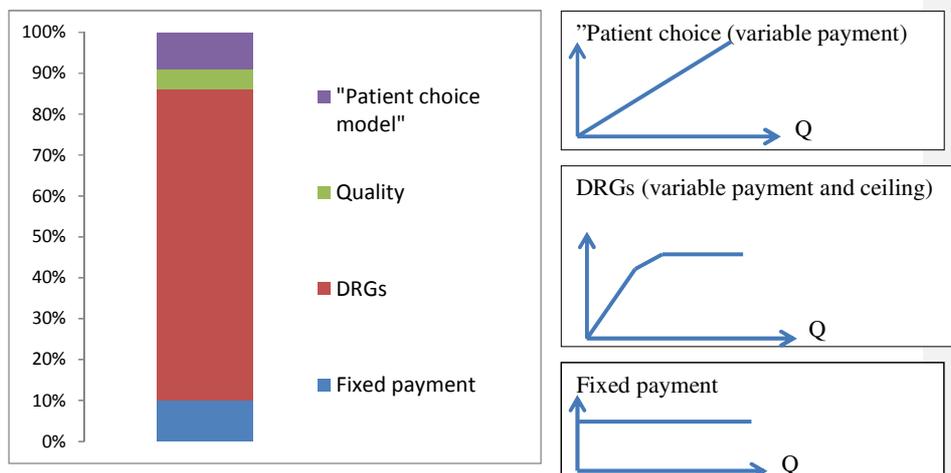
The SCC was one of the first county councils to introduce DRG as a payment system. The first application of the DRG-system in the county council took place in 1992, when a per-case payment system was introduced within a purchaser-provider split model with a single payer. The model replaced the long-term tradition of allocating resources based on global budgets

that were negotiated and in many cases relied on the historical costs with little relation to the produced volume. The new model included several purchasers with responsibility of buying health services for a specified geographical area. Still, the use of the DRG as a prospective payment system was centrally managed. Hence, the prices were decided centrally, but the purchasers could negotiate the volume for their respective geographical areas. The initial use of the DRG-system as a reimbursement tool was limited to four surgical specialties (general surgery, orthopedics, urology and gynecology) within the SCC. The reimbursement system was expanded to cover all somatic care during the 1990s. In 1997 the so-called NordDRG system was implemented and the reimbursement system then covered most of the acute somatic services (Lindqvist 2008).

The first reimbursement model didn't include any ceiling or production limits. Hence, the initial experience in the mid-1990s showed dramatic increases of both volume and productivity. As a consequence the purchasers unit showed large deficits as the cost for delivered services didn't match the tax revenues. It became obvious that the system gave strong incentives for admitting patients, but without a cost containment mechanism. During the late 1990s a complex system with different production limits and rebates was developed for each hospital. Hospitals that exceeded the limit were punished by a reduced reimbursement rate at the margin. Later on a ceiling for each hospital was introduced for each hospital. The cost containment mechanisms and the DRG-system combined the incentives to increase admission but also put a cap on the total hospital costs.

The present DRG cost weights in the SCC are based on the cost accounting ("cost-per-patient") from four acute hospitals, together covering 203,000 admissions. This accounts for around 75 per cent of all in-patient care. The present reimbursement in SCC is not based on the DRGs solely, but includes a fixed payment, payment per performance and payment based on patient choice. Figure 1 summarizes the present reimbursement for the acute hospitals.

Figure 1. The principles for reimbursement of acute somatic hospitals in the Stockholm county council- year 2010.



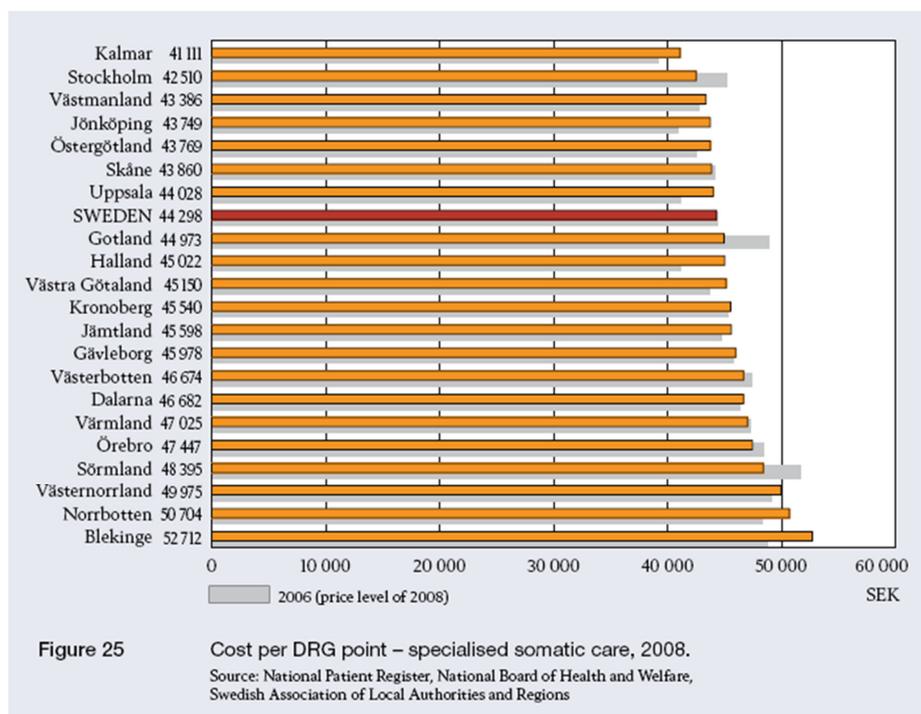
The fixed payment is supposed to cover extra costs for extreme cases as the DRG-system doesn't compensate for all difference in case-mix. To a large extent the outlier reimbursement compensate hospitals with severe cases, but for some DRGs there are extra payments negotiated between the purchaser and the hospitals. The fixed payment also covers extra costs for services that are not captured by the DRG reimbursement. This includes the variations across hospitals for providing services like call-on-duty, education activities, training of new doctors and supervision of medical students. It also considers differences in rents of buildings and facilities and special assignments. In general, the university hospitals receive a larger share of their revenues as fixed payments than other hospitals.

