Health Basket Project: WP 9

Germany

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Contents

1. Introduction

This report is part of the second phase of the Health*BASKET (Health Benefits and Service Costs in Europe)* Project, which was funded by the European Commission. The primary aim of Health*BASKET* is to identify a methodology which allows comparisons of the costs of individual health services between different EU Member States, and which allows to explore the reasons underlying the variations in costs of individual services between or within countries. It is thus essential to describe how the different countries define the health services (Phase I) provided and how cost assessment and price setting (Phase II-III) are used across the participating Member States.

The scope of this report (WP9) for Germany is to calculate the actual costs associated with the delivery of care for ten defined episodes of care and to analyse differences between cases provided by different providers. Finally costs are compared to prices that each provider receives. The cost accounting methodologies used for the price setting process in different sectors have been investigated in the previous project phase (Schreyögg, Tiemann and Busse 2006).

Due to the segmentation of the German health care system the report is divided into two parts each representing one setting for service delivery. In Chapter 3 all inpatient vignettes are described and analysed which are delivered by hospitals contains, while in chapter 4 all ambulatory vignettes are described and analysed which are delivered by ambulatory practices. As the only vignettes cataract occurs in both chapters because it is delivered by hospitals as well as ambulatory practices. Both chapters start with a methodological introduction on the data collection process as well as on the allocation of costs. Subsequently the results for the respective inpatient and outpatient vignettes are presented. Finally, in chapter 5 conclusion are drawn for Germany.

2. Inpatient vignettes

2.1. Methodology for calculating the costs of inpatient vignettes

2.1.1. The standardised framework for the data received from participating hospitals

In Germany, DRGs are calculated based on individual-level cost data collected from German hospitals. The Institute for Hospital Reimbursement (InEK) is responsible for calculating cost weights. For deriving DRG classifications, InEK relies on retrospective cost and claims data collected in German hospitals. The G-DRG system (2006 version) is based on cost and structural data from the 2004 calendar year. Each year, every German hospital is required to provide InEK with hospital-related structural data (e.g. hospital's institution code and ownership, number of beds, number of trainees, number of personnel and total costs) and case-related claims data (e.g. procedure codes, main- and side diagnoses, cost-centre, beddays). The case-related cost data are calculated using a sampling of data from hospitals participating in a voluntary data sharing programme (Institut für das Entgeltsystem im Krankenhaus 2006). As of July 2006, a total of approximately 284 hospitals had agreed to participate in the data sharing programme and thus serve as the calculating base for cost weights in the G-DRG system (2007 version). This corresponds to roughly 16% of the approximately 1,800 hospitals using DRGs in Germany. For the purpose of this project, we only used cost data provided by hospitals participating in this data sharing programme.

The hospitals participating in InEK's cost sample must meet certain cost-accounting standards. They have to calculate costs per case according to the full cost method and using actual costs. This means that all DRG-related costs have to be taken into consideration when calculating the costs of DRG treatment cases. The actual costs are derived from the hospitals' audited annual accounts. Accordingly, the reference period for calculating costs per case is a completed calendar year. The participating hospitals are expected to make step-down accounting a first priority. However, if this is not feasible, they are also allowed to use a mixed calculation between step-down accounting and gross-costing as an alternative.

When calculating costs per case, the only costs to be taken into consideration are those that arise due to the performance of the DRG-related services. The following cost elements are excluded:

- Extraordinary expenses and expenses relating to other periods
- Capital costs (exception: depreciation of fixed assets)
- Core business expenses, insofar as these are not related to general hospital services (e.g. costs of scientific research/teaching and costs of outpatient services are excluded)
- Taxes, charges, insurance for operational sections of the hospital that do not provide general hospital services, as well as tax on profits
- Specific and long-term allowance for bad debts
- Interest payable, insofar as this is not related to capital loans
- Imputed costs (e.g. hospital building)

The process of calculating costs per case is based on a modular approach, which is shown in Table 1. This approach entails arranging each set of case-related data in the calculation results according to cost-element groups and cost-centre groups. Aggregating costs across cost-element groups and cost-centre groups makes it possible to pinpoint the costs per patient or patient group (DRGs) in a concise manner. Therefore, hospitals participating in the voluntary data sharing programme have been instructed to aggregate their treatment costs in this way.

For the purpose of Health Basket project, each hospital provided us with individual-level cost data according to this modular approach. In addition to cost data, hospitals also provided information about the allocation bases they used to assign costs from cost-centres to individual cases. This enabled us to calculate and display the allocation bases used for, and the unit costs of, most cost elements relevant to the vignettes described in Section 4.1.1. All information obtained from hospitals was transferred to the framework of the case vignettes defined in the Health Basket project.

			Cost-Element Groups									
			1: Labour costs of the clinical staff	2: Labour costs of the nursing staff	3: Labour costs of the administrative and technical staff	4a: Drug costs	4b: Drug costs (individual costs/actual consumption)	5: Costs of implants and grafts	6a: Material costs (without drugs, implants/grafts)	6b: Material costs (individual costs/actual consumption, without drugs, implants/grafts)	7: Medical infrastructure costs	8: Non-medical infrastructure costs
			personnel costs			*material costs*					*infrastructure costs*	
Cost -Centre Groups	1: Normal ward	*Hospital units with beds*	1.1	1.2	1.3	1.4a	1.4b	-	1.6a	1.6b	1.7	1.8
	2: Intensive care unit		2.1	2.2	2.3	2.4a	2.4b	2.5	2.6a	2.6b	2.7	2.8
	3: Dialysis unit		3.1	3.2	3.3	3.4a	3.4b	-	3.6a	3.6b	3.7	3.8
	4: Operating rooms	*diagnostic and treatment Areas*	4.1	-	4.3	4.4a	4.4b	4.5	4.6a	4.6b	4.7	4.8
	5: Anaesthesia		5.1	-	5.3	5.4a	5.4b	-	5.6a	5.6b	5.7	5.8
	6: Maternity room		6.1	-	6.3	6.4a	6.4b	-	6.6a	6.6b	6.7	6.8
	7: Cardiac diagnostics/therapy		7.1	-	7.3	7.4a	7.4b	7.5	7.6a	7.6b	7.7	7.8
	8: Endoscopic diagnostics/therapy		8.1	-	8.3	8.4a	8.4b	8.5	8.6a	8.6b	8.7	8.8
	9: Radiology		9.1	-	9.3	9.4a	9.4b	9.5	9.6a	9.6b	9.7	9.8
	10: Laboratories		10.1	-	10.3	10.4a	10.4b	-	10.6a	10.6b	10.7	10.8
	11: Other diagnostic and therapeutic areas		11.1	11.2	11.3	11.4a	11.4b	11.5	11.6a	11.6b	11.7	11.8
	12: Central cost-centre		-	-	-	-		-	-		-	12.8

Table 1. The modular approach of cost calculation in the G-DRG system.

2.1.2. Allocation of costs to cases according to cost-centres

When calculating costs per case, cost unit accounting is needed to determine the costs that were incurred in the production and utilisation of one unit of the cost object. This means that the DRG-related costs allocated to the direct cost-centres in the context of cost unit accounting need to be associated as accurately as possible with the treatment cases. Indirect costs are assigned to treatment cases with the help of calculation rates based on equitable allocation bases. The methodology described in the Calculation Manual requires that there be a proportional relationship between the allocation bases used to develop the calculation rates and the costs shown in the cost-centres. From a cost theory standpoint, the calculation assumes that the cost functions are linear.

Normal Ward

- *Physician costs* are allocated according to beddays
- *Nursing costs* are allocated according to a so called nursing minute (PPR), which is a unique German methodology. First, the costs of one minute of nursing care are calculated and are allocated to each case according to the intensity of care needed by each case. There are three levels of care for general (G1-G3) and special care (S1-S3); these range from level 1, which indicates a basic need for care, to level 3, which indicates the need for very time-consuming care. The staff in each department defines which level of care is assigned to each case. Each combination of general and special care receives a certain number of nursing minutes, as displayed in the following table 2:

Combined level of care	Allocated number of PPR minutes	Combined level of care	Allocated number of PPR minutes	Combined level of care	Allocated number of PPR minutes
A1/S1	52	A2/S1	98	A3/S1	179
A1/S2	62	A2/S2	108	A3/S2	189
A1/S3	88	A2/S3	134	A3/S3	215

Source: Keun and Prott 2006, p. 12.

Table 2. Allocation of minutes for nursing care according to assessed level of care

- *Technical staff costs* are allocated according to beddays
- *Drug costs and material costs* are usually allocated according to the nursing minutes required by each case
- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to actual resource consumption (usually for drug and material costs above €300)
- *Medical and non-medical infrastructure costs* are allocated according to beddays

Intensive Care Unit

- *All staff costs, drug costs, material costs, and medical and non-medical infrastructure costs* are allocated according to hours spent per case in the intensive care unit

- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to actual resource consumption (usually for drug and material costs above €300)
- *All kinds of implants or transplants* have to be allocated according to actual resource consumption

Operating rooms

- *All staff costs, drug costs, material costs, and medical and non-medical infrastructure costs* are allocated according to the surgery time, including preparation time, spent per case in the operating room (in hours and minutes)
- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to actual resource consumption (usually for drug and material costs above €300)
- *All kinds of implants or transplants* have to be allocated according to the actual resource consumption

Anaesthesia

- *All staff costs, drug costs, material costs, and medical and non-medical infrastructure costs* are allocated according to the time spent administering anaesthesia, including preparation time (hours and minutes)
- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to the actual resource consumption (usually for drug and material costs above €300)

Maternity room

- *All staff costs, drug costs, material costs, and medical and non-medical infrastructure costs* are either allocated according to the time spent per case in the maternity room (in hours and minutes) or, alternatively, to the number of births
- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to actual resource consumption (usually for drug and material costs above €300)

Other cost-centres for diagnostic and therapeutic services

- *All staff costs, drug costs, material costs, and medical and non-medical infrastructure costs* are allocated according to the number of DKG-NT/GOÄ points assigned to each service. The classifications DKG-NT (tariff for services a hospital purchases externally from other hospitals or outpatient units) and GOÄ (Physician Fee Scale [*Gebührenordnung für Ärzte*], used for charging services provided to privately insured

patients basis) are used internally as allocation bases by most hospitals to allocate costs from cost-centres for diagnostic and therapeutic services to individual cases. The catalogues list a number of points for most diagnostic and therapeutic services. However non-physician therapy, such as occupational therapy and speech therapy, is not listed in the catalogue and therefore each hospital has to decide how many points to assign to these services (i.e. based on resource consumption).

- *Drug and material costs* that exceed a certain threshold, as defined in a special InEK list, must be allocated according to actual resource consumption (usually for drug and material costs above €300)
- *All kinds of implants or transplants (not relevant for laboratory costs)* must be allocated according to actual resource consumption

Central Cost-Centre

Only non-medical infrastructure costs from cost element group 8 may be assigned to the central cost-centre. The central cost-centre is only set up for hospitals that combine step-down accounting and gross-costing approaches. Costs are only allocated to this cost-centre if they cannot be allocated to one of the regular cost-centres (e.g. due to insufficient information systems). For the purpose of our study, we added the non-medical infrastructure costs of all cost-centres, including the central cost-centre, and displayed only one cost value.

2.1.3. Data collection

Selection of hospitals

We started by identifying DRGs that fit exactly into the scope of our inpatient case vignettes. For some case vignettes, we had to exclude certain cases from DRGs by using main and side diagnoses or procedure codes if the cases did not fit exactly into the description of the case vignette. Because cost data from the hospitals participating in the voluntary data sharing programme are not available to the general public, we had to ask each hospital to provide us with the data set that they regularly submit to InEK. Thus, we approached all 284 hospitals taking part in the voluntary data sharing programme by sending them a formal letter requesting their participation. In the end, after a number of follow-up e-mails and telephone calls, 15 hospitals agreed to provide us with their cost data.

Information requested

Once the hospitals agreed to participate in the project, we requested that they provide us with the following information:

1. The standardised cost data for the DRGs we had defined as being part of our vignettes. In addition, we asked the hospitals to provide us with the information they enter into the DRG-grouper to code a specific DRG and which they also submit to InEK. Therefore they provided procedure codes and side diagnoses for each DRG. They also provided us with the DKG-NT/GOÄ points they used to allocate diagnostic and therapeutic services. Finally they provided us with the reimbursement rate they received per case.
2. The accounting department of each hospital was asked to fill in a comprehensive questionnaire providing general information on the number of beds, personnel, etc. per hospital, as well as very detailed information that went beyond the standardised costs delivered, including primarily data on the use of medication, complex laboratory and imaging services, and implants.
3. Physicians in the various hospital departments were asked to fill in medical questionnaires for the case vignettes covered by their respective department. In many instances, we visited the physicians in person and performed face-to-face interviews.

All of the hospitals that decided to participate in our project provided the data requested under point 1 and the general information requested under point 2. However, not all hospitals were able to provide us information that went beyond this. In particular, the answers provided by physicians under point 3 were often not very reliable. Finally, we attempted to combine the information we received so as to provide as much insight as possible into each hospital's use of resources.

2.1.4. Characteristics of the participating hospitals

Table 3: Characteristics of the participating hospitals

Criteria	**Hospitals**															**Ø**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
Ownership (13% PFP / 13% PB / 74% NFP)	NFP	NFP	NFP	NFP	PB	NFP	NFP	NFP	PFP	NFP	NFP	PB	PFP	NFP	NFP	/
Network of hospitals (Y/N)	Y	Y	Y	N	N	N	Y	N	Y	N	Y	N	Y	Y	Y	62% / 38%
Part of the voluntary data sharing programme in x years	3	2	3	2	3	3	3	1	1	2	3	0	3	3	1	2.25
Beds in hundred	4-6	2-4	2-4	4-6	8-10	4-6	4-6	2-4	2-4	2-4	2-4	6-8	2-4	4-6	2-4	420.71
Ø-LOS (rounded)	7	7	9	7	8	8	7	8	6	/	9	10	9	8	8	7.92
Number of cases (rounded)	23000	8000	10000	14000	28000	21000	13000	15000	12000	/	12000	17000	5000	15000	9000	13674
Physician Staff (rounded)	210	30	60	110	210	170	80	80	60	/	90	100	20	90	50	96.95
Nursing Staff (rounded)	440	90	170	210	520	320	190	300	140	/	250	360	70	230	150	243.77
Other med. and tech. Staff (rounded)	297	65	113	230	419	274	61	150	110	/	160	160	50	90	30	148.40
Administrative Staff (rounded)	60	19	14	44	94	184	13	60	40	/	70	50	20	50	20	52.72
Number of cases per Vignette																**∑ of cases**
Appendectomy	12	11	16	11	9	9	30	33	8	15	9	21	7	18	6	215
Delivery (Mother)	0	267	92	159	484	62	194	229	217	348	0	0	0	249	495	2796
Delivery (Child)	1	536	209	608	1345	268	535	235	722	857	0	0	0	822	513	6651
Delivery in total	*1*	*803*	*301*	*767*	*1829*	*330*	*729*	*464*	*939*	*1205*	*0*	*0*	*0*	*1071*	*1008*	9447
Hip-replacement	83	0	55	64	55	0	0	29	8	0	0	52	1	0	0	347
Stroke	64	16	49	10	22	4	4	30	10	3	37	109	22	6	5	391
AMI	90	5	5	19	64	26	7	17	8	0	6	3	4	34	0	288
Cataract	63	0	0	0	83	115	0	0	0	0	0	73	0	0	0	334
∑ of cases	313	835	426	871	2062	484	770	573	973	1223	52	258	34	1129	1019	

2.2. Results Inpatient vignettes

Vignette 1 - Appendectomy

Description of vignette: A healthy male between 14 and 25 years of age presents at hospital (accident and emergency department, if present; otherwise directly to surgical department) with acute abdominal pain. Start of case vignette: hospital admission. Abdominal palpation yields typical signs of appendicitis. End of vignette: discharge.

Results: To cover the cases specified in the case vignette, we selected DRGs G23Z and G22Z, which cover the following ICD-10 diagnoses: K35, K36, K37, and K38. Fifteen hospitals provided us with data for 190 cases (please see Section 4.1.4. for the general characteristics of the participating hospitals). For the respective departments, the number of beds ranged from 27 to 131, the bed occupancy rate ranged from 37% to 89%, the average length of stay ranged from 6.2 to 10.6 days, the number of cases ranged from 1000 to 4100, the number of medical staff ranged from 5 to 21, and the number of nursing staff ranged from 12 to 47.

Approximately 39% of the total mean costs were attributable to the surgical procedure itself, whereas the costs of pre- and post-operative care in the normal ward represented just 33% of the total mean costs. Diagnostic procedures played only a minor role in the total costs. Differences between hospitals and cases were, in large part, attributable to differences in the length of the surgery. This affected all categories of staff costs for the operation theatre. To a lesser extent, cost variation could also be explained by variations in material costs for the surgery, which, to some extent, were due to the use of different surgical procedures, such as laparoscopic (45%) versus open surgery (55%) (see Table 4 below). In addition, Table 4 also shows that cost variations were due to differences in the length of stay for pre- and post-operative care on the normal ward; these differences led to variations in staff costs, especially for physicians and nurses. None of the other cost categories played a major role with regard to cost variation.

On average, the hospitals participating in our study received a reimbursement of €1934 per appendectomy case, which is €35 more than the mean costs per case (i.e. €1899). However, it would be incorrect to assume that hospitals in Germany always generate a profit per case, as the prices used in this country are calculated based on the cost data provided by all hospitals

participating in the data sharing programme; in the present study, we have selected only 15 of these hospitals.

Table 4: Total costs for appendectomy (n=215)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	MEDIAN	Q1	Q3
Pre- and post-operative phase	**Diagnostic Procedures**	***Imaging***								
		Staff costs		GOÄ Points			6.68	0.00	0.00	0.00
		Material costs		GOÄ Points			1.88	0.00	0.00	0.00
		Others		GOÄ Points			0.97	0.00	0.00	0.00
		Laboratory								
		Staff costs		GOÄ Points			19.61	15.48	0.00	30.10
		Material costs		GOÄ Points			28.17	18.40	7.94	35.30
		Others		GOÄ Points			1.74	0.44	0.00	1.87
		Other								
		Staff costs		GOÄ Points			22.63	0.00	0.00	26.97
		Material costs		GOÄ Points			3.37	0.19	0.00	6.78
		Others		GOÄ Points			0.85	0.00	0.00	0.54
	Pre- and post-operative care (normal ward)	***Staff***	Physician	Beddays			152.31	133.95	99.39	178.12
			Nursing	PPR-Min.			312.44	279.17	222.31	356.05
			Others	Beddays			45.39	32.29	14.07	61.95
		Material costs		PPR-Min.			52.74	32.24	18.61	46.09
		Drugs	Others	PPR-Min.			34.90	26.65	19.21	39.97
		Running costs		Beddays			28.85	19.71	8.55	38.91
Operation (including wake-up room)		***Staff***	Surgeon	Min.			141.79	124.57	91.33	178.48
			Nursing	Min.			147.97	123.97	95.72	170.17
			Anaesthetist	Min.			123.42	101.00	74.81	146.89
5-470.1 laprascopic in 44,94%			Anaesthetic technician	Min.			81.69	69.35	53.77	88.70
5-470.0 open surgery in 55,06%		***Material costs***	Surgery	Min.			141.11	108.70	77.00	161.76
			Anaesthesis	Min.			24.46	22.02	14.38	29.66
		Drugs	Anaesthetics	Min.			8.49	6.45	4.46	10.04
			Others	Min.			7.52	4.14	2.50	8.29
		Running costs		Min.			65.12	59.66	26.32	96.63
Overhead (including administration, catering, etc.)	**On hospital level**									
							444.92	421.56	331.68	516.56
Total Costs							1899.02	1599.94	1162.05	2229.83

Reimbursement							1933.84	1873.39	2128.85	2070.41

Vignette 2 - Normal Delivery

Description of vignette: A healthy woman between 25 and 34 years of age presents at hospital with labour pains after 39 weeks of uncomplicated first pregnancy. Start of case vignette: hospital admission. The woman is examined, the baby presentation is normal (i.e. cephalic/vertex; one foetus), and a "normal" vaginal delivery is carried out without complications (i.e. no transfer to paediatric department or newborn intensive care unit). End of vignette: discharge of mother and child (both are well).

