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## ECONOMICS

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## INPATIENT DIALYSIS IN GERMANY – FINANCING AND ECONOMIC CHALLENGES

**ABSTRACT.** This paper shows the financing situation of inpatient dialysis in the German healthcare system from the providers' perspective. Due to two predominant financing options – Diagnosis Related Groups (DRGs) and additional charges – decision makers need knowledge on the revenue per treatment as well as arising economic challenges. The analysis explains the financing options, compares the revenue per treatment of both options and explains advantages, disadvantages and risks of each option. The results show that the revenues per treatments in case of DRGs including dialysis are in average higher than the revenues generated through additional charges. However, the discussion analyzes the risks and uncertainties which clearly indicate that more than only the average revenue based on the DRG-Report-Browser data has to be regarded.

**Keywords:** inpatient dialysis, diagnosis related groups, additional charges, health care management, Germany.

### Introduction

Changes in the German hospital financing system with fixed revenues, an aging population as well as an increase in the volume of patients showing multi-morbid chronic conditions cause new challenges for all health service providers. Especially in the field of kidney diseases and the need of renal replacement therapies those changes are of particular importance. Several studies have shown that the prevalence as well as the average age of patients have increased during past years (Frei *et al.*, 2008, pp. 29-37). Furthermore, it could be shown that personnel time spent on medical service provision and nursing depends on diverse process options during a dialysis treatment (Krohn, 2014, pp. 59-80). All these factors affect the cost of medical treatments. Due to fixed revenues it is obvious that most health service providers and decision makers focus on the cost, mainly with regard to improvements in process management. However, these improvement activities seem to be limited in the long run. Cost covering and consequently sustainable provision of service can only be possible if the financing of these services can cope with the arising challenges. The identified challenges

are not unique to the German hospital financing system. They can also exist in further lump-sum-based financing systems like the one in Australia (Department of Health, 2014, pp. 28-29), the United States of America (CFR, 2015, §402.104), the United Kingdom (NHS England, 2014, pp. 17-24) and France (Busse *et al.*, 2011, p. 54). Due to different legal regulations and because of a low share of inpatient dialysis in comparison to outpatient treatments the number of economic analyses is rather limited. Existing studies mainly focus on single treatments or annual costs. Thus, a discussion of revenues per lump-payment based on the options given by legal regulation seems to be inevitable.

The purpose of this article is to show various financing options for inpatient dialysis, to analyze the average revenue per dialysis and to state and discuss economic challenges of these financing options from the providers' perspective.

### 1. Financing aspects of dialysis treatments

There are numerous options of financing dialysis treatments in the German health care system. The following analysis focused on inpatient dialysis at a hospital with a dialysis unit. These hospitals mainly can bill dialysis services as additional charges beside the DRG lump sum payment or directly as part of the DRG.

The first and more relevant option are national equal additional charges. These are billed in case of hospital treatment where renal failure is not the principal diagnosis.

Example: A patient with chronic end stage kidney disease gets admitted to the hospital because of another medical condition, e. g. a revision or replacement of the hip joint with an average time of hospitalization of 15.7 days. So the assumed DRG I05A „revision or replacement of the hip joint without complicating diagnoses, ...“ does not include the needed dialysis treatments during these time. The dialysis treatments are compensated by billing the additional charge several times – one additional charge for each dialysis.

In case of inpatient intermittent dialysis three additional charges are predominant. The main additional charges are ZE01.01 (hemodialysis, intermittent, age over 14 years), ZE02 (hemodiafiltration, intermittent) and ZE62 (hemofiltration, intermittent). Furthermore, other intermittent dialysis methods and continuous dialysis can be billed by defined additional charges. *Table 1* provides information on possible treatments at the dialysis unit. Each treatment is defined in the German Procedure Classification (German: OPS – Operations- und Prozedurenschlüssel). In case of intermittent treatments the symbol “□” – normally defined by numbers – differentiates between type of anticoagulation (without, heparin, other (including citrate)) and duration of treatment (4-5 hours or extended up to 6 hours). Within continuous procedures the first “□” provides information on anticoagulation and the second “□” on treatment duration, defined as period of time (InEK, 2014, pp. 147-178).