The payment per performance is a type of payment for quality achievements. This component is rather new and so far the system has paid extra to providers that report quality indicators of defined targets. These targets could be clinical indicators, but also measures of accessibility and patient satisfaction. The next step is to introduce payment according to the achievement of certain quality indicators. The patient choice payment is a variable payment with no ceiling for defined treatment in mainly elective surgery, where long waiting-lists has been a problem. The patient choice system was established in year 2008 and covered during this period (2008-2010) three main areas: hip- and knee plastic surgery, cataract surgery and specialized rehabilitation. All three specialties has experienced long waiting list for many years and the

present system is part of an effort to improve accessibility and reduce the waiting time. As all three specialties are providing elective treatment, also private hospitals and clinics are encouraged to compete with the acute short-term hospitals. The initial experience show drastic reduction of waiting lists and establishment of new private providers, but also an increase in total costs for the three specialties.

There is no national “price” per DRG in Sweden, but each county council set their own DRG prices. Still, the National Board of Health and Welfare (NBHW) develop and publish national prospective weights for DRGs as reference costs weights. The NBHW also publish reports of the productivity per county council where the DRG is used as a measure of output (figure 2).

Figure 2. Cost per DRG point – specialized somatic care, 2008.



The productivity measure applies the national weights and includes all DRGs in somatic care, which are related to the total costs for somatic care. As shown in the table the SCC is the second most efficient county council by this measure. The figure illustrates how the DRG system could be used for productivity measures and benchmarking.

4. Data and Method

The dataset is retrieved from the patient-register in the Stockholm County Council covering a population of 1.9 million inhabitants. The dataset comprise of the 40 largest DRGs for all in-patients above the age of 17 years old, which covers around 50% of all admissions in the county council. The data covers all acute hospitals in the county council during the period 2000-2010. The definition of an acute hospital is that it offers 24-hour emergency service including obstetric wards. In Stockholm there are two university hospitals (Karolinska and Huddinge), three larger acute hospitals (Danderyd, S:t Görän and Södersjukhuset) and two smaller acute hospitals (Norrälje and Södertälje). All hospitals are owned and run by the county council, apart from S:t Görän which is a private for-profit hospital.

In the dataset the following variables were retrieved:

- Average length of stay (ALOS)
- The DRG number
- The DRG weight
- Hospital were patient was treated/admitted
- DRGcosts
- TOTALcosts

The DRG weights are based on the resource use for a large sample of patients from four hospitals in the SCC. These resources are allocated to individual patients through case-costing system where most direct inputs and items are assigned to an individual patient. Indirect costs as administration, buildings, equipment etc. are allocated through different keys and ratio indicators.

The costs are then the product of the DRG weight and a uniform price that is updated yearly. There are two types of costs calculated with different contents. The DRGcosts refer to all in-patient services as hotel costs, physician and nurse inputs, services from anesthesia, X-ray and ancillary services, but exclude use of intensive care unit and all costs borne by outliers. The TOTALcosts includes all costs in the DRGcosts but also all costs for intensive care units and all costs borne by outliers. Hence, for all cases the DRGcosts is below the TOTALcosts.

5. Results

The result section is divided into four parts. The first section shows the development for the top 10 DRGs during the period of 2000-2010. In the second section some special findings about the large DRGs is presented. Then follow a comparison between hospitals and a comparison between diseases.

5.1 The top 10 DRGs

There is a concentration of episodes in a few numbers of DRGs. The 40 most common DRGs account for about 50 % of all episodes in the acute hospitals. The top ten DRGs amount for about 25 % of all cases. In table 1 the volume of top ten DRGs from year 2000 are presented for the years 2000 and 2010 together with the average figure for a ten year period.

Table 1. No. of admissions, top 10 DRGs (year 2000), year 2000, average 2000-2010, and 2010				
		2000	2000-2010 (average)	2010
	Top 10 drg år 2000			
1	373 Vaginal delivery w/o complicating diagnose	13657	14367	17534
2	183 Esophagitis, gastroent & misc digest disor	7272	6502	7316
3	014 Specific cerebrovascular disorders except	4755	4827	5206
4	127 Hearth failure & shock	4683	4447	4795
5	140 Angina pectoris	4434	2578	1448
6	143 Chest pain	4214	5195	6120
7	139 Cardiac arrythmia & conduction disorders w	3395	3187	3379
8	209 Major joint & limb reattachment procedures	3340	4651	6074
9	372 Vaginal delivery w complicating diagnoses	3215	4011	5463
10	371 Cesarean section w/o cc	2280	3172	3803

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The most common DRGs are found in specialties as gynecology/obstetrics, cardiovascular and cerebrovascular diseases. The different procedures for childbirths are constantly showing a large proportion of cases and the trend naturally follows the rate of child-births. An increase could be observed for cerebrovascular disorders (DRG014 includes most cases of stroke) and joint reattachment procedures (DRG209) in orthopedics. The increase in admission is also due to the population growth where the Stockholm County shows a yearly increase of the population with around 30,000 inhabitants. The increase of volumes is also due to the demographic development of more elderly. The percentage of persons above 70 years old has increased during a long period. The consumption of DRG-points per person increases dramatically with age in somatic in-patient care. The average DRG-points per person is 0.142 per year, whereas the rates for people at age 75-84 and above 85 are 0.540 and 0.790 respectively.