Results: To cover the cases specified in the case vignette, we selected DRG O60C. Eleven hospitals provided data for 2796 mothers and 6651 newborn children (please see Section 4.1.4. for general characteristics of the participating hospitals). For the respective departments, the number of beds ranged from 10 to 125, the bed occupancy rate ranged from 39% to 91%, the average length of stay ranged from 2.9 to 5.7 days, the number of cases ranged from 600 to 3200, the number of medical staff ranged from 1 to 15, and the number of nursing staff ranged from 10 to 25.

Approximately 38% of the total mean costs were attributable to pre- and post-delivery care on the normal ward, whereas the delivery itself only accounted for 30% of the total mean costs. Primarily, this was because there were, of course, two persons who required care after the delivery. As almost half of the costs for pre- and post-delivery care on the normal ward were attributable to the child, we can assume that most resources are used during post-delivery care. In general, the total mean costs for mothers (€1628) in our study were nearly twice as high as the total mean costs for children (€918). Diagnostic procedures played only a minor role with regard to the total costs.

Differences between hospitals and cases were, in large part, attributable to a.) differences in staff costs (especially for obstetricians and nurses) during pre- and post-delivery care on the normal ward, which were mainly due to variations in length of stay, b.) required reconstructions after rupture (28% of our cases), and, to a smaller extent, c.) variations in staff wages. To a lesser extent, cost variation could also be explained by variations in midwife costs, which resulted from differences in time spent per case in the maternity room. Material costs, drugs, and diagnostic procedures played only a minor role with regard to cost variation.

On average, the hospitals participating in our study received a reimbursement of €2528 per case for normal delivery, which is €18 less than the mean costs of €2546 per case. However, it would be incorrect to assume that German hospitals always incur an operating loss in this amount, because the prices used in this country are calculated based on the cost data provided by all hospitals participating in the data sharing programme; here, we only received data from eleven of these hospitals.

Table 5: Total costs normal delivery (Mothers n= 2796; children n= 6651)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	M Median	M Q1	M Q3
Pre- and post-delivery phase	**Diagnostic Procedures**	***Imaging***								
		Staff costs		GOÄ Points			5.68	0.00	0.00	0.00
		Material costs		GOÄ Points			1.20	0.00	0.00	0.00
		Others		GOÄ Points			1.08	0.00	0.00	0.00
		Laboratory								
		Staff costs		GOÄ Points			19.51	9.99	1.44	24.76
		Material costs		GOÄ Points			27.87	6.92	2.87	21.36
		Others		GOÄ Points			1.45	0.33	0.06	2.08
		Other								
		Staff costs		GOÄ Points			34.22	0.00	0.00	49.57
		Material costs		GOÄ Points			2.42	0.00	0.00	1.06
		Others		GOÄ Points			1.22	0.00	0.00	0.24
	Pre- and post-delivery care (normal ward for	***Staff***	Obstetrician	Beddays			266.92	230.03	144.30	300.19
			Nursing	PPR-Min.			486.18	385.50	292.13	548.99
			Midwife and others	Beddays			56.56	23.66	10.98	58.46
		Material costs		PPR-Min.			44.35	22.88	9.60	53.90
		Drugs	Others	PPR-Min.			26.23	16.89	2.69	33.89
		Running costs		Beddays			75.21	52.62	25.04	105.98
Delivery 5-758.0 Episiotomy in 0% 5-758.3 or 5-758.2 Reconstruction after rupture in 27,98% 9-262.1 Postpartal care for risk birth in 8.27%		***Staff***	Obstetrician	Min.			170.16	115.25	53.18	171.35
			Midwife and others	Min.			494.61	457.45	326.64	551.74
			Anaesthetist	Min			0.88	0.00	0.00	0.00
			Anaesthetic technician	Min.			0.52	0.00	0.00	0.00
		Material costs	Delivery	Min.			44.62	36.89	31.78	53.42
			Anaesthesis	Min.			0.13	0.00	0.00	0.00
		Drugs	Anaesthetics	Min.			0.07	0.00	0.00	0.00
			Others	Min.			21.53	21.31	12.04	25.60
		Running costs		Min.			21.21	7.54	6.92	17.06
Overhead (including administration, catering, etc.)	**On hos-pital level**									
				Beddays			742.71	677.26	449.60	1001.80
Total Costs							2546.54	2064.52	1369.27	3021.45

Reimbursement	2528.20	2326.78	2227.01	2541.34

Vignette 3 - Hip replacement

Description of vignette: A woman between 65 and 75 years of age with hip osteoarthritis requiring hip replacement because of considerable impairment is finally (after waiting time, i.e. if there is normally a waiting list for the hospital) admitted for her first hip replacement (unilateral). The patient has no comorbidities (i.e. expensive drugs due to treating co-morbidity should be excluded), the surgeon uses the most common implant for female patients; the operation is without severe complications. End of case vignette: discharge (home or to separate rehabilitation centre).

Results: To cover the cases specified in the case vignette, we selected DRGs I05Z and I48Z. This corresponds to ICD-10 diagnosis M16. Eight hospitals provided data for 347 cases (please see Section 4.1.4. for general characteristics of the participating hospitals). For the respective departments, the number of beds ranged from 54 to 125, the bed occupancy rate ranged from 56% to 78%, the average length of stay ranged from 6.2 to 11.7 days, the number of cases ranged from 1900 to 11500, the number of medical staff ranged from 7 to 19, and the number of nursing staff ranged from 25 to 45.

Approximately 39% of the total mean costs were attributable to the surgical procedure itself, whereas the costs of pre- and post-operative care on the normal ward only represented 31% of the total mean costs. The costs of the intensive care unit only accounted for 4% of the total mean costs. Compared to the other vignettes, the share of diagnostic procedures as a percentage of total manpower costs was, at 6%, quite high.

The material costs for hip implants were the most important cost component leading to differences in total costs. In this context, it was quite important whether a patient received an uncemented, partially cemented, or fully cemented hip implant. Cemented hip implants are usually cheaper than uncemented hip implants. Because of this, the distribution of uncemented, partially cemented, and cemented hip implants in our data sample is shown in the table below. Differences between hospitals and cases were also attributable to differences in nursing costs during pre- and post-operative care on the normal ward. Nursing costs for pre- and post-operative care ranged from €740 for cases in the lower quartile to €1146 for cases in the upper quartile. These differences were due to different lengths of stay as well as to the intensity of care required (i.e. because PPR minutes for nursing costs are allocated according to the estimated intensity of care required). Differences in physician and nurse

wages between hospitals did not play a role in total staff costs differences. A similar pattern can be observed for the costs of operating room staff, especially for surgeons, although it should be noted that the costs of operating room staff are responsible only to a lesser extent for variations in total costs. It can also be seen that those cases admitted to the intensive care unit after surgery do also explain a certain variation of total costs.

On average, the hospitals participating in our study received a reimbursement of €6697 for the hip replacement cases, which is €382 more than the mean costs of €6315 per case. However, it would be incorrect to assume that all hospitals in Germany generate a profit of €382 per case, because the prices used in this country are calculated based on the cost data provided by all hospitals participating in the data sharing programme; for this study, we received data from only eight hospitals of these hospitals. In part, this profit is due to the fact that the data provided by the hospitals in our sample contained more cases with the cheaper cemented (36%) or partially cemented (19%) hip implants than can be observed on average in all hospitals participating in the data sharing programme.

Table 6: Total costs for hip replacement (n=347)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	MEDIAN	Q1	Q3
Pre- and post-operative phase	**Diagnostic Procedures**	***Imaging***								
		Staff costs		GOÄ Points			55.54	31.91	6.23	66.77
		Material costs		GOÄ Points			18.63	6.87	3.34	16.55
		Others		GOÄ Points			5.12	1.86	0.00	5.19
		Laboratory								
		Staff costs		GOÄ Points			79.37	59.10	0.00	88.65
		Material costs		GOÄ Points			79.64	43.92	27.66	93.37
		Others		GOÄ Points			4.36	2.46	0.00	5.15
		Other								
		Staff costs		GOÄ Points			40.41	2.69	0.00	49.51
		Material costs		GOÄ Points			30.15	8.88	2.37	29.12
		Others		GOÄ Points			82.81	4.50	0.05	195.08
	Pre- and post-operative care (normal ward)	***Staff***	Physician	Beddays			353.88	332.53	281.84	383.71
			Nursing	PPR-Min.			989.23	925.41	740.07	1145.53
			Physiotherapist[a]	HT Points			182.14	152.49	95.78	251.05
			Others	PPR-Min.			84.62	68.26	29.14	161.47
		Material costs		Beddays			124.84	74.14	24.27	231.84
		Drugs	Others	PPR-Min.			134.16	103.48	64.69	183.59
		Running costs		Beddays			115.99	112.15	28.84	168.62
	Intensive care unit	***Staff***	Physician	ICU-Hours			34.27	0.00	0.00	14.62
			Nursing	ICU-Hours			141.29	0.00	0.00	257.39
			Others	ICU-Hours			2.69	0.00	0.00	0.00
		Material costs	Others	ICU-Hours			21.47	0.00	0.00	1.00
		Drugs	Others	ICU-Hours			22.63	0.00	0.00	22.52
		Running costs		ICU-Hours			5.06	0.00	0.00	2.82
Operation (including wake-up room)		***Staff***	Surgeon	Min.			383.42	378.82	297.46	476.00
			Nursing	Min.			296.70	253.52	202.07	336.49
			Anaesthetist	Min.			252.01	240.36	176.78	289.35
			Anaesthetic technician	Min.			137.81	119.82	97.33	163.02
5-820.00 uncemented in 25.61%		***Material costs***	Anaesthesis	Min.			49.76	40.78	30.85	62.25
5-820.02 partially cemented in 18,73%			Blood products	DC			32.18	0.00	0.00	0.00
5-820.01 fully cemented 36,3%			Hip Implants	DC			847.13	801.03	480.70	1176.70
			Others Surgery	Min.			209.80	184.35	71.13	315.65
8-803.2 or 8-800.2 or 8-803.0		***Drugs***	Anaesthetics	Min.			15.34	14.51	7.42	19.88
or 8-810.0 or 8-800.0										
Blood transfusion in 20,34%										
			Others	Min.			13.04	10.57	5.87	18.11
5-784.0d Bone transplantation										
(of Spongiosa) in 2.87%										
		Running costs		Min.			236.53	204.97	129.34	294.59
Overhead (including administration, catering, etc.)	**On hospital level**			Beddays			1233.41	1080.87	780.16	1648.17
Total Costs							6315.43	5260.25	3583.39	8173.76

Reimbursement							6696.50	6991.65	6180.91	7166.58

Vignette 4 – Cataract operation (inpatient)

Description of vignette: A male subject between the ages of 70 and 75 has consulted a hospital clinic/ophthalmologist's office due to blurred vision. After clinical assessment, a diagnosis of senile cataract is made and the patient is placed on the operating list. The case vignette concerns the surgical procedure in the hospital/ophthalmologist's office (depending on country, please state) including any pre-operative assessment (possibly in separate visits). Please specify the type of implant/ocular lens used (especially if the costs of these implants differ).

Results: To cover the cases specified in the case vignette, we selected DRGs C20Z, C07Z, and C08Z. These cover the following ICD-10 diagnoses: H25 and H26. Four hospitals provided data for 334 cases (please see Section 4.1.4. for general characteristics of the participating hospitals). For the respective departments, the number of beds ranged from 3 to 35, the bed occupancy rate ranged from 12% to 71%, the average length of stay ranged from 1.8 to 4.4, the number of cases ranged from 190 to 2100, and the number of medical staff ranged from 1 to 10.

Approximately 49% of the total mean costs were attributable to the costs of the surgical procedure itself. Among the cost components in the operating room, intraocular lenses were the major cost driver. On their own, intraocular lenses accounted for 15% of the total mean costs; together with other materials needed for surgery, intraocular lenses accounted for 27%. Variation in costs for inocular lenses was one major reason for variations in total costs between hospitals and cases. In this context, it also played a role whether a scleral or corneal incision was performed, and whether a microsurgical technique was used (see table below). Other important cost components associated with variations in total costs were physician and nursing costs for pre- and post-operative care on the normal ward, which were primarily due to different lengths of stay. None of the other cost categories played a major role in cost variations.

On average, the hospitals participating in our study receive a reimbursement for the case vignette cataract of €1044 per case, which is €118 less than the mean costs of €1162 per case. However, it would be incorrect to assume that hospitals in Germany always generate a deficit in this amount, because the prices in this country are calculated based on the cost data

provided by all hospitals participating in the data sharing programme; in this study, we have included only 4 of these hospitals.

Table 7: Total costs for cataract (n=334)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	Median	Q1	Q3
Pre- and post-operative phase	**Diagnostic Procedures**	***Imaging***								
		Staff costs		GOÄ Points			1.36	0.00	0.00	0.00
		Material costs		GOÄ Points			0.34	0.00	0.00	0.00
		Others		GOÄ Points			0.17	0.00	0.00	0.00
		Laboratory								
		Staff costs		GOÄ Points			0.89	0.00	0.00	0.00
		Material costs		GOÄ Points			0.80	0.00	0.00	0.00
		Others		GOÄ Points			0.09	0.00	0.00	0.00
		Other								
		Staff costs		GOÄ Points			0.69	0.00	0.00	0.00
		Material costs		GOÄ Points			0.30	0.00	0.00	0.00
		Others		GOÄ Points			0.03	0.00	0.00	0.00
	Pre- and post-operative care (normal ward)	***Staff***	Physician	Beddays			45.38	45.74	1.10	100.83
			Nursing	PPR-Min.			168.13	159.20	118.93	221.00
			Others	Beddays			19.98	17.40	0.00	29.55
		Material costs					22.30	14.31	2.67	24.44
		Drugs	Others	PPR-Min.			9.28	7.58	0.00	12.28
		Running costs		Beddays			20.87	10.25	5.54	33.00
Operation (including wake-up room)		***Staff***	Surgeon	Min.			32.60	18.77	0.00	71.27
			Nursing	Min.			99.82	80.18	67.11	104.39
			Anaesthetist	Min.			18.72	0.00	0.00	0.00
			Anaesthetic technician	Min.			13.05	0.00	0.00	23.37
5-144.11 corneal incision in 46,41%		***Material costs***	Anaesthesis	Min.			9.60	9.30	0.00	15.03
5-144.01 scleral incision in 49.09%			Intraocular lens				178.46	191.40	112.94	292.83
5-984 microsurgical technique in 74,56%			Others Surgery	Min.			129.35	75.22	75.22	155.92
		Drugs	Anaesthetics	Min.			2.76	1.16	0.00	4.03
			Others	Min.			13.03	1.72	1.17	6.06
		Running costs		Min.			76.92	37.58	35.94	107.25
Overhead (including administration, catering, etc.)	**On hospital level**						296.69	224.22	150.15	467.27
Total Costs							1161.61	894.02	570.77	1668.52

Reimbursement							1043.98	980.84	795.84	1017.25

Vignette 5 – Stroke

Description of vignette: A healthy female subject (i.e. with no comorbidities prior to presentation) between the ages of 60 and 70 with sudden severe hemiparesis (right side) and dependency, and with severe aphasia. Admission to hospital (accident & emergency, medical or neurological department depending on country/hospital) by ambulance. Start of case vignette: hospital admission. All interventions, including diagnosis and treatment, are delivered in the same hospital. The patient is diagnosed and treated according to normal hospital standards (which may or may not include a stroke unit, early rehabilitation, etc.); progress is average for age. Transient (TIA), short, and reversible (RIND), as well as prolonged and reversible (PRIND) ischaemic neurological deficits, are excluded. End of vignette: discharge to rehabilitative institution or home.

Results: To cover the cases specified in the case vignette, we selected DRGs B70A and B70B. These cover the following ICD-10 diagnoses: I60 to I67. Fifteen hospitals provided data for 391 cases (please see Section 4.1.4. for general characteristics of the participating hospitals). For the respective departments, the number of beds ranged from 36 to 102, the bed occupancy rate ranged from 64% to 97%, the average length of stay ranged from 5.7 to 10.4 days, the number of cases ranged from 916 to 4400, the number of medical staff ranged from 8 to 19, and the number of nursing staff ranged from 24 to 59.

Approximately 49% of the total mean costs were attributable to costs incurred on the normal ward, whereas the costs of the intensive care or stroke unit only represented 6% of the total mean costs. Diagnostic procedures accounted for 14% of the total costs. Differences between hospitals and cases were attributable, in large part, to differences in the length of stay, which led, in particular, to differences in physician and nursing costs. To a lesser extent, cost variation could also be explained by variations in material costs and drug costs on the normal ward, as well as by staff costs and material costs for imaging. Variations in imaging costs can be explained, in part, by the use of MRI scans. While most of the cases in participating hospitals received a CT scan (85%), only 54% received an MRI scan, and especially those MRIs accompanied by contrast agent use (7%) are quite costly.

On average, the hospitals participating in our study received a reimbursement of €3649 per case for stroke, which is €192 more than the mean costs of €3457 per case. However, it would be incorrect to assume that all hospitals in German generate a profit in this amount, because

the prices in this country are calculated based on the cost data provided by all hospitals participating in the data sharing programme; here, we have selected only 15 hospitals of these hospitals.

Table 8: Total costs for stroke (n=391)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	MEDIAN	Q1	Q3
Initial and post therapy diagnosis	**Diagnostic procedures**	***Imaging***								
		Staff costs		GOÄ Points			108.58	59.92	0.00	152.42
		Material costs		GOÄ Points			161.83	48.38	16.98	276.29
		Others		GOÄ Points			14.23	0.59	0.00	16.81
			Total consisting of:							
			sonography of the heart 100%							
			24-hour blood pressure 100%							
			long-term ECG (24-hour) 100%							
			ECG 100%							
		Laboratory								
		Staff costs		GOÄ Points			29.36	0.00	0.00	42.24
		Material costs		GOÄ Points			47.89	35.77	19.87	57.05
		Others		GOÄ Points			1.78	0.00	0.00	2.24
			Total consisting of:							
			blood coagulation…							
		Other								
		Staff costs		GOÄ Points			42.00	28.38	0.00	66.22
		Material costs		GOÄ Points			73.20	11.16	5.14	52.19
		Others		GOÄ Points			16.83	0.35	0.00	22.94
			Total consisting of:							
			ECG…							
Hospital care (convalescence)	**Intensive care unit/ Stroke unit**	***Staff***	Physician	Beddays			34.39	0.00	0.00	0.00
			Nursing	PPR-Min.			107.60	0.00	0.00	0.00
			Others	Beddays			11.85	0.00	0.00	0.00
3-200 CT of cranium in 78,78%		***Material costs***		PPR-Min.			24.77	0.00	0.00	5.38
		Drugs	Lysis and others	PPR-Min.			20.84	0.00	0.00	0.00
7,68% of CTs with contrast agent (3-220)			Total consisting of:							
		Running costs	Agent / Product %							
				Beddays			8.75	0.00	0.00	0.00
3-800 or 3-80c MRI of cranium in 46,54%	**Normal ward**	***Staff***	Physician	Beddays			436.39	352.69	236.85	509.44
			Nursing	PPR-Min.			863.83	687.04	442.46	1076.01
			Others	Beddays			78.06	37.06	0.00	92.80
7,41% of MRIs with contrast agent (3-820)		***Material costs***					104.02	62.61	34.03	126.63
		Drugs	Lysis and others	PPR-Min.			125.15	68.42	31.76	149.26
1-207.0 electroencephalography (EEG) in 46,55%			Total consisting of:							
			Agent / Product %							
		Running costs		Beddays			98.75	64.74	29.09	141.69
3-600 arteriography in 6,29%	**Early reha-bilitation**	***Staff***	Physiotherapie, speech therapy, occupational therapy[a]	GOÄ Points			129.09	108.19	0.00	202.32
Overhead (including administration, catering, etc.)	**On hospital level**						918.16	814.35	517.01	1124.47
Total Costs							3457.35	2379.65	1333.19	4116.40
Reimbursement							3648.96	3433.96	3010.36	3935.79

Vignette 6 – Acute Myocardial Infarction

Description of vignette: A male subject between 50 and 60 years of age and healthy until to the moment of presentation has developed sudden, acute chest pain. An ambulance is called and brings the patient within 2 hours of the onset of symptoms to hospital (accident & emergency department, cardiology or ICU depending on country/hospital). Start of case vignette: hospital admission. The patient shows typical ECG alterations and is admitted and treated for acute myocardial infarction (AMI). The patient is diagnosed and treated according to normal hospital standards (if a PTCA is performed, there are no complications, i.e. a referral to heart surgery is excluded); progress is average for age. End of vignette: discharge to rehabilitative institution or home.