Table 1. predominant dialysis procedures

	intermittent	continuous
hemodialysis	8-854.□	8-854.□□
hemofiltration	8-853.□	8-853.□□
hemodiafiltration	8-855.□	8-855.□□
peritoneal dialysis	8-857.□	8-857.□□

Source: own.

In the second option the DRG includes all dialysis treatments if renal disease is the principal diagnosis. These DRGs are named as L60A, L60B, L60C and L71Z (InEK, 2014, pp. 51-52). In detail:

L60A: renal insufficiency, more than one day in hospital, with dialysis, acute renal failure and extremely severe comorbidity and complications or with dialysis, with acute renal failure or extremely severe comorbidity and complications or with calciphylaxis, with dialysis or extremely severe comorbidity and complications and age < 16 years.

L60B: renal insufficiency, more than one day in hospital, with dialysis, with acute renal failure or extremely severe comorbidity and complications or with calciphylaxis, with dialysis or extremely severe comorbidity and complications and age > 15 years.

L60C: renal insufficiency, more than one day in hospital, with dialysis or extremely severe comorbidity and complications, without calciphylaxis.

L71Z: renal insufficiency, one day in hospital, with dialysis.

Each of these four DRGs includes the cost center group “dialysis unit” calculated by the Institute for the Hospital Remuneration System “InEK” (German: Institut für das Entgeltssystem im Krankenhaus). The following example explains the difference between this calculated amount of money within the DRG cost center group “dialysis unit” and the previously described option of the additional charges.

Example: The DRG L60A has an average time of hospitalization of 18.8 days with a standard deviation of 8.0 days. The first day with deduction is day number 5 and the first with increments is day number 36 (InEK, 2014, p. 51). The calculated value for dialysis unit is 15.75% of the total DRG value.

The number of dialysis during this time is variable. Consequently the revenue per treatment also differs even though the revenue per DRG is fixed – even if there is the possibility of deductions or increments in case of a short or very long time of hospitalization. So overall the revenue per dialysis decreases with an increasing number of dialysis per case. Furthermore we see, that – no matter whether the treatment is billed as DRG or additional charge – the revenue is given in each case. Only based on this information it is unclear which option will achieve a better cost coverage.

## 2. Data and empirical analysis

As mentioned above, the objective was to analyze revenue differences between DRGs including dialysis treatments and the option of additional charges. So the main question for the provider is: “Would the revenue for the dialysis unit be higher if there is the option to bill the performed treatments by additional charges?”

To answer this question it is inevitable to calculate the revenue per dialysis unit in case of the DRGs L60A, L60B, L60C and Z71Z (InEK, 2015). In a first step, we gathered the data from the G-DRG-Report-Browser 2015. These cost data, calculated by using information from several hospitals, can be seen as a benchmark for other hospitals (Flessa, 2015, pp.152-153). Referring to these four DRGs the following information could be found (*Table 2*). *Table 2* shows the cost weight per case, the number of cases without deductions or increments in the data year 2013 and the total costs per case in 2013. With the information on cost weight and total costs per case it was possible to calculate the theoretical base rate of 2013 as quotient of total costs per case and cost weight.

Table 2. G-DRG-Report-Browser data (data year 2013)

DRG	cost weight	number of cases	total cost per case referring to InEK-data in €	theoretical base rate in €
L60A	3.538	693	9936.78	2808.59
L60B	2.374	1310	6665.61	2807.75
L60C	1.669	3129	4685.99	2807.66
L71Z	0.437	329	1226.96	2807.69

*Source:* own, based on G-DRG-Report-Browser data (InEK, 2015).