In addition the existence of waiting lists for some procedures and the incentives of the DRG-system for admitting more patients have encouraged a higher intake of patients. The waiting list situation has been a problem of the public provision in the Swedish system for a long period. The change from the former budget-system to DRG-reimbursement aimed at giving incentives for admitting patients and reducing the waiting time. The statistics of waiting list has been poor but improved from year 2006. The best measure is "the share of patients receiving treatment for somatic care within 90 days". In the Stockholm county council this figure has increased from 70% in year 2006 to 81% in year 2010. The corresponding figure for the average in Sweden is 66% and 87%, respectively.

Table 2 shows the development of the average length of stay (ALOS) and the DRG weights for the same top ten DRGs.

Table 2. Length of stay and DRG-weights, top 10 DRGs (year 2000), year 2000, average 2000-2010, and 2010

Top 10 drg year 2000	Average length of stay			DRG-weights		
	2000	2000-2010 (average)	2010	2000	2000-2010 (average)	2010
1 373 Vaginal delivery w/o complicating diag	2,68	2,26	2,14	0,56	0,58	0,56
2 183 Esophagitis, gastroent & misc digest c	2,45	2,26	2,09	0,41	0,45	0,45
3 014 Specific cerebrovascular disorders ex	6,34	6,36	6,16	1,23	1,22	1,13
4 127 Hearth failure & shock	4,64	4,44	4,73	0,82	0,77	0,74
5 140 Angina pectoris	2,52	1,76	1,79	0,68	0,46	0,41
6 143 Chest pain	1,35	1,14	1,05	0,35	0,33	0,34
7 139 Cardiac arrythmia & conduction disorc	1,27	1,42	1,47	0,35	0,34	0,38
8 209 Major joint & limb reattachment procer	6,83	5,83	4,77	2,2	2,09	1,83
9 372 Vaginal delivery w complicating diagnr	4,21	3,51	3,18	1,02	0,93	0,84
10 371 Cesarean section w/o cc	5,01	3,90	3,27	1,36	1,20	1,07

Of the top ten DRGs, the cerebrovascular disorders (DRG014) and major joint reattachment (DRG209) show the highest ALOS and also high DRG-weights. Also Cesarean section (DRG 371) with somewhat lower ALOS shows high weights. We can also notice a declining ALOS for most DRGs, whereas the DRG-weights show a slower decline. There is some correlation between the weights and the LOS, although there are examples of DRGs where this relationship does not exist. One reason for this is the development of more intensive treatment of patients during fewer days of an episode. Still, the DRGs with the largest decline in ALOS also show the largest decrease in DRG-weights (DRG 209, 372 and 371). There is also a link between shorter length-of-stay and an increase in admission. This relationship cannot be observed for weights and admissions.

The shorter length of stay has been discussed in terms of the risk of overcrowding that threatens patient safety. The reduction of hospitals beds has strengthening this development. Most analysis of this trend shows positive signs as more treatments done in ambulatory care settings, less infections of patients etc. Still, a special problem concerns the multiple illnesses among older patients, who need access to institutional care outside hospitals after being discharge.

The DRG weights are the basis for the reimbursement to the hospitals, named DRG-costs or TOTAL-costs. The costs are the product of the weights and a DRG price that is revised yearly. In table 3 the costs for the top ten DRGs are shown.

Table 3. DRG-costs and total costs per DRG, top 10 DRGs (year 2000), year 2000, average 2000-2010, and 2010

Top 10 drg year 2000	DRG costs			Total costs		
	2000	2000-2010 (average)	2010	2000	2000-2010 (average)	2010
	1 373 Vaginal delivery w/o complicating diagnos	12093	17358	21277	12248	18022
2 183 Esophagitis, gastroent & misc digest disor	8898	13547	17288	9715	15092	19153
3 014 Specific cerebrovascular disorders except	26587	36356	42947	27992	41300	48214
4 127 Hearth failure & shock	17656	23171	28114	18931	26906	34088
5 140 Angina pectoris	14703	13041	15644	15289	14067	16981
6 143 Chest pain	7622	10122	12967	7938	10610	13868
7 139 Cardiac arrythmia & conduction disorders	7582	10553	14470	7892	11732	16368
8 209 Major joint & limb reattachment procedure	47450	61516	69745	48954	63276	72049
9 372 Vaginal delivery w complicating diagnoses:	22130	27558	32058	22474	29154	33634
10 371 Cesarean section w/o cc	29422	35295	40785	29667	36344	41615

Both types of costs are given in running prices. The overall pattern shows that the cost has gone up, which is natural giving the inflation in society and the health care sector. The so-called Total-costs show constantly a higher level as it also includes special inputs as well as intensive care, but also all the costs of all outliers. The total costs has also increased more compared with the DRG-costs which could be interpreted as costs for intensive care, outliers etc. has increased at a higher costs or that the volume of inputs for these cases have increased. Table 4 below shows the changes between the years 2000 and 2010 in fixed prices.