Approximately 19% of the total mean costs were attributable to costs incurred on the normal ward, whereas the intensive care or stroke unit accounted for 26% of the total mean costs. The main therapy and cardiac catheter examination accounted also for 26% of the total mean costs. However, in data from the full voluntary data sharing programme sample, this stage of care represents a larger proportion; this is because our sample included a higher proportion of hospitals that do not perform PTCA or stenting. In our data sample, 1.21 PTCAs were performed per case, and among patients who underwent PTCA,a total of 0.51 stents were implanted. Differences between hospitals and cases were, in large part, attributable to differences in stent costs per case. While some cases did not received a stent, others received several stents at a cost of several hundred euros. To a lesser extent, cost variation could also be explained by variations in physician and nursing costs in the intensive care or stroke unit. These differences were due to different lengths of stay, as well as to the intensity of care required (i.e. because PPR minutes for nursing costs are allocated according to the estimated intensity of care required). Different physician and nurse wages between hospitals did not play a role in staff cost differences.

On average, the hospitals participating in our study received a reimbursement of €4045 per case for AMI, which is €876 more than the mean costs of €3169 per case. However, it would be incorrect to assume that hospitals in Germany always generate a profit in this amount, because the prices used in this country are calculated on the basis of the costs provided by all hospitals participating in the data sharing programme; in our study, we have selected only 13 of these hospitals. In part, this profit is also due to the fact that the data from our sample

hospitals contained fewer cases with PTCA/stenting than can be observed on average in all hospitals participating in the data sharing programme.

Table 9: Total costs of AMI (n=288)

Phase	Stage of care	Type of resource use	Elements	Units	No. of units used/ patient	Unit Costs (€)	Total Costs €	MEDIAN	Q1
Initial and post therapy diagnosis	**Diagnostic procedures**	***Imaging***							
		Staff costs		GOÄ Points			25.36	10.23	0.00
		Material costs		GOÄ Points			15.41	7.38	1.63
		Others		GOÄ Points			4.02	0.83	0.00
		Laboratory							
		Staff costs		GOÄ Points			55.70	46.60	30.10
		Material costs		GOÄ Points			34.36	27.75	17.18
		Others		GOÄ Points			4.87	3.98	1.99
		Other							
		Staff costs		GOÄ Points			100.69	70.02	19.81
		Material costs		GOÄ Points			9.32	4.55	1.00
		Others		GOÄ Points			8.19	2.94	0.11
Main therapy and cardiac catheter examination 1-272.0 or 1-273.1 or 1-275.0-1-275.5 or 1-279.0 or 1-279.1 Cardiac catheter 0.92 8-837.00 or 8837.01 PTCA 1.21 8-837.k0 PTCA with stent implant: 0.51 8-837.m0 PTCA with drug eluting stent implant: 0.13	**Cardiological treatment room**	***Staff***	Cardiologist	GOÄ Points			97.73	84.15	8.83
			Nursing	GOÄ Points			122.65	98.50	4.09
		Material costs	Stent	DC			429.65	246.10	0.00
			Other Material	GOÄ Points			152.10	0.00	0.00
		Drugs	Lysis and other drugs	GOÄ Points			8.66	4.20	0.24
		Running costs		GOÄ Points			39.37	29.02	2.20
Hospital care (convalescence)	**Normal ward**	***Staff***	Physician	Beddays			185.77	187.47	67.94
			Nursing	PPR-Min.			268.10	199.96	59.85
			Others	Beddays			19.19	2.50	0.00
		Material costs					32.75	16.38	0.00
		Drugs	Others	PPR-Min.			35.86	11.79	0.00
			Total consisting of:						
			Agent / Product %						
		Running costs		Beddays			62.74	38.11	13.01
	Intensive care unit/ Stroke unit	***Staff***	Physician	ICU-Hours			142.73	87.50	29.77
			Nursing	ICU-Hours			453.70	390.74	211.56
			Others	ICU-Hours			10.89	2.93	0.00
		Material costs		ICU-Hours			82.39	60.12	29.55
		Drugs	Others	ICU-Hours			93.51	56.31	24.22
		Running costs		ICU-Hours			29.85	20.35	12.96
Overhead (including administration, catering, etc.)	**On hospital level**								
				Beddays			643.15	531.79	234.92
Total Costs							3168.71	2242.20	770.96
Reimbursement							4045.40	4163.57	2938.23

3. Outpatient vignettes

3.1. Methodology for calculating the costs of ambulatory vignettes

The objective of the following cost studies is to document and calculate in the most differentiated way possible the services provided for each case vignette, together with corresponding costs from the point of view of the provider of outpatient care. In addition, a comparison will also be made between the average costs determined and the actual remunerations, distinguishing between statutory health insurance (SHI) and private health insurance (PHI). It is first necessary to determine the average individual costs per case, and then to divide total general costs as equitably as possible between the cost-generating cases. The following general approach to the calculation of average case costs per case vignette was adopted.

Initially, within the framework of cost element accounting, the relevant costs are systematically determined over a given period, e.g. a month or a year. The goal of the cost element accounting for the relevant case-cost calculation was to determine the specific costs and services for cases from the overall volumes of services and costs for a doctor's or dentist's surgery. State-registered physicians surgeries were not sub-divided in terms of cost-centres because no sub-sections could be identified which provided uniform and calculable services.

For the further calculations, the registered costs were divided into individual costs and general costs. Individual costs arise specifically for the defined treatment case and can be directly attributed to this case. Costs for the use of materials, including pharmaceuticals, one-way equipment, etc., were registered at the purchase costs. Specific personnel costs were calculated in accordance with the time spent on the case by the doctor and doctor's assistant. Since the wage costs represent a major part of the overall costs for the out-patient vignettes these were registered in a highly differentiated fashion, which is described in the following.

3.1.1. Valuation of the costs of the doctor and dentist per minute

A Uniform Value Scale 2000plus introduced on 1 April 2005 represents a new fee system for SHI-accredited physicians in the Federal Republic of Germany. Emoluments were to be based on the actual costs of providing the service and are therefore calculated using cost studies.

The evaluation of doctor's services within the framework of case vignettes for outpatient treatment was monitored in the *Health*BASKET project.

The valuation of the services provided by the physician is oriented on the methodology used when setting the Uniform Value Scale 2000plus, from which the working hours of a physician were taken (51 hours / week). However, instead using the "imputed employer's salary" based on a comparisons with the earnings of a similarly qualified physician who is working in a hospital, which was used by the Federal Association of SHI-accredited physicians, the average income from working in practices of each specialist group (paediatrician € 94,929; dentists € 114,366; Physician € 110,066; Ophthalmologist € 96,515) was used to calculate the value of a physician minute.

Productivity is also taken into account for the valuation of the physician's services. The gross working week is set at 51 hours, which corresponds to an overall annual working time of 140,148 minutes, including both time spent with patients and other activities. Within the framework of the Uniform Value Scale (EBM 2000plus), the physician's services are viewed as the sum of all directly patient-related activity. This does not take account of the time spent on so-called secondary activities, such as office management, the study of files, and other activities not directly related to a specific patient. With regard to the valuation of the physician's services, it is assumed that the net working time amounts to 45 hours per week. This is the product of the overall annual working time and the productivity or the efficiency. The productivity of an SHI-accredited physician is taken to be approximately 87.5 percent, which gives a net annual working time of 122,629 minutes. The cost rate (EUR/min) is obtained by dividing the annual income from working in a practice by the net annual working time of 122,629 minutes. However, the differences between the specialities do not differ very much from the € 0.779 calculated by the Federal Association of SHI-accredited physicians (Partsch, Held 2004: 29) (see table 10).

Table 10: Calculation of cost per physician minute.

	Pediatrician	Dentist	Physician	Ophthalmologist
Working time of SHI-accredited physician per week	~51 hours/week[1)]			
-time not spent on patient related activity a) secondary activities (office management, study of files)	6 hours/week[1)]			

b) idle time / productivity	87.5%[1)]			
Net-working time (minute/year)	122.629[1)]			
Average income	94.929 €[2)]	114.366 €[3)]	110.066 €[2)]	96.515 €[2)]
Cost per physician minute	0.774€	0.933€	0.898€	0.787€

Sources: [1)] Federal Association of SHI Physicians; [2)] Calculated on basis of information of Federal Association of SHI Physicians [3)] Calculated on basis of "KZBV Jahrbuch 2005" (Federal Association of SHI dentists annual 2005)

3.1.2. Valuation of the costs of the assistants per minute

The costs-per-minute of assistants were calculated in accordance with the recommendations of the Working Group on Rehabilitation Economics (AG Reha-Ökonomie 1999b, 7). To obtain the gross number of working days per annum, the 104 weekend-days were subtracted from the 365 days in a year, as well as 9.5 days for public holidays, and one day for attending further training courses. The length of holidays is governed by wage tariff agreements. Since the holiday entitlement increases with the age of the employee, details obtained from the Federal Employment Agency on the age structure of assistants to doctors, dentists, and veterinary surgeons were used to calculate a weighting factor. It was found that doctors' assistants working 38.5 hours per week are entitled to approximately 28.2 days holiday, whereas dentists' assistants working 38 hours per week are entitled to approx. 30.3 days holiday under their tariff agreement. The figures of the Federal Ministry of Health for the average rate of absence due to illness for 2004 (3.4%) were also taken into account to calculate the net working hours per annum (see Table 11)

Table 11: Net working hours per annum for doctors' and dentists' assistants

	Doctors' assistants	Dentists' assistants
Calendar days in year	365	365
- Saturdays and Sundays	104	104
- public holidays*	9.5	9.5
- further training	1	1
- holidays	28.2	30.3
Gross no. of working days	222.3	220.2
Working hours /day (38 hour-week)	7.7	7.6
Gross no. of hours per annum	1712	1674
Estimated rate of absence	3.4%	3.4%
Net no. of working hours per annum	1654	1617

*= In Germany (with regional variations): New Year's Day, Good Friday, Easter Monday, 1st May, Pentecost, Ascension Day, German Unity Day, Christmas Day, Boxing Day; 1/2 day each for All-Saints' Day, Reformation Day; 1/4 day for Corpus Christi, Epiphany. One day is subtracted to allow for public holidays which fall on a weekend.

Because the questions concerning the wages of the employees frequently remained unanswered, and the available responses led in part to unrealistic costs per minute for assistants, an average gross wage was used based on the figures of the Federal Employment Agency, according to which each group of assistants received an average gross monthly wage of € 1580. On the basis of the gross annual wages, and the employers' contribution to social security payments (also including Christmas gratifications, traditionally in the form of a so-called 13th monthly wage), it was possible to determine the gross annual costs to the employer. Dividing the gross employer's costs by the time worked gives costs for assistants of € 0.25 per minute (see Table 12).

Table 12: Employer's costs for assistants per minute

	Doctors	Dentists
Gross monthly assistant's wage (2005)	1580	1580
+ social health insurance contribution	6.13%	6.13%
+ social long-term care insurance contribution	0.85%	0.85%
+ unemployment fund contribution	3.25%	3.25%
+ pension fund contribution	9.75%	9.75%
Employer's total social security costs	315.68	315.68
Monthly gross employer's costs	1895.68	1895.68
Annual gross employer's costs	24643.89	24643.89
Cost per assistant-minute (in EUR)	0.248	0.254

3.1.3. Calculating the general costs

An important factor in the average costs per case is the proportionally allocated general costs of the doctor's or dentists surgery. These are the necessary costs which cannot be directly attributed to individual patients, for example rental payments, personnel costs for administration and organisation, or insurance premiums. With respect to the costs for the depreciation of infrastructure, a distinction is made between the medical infrastructure (e.g. medical equipment) and non-medical infrastructure (e.g. office furniture, etc.).

Depreciation of investment assets represents an important part of the general costs. The period of use and the depreciation of fittings and equipment have a considerable influence not only

on the level of the general costs, but also on the relationship between costs and earnings per case. For the calculations, depreciation was calculated linearly over the periods specified by the German tax authorities for fiscal purposes. Since most of the interviewees were unable to provide details about their loans and interest payments, the calculations were based on the current nominal interest rate for long-term government stocks of 4% (Federal Ministry of Economy and Technology 2006). For the calculation of remunerations on the basis of Uniform Value Scale (EBM) only interest paid on existing loans is included as a cost item. Since this information is not available as a rule and it is thus unclear whether service providers are actually paying interest on loans or not, the most appropriate approach seemed to be the use of imputed interest costs. A similar problem arose with the costs for the doctor's surgery. In many cases, the sum payable under a rental or leasing agreement was known, but in other cases a doctor owned the building or apartment in question. In these cases an imputed rent was used for the property in question, calculated on the basis of the local table for commercial rents and the size of the surgery. The calculations of both the imputed rent and the imputed interest payments led to an overestimation or underestimation of the costs. This is the case because the distribution of service providers with their loan costs and rental costs used for the calculation of the EBM2000+ is not known.

In order to be able to allocate the general costs proportionately to the specific treatment cases, it was necessary to form suitable valuation rates. In the case of a very homogeneous service, such as a coloscopy by a gastroenterologist, an equally weighted distribution was used for all cases. In other cases, in view of the differences in the time taken for each appointment depending on the diagnosis, a weighting was introduced using the average total contact time per case. This makes it possible to take into account the differing numbers of appointments and possibly the longer duration of treatment for privately-insured patients when calculating the general costs.

3.1.4. Survey design

Information relating to costs and services was collected in three different ways. The most important of these was the personal interview with the service provider, but in the light of the experience with the first interviews, additional methods were introduced.

Face to face interviews

In face to face interviews, the constellation of cases used in the survey was first explained, so that the doctor could gain an impression of the relevant services involved and the

corresponding costs. In particular it was pointed out that the survey would relate to the last ten cases and that an average would be derived from these. Prepared guidelines were used for the interview, and questions were asked in chronological order about the treatment procedure, followed by questions about the corresponding costs. The standard guidelines meant that it was possible to compare interview responses afterwards. The interviews generally took 20 – 40 minutes, and above all offered an opportunity for the interviewer to respond to queries, and also to ask detailed follow-up questions.

Telephone interviews

Telephone interviews were carried out if it had not been possible to arrange an appointment for a personal interview, but the service provider was interested in a personal interview. The same guidelines were used as in the face to face interviews.

Standardised questionnaires sent by post

In order to reach service providers who had been unable to provide an appointment for a personal or a telephone interview due to time constraints, or in order to increase the numbers of surgeries covered by the survey, a standard questionnaire was developed for three vignettes in addition to the personal interviews. The questionnaire was sent out to doctors by post together with a cover letter and a stamped return envelope. In order to ensure the comparability with the personal interviews, in the questionnaire only the questions from the personal interviews were used.

3.2. Results Outpatient vignettes

Vignette 4 – Cataract Operation (outpatient)

Description of vignette: Male, 70-75 years old, has consulted a hospital clinic/ ophtalmologist's office because of blurred vision. After clinical assessment a diagnosis of *Cataracta Senilis* is made and the patient put on the operating list. The case vignette concerns the actual operation in the hospital/ ophtalmologist's office (depending on country, please state) including any pre-operative assessment (possibly in separate visits). Please specify the type of implant/ ocular lens used (especially if costs differ).

Medical Basis

Cataract surgery is the most commonly performed operation in Germany; the procedure is exceptional insofar as it is performed both in the outpatient setting (i.e. by ophthalmologists or in eye clinics) and in hospital in the inpatient setting. The word cataract is used to describe any form of opacity that develops in the lens of the eye. Ninety percent of cataract cases are due to advanced age (senile cataract); this represents the most common cause of blindness. Other causes of cataracts include physical trauma to the eye (traumatic cataract), diabetes (diabetic cataract), or positive family history (congenital cataract). Extracapsular cataract extraction of the opaque lens, followed by the implantation of a posterior chamber lens in the lens capsule, is the most frequently performed procedure. The artificial lens is made for example, of silicone or acrylic (see: Bundesverband für Ambulantes Operieren [Federal Association for Outpatient Surgery])

One of the preparatory steps is to test the patient's sight. First, the eye is measured with an ultrasound device and slit lamp (corneal microscope). Subsequently, a refractometre measures the refractive power of the planned artificial lens and a tonometre determines internal eye pressure. In addition, the physician must discuss the risks, benefits, and details of the surgery with the patient.

For the surgery itself, phacoemulsification is the most commonly employed technique. After local anaesthesia is administered and measures to protect against infection are taken, the opaque lens is emulsified with an ultrasonic handpiece with a rapidly vibrating needle and then aspirated from an incision that is approximately three mm wide. This leaves behind only the so-called lens capsule, which is used to hold the newly inserted artificial lens in place. Follow-up treatment/care by ophthalmologists takes place up to six weeks after the operation (see: Zentrum für Augenheilkunde Universitätsklinikum Essen [Centre for Ophthalmology, University Clinic Essen]).

Selection of Study Participants

Study participants were chosen based on the contact information available from the physician search provided by the Berlin Regional Association of Social Health Insurance-accredited Physicians. Firstly, we contacted the approximately 381 ophthalmologists in Berlin by phone to determine which of them offer cataract surgery as part of their services. We then wrote letters to the 42 physicians who perform this surgery and informed them about the research project, asking them if they would be interested in participating. In total, we were able to

recruit five physicians for the study, with whom we subsequently conducted personal interviews.

Of the five participating physicians, two worked in individual practices, one in a group practice, and two in an eye clinic. Hence, the major distinction between the participating physicians was the number of cataract surgeries they performed each month: whereas the two ophthalmologists in the eye clinics performed an average of 400 cataract surgeries a month (out of a total of approximately 700 cases), the volume of cataract surgeries performed by their outpatient colleagues was considerably smaller (i.e. 37, 65, and 140 cases). It should also be noted that some of the outpatient physicians rented an operating theatre (in part including an operation team) outside of their own practice, so as to be able to perform the surgery there (see Table 13).

Table 13: Staff employed by participating ophthalmologists

	1	2	3	4	5
Type of practice	clinic	individual	individual	clinic	group
Number of ophthalmologists	2	1	1	2	2
Surgical nurses	2	1	2	1	2
Number of medical assistants	8	2	5	7	9
Number of trainees	6	1	0	3	0

With the majority of participating ophthalmologists, we conducted personal interviews of 20 to 90 minutes in length. Although the data we obtained on treatment procedures and their duration can be regarded as particularly robust, the information provided to us on costs were, in part, incomplete. In particular, the participating ophthalmologists clearly experienced difficulties gathering information on the costs of materials. For the salaries of the ophthalmologists' employees (medical assistants, surgery nurses), we referred to the data provided by the German Federal Employment Office.

Description of Study Results

Because five of the participating ophthalmologists indicated that the necessary preliminary examinations for the surgery had already been conducted by the referring physician (i.e. general practitioner or another ophthalmologist), the costs of the preliminary examinations could not be included in our study. These examinations generally include a vision test, an examination of the back part of the eye (fundoscopy), measurement of the corneal curvature (keratometry), an examination of the cellular structure of the cornea (slit-lamp exam, or

biomicroscopy), and an intraocular pressure measurement (tonometry). In addition, the physician should obtain a blood count (including CRP measurements) and, if necessary, perform an ECG and pulmonary function test.

As to the operation itself, there were clear differences between the study participants with regard to the duration of the procedure and the number of physicians required. Whereas in the eye clinics and group practices the operation was always performed by two ophthalmologists and took an average of 21.7 minutes, in the individual practices the operation was performed by only one physician and took an average of 30 minutes. Further differences could be observed in the number and labour time of anaesthetists, the number of surgery nurses required, and the number of medical assistants present. Analogous to the costs of the ophthalmologists, the costs of the anaesthetists were set at €0.787 (see section 3.1.1). The costs of the surgery nurses per minute were €0.47, which were the same as those for the medical assistants, as calculated in section 3.1.2. Here, an employer's salary of €2967.50 per month was assumed, based on data from the German Federal Employment Office.