The calculated base rate in 2013 of approximately 2808€ is not comparable to the 2015 national base rate of 3231.20€. Thus, it was necessary to adjust the given cost data. These data also can be seen as revenue data, due to the fact that the calculated DRG should cover the cost completely. As interim result of this linear adjustment we see a cost/revenue increase of about 15.08%. Furthermore, the G-DRG-Report-Browser provides information on the cost types and cost centers. The overall amount of the cost center “dialysis unit” concerning the total DRG cost lays between 8.71% (L60C) and 30.63% (L71Z). So the calculated cost/revenue for the cost center “dialysis unit” differs between 432.51€ (L71Z) and 1800.17€ (L60A). *Table 3* shows the cost weight, the 2015 base rate, total DRG cost/revenue, the amount calculated for cost center “dialysis unit” and the consequent cost/revenue in Euro (€).

Table 3. Adjusted G-DRG-Report-Browser data

DRG	cost weight	base rate 2015 in €	total cost/ revenue in 2015 in €	amount calculated for dialysis unit based on InEK in %	cost/revenue calculated for dialysis unit based on InEK in €
L60A	3.538	3231.20	11431.99	15.75%	1800.17
L60B	2.374	3231.20	7670.87	17.94%	1376.33
L60C	1.669	3231.20	5392.87	8.71%	469.79
L71Z	0.437	3231.20	1412.03	30.63%	432.51

*Source:* own, partly based on G-DRG-Report-Browser data (InEK, 2015).

The previous explanations only reveal information on the total revenue/cost at the cost center “dialysis unit”. The following *Table 4* shows adjusted cost of relevant cost types in detail. These types are defined as personnel costs for medical service, nursing and medical engineering/ functional service; material costs for pharmaceuticals (indirect and direct) and further medical needs (indirect and direct); personnel and material costs for medical and nonmedical infrastructure. Based on the InEK calculation methodology we have to take into account that the cost type “further medical needs (direct)” can include personnel as well as other material costs if the treatment is performed by a third party provider (e.g. hospital without own dialysis unit) (InEK, 2007, pp. 144-156). Overall, we see that the amount of personnel costs in the cost center “dialysis unit” makes up more than 36% within each DRG.

Table 4. Adjusted G-DRG-Report-Browser cost center data

DRG	personnel costs [€]			material costs [€]				personnel and material costs [€]		total [€]
	medical service	nursing	medical engineering and functional service	Pharmaceuticals (indirect)	Pharmaceuticals (direct)	further medical needs (indirect)	further medical needs (direct)	medical infrastructure	non-medical infrastructure	
L60A	217.86	363.22	67.03	58.73	10.45	209.77	550.50	88.82	233.80	1800.17
L60B	159.38	280.83	59.08	38.71	14.98	154.84	425.63	67.06	175.81	1376.33
L60C	57.06	112.54	21.54	15.36	3.08	59.00	107.70	26.00	67.50	469.79
L71Z	52.18	108.28	19.86	10.44	2.31	57.67	100.79	23.56	57.42	432.51

Source: own calculation, partly based on G-DRG-Report-Browser data (InEK, 2015).

The data shown only presents an overview of total cost/revenue at the cost center “dialysis unit”. This cost data results from a big portfolio of treatment options at a dialysis unit. Consequently, the question was raised which and how many treatments are included in this cost data. The G-DRG-Report-Browser provides information on the number of procedures in each single DRG, if the procedure was performed more than four times over all cases in the data year (InEK, 2015).

Example: In 2013 the calculation hospitals treated 653 patients with the DRG L60A. Within these 653 DRGs 2984 intermittent hemodialysis without anticoagulation or with heparin (OPS 8-854.2), 173 intermittent hemofiltrations without anticoagulation or with heparin (OPS 8-853.3), (...) and 4 continuous venovenous hemodiafiltrations with other anticoagulation and a duration of 72 up to 144 hours were treated.