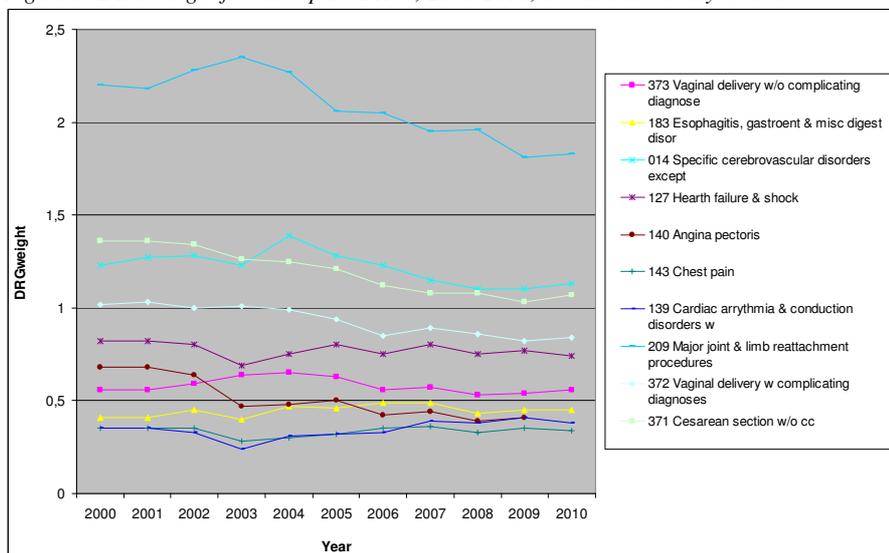
Table 4. DRG-costs and total costs per DRG (see tabel 3), fixed prices.

	DRG costs	DRG costs			Total costs		
		2000	2010	% change	2000	2010	% change
1 373 Vaginal delivery w/o compl	12093	15325	27%	12248	15812	29%	
2 183 Esophagitis, gastroent & r	8898	12452	40%	9715	13794	42%	
3 014 Specific cerebrovascular d	26587	30932	16%	27992	34725	24%	
4 127 Hearth failure & shock	17656	20248	15%	18931	24551	30%	
5 140 Angina pectoris	14703	11267	-23%	15289	12230	-20%	
6 143 Chest pain	7622	9339	23%	7938	9988	26%	
7 139 Cardiac arrythmia & condu	7582	10422	37%	7892	11789	49%	
8 209 Major joint & limb reattachi	47450	50232	6%	48954	51892	6%	
9 372 Vaginal delivery w complic	22130	23089	4%	22474	24225	8%	

As shown in the table most DRG costs show an increase in fixed prices, although there are large variations between the DRGs. The changes could also be explained by changes of patients between DRGs.

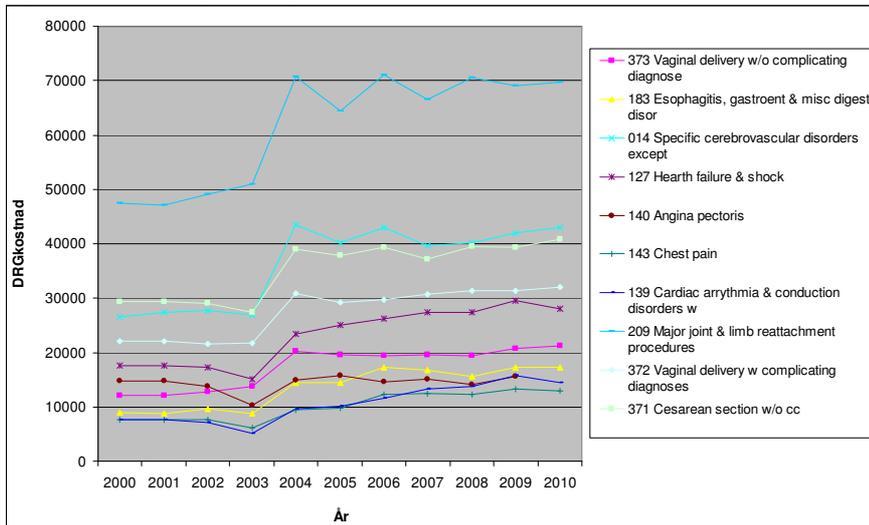
Hence, the cost measures are a function of the DRG-weights (reflecting case-mix and relative resource use) and a yearly set base price (reflecting the cost inflation in health care). In figure 3 the DRG weight for the most frequent DRGs is presented

Figure 3. DRG weight for the top 10 DRGs, 2000-2010, Stockholm County Council.