According to information provided by the participating ophthalmologists, implants made of acrylic, silicone, or plexiglas were included in the calculation. In this context, the costs ranged from €100 to €175, and amounted on the average to €140 per case. The costs associated with materials, sterilisation, and the use of the operating theatre could only be estimated by the participating physicians and amounted to €118 on the average. The total costs of the operation were €382.03 (see Table 14).

Table 14: Cataract Vignette – cost of treatment

Treatment phase	**Cost components**	**Units of measure**	**Costs per unit in €**	**Units per case of treatment**	**Total costs in €**
Surgery					
	Ophthalmologists (1.6)	minutes	0.78	38	29.91
	Anaesthetists (1)	minutes	0.78	33	25.97
	Surgery nurses (1.8)	minutes	0.57	68	38.52
	Medical assistants (3.0)	minutes	0.47	93	43.15
	Implant	implant units	139.50	1	139.50
	Operating theatre and material				104.98
	Total				382.03

Calculations are based on information provided by five ophthalmologists.

Regarding overhead costs, we took into account the monthly costs of maintaining medical equipment, as well as for rent, electricity, heating, and water, cleaning costs, computer equipment, practice furnishings, telecommunications equipment, and insurance. We also took into consideration the data on useful service life, which differed from practice to practice.

For the personnel requirements in the reception room, we included a 50% medical assistant position for administrative activities. In doing so, we assumed that the medical assistants spent the other half of their time working with the physician in direct contact with the patient. This seemed realistic to us because of the fact that the physicians in the eye clinic, as well as the physicians in the group practice, shared the reception desk. To account for the administrative activities performed by the physician, we included 20 physician hours per month in our calculation. To calculate imputed interest (i.e. the capital invested in equipment and furnishings for the practice that would otherwise be used for an interest-paying investment), the long-term rate for government bonds (4%) was assumed.

We distributed the overhead costs based on the number of cases of treatment per month. For the sake of simplicity, we assumed that each case of treatment incurred the same proportion of overhead costs. In total, the participating ophthalmologists had an average of 600 cases per month, whereby the eye clinics, in particular, had an above-average number of cases. The costs of rent, which averaged €4380 per month, and the costs of maintaining medical equipment, which averaged €2810 per month, were the biggest cost drivers in terms of overhead costs (see Table 15). It is important to note, however, that the largest overhead expense – namely the costs of renting the operating theatre – is already directly allocated to each case as part of the treatment costs.

Table 15: Overhead costs of cataract surgery

Overhead costs			
			Monthly costs
	Medical infrastructure		
	- Equipment maintenance		2810.25[1)]
	Non-medical infrastructure		
	- Rent		4380.00[2)]
	- Electricity, heating, water		335.00[1)]
	- Cleaning costs		507.09[2)]
	- Computer equipment and electronic data processing		555.56[3)]

	- Furnishings for practice		833.33[4)]
	- Communications		181.75[2)]
	- Insurance		154.50[5)]
	- Administration (receptionist)		1026.80
	- Administration (physician)		944.40
	- Imputed interest		222.20[4)]
			11950.90
	Number of cases:	626.60	
	Total (per case)		**19.07**

Calculations are based on information provided by: [1)] four physicians; [2)] five physicians; [3)] three physicians; [4)] one physician; [5)] two physicians

The total costs of cataract surgery amounted to €401.10 on average. Direct personnel costs comprised 34.2% of the total costs, whereas material and overhead costs made up 65.8% of the total costs. The largest single expense in this context was the implant itself, which at 34.8% of the total costs represented the decisive influence on the average costs of the case described in this vignette.

The reimbursement of SHI-accredited physician services for publicly-insured patients took place according to EMB2000plus. The EBM represents a standard index of all services that may be billed to an SHI by an SHI-accredited physician (Busse/Stargardt/Schreyögg/Velasco 2005). The number of points reflects the respective value of the services in relation to one another. Cataract surgery is assigned the service code 31351 “Intraocular intervention of the category X 2” and is assigned 9810 points. In addition, physicians may bill for the service numbered 31503 (“post-operative monitoring”; 1400 points) as well as for the service numbered 31822 (“anaesthesia”; 2945 points). Together, these result in a total number of 14,155 points (see German National Association of Social Health Insurance-accredited Physicians).

Multiplying the total number of points by the respective point value in euros leads to the actual amount of reimbursement (Schreyögg, Tiemann, Busse 2005:58). The point value is calculated ex post by dividing the total of flat-fee, per-patient payments to the Regional Associations of Social Health Insurance-accredited Physicians by the number of points used in each of the regions administered by these associations. In the Berlin region, where the ophthalmologists who participated in this study are located, the point value for the so-called *Primärkassen* (Primary Health Insurance Funds) was 4.1831, and the point value for the so-called *Ersatzkassen* (Substitutional Health Insurance Funds) was 4.2564 in the fourth quarter

of the year 2005. The point value of €0.0422 applied in the present study is based on these figures (KV Berlin). This results in a reimbursement of €597.43 per publicly-insured patient.

When billing for services provided to privately-insured patients, the same billing items are used as those applied for publicly insured patient according to the Physician Fee Scale (*Gebührenordnung für Ärzte*, or "GOÄ"). In this scale, each billing item is assigned an amount in euros, which is then multiplied by an incremental factor that is negotiated between the patient and the physician. In our calculations, we have usually assumed a incremental rate of 2.3 (see Table 16). The representation of costs for privately-insured patients has been simplified to ensure comparability with the billing items relevant to this vignette. For patients with private insurance, physicians received reimbursement in the amount of €764.15. In everyday practice, we can assume that additional services are provided and invoiced.

Table 16: Reimbursement of cataract surgery in patients with public (SHI) and private (PHI) insurance

Item	**SHI service code**	**PHI service code**	**SHI**	**PHI**
Anaesthesia	31822		€124.28	?
Cataract surgery	31351	1375	€413.98	€469.22
Post-operative monitoring	31503		€59.08	
Surcharge for outpatient surgery		445		€294.93
Total reimbursement			**€597.34**	**€764.15**
Payment by SHI (approx. 88% of the population)			597.34	
Payment by PHI (approx. 9% of the population)				764.15
Patient co-payment			**€0.00**	**€0.00**

When comparing reimbursement and costs, the operating profit for both publicly- and privately-insured patients is so high that we must assume that we were unable to collect complete data on the costs of cataract surgery (see Table 17).

Table 17. Cataract surgery: costs and reimbursement

Costs of cataract surgery Surgery Overhead costs **Total**	 €382.03 €19.07 **€401.10**	
Reimbursement for cataract surgery	SHI: €597.34	PHI: €764.15

Operating profit	**SHI: + €196.14**	**PHI: + €363.05**

Vignette 7 - Cough

Parents presenting at a GP/ paediatric GP office with their 2 yr. old boy having cough and fever (38.5°C) since two days. Drug prescriptions and whether a second visit is scheduled should be noted.

Medical basis

Coughing is the spasmodic, explosive expulsion of breath. It serves to expel impedient materials (mucus, dust, or other foreign particles) from the lungs and airways. Coughing is not an illness in the traditional sense, but rather a symptom of infection of the air passages. Because of their weaker immune systems, children are more often affected by sniffling, influenza, and colds, which can be the cause of coughing. In the cooler seasons, more than 50% of children born in any given year will visit a doctor as a result of cough symptoms. Statistically, children suffer from cold-related coughing six to ten times annually.

The cause of coughing is usually a viral infection of the respiratory tract. This leads to an increased production of thickened mucous, which aggravates the airways and triggers normal coughing in order to expel the virus with the mucus. If the mucus is not expelled, the coughing is considered to be unproductive, because the vulnerable airways can be harmed. Coughing is often accompanied by fever, whereby we may first speak of fever when the body temperature exceeds 38.0 °C. If body temperature exceeds 38.5 °C, a value defined by this vignette, we would be referring to a moderate fever.

When parents bring their child to a paediatrician with a fever and cough, the doctor obtains a medical history and information about the medical condition, insofar as this is possible in young children. Subsequently, the physician performs a physical examination. Other tests may also be necessary, for example a blood test to determine infection parameters and an analysis of the sputum. In serious cases, for example by inordinately persistent coughing, imaging with ultrasound, x-rays pictures or a lung function test may be made.

When treating a cough, the focus should be on the underlying illness. If the cough is due to a bacterial infection, antibiotics are prescribed. The coughing itself can be suppressed by

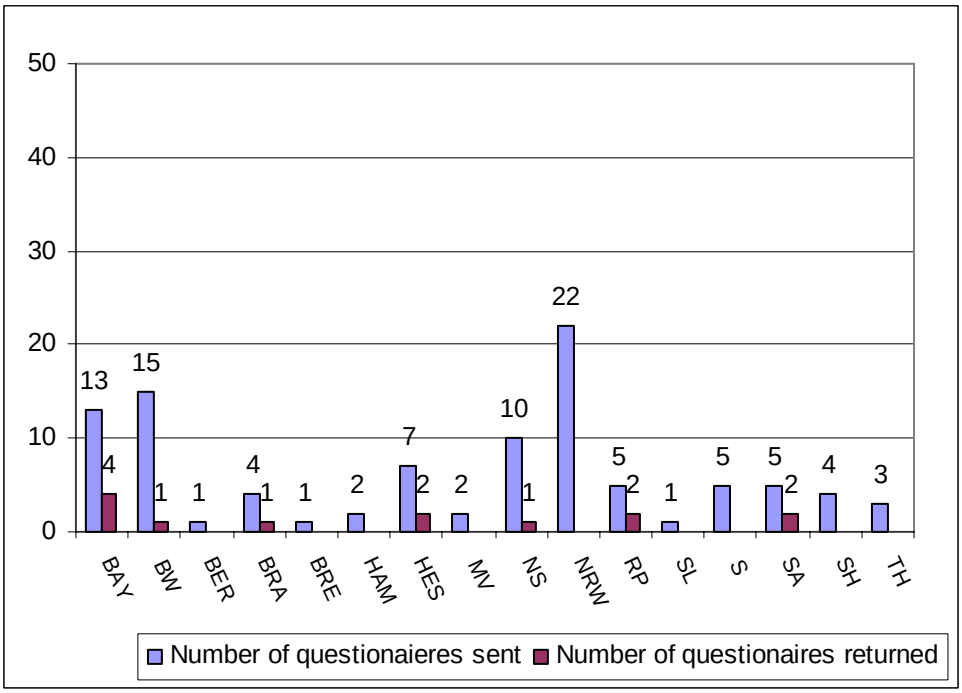
subscribing cough suppressants or expectorants. However, because productive coughing is a protective reflex of the body, it is only treated in cases where sleep disturbances occur.

Selection of study participants

Our first step was to conduct personal interviews with three paediatricians in Berlin. We developed questionnaires based on the information gathered in these interviews and sent these to a random sample of 100 paediatricians, whose contact data was obtained by means of a physician search made available by the Regional Associations of Social Health Insurance-accredited Physicians of all German federal states. Only those doctors were selected who indicated a specialty in paediatric medicine. The number of doctors contacted in each state was determined by the percentage of certified physicians in each state as compared to the total number of physicians in Germany. For example, 22 questionnaires were sent to North-Rhine Westphalia because this state is home to 22 percent of Germany's physicians accredited in outpatient care (see Figure 1).

The questionnaire was sent by standard mail together with an accompanying letter and a pre-stamped envelope. After one week, the response rate was already 12.9% (13 questionnaires). Approximately 10 days after sending the questionnaires, we made a follow-up telephone call during which the physicians were specifically informed about the questionnaire and the purpose of the project. This resulted in the response of additional physician which will be addressed in the final version of the report. The questionnaires returned had generally been filled in completely. Details about treatment information and measurements of their duration were particularly difficult to estimate. Only the prices for the generally rarely conducted blood tests and the purchase prices of materials used needed to be estimated afterward or researched at service providers or suppliers. For medications, prices for the prescriptions listed were taken from the manufacturers' recommended retail prices.

Figure 1: Number of questionnaires sent and returned



The average age of the 13 participating paediatricians was 52 years. Although the random sample of doctors who were approached included 40% female physicians, 69.2% of the responses came from male physicians. Of this number, 38.5% of the physicians were in group practices, while 61.5% were in individual practices. The number of employees in full-time positions varied in the practices from 1.5 to 6 employees, whereby 58.3% of the physicians questioned retained the services not only of medical assistants but also of trainees (see Table 18).

Table 18: Characteristics of the participating ambulatory practices

Physician's practice	1	2	3	4	5	6	7	8	9	10	11	12	13
Individual/group practice	I	I	G	I	G	I	G	I	G	G	I	I	I
Age of physician	56	51	58	51	58	50	49	40	57	52	62	45	58
Gender of physician	m	m	m	f	f	m	m	m	m	f	m	m	f
Number of medical assistants	1.5	2.5	2.5	1	2	5	3	3	3	3	1	3	5
Number of trainees	0	1	1	1	0	1	0	0	1	2	0	1	0

Study results

Determining case costs for a physician visit is organised into three blocks: the examination block, the treatment block, and the overhead costs block. Additionally, a fourth block defines the costs of prescribed medications. These, however, are paid directly by the insurance carrier, therefore incurring no costs to the physicians. Analogous to the amounts used in the EBM (see section 3.1.1), the monetary value of a physician minute was set at €0.774. In the rare

cases where information was missing, an average value was calculated from the information provided by other physicians.

In determining the amount of physician minutes required, the overall duration of examination and treatment procedures were both queried, as well as the duration and relative frequency of individual examination and treatment measures. With respect to the average values for all physicians, the difference between the total times calculated for individual steps and the total time estimated by the physicians was only 0.1 minute. The average inquired physician time for examination based on individual treatment steps was calculated to be 6.8 minutes. While a doctor from Saxony-Anhalt indicated he needed 10.2 minutes, a Brandenburg doctor needed only 4.05 minutes per case. The differences between the doctors can be explained by different durations for individual steps as well as by different examination approaches. For example, the doctor from Saxony-Anhalt spent two minutes more than his colleague from Brandenburg on the full-body examination, and reserved three more minutes for the initial consultation with the parents. Furthermore, the doctor from Saxony-Anhalt conducted a throat culture more often and also ordered a urine test for 10% of his patients.

The majority of participating physicians trusted the fever temperature indications of the parents. Only in 37.8% of the cases the temperature was taken again. The physician time required for this step measured between 0.5 and 2 minutes, with an average of 0.8 minutes (48 seconds). While approximately 80% of the participating physicians conducted a complete full-body examination, 30.8% indicated that they had performed the additional step of ascultation; 23.1% examined the ear, nose, and throat area, while only 6.9% indicated that they had performed the additional step of percussion. Any information that appears to have been entered twice, especially regarding the steps conducted within the context of the full-body examination, is not the result of a mistake, as the physicians entered the treatment methods and their frequency directly into the questionnaire. Therefore it might be possible that there are not only differences in the kind examination performed among the doctors, but also what is considered to be part of a “full body examination”. The material costs associated with these examinations are limited to the use of an ear probe, a tongue depressor, and the use of soap or detergent to wash the hands. To determine these relatively minimal costs, a medical catalogue was referenced. For the use of hand washing medium, an amount of 5 ml per case was assumed.

As well as examining the patient directly, physicians took a throat culture in an average of 19.3% of the cases. Costs for swabs and transport medium were based on the frequency of the procedure. In 11.8% of the cases, a blood test was also conducted. Some physicians sent their samples to a lab while others conducted the tests in-house. Because several physicians use a QBC device for this, the cost of the device (manufactured by Becton and Dickenson) was taken into account under overhead costs for medical infrastructure. In addition, we accounted for a QBC capillary tube under material costs during the treatment phase of testing. In an average of 6.4% of case, the doctors determined the CRP values with the aid of a CRP test. Accounted costs corresponded to those of the material costs.

In very few cases, there was a call for a urine test (1.2% of cases) and a thorax x-ray (0.2% of cases). Because of the minimal frequency, we did not take the costs of these testing steps into account. In addition, the participating physicians indicated that during the test an average of three minutes medical assistant time were required. Costs were accounted at a rate of €0.25 per minute (see section 3.1.2). The total cost for the test was €6.68 (see Table 19).

Standard patient treatment is much less complex when compared to the testing phase, as the former is normally comprised of the prescription of medication and a consultation with the child's parents. For the consultation, the physicians required an average of 3.54 minutes for each case, whereby the duration was between two and five minutes, depending on the doctor queried. At €2.74, the cost of the treatment phase was significantly less than the cost of the testing phase (see Table X). The physicians also indicated that they requested that the child return for a follow-up appointment in 43.1% of the cases.

Table 19. Coughs Vignette – Costs of testing and treatment

Treatment phase		Cost component	Allocation Base	Costs per unit in €	Units per case of treatment	Total costs in €
Examination						
		Labour utilisation:				
Initial consultation	100.0%	Paediatrician	minutes	0.77	6.8	5.26
Temperature taken	37.8%	Medical assistant	minutes	0.25	3.0	0.74
Full body examination	80.0%					
Ascultation	30.8%	Material utilisation:				
Ear-nose-throat check	23.1%	Ear probe	pcs	0.05	1.0	0.05
Percussion	6.9%	Depressor	pcs	0.01	1.0	0.01

		Soap/cleaner	per case	0.03	1.0	0.03
Throat culture	19.3%	Culture				
Blood test	11.8%	Swab with transport medium	pcs	0.32	0.19	0.06
CRP	6.4%	Blood test				
Urine test	1.2%	QBC tube	pcs	2.55	0.12	0.30
Thorax x-ray	0.2%	Disinfectant	per case	0.09	0.12	0.01
		Non-sterile swabs	pcs	0.00	0.12	0.00
		Bandages	pcs	0.02	0.12	0.00
		CRP test				
		CRP instant test	pcs	3.35	0.06	0.21
		Total				**6.68**
Treatment						
		Labour utilisation:				
Follow-up consultation		Pediatrician	minutes	0.77	3.54	2.74
Prescription						
		Total				**2.74**
Additional appointments arranged in 43.1% of cases.						

The overhead costs were distributed based on the total monthly treatment time. For this the physicians were asked about their total weekly working hours, which averaged 54.4 hours. The information varied from a minimum of 40 hours per week to a maximum of 70 hours per week. Because 10 of the 13 doctors indicted they worked between 50 and 60 hours each week, the mean value of 54.4 can be seen as a steady value not offset by any radical variations in either direction. Hours spent on administrative work were deducted from the total weekly work time. Physicians indicated such time to be between two and 15 hours, at an average of 7.7 hours per week. We assumed that the practices were working at 90% capacity, such that the net treatment time per week was calculated at 42 hours. The net treatment time was then extrapolated from hours/week to hours/month by multiplying by a factor of four. Multiplying by 60 resulted in the number of treatment minutes per month. The monthly overhead costs were determined using a case (10.29 minutes) as a percentage of the total treatment time (10085.5 minutes) (see overview).

Calculation of the net treatment time in minutes per month

Average weekly working time	54.4 hours
Subtract average admin time	7.7 hours
Gross weekly treatment time	46.69 hours
Accounting for practices working at 90% capacity	
Net weekly treatment time	42.02 hours
Net monthly treatment time (x4 x60)	**10,085.5 minutes**

In determining the overhead costs, a separation was made between medical and non-medical infrastructure (AG-Rehaökonomie 1999). Within the framework of medical infrastructure, costs were taken into account for the otoscope, stethoscope, thermometer, diagnostic light, and the abovementioned QBC device. The otoscope and stethoscope were assumed to have a service life of one year, a thermometer six months, and the diagnostic light and QBC device each 10 years. Because the costs of medical infrastructure (€0.07 per case) were minimal compared to non-medical infrastructure (€8.35 per case), a variation in the assumed duration of use does not lead to changes in the overall results.