In order to calculate the number of treatments per DRG and to calculate the theoretic revenue if the treatments could be billed by additional charges we looked for all relevant procedures based on the calculation standards given by the InEK-manual “calculation of case costs – manual for use in hospitals v3.0” (German: Kalkulation von Fallkosten – Handbuch zur Anwendung in Krankenhäusern – Version 3.0) (InEK, 2007, pp. 147-148). Furthermore revenues for additional charges were gained from the 2015 DRG catalog (InEK, 2014, pp. 121-174).

The revenue for the predominant additional charges are:  
 ZE01.01 (hemodialysis, intermittent, age over 14 years): 227.58€;  
 ZE02 (hemodiafiltration, intermittent): 231.66€;  
 ZE62 (hemofiltration, intermittent): 263.58€.

Due to the fact that some additional charges are calculated individually to each hospital, we used the data from the University Medicine Berlin (Charité) in case of the revenue for the OPSs 8-857.2□ “peritoneal dialysis, continuous, mechanically supported, with auxiliary equipment” (Die Charité, 2015, p. 25).

### 3. Findings and results

Table 5 shows the average number of all relevant procedures per DRG. It becomes clear that intermittent extracorporeal dialysis (8.854.□, 8.853.□, 8.855.□) is of special importance. We could find an average of 5.144 intermittent dialysis for L60A, 4.398 for L60B, 1.353 for L60C and 1.018 for L71Z. At this point it is essential to focus on the average length of stay which is at 18.8 days (L60A), 14.1 days (L60B), 11.8 days (L60C) and 1 day (Z71Z) (InEK 2015). If we assume that intermittent dialysis normally are necessary on three days per week (3/7) the theoretical number of dialysis would be at 8.057 (L60A), 6.043 (L60B), 5.000 (L60C) and 1.000 (L71Z). The number of dialysis in the DRGs L60A, L60B and L60C is lower than the theoretic number of dialysis because not all patient are treated with intermittent extracorporeal dialysis. Furthermore, table 5 shows the theoretic additional charge per procedure. These national equal or hospital individual additional charges are between 197.98€ and 2030.00€. Due to this information it is possible to calculate the theoretic revenue if this service portfolio could be billed through additional charges.

Table 5. Average number of treatments per DRG

OPS-Code	L60A	L60B	L60C	L71Z	additional charge per treatment in € (if DRG does not include dialysis)
1	2	3	4	5	6
8-854.2	4.306	3.815	1.190	0.839	227.58
8-854.3	0.237	0.145	0.042	0.055	227.58
8-854.4	0.088	0.028	0.004	0.030	227.58
8-854.5		0.005			227.58
8-854.8		0.018			227.58
8-855.3	0.242	0.218	0.086	0.094	231.66
8-855.4		0.009			231.66
8-853.70	0.027	0.005			384.80
8-853.71	0.013	0.007			923.52
8-853.81		0.005			923.52
8-853.72	0.009				1847.04
8-854.60	0.022	0.018			324.05
8-854.70		0.010			324.05
8-854.61	0.020	0.009			777.72
8-854.71	0.027	0.015	0.001		777.72
8-854.72	0.016				1480.91
8-855.70	0.016	0.015			360.37
8-855.80				0.015	360.37
8-855.71	0.026	0.010			850.47
8-855.81	0.007	0.004			850.47
8-855.72	0.006				1664.91
8-855.82	0.006				1664.91
8-857.0		0.030	0.041		270.39
8-857.10			0.002	0.024	197.98
8-857.11			0.004	0.015	445.46
8-857.12			0.006		950.30

RECENT ISSUES IN ECONOMIC DEVELOPMENT

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
8-857.13			0.008		1702.63
8-857.14			0.002		2805.38
8-857.20				0.024	140.00*
8-857.22			0.002		630.00*
8-857.23			0.002		1190.00*
8-857.24			0.002		2030.00*
8-853.3	0.250	0.160	0.031		263.58
8-853.4	0.010				263.58
8-853.5	0.012				263.58

\*hospital individual

Source: own, based on G-DRG-Report-Browser data (InEK, 2015).