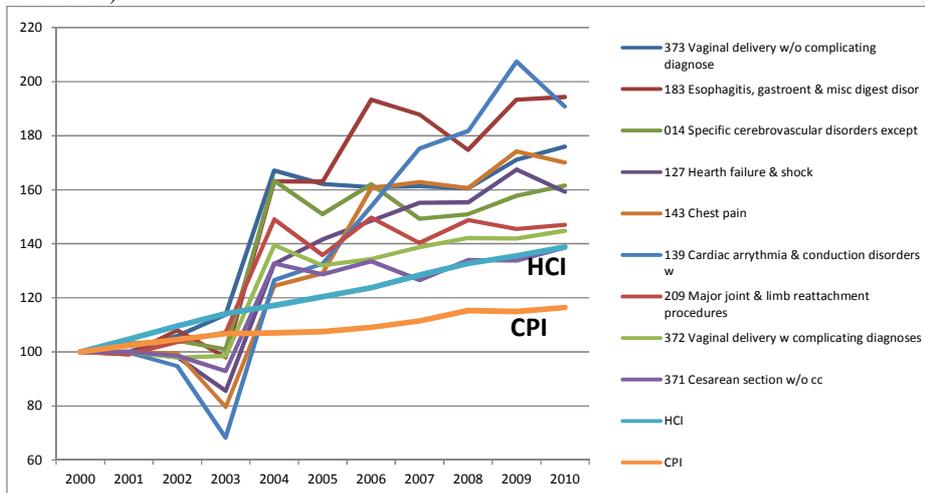
As shown in the figure most of the top 10 DRGs have experienced a decrease in the weights. This could be due to reduced length of stay, but also because on the introduction of cost-savings treatment per case. Several of the DRGs with large volume are characterized as established treatments and procedures that has been standardized and “streamlined”. The incentives giving by the DRG system and to some extent the competition between the hospitals has strengthening this development towards shorter length of stay. We could also observe increases for the DRG 183 and 139, which could be explained by more resource intensive treatment. The development for the DRG costs during the entire period is shown in figure 4.

Figure 4. DRG costs for the top 10 DRGs, 2000-2010, Stockholm county council.



As shown in the figure there is a clear pattern of increase costs all the top ten DRGs. However, as these costs are not adjusted for the cost inflation a comparison with the overall price indices shows if the reimbursement is compensated for price changes of salaries and prices for other inputs (figure 5).

Figure 5. Index for the DRG costs, Health care index and Consumer price index (Sweden 2000-2010).

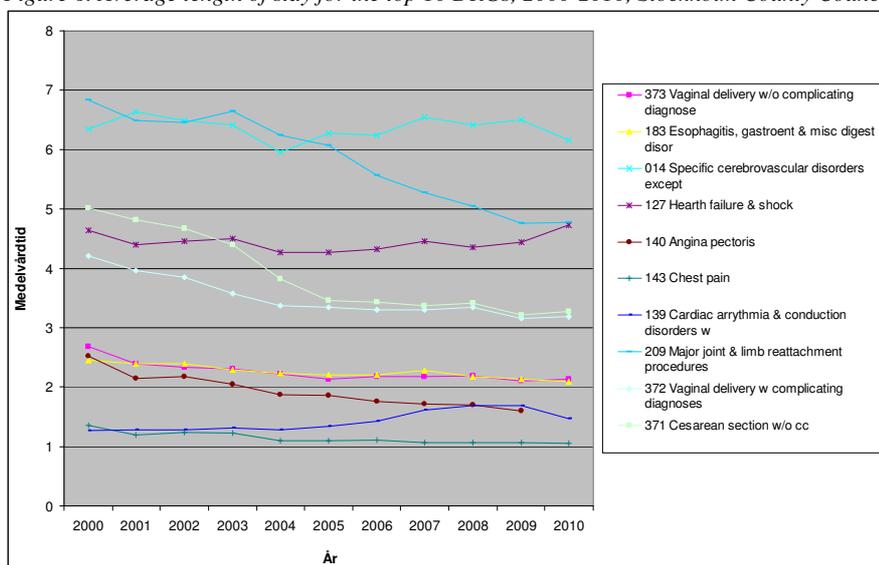


The changes of the DRG costs are a function of price adjustment, the DRG-weights and changes of technology. The total cost for somatic care has also increased at a higher level than other sub-sectors in health care. During the ten year period the DRG costs per patient for all ten DRGs have increased well over the general cost inflation (PCI) and the health care cost inflation (HCI). The changes of prices don't follow a continuous pattern, but has been rather unsteady, although with an increasing trend. The prices were not set by a market, but the purchasing unit of the county council could use its monopsony power to administrative prices. Obviously there was no price compensation during the first part of the period. During this period several hospitals experienced large deficit. Especially the university hospitals reported deficits that later was covered by extra payments from the county councils as owner. This process sidelined the intention of the reimbursement system and could be considered as an example of "soft-budget constraints". The concept refers to a phenomenon in the public sector when the strict relationship between expenditure and revenues has been relaxed because excess of expenditure over earnings will be paid by some other institution typically by a government agency. According to representatives from both the hospitals and the purchaser this was a problem in the beginning of the period (2000-2005). Both sides also agree on that the reimbursement did not compensate the university hospitals for their duties in research and teaching.

Another problem has been the rather dramatic changes between the years that some hospitals experienced for some DRGs. This caused a volatile pattern on the revenue side. In order to stabilize the revenues a three-year contract has been introduced since year 2009. The private hospital (S:t Göran has a longer contract until year 2012).

Changes of the length of stay could have an impact of the reimbursement, but not necessarily. In-patient care has shown a downward trend during the last twenty years in Sweden. Figure 6 shows the development of the length of stay for the DRGs.

Figure 6. Average length of stay for the top 10 DRGs, 2000-2010, Stockholm County Council.