For non-medical infrastructure, the expenditures accounted include those for rent (including waste collection), utilities (electricity, heating, and water), cleaning services, communications (telephone, internet), monthly expenditures for insurance, and the costs of other purchases, such as work clothing and office supplies. The monthly wear and tear on data processing systems and equipment was derived from the purchase price and service life indicated. In this case there was a great difference, for example, in the purchase prices of data processing systems (between €3,000 and €30,000). For the service life, the physicians indicated between four and 15 years. One of the doctors indicated that he leases his data processing equipment for €140 per month. Overall, the average monthly expenditures for data processing were €115.61. From the information supplied by participating physicians about physician administrative time, at an average of 7.7 physician hours per week and a value of €0.774 per physician minute, the monthly costs were calculated to be €1428.97. To account for the administrative activities of medical assistants, physicians were asked to indicate how much time the assistants spent in the practice that is not involved directly with patients. The physicians indicated an average of 61.9%. Multiplying by the average number of full-time assistants (2.62) resulted in an average of 1.52 medical assistant positions required for administrative duties at a total cost of €3,120. For the average of 0.54 trainees per practice, a monthly flat rate of €700 per trainee was calculated, which includes employers' contributions to social insurance. To calculate the imputed interest, meaning the lost earnings for the capital tied up in practice equipment, the long-term interest rate for government loans (4%) was used. The sum of overhead costs resulted in €8.95 per case (see Table 20).

Table 20. Coughs Vignette – Overhead costs per case

Overhead costs		**Monthly cost**
	Medical infrastructure	
	- Otoscope	13.60
	- Stethoscope	11.47

	- Thermometer	1.10
	- Diagnostic light	0.05
	- QBC device (blood test)	42.05
	Non-medical infrastructure	
	- Rent (incl. trash collection)	1477.95
	- Utilities (electricity, heat, water)	200.35
	- Cleaning	354.58
	- Communications	84.38
	- Insurance	452.50
	- Data processing	115.61
	- Practice furnishings	379.46
	- Miscellaneous purchases	557.58
	- Administration (medical assistants)	3120.00
	- Administration (physician)	1428.97
	- Trainee costs	403.80
	- Imputed interest	130.80
		8774.17
	Treatment duration: 10.29 minutes	
	Net treatment time: 10085.5 minutes	
	Total (per case)	**8.95**

The costs to a physician for treating a case of cough thus total €18.37. In comparing the cost types, it can be seen that the non-medical infrastructure, at 48.3% of total costs, represents the most predominant block of costs for this vignette, coming in above even the personnel costs (physician) at 43.6% of total costs. In comparison, the percentage of total costs attributed to the use of a medical assistant is relatively low, at 4.0%. For total costs, the percentage of material costs and medical infrastructure are 3.7% and 0.4%, respectively.

In addition to the costs incurred by physician treatment, the costs of prescribed medications were also determined using the manufacturer's suggested retail prices. In 30% of cases, doctors prescribed Paracetamol (acetaminophen). Ambroxol, an expectorant, was prescribed in 24% of cases. Furthermore, xylometazoline hydrochloride was prescribed in 21% of cases. Other prescriptions included 20% for an ivy leaf extract, 18% for ibuprofen, and 15% for acetylcysteine. Antibiotics and other substances, however, were only prescribed in very few cases (see Table 21).

Table 21. Averaged prescribed medications and their costs

	Active ingredient (concentration)	**Size of pkg**	**Cost per pkg in €**	**Units per case**	**Total cost in €**
Prescribed medications					
	Paracetamol 100mg	10 supposit.	1.43	0.30	0.43
	Ibuprofen 100mg/5ml	100 ml	5.38	0.18	0.95
	Ambroxol 15mg/2l	100 ml	4.49	0.24	1.07

	Acetylcysteine 200mg/10ml	50 ml	2.25	0.15	0.35
	Emser salts 11.75/ml	15 ml	8.85	0.03	0.27
	Xylometazoline hydrochloride 0.05%	10 ml	2.50	0.21	0.52
	Ivy leaf extract 35 mg/5ml	100 ml	5.98	0.20	1.20
	Cowslip, thyme	100 ml	8.84	0.07	0.61
	Cefaclor 125/5ml	100 ml	7.90	0.03	0.21
	Amoxicillin 250/ml	100 ml	6.80	0.03	0.18
	Erythromycin 40mg/ml	100 ml	11.97	0.004	0.05
	Pelargonium Extrakt	20 ml	9.30	0.03	0.29
	Terbutaline 1.5mg/ml	100 ml	12.15	0.02	0.19
	Marshmallow root 35.61g/100g	150 ml	8.60	0.01	0.07
	Clobutinol 6g/100g	15 ml	3.85	0.01	0.03
	Aconitinum	35 g	8.98	0.04	0.35
			Total	**per case**	**6.75**

The reimbursement of SHI-accredited physician services for publicly-insured patients takes place according to EMB2000plus. The EBM represents a standard index of all services that may be billed to an SHI by an SHI-accredited physician (Busse/Stargardt/Schreyögg/Velasco 2005). The number of points reflects the respective value of the services in relation to one another. Multiplying of the number of points by the corresponding point value in euros results in the actual reimbursement (Schreyögg, Tiemann, Busse 2005: 58). The point value is calculated retroactively by taking the sum of the flat-rate payments per patient to the Regional Associations of Social Health Insurance-accredited Physicians divided by the number of points used in the corresponding association region. Because the point value varies not only among the 16 regions but also depending on the particular physician specialty category, we assumed an approximate average of €0.045 per point. Laboratory services performed are indicated in EBM2000plus directly in euro sums and reimbursed accordingly.

The accounting service codes varied between the individual physicians because the EBM offers three possible codes for billing a consultation (04115, 04110, 04111), whereby the codes 04110 and 04111 allow for additional services along with the consultation. In addition to the consultation, the code 04120 (Consultation) and the code 04311 (Full body status) were indicated as billing items by the participating physicians. Our questionnaire also asked about the frequency with which the physicians bill for particular reimbursement items on the case spectrum. For laboratory services, the physicians sometimes used different codes since, for example, there are different options to charge for a complete blood count (code 32122) or for specifically identified values (such as code 32039 for hematocrit). To simplify the picture, the billing for a complete blood count was assumed for 11.9% of the cases (analogous to the

taking of blood tests on the cost side). The same method was used for determining the reimbursement level for the CRP self test and the throat culture. Because the collection of urine samples (1.6% of cases) and thorax x-rays (0.4% of cases) were not taken into account on the cost side, we did not calculate the corresponding codes when determining reimbursement. In 0.4% of cases, physicians' indications resulted in an obligation to report an illness. However, because of the minor impact on the total reimbursement, the corresponding code 32006 was not taken into account. For German statutory insurance patients (SHI), the result was a reimbursement of €15.33 (see Table 22).

When billing for services provided to privately-insured patients, the same billing items are used as those applied for publicly insured patient according to the Physician Fee Scale (*Gebührenordnung für Ärzte*, or "GOÄ"). In this scale, each billing item is assigned an amount in euros, which is then multiplied by an incremental factor that is negotiated between the patient and the physician. For the purposes of our calculations, 2.3 was used as the multiplier, which was the average incremental rate indicated by the doctors. For reasons of comparability, it was assumed that the percentage of ancillary treatments (blood tests, CRP, etc.) for PHI and SHI patients was the same. For privately-insured patients, this resulted in a reimbursement of €54.20 (see Table 21).

Table 22: Coughs Vignette – Reimbursement for patients with private (PHI) and statutory (SHI) insurance

	SHI code	% of cases	SHI reimburs. (point value =0.042)	PHI code	% of cases	Incremental factor	PHI Reimburs.
Consultation / Anamnesis	04115	40.8%	€0.64	7	65.4%	2.3	€14.00
	04110	66.2%	€4.61	4	15.4%	2.3	€4.50
	04111	9.2%	€0.60				
Surcharge	-			K1	84.6%	1.83	€10.80
Consultation	04120	13.1%	€0.88	1	84.6%	2.3	€9.10
Full body status	04311	58.5%	€7.89	8	42.3%	2.3	€14.70
Throat culture	32152	19.3%	€0.49	-			
Blood panel	32122	11.8%	€0.13	250a;3550	11.8%	-	€0.69
CRP	32128	6.4%	€0.07	3524	11.8%	-	€0.37
Total		SHI	€15.33			PHI	€54.20

One potential limitation of our study can be found in collecting the data within the framework of a survey of care providers. The accuracy of the information provided by physicians can only be controlled to a limited extent. Particularly with regard to the duration of examinations

or treatment, it is noticeable that the physicians tended to specify numbers that had been rounded. Indications of one minute, a half-minute, or two, three, five, or ten minutes were clearly more common than specific durations that were not rounded. Using a stopwatch to make determinations, a process sometimes used in other studies (Maibach-Nagel, Prchala 2003: 30), would thus be preferable. However, based on the minor difference between the sum of times for individual treatment steps and the total treatment duration, it is assumed that the indications are valid.

For studies with low numbers of cases, there is also the danger that the random sample does not represent the target population. For measured values that are derived from non-representative random samples, there is the concern that they exhibit distortions or selection errors in comparison to the actual dimensions of the target population (AG Reha-Ökonomie 1999a: 23). To establish that the results are representative for all of Germany, a larger number of care providers must be queried.

On the one hand, our study only has only accounted for imputed interest that lies below the higher rate of interest on loans, thus underestimating the overhead costs. For material costs, there is also the tendency to assume an underestimation of costs, since it is questionable whether all the materials used are actually accounted for. On the other hand, it is possible that the physicians in the study may have perceived their fee structures to be under scrutiny. To this extent, it was in the care providers' interest to tend to overestimate costs in order to justify the current level of reimbursement (in the case of private insurance) or to question the levels (in the case of statutory insurance).

Table 23. Coughs Vignette – Comparison of costs and reimbursement

	SHI	PHI
Costs for examination/testing	€6.68	
Cost for treatment	€2.74	
Overhead costs per case	€8.95	
Total treatment cost	€18.37	
Reimbursement	€15.33	€54.20
Operating profit (from the physician's perspective)	- €3.04	+ €35.83
Cost of medications (for information only)	€6.75	€6.75
Patient co-payment	€0.00	€0.00

In comparing reimbursements and costs (see Table 23), the result for a privately insured patient is the positive value of €35.83 per case, while the result for a patient with statutory

insurance is - €3.04 per case. Because the average percentage of privately insured patients is 10.6% per practice, the net result for the average doctor is + €1.08 per cough case. It should be noted that the vignette already takes into account a physician payment of €0.774 per minute, such that in addition to the implied reimbursement of €7.96 (€0.774 * 10.29 minutes), the physician earns €9.04 per case or €0.88 for each minute of service. Statutory insurance patients contribute €4.92 per case (€0.774 x 10.29 minutes - €3.04) to the income or €0.48 per minute of service, while privately insured patients contribute €43.79 per case (€0.774 x 10.29 + 35.83) or €4.26 per minute of service. The Coughs Vignette therefore presents a drastic imbalance between the reimbursements by statutory and private insurance. It is thus no wonder that privately insured patients are given preference in scheduling doctor's appointments and in waiting times.

Vignette 8 - Colonoscopy

Description of vignette: Male 55-70 year old with positive Faecal Occult Blood test is referred to an internist's/ gastroenterologist's office/ hospital out-patient department for diagnostic colonoscopy. Start of vignette: patient presents for the first time in office/ out-patient department. Please include all visits including the one where the colonoscopy is performed (i.e. most likely two), specify explicitly if and which sedatives, e.g. Benzodiazepines (flumazenil), fluids etc. are used/ prescribed. Cases with polypectomy during colonoscopy, pathological examinations and follow-up visits are excluded.

Results: in the industrialised world, the incidence of colorectal cancer has risen markedly over the past 30 years. Indeed, with an annual incidence of 30-35 cases per 100,000 population, colorectal cancer is one of the most common malignant diseases in Central Europe and is responsible for approximately 15% of a all cancer deaths. The annual worldwide incidence of colorectal cancel is estimated at one million cases, and in Germany, colorectal cancer is the second most frequent form of cancer in terms of incidence and cancers deaths. Approximately 24,000 people die each year from the disease (Felix-Burda-Stiftung 2006).

For colorectal cancer screening in Germany, colonoscopies are performed every 10 years in individuals 55 years of age or older. If an individual is thought to be at an increased risk of adenoma or colorectal carcinoma due to a family history of colorectal cancer, current recommendations specify that screening take place starting at the age of 40 or even earlier (Sieg, Theilmeier 2005: 379-383). The case vignette presented here does not apply to this

latter, high-risk group, but rather to patients receiving a routine colonoscopy. The starting point for collecting data on costs and services for this case vignette was the following case description: A male subject between 55 and 70 years of age and with a positive faecal occult blood test is referred to an internist's office, gastroenterologist's office, or hospital outpatient department for diagnostic colonoscopy. Start of vignette: A patient presents for the first time at the physician's practice or outpatient department. Please include all of the patients' visits, including the one during which the colonoscopy is performed (i.e. most likely two visits in total). Be sure to specify explicitly which sedatives, e.g. Benzodiazepines (flumazenil), fluids etc., are used/prescribed, if any. In cases where polypectomy is performed during colonoscopy, data on pathological examinations and follow-up visits should be excluded from the study.

Medical Basis

Colonoscopy is the most effective method for the early detection of colorectal cancer. Performed regularly, the procedure enables physicians to identify and remove colorectal polyps. If colorectal tumours are discovered at an early stage, colorectal cancel is still curable. During the procedure, a thin, flexible tube called a colonoscope is inserted into the patient's colon through the anus. At the end of the tube is a small, fibre-optic camera, which allows the physician to perform a detailed examination of the inside of the colon. Using small tools passed through channels within the scope, the physician can remove tissue samples or potentially dangerous polyps.

During an initial consultation prior to the day of the examination, the physician provides the patient with information on the risks of the procedure and gains a first impression of the patient. The patient is also asked to fill in a questionnaire requesting detailed information on his or her medical history, especially on any risk factors. The questionnaire is then evaluated by the physician or a medical assistant. This initial consultation is also necessary because the large intestine must be emptied of faecal matter so that the physician conducting the examination has a clear view. This is done one day or, at the latest, several hours before the examination by means of a powerful laxative, also known as a purgative – usually in the form of an orthograde intestinal lavage. The choice of purgative is based on personal factors related to the patient, and the administration of the purgative agent is explained by the physician or medical assistant.

On the day of the colonoscopy, a digital (i.e. finger) rectal examination is performed to avoid perforation in the event that polyps etc. are present. Cases of treatment involving polypectomy were not considered as part of this study because they entail a considerably greater use of resources. Subsequently, the patient is often given sedation, which makes the procedure less uncomfortable, as well as easier for the physician to perform. After the tip of the colonoscope is inserted, it is advanced carefully to the end of the large intestine (cecum), with minimal insufflation. While the scope is being withdrawn, the physician conducts a visual inspection to detect any lesions on the intestinal wall and, if necessary, performs a biopsy or polypectomy (Pott 2003: 38).

Selection of Study Participants

To ensure the inclusion of as broad a spectrum of healthcare providers as possible, we contacted a total of 58 gastroenterologists/internists in private practice and located in cities such as Berlin, Frankfurt, and Hamburg, as well as in rural regions such as Brandenburg or the area surrounding Frankfurt. These physicians were chosen randomly from the index of doctors published by the Federal Association of SHI Physicians. To avoid problems with the limited comparability of individual and group practices, we only chose from among individual practices. The physicians thus selected were contacted by standard mail and asked if they would be interested in participating the *Health*BASKET research project.

After a subsequent telephone follow-up, a total of 11 physicians indicated that they would be willing to participate in the study. Of these physicians, a total of four answered questions about costs and services related to the case vignette in face-to-face interviews. Two other physicians were available for a telephone interview. The structure of these six interviews was based on a set of interview guidelines, which had been drawn up in advance. The remaining five physicians did not have time for a personal or telephone interview, but rather filled in a standardised questionnaire containing the same questions and wording used during the telephone interviews. In this manner, we were able to ensure the comparability of the different forms of data collection.

Description of Study Results

According to information provided by the participating physicians, it appears reasonable to distinguish between average-risk and high-risk patients due to the increased use of resources

in the latter group. To take into account the higher costs caused by the additional services provided to high-risk patients, we identified the following risk groups, while paying particular consideration to the increase in the average treatment duration among these groups. As specified in the case description given above, patients in our study ranged in age from 55 to 70 years. Among this age group, patients with diabetes, severe coronary heart disease, heart failure, pacemaker use, or severe pulmonary disease were classified as high-risk. Especially in patients at the upper limit of the age range, we had to consider the effects of general infirmity (Pott 2003: 22).

Treatment in this patient group requires, in particular, more extensive pre-procedure consultation and additional assessments with regard to risks. In addition, physicians need to take special precautions during the procedure itself, such as keeping a defibrillator and magnets ready, performing continuous pulse oximetry, as well as administering additional medication if necessary (Messmann 2004: 4). Participating physicians estimated the average percentage of known high-risk patients to be 17%; for this percentage of patients, we calculated an increased use of resources (i.e. increased duration of service).

Based on the medical fundamentals described above, we evaluated the use of resources associated with an average case of colonoscopy. In this context, we distinguished, in particular, between direct and overhead costs.

Because of the importance of labour costs in relation to the direct costs of colonoscopy treatment, the labour costs for the attending physician and medical assistants were recorded as direct personnel costs. Because physicians in private practice are self-employed and generally do not receive a monthly salary, we evaluated their working time (€0.898 per minute) according to a special methodological approach, which is described in detail in Chapter 3.1.

We evaluated the working time of medical assistants strictly from the perspective of the physician, i.e. based on the prime costs of his or her practice. These consist of the salaries paid to the physician’s employees plus the respective national insurance contributions. Although our questionnaire asked about the salary of employees, the information supplied by the physicians on this point was incomplete and contradictory. Because of this, we evaluated the labour time of medical assistants based on the current fixed salary rates, i.e. at €0.248 per minute (see Chapter 3.1). The Allocation Base was working time in minutes. The amount of

medical assistant time required is based on the average figures specified by the participating physicians and refers to the last 10 cases of treatment within the case spectrum.

Medication costs related to the colonoscopy procedure were calculated as direct costs. These included the costs of purgatives for intestinal cleaning and of sedatives. However, a large number of the participating physicians were located in Berlin, all of whom indicated that the AOK statutory health insurance company had provided them with the medication free of charge. As a result, the physicians were unable to give data on the actual cost of the medication they had used, making it impossible to evaluate direct costs at the physicians' purchase prices. Instead, we used the pharmacy retail prices for our calculations, basing these on the product names indicated by the physicians and the respective amounts of medications used. To ensure that we did not overlook the physician's potential economies of scale, we referred to the largest package size in each case.

One dose of purgatives was associated with average per-case costs of €8.42, whereas the use of a sedative was associated with average per-case costs of €2.82. Here, it is important to consider that a purgative was used in 100% of cases, but a sedative was used only in 83% of cases (range: 50% to 99%). Some of the physicians surveyed also indicated that they prescribed additional medication in a very few cases (1-2%). Because of incomplete information and their only marginal importance, the costs of these miscellaneous medications were disregarded.

As explained in detail in Chapter 3.1, the calculation of overhead costs plays an important role. For the present analysis, the total average number of colonoscopies performed per year, as indicated by the participating physicians, was used as an allocation rate for overhead costs. The proportion of overhead costs per colonoscopy case was determined using a simple overhead calculation based on the total amount of annual overhead costs indicated by the physicians. Based on the assumption that performing the endoscopic procedure (colonoscopies, sigmoidoscopies, etc.) remains, overall, very similar from patient to patient, we did not carry out any further weighting. Furthermore, in the physician practices participating in our study, colonoscopies comprised approximately 50% of all endoscopies, something that also supported our unweigted approach using the number of cases.

By means of a simple overhead calculation based on a full costing approach, we calculated the per-case costs of rent (incl. heating, lighting, and services), insurance costs, cleaning costs, and miscellaneous costs (e.g. general expendable items, special waste disposal, etc.). Moreover, we determined the per-case overhead costs of general administrative activities. The amount of overhead costs associated with administrative activities is based, firstly, on estimates provided by the participating physicians, who were asked which proportion of medical assistant time was spent on administrative activities. Secondly, we assumed each physician spent a total of 20 hours per month performing administrative activities. This reason for this assumption is that we only considered the contact time with the patients as part of our calculation of direct personnel costs. Above and beyond this, the physician clearly needs time for the preparation and post-processing of a case, for billing the services provided in each case, and for managing the physician practice itself. We estimated that these non-patient-related activities require 20 hours of physician time. Finally, we assumed that each physician practice was working at 90% capacity and used this figure when calculating overhead costs.