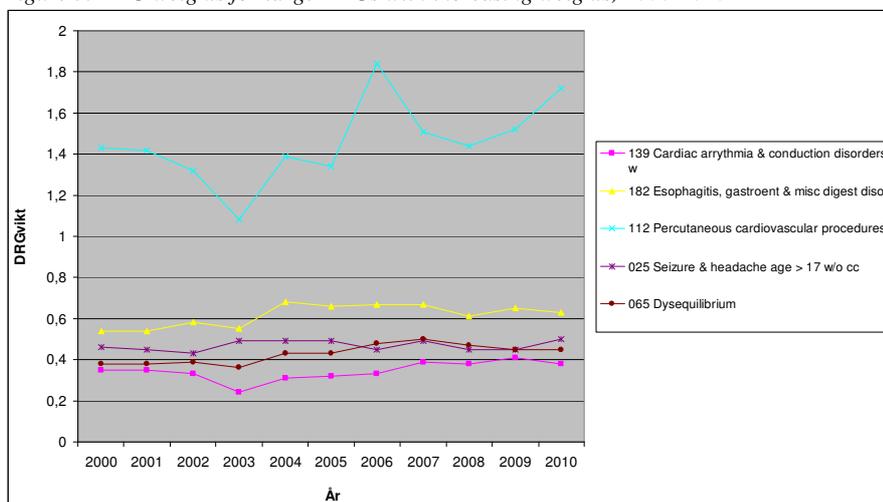
Most DRGs show the downward trend, although there are exceptions. All DRGs in obstetrics show a clear reduction in the length of stay. The various patterns for cardiovascular diseases could be explained by transfers of patients across different DRGs.

Overall the hospitals have been faced with a reduction of the DRG-weights. Their response has been to increase the number of admission, which has been possible due to the presence of waiting-lists. As the bed-capacity has been controlled by the public owner, a change towards shorter length-of-stay has been implemented. This is also due to the technology change towards more day-care service and day-care surgery. This development has been encouraged and contributed higher efficiency within the same capacity.

5.2 The development of DRG weights for some DRGs

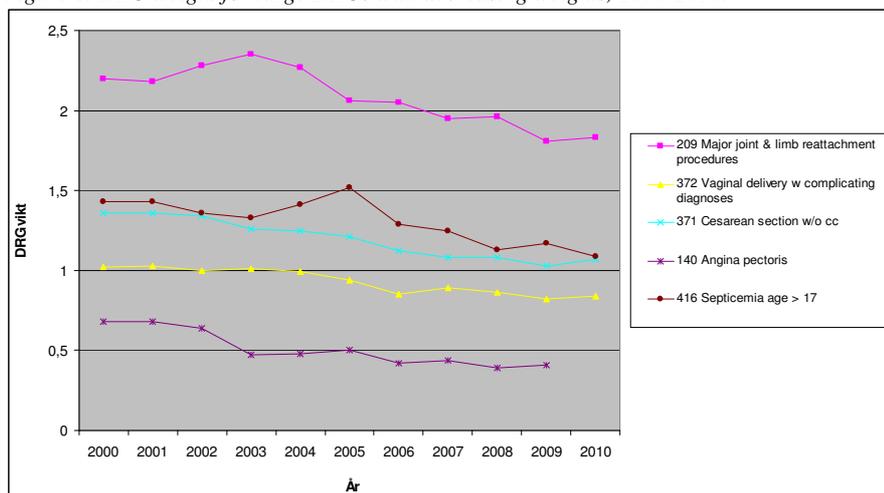
For most DRGs the development shows decreasing weights indicating that most procedures are delivered with less intensive use of resources. This could be explained by a shorter length of stay for patients, but also more efficient use of ancillary services and medical equipment. For patients in some DRGs there is a change of treatment from in-patient care to day-care surgery and other day treatments. Still, the development differs between DRGs where some show a slower pattern, but some also show increasing weights. This could be due to diffusion of new technologies and procedures that increases the use of resources for a patient group. Figure 7 includes the large DRGs showing an increasing weight.

Figure 7. DRG weights for large DRGs with increasing weights, 2000-2010



As shown in the table DRG 112 (percutaneous cardiovascular procedures) show the highest increase. This could be explained new innovations and/or that the patients in the DRG have become older or more severe. Figure 8 shows the other spectrum of DRGs which experienced lower weights during the period.

Figure 8. DRG weight for large DRGs with decreasing weights, 2000-2010.



According to the figure the procedures for birth delivery (DRG 371 and 372) and major joint reattachment (DRG 209) show the largest decreases. This development could also be linked to changes of procedures requiring shorter length of stay and more efficient use of resources. Another reason for the changes in weights is the transfer of certain patients across DRGs which for example could occur when a surgical procedure is replaced by medical and pharmaceutical treatment. Hence, it is difficult, and sometimes misleading, to only look at the DRG-weights and costs to judge the improvement of resource use over time, as the patients in each DRGs is not necessarily the same across the years.

5.3 Development per hospital and disease

As described in the previous section the reimbursement system has been adjusted to the hospitals cost structure and the differences in case-mix and commitments in teaching and research. A revision of the cost structure lead to special reimbursement for the university hospitals, but also some other units with special commitments that was not included in the DRG payment. Even if attempts has been made to give all the hospitals equal reimbursement per treatment but this goal – stressing competition on equal terms – resulted in big deficits for a number of hospitals. In response, the purchaser in the county councils decided to accept paying some hospitals a little more and some a little less than the standard rate. The hospitals had to accept most of the rules regarding tariffs and regulations set by the purchasers which exercised a monopsony power. The county council could also exercise their mandate as owner of all the hospitals except from one private (S:t Göran). Still, the problems of deficit needed to be solved.