In our treatment of overhead costs, we made a fundamental distinction between the costs of medical infrastructure and the costs of non-medical infrastructure. To calculate amortisation costs, we determined the purchase costs of specialist medical equipment (e.g. colonoscope, etc.), as well as the purchase costs of general furnishings for the physician practice (e.g. office furniture, etc.). The participating physicians estimated the actual amortisation period of medical equipment to be seven years and of furnishings for the practice to be 10 years. Based on this information, we were able to use the linear amortisation method to calculate annual resource utilisation/consumption of capital. The proportion of imputed interest per colonoscopy case was determined using the methodology described in Chapter 3.1.

Treatment phase		Cost component	Units of measure	Costs per unit in €	Units per case of treatment	Total costs in €
Preliminary consultation		**Labour utilisation**				
(1st appointment)		Physician	minutes	0.90	8.8	7.93
		Physician's assistant	minutes	0.25	15.45	3.86
preliminary talk	100%	**Material utilisation**				
blood panel	97%	*Purgative 100%:*				
		Endofalk in 31%	doses	7.57	0.31	2.35
		KleanPrep in 31%	doses	11.87	0.31	3.68
		Fleet in 19%	doses	10.37	0.19	1.97
		Colonorm in 10%	doses	0.82	0.10	0.08
		Prepacol in 9%	doses	3.79	0.09	0.34
			Total			**20.22**
Examination		**Labour utilisation**				
(2nd appointment)		Physician	minutes	0.90	24.50	22.00
Pre-procedure talk	100%	Physician's assistant (1.7)	minutes	0.25	41.10	10.28
Colonoscopy	100%	**Material utilisation**				
Pulse oximetry	85%	*Sedativum in 83%:*				
Biopsy	54%	Dormicum in 41%	doses	2.60	0.34	0.88
Blood pressure test	58%	Midazolam in 27%	doses	3.38	0.22	0.76
High risk cases	17%	Propofol in 27%	doses	5.20	0.22	1.17
		Tramal in 5%	doses	0.38	0.04	0.02
			Total			**35.10**
Post-screening talk and procedures		**Labour utilisation**				
(2nd appointment)		Physician	minutes	0.90	5.7	5.14
		Physician's assistant	minutes	0.25	18.9	4.73
			Total			**9.87**
Overhead costs		**Ø-number of treatment cases per month**			217	
		Ø-number of Colonoscopy cases per month			106	
			Acquisition costs	**Economic life**	**Monthly costs**	
		Medical infrastructure				
		Medical equipment	152660	7	1817.39	
		Maintenance / leasing			1250.00	
			Total		**3067.39**	**14.11**
		Non-medical infrastructure				
		Rent			3000.00	
		Cleaning costs			350.00	
		Insurance			304.06	
		Furnishings	106548	9.7	915.36	
		Administration			2104.43	
		Miscellaneous			395.83	
		Imputed interest			650.00	
			Total		**7719.68**	**35.51**
Total costs						**114.80**

Table 24: Costs per colonoscopy case

Below we will analyse several differences related to the participating physicians' methods and treatment time, as well as related deviations in the corresponding costs. According to the information provided by participating physicians, the duration of the colonoscopy ranged from 16 to 37 minutes. Here, it should be noted that the physicians who needed 37 minutes to perform the colonoscopy had only been in private practice for just under one year. Indeed, in

interviews with the physicians, it became clear that the time a physician needed to perform a colonoscopy decreases with the total number of colonoscopies performed, due to the resulting learning effect. In this context, a reduction in the time needed to perform the colonoscopy should not be equated with a reduction in the quality of the procedure. On the average, the physicians participating in our study needed 24.5 minutes to perform the colonoscopy procedure itself.

In addition to the time needed to perform the colonoscopy itself, the physicians in our study indicated that they also spent time on a variety of other activities related to the procedure. In total, the average physician time per colonoscopy case amounted to 39.06 minutes (range: 32.9-78 minutes). The differences are even more striking if we take into account the cumulative medical assistant time, which ranged from 52.5 to 141 minutes (average: 75.46 minutes). In this context, it is important to consider that it takes approximately 30 minutes to clean the endoscope manually. In cases where an automated cleaning system is used, the amount of medical assistant time needed is only 5-10 minutes. Nevertheless, even if this factor is ignored, the differences in medical assistant time are relatively large.

Furthermore, there were clear differences with regard to the different treatments performed in each colonoscopy case. For example, five of the 11 physicians indicated that they always measure a patient's blood pressure prior to the examination. Approximately 97% of the physicians stated that they obtain a blood count and order coagulation tests prior to the colonoscopy. Larger differences could be seen in the use of sedatives, with responses ranging from 50% to 99%. On the average, participating physicians administered sedatives in 83% of all cases. Large differences could also be observed in the number of biopsies performed. Although it is not necessary to do so in all cases, obtaining tissue samples during a colonoscopy represents an important means of prevention. However, the respective percentages of biopsies performed by participating physicians ranged from 20% to 100%. In part, this variation may be due to different degrees of experience, or to estimation errors on the part of the physicians.

In our study, overhead costs comprised about 43% of the total costs. This high percentage is due, in particular, to high capital costs and the resulting amortisation costs and imputed interest. On the average, participating physicians indicated that they had invested €153,000 in medical infrastructure and €107,000 in non-medical infrastructure. The amortisation costs

comprise 25% of the overhead costs. With regard to the direct costs, it is the direct personnel costs that are of the greatest consequence. Indeed, 47% of total costs consist of direct personnel costs. In this context, the costs of physician time comprised 31%, whereas the costs of medical assistant time comprised only 16%.

Services provided by SHI-accredited physicians to patients with statutory health insurance are reimbursed on the basis of EMB 2000plus. The EBM represents a standard index of all services that may be billed to a statutory health insurance company by an SHI-accredited physician. The number of points reflects the respective value of the services in relation to one another (Busse, Stargardt, Schreyögg, Velasco 2005: 30-36). Multiplying the number of points by the respective point value (i.e. a monetary conversion factor) results in the actual amount that is to be reimbursed (Schreyögg, Tiemann, Busse 2005: 58). Because the point value varies among the 16 different regions administered by the Regional Association of SHI Physicians, as well as among the different groups of medical specialists, we calculated an average value of €0.045 per point. For the reimbursement of a colonoscopy case, we assumed that all participating physicians billed for the examination using the EBM item "colonoscopy complex" (*koloscopischer Komplex*). In the EBM Catalogue, this treatment complex is assigned 4100 points (Kassenärztliche Bundesvereinigung 2004:154). This results in a reimbursement in the amount of €184.50 per case of treatment.

The participating physicians were also asked what percentage of their patients are privately insured and at which rate they billed private insurance companies. When billing for private patients, the physicians in Germany use the Physician Fee Scale (*Gebührenordnung für Ärzte*, or "GOÄ") as their basis. The corresponding service can be found in Section F (GOÄ (2002): 40, Nr.687). The reimbursement is calculated by multiplying the number of points listed for the service in question – in this case, 1500 points – by €0.0582. Thus, the simple rate amounts to €87.43. The majority of participating physicians billed the PHI at 2.3 times this rate, meaning that the physicians in question received a fee of €201.09 for the entire examination. The proportion of patients with public insurance to patients with private insurance thus determines the average reimbursement per colonoscopy case and per physician. The differences in the reimbursement structures can thus be traced back to the proportion of privately insurance patients a physician has, as well as to the rate he or she uses to bill for the services provided. The average reimbursement per colonoscopy case for all physician practices was €175.97. The difference between costs and revenues per colonoscopy—that is,

the costs from the perspective of the physicians, and the reimbursement according to insurance type—is shown in Table 25.

Type of Insurance	Revenue	DC	OC	DC + OC	Operating profit
SHI	170.15 €	€59.86	€65.19	€114.80	€55.35
PHI	201.09 €	€59.86	€65.19	€114.80	€86.29

Table 25: Comparison of average costs and revenues in patients with public (SHI) or private (PHI) insurance; DC= direct costs; OC= overhead costs

When looking at SHI patients and PHI patients separately in this manner, the average values show that the revenue for treating a patient with private insurance (€201) is approximately 18% higher than the revenue for treating a patient with public insurance (€170). This is disproportionate with regard to the average number and types of services performed, as we were unable to observe any differences in this regard. The per-case operating profit when treating a privately insured patient is, on the average, 55% higher than the per-case operating profit when treating a publicly insured patient. However, even if this represents an incentive to treat privately insured patients, it is important to consider that a markedly lower percentage of patients have private insurance. Indeed, according to information provided by the physicians in our study, an average of only 10% of the colonoscopy patients have private insurance.

It also needs to be taken into consideration that the calculation of physicians' costs already contains an imputed employer's salary in the amount of €0.898 per physician minute. The EBM calculation is based, in this context, on an estimated annual salary of €110.066. The difference shown here represents the profit per colonoscopy in addition to this. Thus, the reimbursement received by 10 of the 11 participating physicians was higher than the reimbursement per colonoscopy calculated in the EBM €0.779. If the imputed employer's salary is not taken into account in the calculation of prime costs from the perspective of the physician (i.e. if the physician time is not calculated at €0.898 per minute), then this results in lower total costs altogether. The difference between the average reimbursement and these total costs represents profit before taxes, without any consideration of the physician labour time. The quotient of this profit and the utilised labour time of the physician results in the endogenous point value per physician minute when performing a colonoscopy. The endogenous point value indicates the average rate at which a physician minute is reimbursed by the health insurance companies in the context of colonoscopy. At an average of €2.32 per

physician minute, this amount is approximately three times higher than the reimbursement calculated in the EMB, which is €0.779.

Vignette 9 – Tooth filling

Description of vignette: Ca. 12 y/o child presents with a toothache in a lower molar tooth at dentist's office; after diagnosis, the dentist decides to provide an Amalgam filling.

Medical background

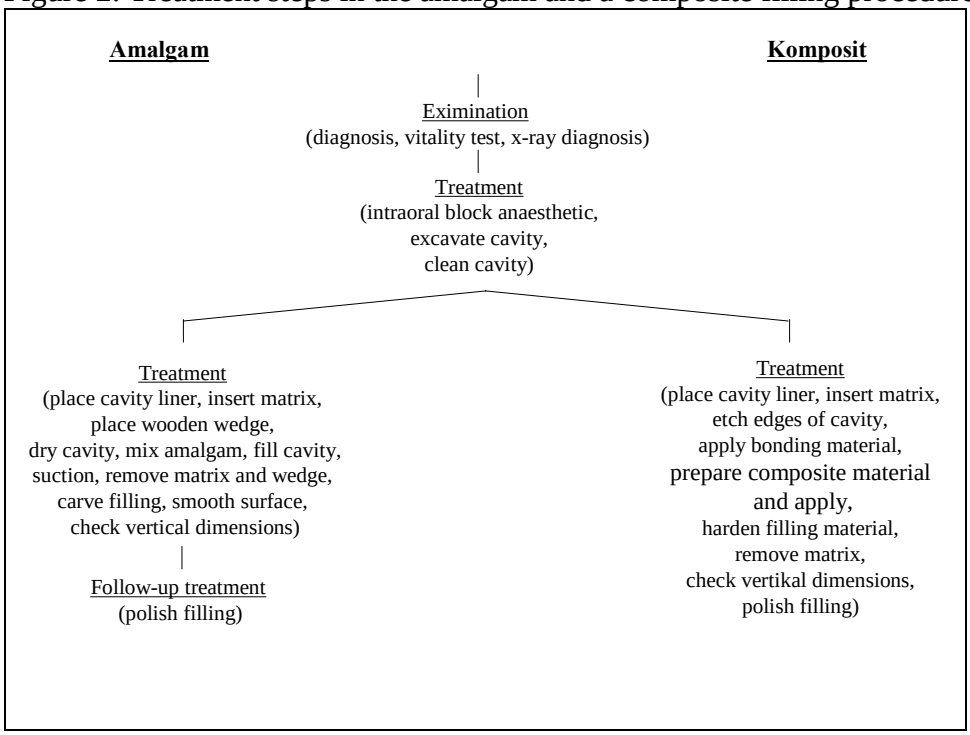
If a caries lesion is found in a molar, a filling is indicated. At first, the dentist administers a local anaesthetic. Thereafter the dentist excavates the caries from the affected tooth. If the patient decides on an amalgam filling, which is a mixture if mercury and a variety of different metals, the dentist, using a diamond and carbide burm shapes the cavity in which the amalgam remains anchored once it has hardened. The filling may only be polished at the earliest after 24 hours (Rateitschak, Riethe, Wolf 1994: 131-159).

Many patients reject amalgam for aesthetic, toxicological or ecological reasons (Lehmann, Hellwig 1993: 140). Therefore, a composite filling is the treatment of choice in Germany (Hoffmann-Axthelm 1995: 30). A composite filling consists of matrix plastic, the mechanical properties of which are improved by adding up to 80% filling material (glass, quartz or ceramic) (Hoffman-Axthelm 1995: 401). The preparation of the affected tooth at this point is the same as for an amalgam filling. An anaesthetic is administered and the caries removed. However, the enamel must then be prepared for the filling. To dry the cavity, the tooth is insulated with a matrix, and then the enamel is etched with 38% phosphoric acid, removed with a water spray, and conditioned with a bonding medium (Rateitschak, Riethe, Wolf 1994: 125). The bonding material and the composite are hardened through the added catalysts, which are activated by a special light source (UV lamp) (Hoffman-Axthelm.1995: 401). The advantages of the composite filling are the minimally invasive procedure during the preparation of the tooth. Furthermore, individual colour nuances lead to a highly aesthetic result (DGZ 2003: 1).

During the costing exercise, both types of filling were examined, since, on the one hand, the amalgam filling material was stipulated by the vignette, while in practice composite fillings are used. The differing and common treatment steps in the amalgam and composite filling procedure are shown in Figure 2. At this point it should be noted that the original definition of

the case vignette did not specify details of the fillings. The two-surface filling was chosen for further investigations since it is by far the most commonly used type of filling. Some dentists pointed out that, in such a case, however, a three-surface filling may be necessary.

Figure 2: Treatment steps in the amalgam and a composite filling procedure



Selection of Study Participants

The dentists were selected on the basis of contact data, which can accessed via the doctor search serviced provided by the Berlin Regional Dentists' Association. We excluded orthodontic practices as well as practices specialising in implantology or cosmetic treatments. In all, we wrote to a total of 118 randomly selected Berlin dentists. At the same time, we placed a call to participate in the dental information bulletin published by the association. A total of 57 dentists in Hamburg were also contacted per e-mail having been selected from an online directory of dentists. Following this approach, 10 Berlin dentists and three Hamburg dentists agreed to participate in the study. In addition, one dentist from Mecklenburg-West Pomerania and one dentist from Bavaria took part in the study. Both were approached through personal contacts and agreed to participate in the study.

Of the 15 dentists who took part in our survey, seven worked in individual practices and eight in group practices. The number of staff varied in the practices from between two and 10, although only one practice employed staff other than dental assistants and trainees. None of the practices employed dental technicians. Of all the practices contacted, only five said they

used a very small proportion of amalgam fillings, so in the 10 other practices, only the composite filling was costed. A composite filling was also costed in two of the practices that also gave information on amalgam fillings (see Table 26).

Table 26: Staff employed in participating dentist's practices

Dentist's practice	**1**	**2**	**3**	**4***	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Type of filling method examined (A/C)	A/C	C	A/C	C	C	A	C	A	A	C	C	C	C	C	C
Number of dentists	2	3	1	1	1	2	2	1	1	3	2	3	1	1	1
Number of dental assistants	3	4	1	3	2	4	4	4	3	7	4	9	2	2	3
Number of trainees	0	1	2	0	0	1	1	1	1	0	0	1	0	1	0
Other staff members	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Individual/Group practice	G	G	I	G	I	G	G	I	I	G	G	G	I	I	I

*For dentist's practice 4, the information was provided by staff members, but not the dentist himself.

Most of the participants were interviewed personally for 20 to 90 minutes. Three dentists were interviewed by phone, and five dentists completed a questionnaire. Information given about the treatment steps and the time the treatment took can be considered to be particularly reliable, while the information on costs cannot be seen as complete. Especially, because the dentists had difficulties in specifying overheads. They also rarely provided information about the costs of the materials and equipment used. Therefore information was obtained either from the manufacturers or suppliers on the basis of exact descriptions of the materials or the name of the manufacturers of the equipment.

Description of the study results

Case costing was conducted in the same manner in all the practices as far as the treatment step "Cavity cleaning" (see figure 2). For all subsequent treatment steps costing was conducted separately for amalgam (five practices) and for composite fillings (12 practices). Overheads were calculated on the basis of the data collected from all practices, because – with one exception – there were no case-relevant differences between amalgam and composite fillings. If dentists did not provide relevant information, in particular in the area of material costs and overheads, we computed an average value from the available data and included it in the costing for the respective practice.

Although an X-ray is almost always required for diagnosis and treatment in dental surgery (Gutwald, Gellrich and Schmelzeisen 2003: 138), the X-rays were only used in an average of

approximately 21% of the cases with a variation of between 10% and 35% among the practices. This is probably because X-rays are usually used to investigate the status of a patient's teeth at the first time they visit a practice which is not true for the patient group of the vignette. The reference value for determining the costs per X-ray was set, in consultation with the dentists, at 10 X-rays per day on 220 working days per year. The costs of an X-ray varied therefore from €0.11 to €2.12 per X-ray, depending on cited costs of the equipment (€5000 to €70,000) and the expected service life (five to 20 years).

If the dentist finds a tooth that requires treatment, a vitality test was conducted in an average of 38.8% of cases as the next step in the diagnosis. While two dentists conducted a vitality test in 90% of the cases described in the vignette, other dentists conducted this test either not at all or very rarely. On average, the diagnosis took 7.7 minutes with three of the 15 interviewed dentists taking five to six minutes, and two requiring 11 minutes. All the dentists reported that they worked together with a dental assistant throughout the whole of the diagnostic and treatment period, so that the time calculated for the dental assistant is identical to that of the dentist. The cost per minute values for the dentist and the dental assistant was taken from section 3.1.1 and 3.1.2. Expendables used for the examination were not costed since the costs of the cold spray, mirror, probe, cotton balls, or tweezers were less than €0.01 per patient. As a result, the costs of the examination heavily dependent on the personnel involved and range from a minimum of €5.98 to a maximum of €14.25, averaging €9.25 (see Table 27).

Table 27: Costs of examination for amalgam and composite

Examination phase		Cost components	Units of measure	Costs per unit in €	Units per case and procedure	Total costs in €
Examination (amalgam and composite)						
		Dentist	minutes	0.93	7.7	7.18[1)]
Diagnosis	100%	Dental assistant	minutes	0.25	7.7	1.96[1)]
Vitality test	38.8%	Material utilisation				
X-ray diagnosis	20.6%	- X-ray equipment	images	0.52	0.21	0.11[2)]
		Total				**9.25**

Calculations are based on information provided by: [1)]15 dentist; [2)] 9 dentists

At the start of treatment, an intraoral block anaesthetic was administered in 73% of the cases. Ultracaine or xylocaine are used for the anaesthetic. The frequency of the anaesthesia, however, varied among the dentists from 10% to 100% of the cases. For the amalgam filling, the dentists required an average of approximately 27 minutes. However, the average time of the treatment cannot be seen as being representative since all five dentists reported that they only used amalgam in very rare cases. It can be therefore expected that the time required per amalgam filling is overestimated since the dentists reported little routine with amalgam treatment. Since the personnel costs of the amalgam treatment make up 93.4% of the total costs of the treatment phase, this automatically leads to a systematic over-estimation of the treatment costs.

When costing treatment materials, a distinction was made between expendable materials, i.e. for once-off usage (e.g. amalgam, composite, matrices, or wooden wedges) and durables. The costs of expendables were assigned per item, and for amalgam and the phosphate cement layer according to the possible number of treatments per packet. In the case of durables, the varying information regarding length of service was taken into consideration. For example, the drill bits for diamond drills were not only purchased from different manufacturers, they were in part used for different lengths of time. Some dentists changed the drill bits after only five treatments while others used them for up to 20 treatments. This led to differences in the cost of the drill bits ranging from €0.17 to €0.77 per case. Overall, the costs of the amalgam filling averaged €34.52, and this included in all cases a follow-up treatment (polishing) since the filling cannot be polished until after 24 hours. The cost of the follow-up treatment averaged at €4.04.