The tables below illustrate this problem and gives example of volumes, weights and reimbursement within the specialties of orthopedics, obstetrics and for the case of sepsis. Table 5 shows the differences for major limp and hip procedures.

Table 5. Admissions, DRG weights, DRG costs, ALOS, year 2000 and 2010

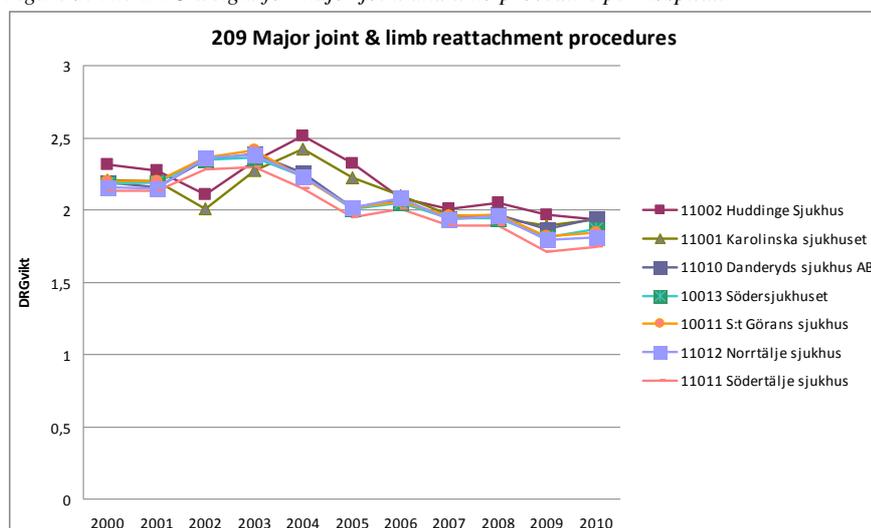
Major limp and hip/femur procedures (DRG 209 and 210)

HOSPITAL	Admissions		DRG weights		DRG costs		Total costs		ALOS	
	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
University hospitals										
Karolinska sjukhuset	512	676	2,02	1,75	43590	66417	48331	79622	8,04	6,44
Huddinge Sjukhus	353	527	2,07	1,75	44717	66645	46298	80345	7,41	7,02
Larger hospitals										
Danderyds sjukhus AB	1001	1206	2,01	1,75	43415	66615	45102	73366	7,58	5,58
Södersjukhuset	1439	1734	2,01	1,72	43302	65286	44339	71088	6,73	5,85
S:t Görans sjukhus	1130	1510	2,02	1,70	43563	64683	43876	64683	7,18	5,12
Smaller hospital										
Södertälje sjukhus	268	353	1,98	1,65	42722	62781	42799	62781	7,07	5,24
Norrtälje sjukhus	246	341	2,00	1,69	43107	64096	44216	64251	5,45	5,43

The major limp and hip procedures is a standardized treatment mainly taking place at the larger non-university hospitals. The weights have decreased generally but do also differ somewhat between the hospitals. The DRG costs is rather similar across the hospitals, whereas the total costs show larger differences. The variation in Total costs indicates that the university hospitals and some of the larger hospitals have a more severe case-mix which requires more intensive care and other services. Another cause could be a higher rate of outliers. The figures for average length of stay support the differences in case-mix.

During some years the purchasing unit set different weight for the same DRG at different hospitals in order to compensate for differences in structural costs. More recently these differences has been handled through specified compensation and joint DRG weights and price has been applied. In figure 9 the development the DRG weight is presented for DRG 209.

Figure 9. The DRG weight for major joint and limb procedure per hospital.



As shown in the figure a diminishing difference between the hospitals could be observed at the end of the period. The more advanced hospitals then got extra reimbursement through fixed payment where costs for teaching and research are considered. These hospitals also receive extra payments for cost and day outliers. In order to get the outlier payment the hospital is required to give evidence why and how the patient differed from the standard case in the specific DRG. In table 6 the differences across hospitals for the most frequent DRGs in obstetrics are shown.

Table 6. Admissions, DRG weights, DRG costs, ALOS, year 2000 and 2010

Ceasarian section and vaginal delivery (DRG 370-373)

HOSPITAL	Admissions		DRG weights		DRG costs		Total costs		ALOS	
	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
University hospitals										
Karolinska sjukhuset	4440	4855	1,20	0,96	25954	36336	26428	40241	4,66	3,48
Huddinge Sjukhus	3637	4633	1,20	0,95	25954	36335	26497	38888	4,21	3,34
Larger hospitals										
Danderyds sjukhus AB	5288	10191	1,20	0,96	25954	36335	26860	37522	5,24	3,17
Södersjukhuset	5326	7498	1,20	0,96	25954	36335	26154	39042	4,35	3,63
Smaller hospital										
Södertälje sjukhus	1649	1782	1,20	0,96	25954	36335	26229	36335	4,68	2,92

As shown in the table the DRGs in obstetrics are given the same DRG weights and the DRG costs as the reimbursement is the same for all hospitals. Hence, the resource use is rather homogenous for those DRGs. Still, the figures regarding the Total costs and the ALOS differ somewhat indicating that university hospitals take care of the most severe patients. In table 7 the figures per hospital is given for DRG 416 (septicemia).