Table 28: Costs of treatment and follow-up for amalgam filling

Treatment phase		Cost components	Units of measure	Costs per unit in €	Units per case and procedure	Total costs in €
Treatment (amalgam)						
Intraoral block anaeshetic	73%	Dentist	minutes	0.93	27.4	25.56[1)]
Excavate cavity		Dental assistant	minutes	0.25	27.4	6.96[1)]
Clean cavity		Material utilisation:				
Place cavity liner		- Needles	items	0.11	0.73	0.08[2)]
Insert matrix		- Anaesthesia	ampoules	0.48	0.73	0.35[2)]
Place wooden wedge		- Diamond bur	treatments	0.26	1	0.26[2)]
Dry cavity		- Carbide bur	treatments	0.27	1	0.27[3)]
Mix amalgam		- Dental phosphate	treatments	0.05	1	0.05[1)]
Fill cavity		- Matrix	items	0.02	1	0.02[1)]
Suction		- Wooden wedge	items	0.04	1	0.04[4)]
Remove matrix, wedge		- Amalgam	treatments	0.91	1	0.91[1)]
Carve filling		- Articulating paper	items	0.03	1	0.03[1)]
Check vertical dimension		**Total**				**34.52**
Follow-up treatment (amalgam)		Dentist	minutes	0.93	3.0	2.80[4)]
Polish	100%	Dental assistant	minutes	0.25	3.0	0.76[4)]
		Material utilisation:				
		- Diamond finisher	treatments	0.31	1	0.31[4)]
		- Rubber polisher	treatments	0.17	1	0.17[4)]
		Total				**4.04**

Calculations are based on information provided by: [1)] five dentists; [2)] 12 dentists; [3)] seven dentists; [4)] three dentists

In contrast to the amalgam filling, the cavity liner for the composite filling consists of glass ionomer cement. As well as this, the composite is inserted, portion by portion, into the cavity using a plastic injector and is hardened layer by layer using an infrared, polymerisation, or UV lamp. Since the costs of the lamp used for hardening cannot be distributed directly to the case, they were assigned to the overhead costs as were the cost of the capsule mixing device for the amalgam fillings. The last step of the treatment consists of polishing the filling, which can be done immediately. The treatment took an average of approximately 28 minutes with the dentists requiring between 19 and 50 minutes. However, the interval for eight of the dentists ranged from 25 to 31 minutes, so that the average would seem realistic. In comparison with the amalgam filling, the proportion of material costs was much higher at an

average of €6.09 per case. The overall average cost of the actual filling was €38.85 per case (see Table 29).

Table 29: Costs of treatment and follow-up for composite filling

Treatment phase		Cost components	Units of measure	Costs per u-nit in €	Units per case	Total costs in €
Treatment (composite)						
Intraoral clock anaesthetic	73%	Dentist		0.93	27.72	25.78[1)]
Excavate cavity		Dental assistant	minutes	0.25	27.72	7.04[1)]
Clean cavity		Material utilisation:				
Place cavity liner		- Needles	items	0.11	0.73	0.08[1)]
Insert matrix		- Anaesthesia	ampoules	0.48	0.73	0.35[1)]
Etch edges of cavity		- Diamond burs	treatments	0.26	1	0.26[1)]
Apply bonding material		- Bud bur	treatments	0.27	1	0.27[2)]
Prepare composite material and apply		- Glass ionomer cement	treatments	0.10	1	0.10[3)]
Harden filling material		- Matrix	items	0.30	1	0.30[4)]
Remove matrix		- Phosphoric acid	treatments	0.51	1	0.51[4)]
Check vertical dimension		- Application sticks	treatments	0.25	1	0.25[5)]
Polish filling		- Primers		0.72	1	0.72[6)]
		- Resin capsule	items	2.39	1	2.39[6)]
		- Articulating paper	items	0.03	1	0.03[2)]
		- Polishing disc/brush	treatment	0.77	1	0.77[2)]
		Total				**38.85**

Calculations are based on information provided by: [1)] 12 Dentists; [2)] 7 Dentists; [3)] 4 Dentists; [4)] 9 Dentists; [5)] 2 Dentists;

The overhead costs were distributed on the basis of the total monthly treatment time. The average opening times of the practices included in the study were 32.5 hours per week. Since the dentists perform operations outside the normal opening hours and usually have extended opening hours for private patients, a net weekly treatment time of 40 hours was assumed, i.e. approximately 1.5 hours in addition to the opening times. This works out as approximately 160 treatment hours or 9600 treatment minutes per month. With an assumed utilisation of 90%, this results in 8640 net minutes per month. The overhead costs were distributed as a proportion of respective contact time (amalgam filling: 38:14 minutes, composite filling: 35:45 minutes).

In addition, a distinction was made between medicinal and non-medicinal infrastructure. Within the context of the medicinal infrastructure, we queried the participating dentists about

the costs of the treatment chair (including devices), the costs of the basic dental equipment (e.g. the instruments), and the costs of other equipment. The costs of a treatment chair (including devices) varied between €22,000 and €40,000. The average duration of use is slightly over 10 years, resulting in an average monthly depreciation of €225.56. Furthermore, in the case of an amalgam filling, we included the cost of the capsule mixing device, while for composite fillings the costs of the lamp used to harden the material was included.

In the case of non-medicinal infrastructure, the costs of maintenance and small repairs, the costs of fixtures and furnishings in the waiting room and the reception area, the depreciation of the computers, cleaning costs, monthly cold rent, the cost of electricity, heating and water, the costs of disposing of special waste, the costs of communications and office supplies as well as insurance costs were calculated on a monthly basis or from the purchase costs and included in the figures. The administration activities of the dentist were calculated as 20 dentist's working hours, i.e. five hours per week. Half a dental assistant position was allocated to the staffing of the reception. This was assumed on the basis that the other half of the position was dedicated to working directly with the patient and the dentist.

In the non-medicinal infrastructure, the most expensive items were administrative costs, averaging € 2146.43 1961.61, rent, averaging €1689.57 (from €960 to €2500) and monthly insurance costs, averaging €813.33. To calculate imputed interest (i.e. the capital invested in equipment and furnishings for the practice that would otherwise be used for an interest-paying investment), the long-term rate for government bonds (4%) was assumed. Overall, the overhead costs for composite fillings averaged € 27.73 per case and € 29.85 for amalgam fillings (see Table 30).

Table 30: Overhead costs per case of treatment for composite fillings

Overhead costs (composite)	**Costs per month**	
Medical infrastructure		
- Basic dental tools(e.g. instruments)	41.67[1)]	
- Treatment chair including devices	225.56[1)]	
- Infra-red/Polymerisation/UV lamp	19.43[2)]	
- Misc. equipment (e.g. cleaning unit)	25.67[1)]	
Non-medical infrastructure		
- Maintenance/repair	480.00[1)]	
- Furnishings (waiting room/reception)	75.00[1)]	
- Computers	256.67[1)]	
- Cleaning costs	239.07[3)]	
- Rent (exclusive of heating / imputed rent)	1689.57[4)]	
- Electricity, heating, water	383.14[5)]	
- Special waste disposal	24.59[6)]	
- Communications, office supplies	237.00[7)]	
- Insurance	813.33[8)]	
- Administration	2146.43	
- Imputed costs	115.57	
	6758.17	
Treatment duration: **35:45 minutes**		
Net treatment time: **8640 minute**		
Total (per case of treatment)		**27.73**

Calculations are based on information provided by: [1)] five dentists; [2)] seven dentists; [3)] six dentists; [4)] 14 dentists;[5)] 12 dentists; [6)] four dentists; [7)] 10 dentists; [8)] 9 dentists

The personnel costs for an amalgam filling were 58.2% (dentist: 45.8%, dental assistant 12.4%) of the total cost, and less for the composite filling at 55.3% (dentist: 43.5%, dental assistant: 11.8%). In contrast, the proportion of material costs for composite fillings at 8.0% are almost three times as high as those for amalgam fillings (2.6%). The overhead costs are approximately 38.2% (amalgam) and 36.7% (composite) and represent the second highest cost item. Overall, the composite is slightly less expensive at €75.83 per case in comparison to €77.66 per case for an amalgam filling. Taking into consideration the fact that the costs of the amalgam filling are heavily dependent on personnel costs (individual personnel costs, allocation of the overheads according to the duration of treatment) as well as the fact that amalgam fillings are rarely used in the practices questioned, the cited times for conducting amalgam fillings must be seen as being upwardly distorted. The total costs are shown in Table 31.

Table 31: Comparison of average costs of amalgam and composite fillings

	Amalgam	**Composite**
Costs of examination	€9.25	€9.25
Costs of treatment	€34.52	€38.85
Costs of follow-up treatment	€4.04	-
Overhead costs	€29.85	€27.73
Total	€77.66	€75.83

The key element in the reimbursement of dentists by the social health insurance (SHI) is the Uniform Value Scale for Dentists (BEMA; *Bewertunsmaßstab für zahnärztliche Leistungen*). The BEMA stipulates, on the one hand, the services that are covered by SHI, and, on the other hand, the value relationship of the individual services to each other through the distribution of points (Marbé, Muschter 2002: 1). The actual reimbursement is calculated by multiplying the relevant point number by the respective point value in euros (Schreyögg, Tiemann, Busse 2005: 58). The point value is calculated retrospectively by dividing the sum of the flat-rate payments per patient of the sickness funds to the regional dentists' associations by the number of points generated in the respective association region. The point value thus differs in all 16 regions. In 2005 the German national average was € 0.7143 per point (KZBV 2005).

The detailed procedures to diagnose dental buccal and orthodontal conditions are listed under charge number 01U and are valued at 18 points. Doctors who conduct a diagnostic X-ray charge number Ä 925, valued at 12 points. The vitality test is valued under the number eight at six points. A further 11 points can be filed for the intraoral block anaesthesia under the number 41 L1. In addition, for pulp-crowning or special measures required during a filling (e.g. in the case of severe bleeding of the gums) the numbers 12 (10 points), 25 (six points) or 26 (six points) can be filed. Since according to the statistics of the Federal Dentist's Association of (KZBV 2005), number 12 was filed in 21% of all conservative treatments and number 25 in 15.5%. Addiotionally a total of 49 points are allocated for a two-surface amalgam filling in accordance with service code 13 F2.

SHI only covers the cost of a composite filling in the case of proven severe renal insufficiency or amalgam allergy. Since this does not apply to the patient population of the vignette, the service code 13 F2 [two-surface filling and polishing], service code 207 [two-surface filling] and 208 [polishing a two-surface filling] from the dentists' scale of fees, which applies to private patients and extra services, are filed. During the study, other accounting options were named (e.g. 216 Dentists Fee Scale instead of 13 F2), which were not included in the calculations for reasons of comparability.

Charging for private patients is similar to the service code charges of the SHI in accordance with the Fee Scales for dentists and the Fee Scale for doctors. In both fee scales, each service code is assigned a sum in euros that is to be multiplied by an incremental factor that is negotiated between the patient and the dentist. The calculations here were made on the basis of an incremental factor of 3.0 (see Table 32). The service codes filed for private patients have been limited here to those relevant to the vignette for reasons of comparison. According to this calculation, the dentist receives a reimbursement of €83.74 for privately insured patients. In practice, it can be assumed that further services are both provided (e.g. the removal of tartar) and billed. The calculation of invoicing for an amalgam filling for privately-insured patients is not shown since - according to the participating dentists – privately-insured patients generally do not choose amalgam treatment. The calculation for SHI patients for an amalgam filling is €51.92. The dentist receives €69.09 for a composite filling, with the patient paying the difference to the cost of an amalgam filling of €17.14 (see Table 32).

Table 32: Reimbursement of amalgam and composite fillings for patients with public (SHI) and private (PHI) insurance

Item	**SHI service code**	**PKV service code**	**SHI amalgam**	**SHI composite**	**PHI composite**
Examination	01U	001	€12.86	12.86	17.98
X-ray image (20.6% of the treatment cases)	Ä 925	5000	€1.77	1.77	1.92
Vitality test (38.8% of the treatment cases)	8	007	€1.66	1.66	3.49
Anaesthesia (73% of the treatment cases)	41 L1	010	€5.74	5.74	9.20
Filling, polishing	13 F2	207,208	€27.86	44.99	44.99
Pulp-capping (21.89% of the treatment cases)	25	233	€0.94	0.94	4.34
Special procedures (15.5% of the treatment cases)	12	203	€1.11	1.11	1.82
Total reimbursement			**€51.92**	**€69.06**	**€83.74**
Payment by SHI (approx. 88% of the population)			€51.92	€51.92	-
Payment by PKV (approx. 9% of the population)					€83.74
Patient co-payment			€0.00	€17.14	€0.00

One potential limitation of our study can be found in collecting the data within the framework of a survey of care providers. The accuracy of the information provided by physicians can only be controlled to a limited extent. Particularly with regard to the duration of examinations or treatment, it is noticeable that the physicians tended to specify numbers that had been

rounded. Indications of one minute, a half-minute, or two, three, five, or ten minutes were clearly more common than specific durations that were not rounded. Using a stopwatch to make determinations, a process sometimes used in other studies (Maibach-Nagel, Prchala 2003: 30), would thus be preferable.

For studies with low numbers of cases, there is also the danger that the random sample does not represent the target population. For measured values that are derived from non-representative random samples, there is the concern that they exhibit distortions or selection errors in comparison to the actual dimensions of the target population (AG Reha-Ökonomie 1999a: 23). Against this background, a larger number of service providers would have had to be included in the study for the results to be seen as representative for the whole of Germany. The results can thus only partially reflect costs of an amalgam or a composite filling.

On the one hand, our study only has only accounted for imputed interest that lies below the higher rate of interest on loans, thus underestimating the overhead costs. For material costs, there is also the tendency to assume an underestimation of costs, since it is questionable whether all the materials used are actually accounted for. On the other hand, it is possible that the physicians in the study may have perceived their fee structures to be under scrutiny. To this extent, it was in the care providers' interest to tend to overestimate costs in order to justify the current level of reimbursement (in the case of private insurance) or to question the levels (in the case of statutory insurance). A further problem lies in the potential overestimation of overhead costs per case since the calculation was on the basis of only 40 treatment hours per week (+ additional administrative time). The study for the recalibration of the point values for EBM2000plus (see section 3.X) was based on 46 hours. If the dentist worked 41 hours instead of 40 hours per week the overhead costs decline. If, instead of 20 hours per month, 25 hours are used for administrative work by the dentist, overhead cost increase.

When reimbursement and costs are compared to each other, the result for an amalgam filling is negative (- €25.74). This would lead to a dentist's fee of € 9.84 per case (- €25.74 + 38.14 minutes * 0.933) or €0.26 per dentist's minute. As described above this might be partly due to the small number of amalgam patients at the dentists questioned and the resulting increased treatment time. Another explanation for the negative result might be an undervaluation in the Uniform value Scale for Dentists.

In the case of the composite filling, it is of note that the result is slightly negative for SHI-patients (€-6.77), while it is positive for privately insured patients (+ €7.91). This means that the dentists' overall income for the composite filling for an SHI patient is €26.30 (-€6.77 + 35:45 minutes * € 0.933) or € 0.74 per dentist' minute. The income per privately insured patient is €40.98 (€7.91 + 35:45 minutes * € 0.933) or €1.16 per dentist' minute. This means that the reimbursement of the dentist minute for a composite filling for a privately insured patient is almost 50% above the reimbursement for an SHI patient.

Vignette 10 – Physiotherapy

Description of vignette: Male 25-35 years after anterior cruciate ligament reconstruction, consulting for ambulatory rehabilitation after discharge from hospital (with a referral if necessary in the country). Repair and hospital stay were without complications and discharge occurred after average length of stay. Please specify the duration and frequency of physiotherapy (e.g. 4-6 weeks, 3 times per week with 1 hour per session).

Results: In Germany, the incidence of anterior cruciate ligament (ACL) rupture is estimated at 95,000 cases annually (Miyasaka et al. 1991), the majority of which are due to popular sports such as football and skiing (Steinbrück et al. 1999). The prevalence of ACL ruptures in Central Europe is 0.5-1 per 1000 population. This case vignette is based on the therapeutic follow-up of such a case of treatment in the context of outpatient physical therapy. The starting point for collecting data on costs and services for this vignette was the following case description: A male subject between the age of 25 and 35 years consults for outpatient rehabilitation after discharge from hospital following anterior cruciate ligament reconstruction (with a referral if necessary in a rural area). Repair and hospital stay were without complications and discharge occurred after an average length of stay.

Medical Basis

The anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) are located in the centre of the knee and run diagonally, at ninety-degree angels to each other. Together with the medial collateral (MCL) and lateral collateral (LCL) ligaments, the menisci, and the muscles, the ACL and PCL play an especially important role in the stability of the knee joint. Partial or complete tears of one or both cruciate ligaments are referred to as ruptures. If a cruciate ligament is completely abrupt, parts of the bone may also be affected. Because bone

involvement is considerably less common, this indication will not be considered in this study In addition, only ACL ruptures are considered in this study, because this indication is approximately 10 times more common than PCL ruptures, and treatment for ACL ruptures is accordingly more standardised (Bergfeld et al. 1991).

The most frequent types of injuries are those resulting from stiff landing, or twisting the knee while landing, especially when the knee is in the so-called valgus position. Typical causes are jerk-like, twisting movements of the knee when it is turned in or out, or direct blows to the tibial plateau. People who play stop-and-go sports, such as tennis or squash, are particularly susceptible to ACL rupture, as are those who play team sports such as football, handball, and basketball, where the injuries are frequently caused by another person. ACL ruptures seldom occur in isolation and are usually accompanied by injuries to the MCL and LCL, as well as to the menisci. In the case spectrum of this case vignette, however, only isolated ACL ruptures are taken into account. Also, in contrast to the original case definition, we chose not to differentiate between female and male patients, or between the right and left knee. All of the physical therapists participating in our study indicated that the treatments provided, and thus the resources used, did not differ in these cases.

Due to the individual factors related to age, physical fitness/activity, and morbidity, not every patient needs to undergo an operation after an ACL rupture. In principle, patients may choose conservative therapy, which entails regularly exercising the femoral muscles; if successful, this can provide enough stability that the knee can be subjected to normal, everyday strain. The current case vignette, however, covers operative cases that require follow-up in the area of outpatient physical therapy. Depending on the type of operation, physical therapy can allow patients to place their full weight on their knee after approximately two weeks. Patients can generally engage in light sport activities after three months, with a return to full ability to participate in sports after six months.

Types of Treatment in Outpatient Physiotherapy

Following an ACL rupture, post-operative physical therapy is classified according to current German legislation as a remedy (*Heilmittel*). Patients insured by one of the statutory health insurance companies are not only entitled to medical treatment, but also to medication, dressing/bandaging material, and remedies (§ 32 Code of Social Law V; *Sozialgesetzbuch*, or “SGB”) In this context, remedies are primarily external treatments intended to aid in the

healing process or provide relief from illness; examples include physical therapy, massage, and speech therapy. Services like these can, if prescribed by a physician, be covered by SHI. The reimbursement of these services is regulated by the Directives on the Prescription of Remedies and Medical Devices (*Heil- und Hilfsmittelrichtlinien*, or "HMR"), which represent agreements between physicians (represented by the German National Association of Social Health Insurance-accredited Physicians) and the National Associations of Health Insurance Funds. The HMR provide guidelines on the prescription of remedies for patients with statutory health insurance. According to these guidelines, SHI-accredited physicians have discretionary authority to decide which services a patient will receive at the expense of his or her health insurance company. Accordingly, the number and type of prescriptions a physician makes determine the SHI costs in this context.

The fundamental second component of the HMR is the so-called Remedy Catalogue (*Heilmittelkatalog*, or "HMK"). The Remedy Catalogue specifies which remedies may be prescribed for particular diagnoses (indications and diagnosis groups), and in which amounts. The remedies and corresponding amounts listed in the HMK are based on experiences gathered in everyday practice. With regard to physical therapy after surgery for ACL rupture, the HMK specifies six units per prescription, whereby the total number of units that may be prescribed is 30. On one prescription form, in addition to one of main remedies listed in the HMK, the physician may prescribe a supplementary remedy or a combination of remedies, such as D1 treatment. The main remedies for ACL rupture are defined as physical therapy and manual therapy. In this context, thermal therapy represents a supplementary remedy, although it should be noted that manual lymph drainage is often prescribed following a surgical procedure. Here, the amount that may be prescribed is six units per prescription, with a maximum of 12 units. This type of "positive list" does not apply to patients with private insurance. For this patient group, physicians may select the type and quantity of remedies at their own discretion.

Below, we describe the five follow-up procedures that can be prescribed and reimbursed for patients who have undergone surgery for ACL rupture:

Physical Therapy (PT)

Physical therapy is used to help patients avoid injuries caused by shortened muscle groups and muscular imbalance. To prevent these negative effects, the patients perform targeted

exercises to strengthen muscle groups and learn to alter detrimental sequences of movements. The standard treatment duration for one unit of physical therapy is 15-25 minutes.

Manual Therapy (MT)

Manual therapy is a type of hands-on intervention performed by therapists to treat dysfunctions of the musculoskeletal system. The treatment aims to correct imbalances in the physiological interaction between joins, muscles, and neural structures. The therapist applies passive, mobilising techniques, and the patient performs strengthening and stabilisation exercises. The standard duration of a manual therapy session is 15-25 minutes. Manual therapy can only be reimbursed if it is performed by a physical therapist who has completed training in this form of treatment.

Thermal Therapy (TT)

Thermal therapy consists of different forms of ice and heat therapy. One type of ice therapy is the use of ice packs, for example, which reduce the temperature of tissues locally for therapeutic purposes. Ice therapy is often prescribed together with physical therapy. It helps alleviate pain in the affected region, reduces inflammation, and decreases nerve conduction speed. The standard duration of ice therapy is 5-10 minutes. Different types of heat therapy include the application of heat by means of heat lamps, warm compresses, or ultrasound. The goals of heat therapy are to reduce pain, improve circulation, and help relax muscles. The standard duration of heat therapy is 10-20 minutes.

Manual Lymph Drainage (ML)

Manual lymph drainage is a manual massage technique consisting of a gentle and systematic pumping technique that enhances the flow of interstitial fluids through the lymphatic and vascular systems, as well as the interstitial space between cells. The goal is to simultaneously improve impaired lymph drainage and reduce pain. The standard duration of this form of treatment is 30 minutes. The treatment may only be reimbursed if it is performed by a physical therapist who has completed further training in the manual lymph drainage technique.

D1 Treatment (D1)

If the patient's injuries are particularly complex, and a combination of three or more remedies is advisable in terms of synergy, then a standardised combination of remedies may be prescribed. The so-called D1 treatment represents a standardised combination of three or more physical therapy procedures. The HMK lists the diagnosis groups for which this type of treatment is generally permissible. The D1 remedy combination consists of obligatory and supplementary procedures. For treating ACL rupture, the obligatory procedures are physical therapy and manual therapy. The supplementary measures include classical massage therapy, thermal therapy, and electrotherapy. The standard duration of treatment for a combination of procedures like this is 60 minutes. The service may only be performed by a physical therapy practice if this practice fulfils the requirements for carrying out the combination of procedures in question, especially the obligatory ones.

Selection of Study Participants

We chose the outpatient healthcare providers for physical therapy from the directory provided at www.physio.de, where the contact information of the practices is available to the public. In total, we wrote to 76 randomly selected practices in the federal states of Berlin, Brandenburg, and Lower Saxony asking if they would be interested in participating in the *Health*BASKET research project. Subsequently, we made a follow-up telephone call to determine the readiness and eligibility of the individual practices for conducting a detailed survey. To be eligible for inclusion in the study, the practice had to have treated patients with an ACL rupture during the calendar year 2005. In total, we were able to include four outpatient physical therapy practices in each federal state (B1 – B4, BRB1 – BRB4, LS1 – LS4) in the survey, which consisted of a personal, on-site interview. In each of the 12 practices, the owner was asked to provide information on costs and services. The survey was based on a set of predetermined guidelines and structured much like a questionnaire to guarantee the comparability of results. In addition, we recorded information on any special infrastructural aspects of the practices and other detailed information. We used these additional data at a later point in time in cases where the main information on costs and services required interpretation.

Description of Study Results

The participating physical therapy practices can be distinguished from one another by a number of different criteria (see Table 1). The weekly working hours per practice (WWH) varied considerably and were related to the average number of physical therapists (PT) employed at each practice. Practice B2 had the lowest number of weekly working hours (i.e. 20 hours), because it was run by only one self-employed physiotherapist. In contrast, Practice LS3 had 180 weekly working hours and employed an average number of 4.5 physiotherapists. When distinguishing between the participating practices in this manner, we also observed that the size of the practice (in square metres) was associated to a certain degree with the size of the owner's investment in capital goods (CG). Indeed, the largest of the participating practices (LS3) had also made the largest investment (i.e. €66,590), whereas the smallest of the participating practices (B2) had made the smallest investment (i.e. €2922). Looking at the average gross hourly wages (GHW) shows that the highest hourly wages are paid in Lower Saxony, followed by Brandenburg. The lowest hourly wages are paid in Berlin.

Physician's practice	**WHW**	**Ø-PT**	**Ø-GHW**	**m²**	**CG**
B1	85	2.13	€10.12	130	€63,000
B2	20	0.50	€11.00	35	€2922
B3	86	2.15	€12.00	120	€64,000
B4	70	1.75	€11.00	90	€61,500
Ø-B	**65**	**1.63**	**€11.03**	**93.75**	**€47,856**
BRB1	60	1.50	€13.75	71	€41,000
BRB2	48	1.20	€12.50	68	€29,000
BRB3	40	1.00	€11.25	70	€16,000
BRB4	45	1.13	€12.50	62	€30,000
Ø-BRB	**48**	**1.21**	**€12.50**	**67.75**	**€29,000**
LS1	120	3.00	€13.40	150	€56,500
LS2	46	1.15	€13.20	140	€24,853
LS3	180	4.50	€13.00	200	€66,590
LS4	115	2.88	€13.20	160	€49,800
Ø-LS	**115**	**2.88**	**€13.20**	**162.5**	**€49,436**
Ø-total	**76**	**1.91**	**€12.24**	**108**	**€42,097**

Table 33: Structural differences among physician's practices; GHW= gross hourly wage; CG= capital goods; B= Berlin; BRB= Brandenburg; LS= Lower Saxony

Looking at the figures from all three federal states shows that, on the average, the physical therapy practices in our study employed 1.91 physical therapists who together worked 76 hours per week at an hourly rate of €12.24. Furthermore, the practices were, on the average, 108 m² in size and had capital assets in the amount of €42,097.

With physical therapy services, the largest component of the direct costs is the cost of labour. Because of this, the physical therapist's gross hourly wage plays a particularly important role.

As part of our survey, we collected data on the gross hourly wage of all employees working at the individual physical therapy practices, as well as the weekly working hours. Using this data, we computed the average gross hourly wage per practice, weighted according to the weekly working hours in this practice. It is important to note that our figure for the weekly working hours took into account a rate of 3.4% for absenteeism due to sickness (i.e. the rate determined by the German Federal Ministry of Health for the year 2004). In addition, we included the employer's perspective by adding the income-dependent employer's social insurance contribution. Because of this, the question of which physiotherapist treated which patient within an individual practice was irrelevant to our study.

By using this method, the employer's costs per hour and the imputed employer's salary assigned to the owner of the practice, as well as to all other self-employed physical therapists, were identical. This means that the costs for providing the services do not include profit. This ensures the comparability of the practices, because it is thus no longer important whether, or to which extent, the owner of the practice participated in providing services. Nevertheless, we also collected data on the weekly working hours of self-employed individuals in order to be able to compute the number of employees per practice. For physical therapy practices without any employees, the average gross hourly wage in the participating practices from the same federal state was assumed as the imputed employer's wage.

In each federal state, at least two of the participating practices had employees. On the average, their hourly gross wage amounted to €12.24, thus leading to employer's costs in the amount of €17.85 (29.75 Cent per minute). As described above, some types of treatment may only be provided by physical therapists who have completed the necessary training. Although, as a form of manpower development, the costs of this training themselves represent investments, taking these into account would be complex from a cost-accounting perspective. Instead, we assumed that the degree of a physical therapist's qualifications was reflected in his or her gross hourly wage and thus did not perform any further differentiation. To determine per-case direct costs, we used the average duration of therapy for each kind of therapy, as well as the average number of therapy units utilised. Table 34 summarises costs for an SHI-insured case of treatment.

Treatment phase		Cost component	Units of measure	Costs per unit in €	Units per case of treatment	Total costs in €
Components		**Labour utilisation**		**No. of sessions**	**minutes**	
Physiotherapy in	65.3%	*Physiotherapy*	minutes	18.08	426.47	
Ø-session duration	*23.58*	*D1 treatment*	minutes	0.17	10.00	
D1 treatment in	1.5%	*Manual therapy*	minutes	1.17	35.00	
Ø-session duration	*60.00*	*Thermal therapy*	minutes	3.67	25.67	
Manual therapy in	5.4%	*Lymphdrainage*	minutes	5.42	155.73	
Ø-session duration	*30.00*	Physiotherapist	minutes	0.298	652.86	**194.27**
Thermal therapy in	0.04					
Ø-session duration	*7.00*	**Material utilisation**				
Lymphdrainage in	23.9%	*Beverages*				1.27
Ø-session duration	*28.75*	*Sports ointment*				2.39
		Miscellaneous				0.00
				Total		**197.92**
Overhead costs		**Ø-number of therapy minutes per month**			20029.17	
		Ø-number of therapy minutes per ACLR patient			652.86	
					Monthly costs	
		Non-medical infrastructure				
		Rent (exclusive of heating)			757.83	
		Running costs (electricity, heating, etc.)			214.36	
		Telephone costs			65.42	
		Cleaning costs			96.39	
		Insurance			114.38	
		Furnishings			65.79	
		Computer + electronic data processing			15.05	
		Telephone system			0.83	
		Administration			449.57	
		Passenger car			94.33	
		Miscellaneous			15.32	
		Imputed interest			87.03	
				Total	**1976.29**	**64.42**
		Medical infrastructure				
		Medical equipment (incl. maintenance)			81.46	
		Sports equipment			86.12	
				Total	**167.58**	**5.46**
Total Costs						**267.80**

Table 34: Costs per SHI-insured case of treatment

Because of the different levels of reimbursement, we collected data separately for SHI insured patients and privately insured patients in our interviews with participating practices. With regard to the types of therapy described above, we were unable to observe any differences between SHI and privately insured patients, because privately insured patients were not prescribed any different types of therapy. Rather, the difference between the two groups can be seen in the combination of individual types of therapy in the entire episode of care and the duration of treatment per appointment. (see Table 2 and 3). The use of average duration of treatment per type of therapy, as well as the average number of units utilised per case, to

calculate direct costs justifies a separate consideration of privately insured patients in the analysis. Due to the different distribution of the various types of therapy and a trend toward longer treatment duration, the direct personnel costs per appointment among private patients were approximately €35 higher, in total (see Table 35).

Treatment phase		**Cost component**	**Units of measure**	**Costs per unit in €**	**Units per case of treatment**	**Total costs in €**
Components		**Labour utilisation**		**No. of sessions**	**minutes**	
Physiotherapy in	57.2%	*Physiotherapy*	minutes	18.67	448.00	
Ø-session duration	*24.00*	*D1 treatment*	minutes	1.50	90.00	
D1 treatment in	11.5%	*Manual therapy*	minutes	1.33	40.00	
Ø-session duration	*60.00*	*Thermal therapy*	minutes	5.17	38.46	
Manual therapy in	5.1%	*Lymphdrainage*	minutes	5.67	166.46	
Ø-session duration	*30.00*	Physiotherapist	minutes	0.298	782.92	**232.97**
Thermal therapy in	4.9%					
Ø-session duration	*7.44*	**Material utilisation**				
Lymphdrainage in	21.3%	*Beverages*				2.02
Ø-session duration	*29.38*	*Sports ointment*				2.57
		Miscellaneous				0.83
				Total		**238.38**
Overhead costs		**Ø-number of therapy minutes per month**			20029.17	
		Ø-number of therapy minutes per ACLR patient			782.92	
		Non-medical infrastructure			**Monthly costs**	
		Rent (exclusive of heating)			757.83	
		Running costs (electricity, heating, etc.)			214.36	
		Telephone costs			65.42	
		Cleaning costs			96.39	
		Insurance			114.38	
		Furnishings			65.79	
		Computer + electronic data processing			15.05	
		Telephone system			0.83	
		Administration			449.57	
		Passenger car			94.33	
		Miscellaneous			15.32	
		Imputed interest			87.03	
				Total	**1976.29**	**77.25**
		Medical infrastructure				
		Medical equipment (incl. maintenance)			81.46	
		Sports equipment			86.12	
				Total	**167.58**	**6.55**
Total Costs						**322.18**

Table 35: Costs per PHI-case of treatment

Both of the tables above (table 34 and 35) show that, of the main forms of therapy used in the follow-up care of patients who had undergone surgery for ACL rupture, physical therapy was used most frequently. On the average, patients with public insurance received 18.08 units of physical therapy, and patients with private insurance 18.67 units, which does not represented

a marked difference. However, with regard to the frequency with which D1 treatment was prescribed, it should be noted that patients with private insurance clearly received D1 treatment more frequently (1.5 per case) than did patients with public insurance (0.17 per case). When we look at the average number of units prescribed per case, it seems even clearer that privately insured patients, who received an average of 32.2 therapy units in our study, tend to be provided with more service per case of treatment than do the SHI insured patients, who received an average of 28.5 therapy units.

An important component of overhead costs is the amortisation of capital goods, because the estimates of useful service life (SL) and the amortisation period related to these have a considerable influence on the amount of overhead costs and thus, also, on the relationship between costs and revenues per case. In our calculation, we used linear amortisation, as is specified according to German tax law. Because the participating physical therapists were unable to provide us with any data on their costs of capital, we applied imputed interest in the amount of 4% as part of our calculation. This method is also appropriate for capital assets financed by equity capital, because this capital could otherwise be used for an interest-paying investment (i.e. opportunity cost approach).

To allocate overhead costs proportionally to the cases of treatment, it was necessary to create a suitable cost rate. Because of the different durations of treatment per appointment among the various diagnoses, we took into account the average total contact time per case in this calculation. In this way, we were also able to take into account the different number of appointments and the generally longer duration of treatment per case in privately insured patients. Finally, we assumed that each physical therapy practice was working at 90% capacity and used this figure when calculating overhead costs.

$$\text{Proportion of overhead costs} = \frac{\text{Ø-total contact time with an ACL rupture patient}}{\text{Total labour time of a physical therapy practice}}$$

In Table 34 and 35, the overhead costs are listed separately as overhead costs of medical infrastructure and overhead costs of non-medical infrastructure.

It is notable when comparing the two cost categories that the costs of non-medical infrastructure in the participating practices (€1976) were approximately 12 times higher than the costs of medical infrastructure (€168). This can be traced back to the fact that the service provided in this context is frequently performed manually by the physical therapist him- or herself, and the use of medical/technical equipment is considerably lower than in private physician practices. The biggest cost drivers are rent (i.e. an average of €758 per month) and administrative tasks (i.e. an average of approximately €450 per month).

For the reimbursement of physical therapy services provided to SHI-insured patients, there are standard prices for primary and substitute sickness funds in each federal state. The reimbursement received by a physical therapist is thus based on the location of the practice (i.e. in which state it is located) and whether the patient is insured under a primary or a substitute sickness fund. For each federal state, we took the prices from the respective list and determined the average prices paid by primary and substitute sickness funds. This means that we assumed an equal distribution of insured among primary and substitute sickness funds. Table 36 shows how much the prices between the various federal states vary with regard to physical therapy.

Federal State:	**Service code:**	**Type of therapy**	**Price**
Berlin	20502	Physiotherapy	€13.60
Lower Saxony	20501	Physiotherapy	€13.36
Brandenburg	20502	Physiotherapy	€11.29
		Ø- price	**€12.76**

Table 36: Reimbursement for physiotherapy according to federal state

The statutory co-payments to be made by patients with public insurance are contained within the standard price lists for each federal state. This means that when the physical therapy practice bills the SHI for the services it has provided, the amount of the reimbursement is decreased by the amount of the patient's co-payment. Since 1 January 2004, patients have been required to pay 10% of the sales price for remedies (i.e. massages, physical therapy, etc.), as well as €10 per prescription. In the case described in this vignette, the average co-payment was €69 per treatment episode (sum of all appointments of one patient per case). Theoretically, the prices for treatment provided to privately insured patients are freely negotiable, but according to the physical therapists participating in our study, these are limited by the reimbursement amounts set by the private insurance companies. Generally, private patients are not willing to accept prices higher than these. Thus, according to information provided by physical therapists participating in our study, services were billed at a 1.4 to 2.3

times the standard rate. Table 37 below shows the average revenues and costs, listed separately for patients with public (SHI) and private (PHI) insurance:

	Revenues	DC	OC	DC+OK	Operating profit
SHI	337.24	197.92	69.88	267.80	69.44
PHI	736.84	238.38	83.80	322.18	414.66
Ø- total	**537.04**	**218.15**	**76.84**	**294.99**	**242.05**

Table 37: Comparison of average costs and revenues in patients with public (SHI) or private (PHI) insurance

When comparing the average values for patients with public insurance and patients with private insurance, we can see that the average revenue for treating a privately-insured patient (€737) is approximately 220% higher than the average revenue for treating a SHI insured patient (€337). In contrast, the average costs for treating a privately insured patient (€322) are only 20% higher than the costs for treating a SHI-insured patient (€267). This difference in costs is due primarily to the greater number of treatment appointments and the longer duration of treatment, on the average. The revenues differ according to the type of therapy that the practices provide. Because the direct costs are comprised, for the most part, of direct personnel costs, the amount of direct costs is dependent primarily on the duration of treatment, which differs considerably depending on the type of therapy provided.

For a physical therapy practice, the per-case operating profit when treating a privately insured patients with ACL rupture is, on the average, six times higher than the per-case operating profit when treating a SHI insured patient. However, even if this represents an incentive to treat privately insured patients, it is important to consider that a markedly lower percentage of patients have private insurance. In our data sample approximately 30% of patients with ACL ruptures have private health insurance.

4. Conclusion

For the inpatient as well as the outpatient vignettes the main challenge was to find providers willing to provide the necessary data. However, we finally managed to convince a considerable number of providers to provide us their data, a much higher number than we originally assumed.

For the outpatient vignettes the methodology to obtain data by questionnaires turned out to be more promising than face-to-face interviews because it enabled better access to the physician him/herself who usually have easy access to patient files and cost data. The main challenge in obtaining data for outpatient vignettes was to standardize data to be delivered by physicians. Therefore we developed a standardized reporting system which is easy to understand for physicians. Especially regarding overhead costs physicians needed very detailed guidance on how to put them together.

For the inpatient vignettes we were able to rely on hospitals which voluntarily participate in the cost data sample for calculating the German DRGs. These hospitals follow standardized accounting principles, the so called modular system of cost calculation in the G-DRG system, ensuring the use of the same allocation bases. All of the hospitals that decided to participate in our project provided good cost data. However, not all hospitals were able to provide us detailed information on utilization of resources as diagnostic services and drugs. Therefore we know pretty well, how much costs were incurred for each phase of the vignettes and their cost components (e.g. drugs given on the normal ward) but are sometimes not able to list the drugs in detail. By having individual level data we are even in position to adjust for different side-diagnoses and procedures (according to OPS procedure codes).

After receiving the requested data from each provider we performed several plausibility tests for ambulatory as well as inpatient vignettes. Although we identified certain differences between providers, often due to varying length of stay, there were no major inconsistencies in the delivered data sets. Finally it can be concluded that the data provided in this country report can serve as a solid basis for cross-country comparison which represents the final phase of the Health Basket Project (WP10).

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Appendix

Attachment 1: Vignette Appendectomy by provider

Attachment 2: Vignette Normal Delivery by provider

Attachment 3: Vignette Hip replacement by provider

Attachment 4a: Vignette Cataract operation (inpatient) by provider

Attachment 4b: Vignette Cataract operation (outpatient) by provider

Attachment 5: Vignette Stroke by provider

Attachment 6: Vignette AMI by provider

Attachment 7: Vignette Cough by provider

Attachment 8: Colonoscopy

Attachment 9: Vignette Tooth filling by provider

Attachment 10: Vignette Physiotherapy by provider