Table 7. Admissions, DRG weights, DRG costs, ALOS, year 2000 and 2010

Septicemia, age > 17 (DRG 416)

HOSPITAL	Admissions		DRG weights		DRG costs		Total costs		ALOS	
	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
University hospitals										
Karolinska sjukhuset	309	528	1,43	1,09	30863	41355	39526	72456	7,94	6,92
Huddinge Sjukhus	362	527	1,43	1,09	30977	41359	39696	69047	9,52	7,67
Larger hospitals										
Danderyds sjukhus AB	220	464	1,42	1,09	30751	41347	35644	48016	8,65	5,85
Södersjukhuset	202	519	1,44	1,09	31110	41347	36065	58723	7,18	6,77
S:t Görans sjukhus	115	430	1,42	1,09	30633	41361	40700	41390	7,63	6,68
Smaller hospitals										
Södertälje sjukhus	59	78	1,42	1,09	30663	41347	32089	41347	7,19	5,82
Norrälje sjukhus	30	63	1,42	1,09	30601	41347	31415	41347	7,60	6,02

Patients in DRG 416 are mainly treated in university or larger hospitals. The DRG weights and the DRG costs are the across the hospitals whereas the Total costs show large differences. This indicates that the more severe patients at university hospitals require more intensive care and include more outliers. Since the revision of the fixed payments and extra reimbursement to university hospitals the problems of deficit has almost disappeared.

6. Conclusion and discussions

The DRG systems were introduced in the mid-1990s in the Stockholm County Council to give incentives for greater efficiency in the use of resources invested in acute hospitals. Problems with long waiting lists and low efficiency due to lack of incentives in a budget and salary-based reimbursement system was a major reason for introducing the system. The new compensation system replaced the allocation of resources by means of central or global budgets. Hospitals were instead paid according to what they really delivered, not according to what they were supposed to produce or how much resource were spent.

After almost 20 years of experience with using DRGs in Stockholm, the system has been developed and settled. After a careful introduction where the system was tested for four specialties in two hospitals, the system is widely accepted and generally seen as a reasonable way of reimbursing acute hospitals.

The reform had several important outcomes. The mentality of hospital managers changed dramatically. By providing a new way of planning and paying for additional care, the DRG system broke up traditional bureaucratic behaviors.

The effect on the productivity showed that in the first year of the new reimbursement system, the average productivity in Stockholm hospitals grew by 19 percent, and some hospitals improved by as much as 30 percent.

A better transparency and more accurate information is another improvement due to the DRG-system. The basis for negotiation and development of weights and prices between purchasers and providers has been improvement as access to accurate information on costs and outputs has been available. The improvement of information and transparency of services provided by hospitals has also lead to a more fair competition and comparison of hospitals' efficiency.

However, available **data are still insufficient** to answer the question of whether changes in **quality and overall efficiency** of the hospital sector can be attributed to the introduction of DRG-type hospital payment. Further development is required for the impact on quality and efficiency. Other problems concerning the DRG system is the behavior of providers as the focus on **'profitable' DRGs**, increased registration of secondary diagnosis etc. in order to get a higher reimbursement (Serdén et al. 2003). It is also important to update the system with changes of technologies and medical practice. One should also noticed that the purchaser-provider split system in the SCC is mainly a "quasi-market" with the same owner on both sides. Still, the system has created some competition between public hospitals and they are also challenged by private providers.

Comparison of county councils in Sweden with and without internal market mechanisms show that systems based on purchaser-provider split and prospective payments had higher productivity than those counties relying on the traditional budget system (Gerdtham et al. 1999). When combining with a market environment, with a greater number of dispersed providers, it encouraged providers to seek and adopt better, more efficient practices.

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APPENDICES. List of DRGs.

Top 20 DRG (average 2000-2010)	Volume (admission)	DRG weight	DRG costs	Tot costs	ALOS
373 Vaginal delivery w/o complicating diagnose	14367	0,58	17357,99	18021,94	2,26
183 Esophagitis, gastroent & misc digest disor	6502	0,45	13547,33	15092,37	2,26
143 Chest pain	5195	0,33	10121,84	10610,26	1,14
014 Specific cerebrovascular disorders except	4827	1,22	36355,80	41299,78	6,36
209 Major joint & limb reattachment procedures	4651	2,09	61515,97	63275,79	5,83
127 Hearth failure & shock	4447	0,77	23171,24	26906,13	4,44
372 Vaginal delivery w complicating diagnoses	4011	0,93	27558,14	29153,79	3,51
139 Cardiac arrythmia & conduction disorders w	3187	0,34	10552,89	11731,64	1,42
371 Cesarean section w/o cc	3172	1,20	35295,48	36343,61	3,90
112 Percutaneous cardiovascular procedures	2758	1,46	44690,91	65873,89	3,07
182 Esophagitis, gastroent & misc digest disor	2689	0,62	18826,77	22298,51	3,66
140 Angina pectoris	2578	0,46	13040,65	14066,56	1,76
089 Simple pneumonia & pleurisy, age > 17 w cc	2429	0,95	28445,47	34032,69	5,55
125 Circulatory disorders except ami, w card c	2293	0,64	19126,26	21990,90	1,55
088 Chronic obstructive pulmonary disease	2216	0,66	19734,70	23267,96	3,85
025 Seizure & headache age > 17 w/o cc	2193	0,47	14135,53	17857,76	1,93
210 Hip & femur procedures except major joint,	2090	1,64	48622,28	51998,21	6,29
065 Dysequilibrium	2072	0,43	13116,30	14381,13	1,95
416 Septicemia age > 17	2005	1,31	38852,26	51482,52	7,20
359 Uterine & adnexa proc for ovarian or adnex	1962	1,06	31498,22	31928,28	2,79