Table 6 shows that the theoretic revenue would be at 1340.75€ (L60A), 1073.29€ (L60B), 355.97€ (L60C) and 252.28€ (L71Z). In comparison to the G-DRG-Report-Browser data we see decreased revenues of -459.41€ (-25.52% – L60A), -303.03€ (-22.02% – L60B), -113.82€ (-24.23% – L60C) and -179.93€ (-41.60% – L71Z).

Table 6. Theoretic revenue if treatments could be billed through additional charges in €

OPS-Code	L60A	L60B	L60C	L71Z
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
8-854.2	979.94	868.10	270.71	190.92
8-854.3	53.86	33.01	9.53	12.45
8-854.4	20.03	6.43	0.95	6.92
8-854.5	0.00	1.22	0.00	0.00
8-854.8	0.00	4.00	0.00	0.00
8-855.3	56.16	50.58	19.99	21.83
8-855.4	0.00	2.12	0.00	0.00
8-853.70	10.55	1.76	0.00	0.00
8-853.71	11.99	6.34	0.00	0.00
8-853.81	0.00	4.93	0.00	0.00
8-853.72	15.99	0.00	0.00	0.00
8-854.60	7.01	5.69	0.00	0.00
8-854.70	0.00	3.22	0.00	0.00
8-854.61	15.71	7.12	0.00	0.00
8-854.71	21.32	11.28	0.99	0.00
8-854.72	23.51	0.00	0.00	0.00
8-855.70	5.72	5.50	0.00	0.00
8-855.80	0.00	0.00	0.00	5.48
8-855.71	22.09	8.44	0.00	0.00
8-855.81	6.14	3.25	0.00	0.00
8-855.72	9.61	0.00	0.00	0.00
8-855.82	9.61	0.00	0.00	0.00
8-857.0	0.00	8.05	11.15	0.00

RECENT ISSUES IN ECONOMIC DEVELOPMENT

	1	2	3	4	5
8-857.10	0.00	0.00	0.38	4.81	
8-857.11	0.00	0.00	1.57	6.77	
8-857.12	0.00	0.00	5.47	0.00	
8-857.13	0.00	0.00	14.15	0.00	
8-857.14	0.00	0.00	6.28	0.00	
8-857.20	0.00	0.00	0.00	3.40	
8-857.22	0.00	0.00	1.21	0.00	
8-857.23	0.00	0.00	2.28	0.00	
8-857.24	0.00	0.00	3.24	0.00	
8-853.3	65.80	42.25	8.09	0.00	
8-853.4	2.66	0.00	0.00	0.00	
8-853.5	3.04	0.00	0.00	0.00	
sum	1340.75	1073.29	355.97	252.58	

Source: own, partly based on G-DRG-Report-Browser data (InEK, 2015).

This basically means that revenues through additional charges have lower cost coverage. Based on the calculation methodology it could be argued that DRGs are calculated as absorbed cost and additional charges tendentiously as marginal costs (InEK, 2005, pp. 10-18). But based on the manual “assistance for the calculation of additional charges ...” given by the InEK (German: Hilfestellung für die Kalkulation von Zusatzentgelten ...) we have to regard personnel costs for medical service and nursing, material costs for pharmaceuticals (indirect), further medical needs (indirect) and infrastructure only for hardware maintenance (InEK, 2005, pp. 10-18). So if we exclude personnel costs for medical engineering and functional service; personnel and material costs for medical and non-medical infrastructure and material costs for pharmaceuticals (direct) completely we still have to include the further medical needs (direct) because they can contain personnel and other material costs if the treatments are performed by a third party provider. Even in this situation the additional charge revenue would be lower than the DRG-Report-Browser data revenue in two of four DRGs. The results are shown in *Table 7*.

Table 7. comparison with DRG-Report-Browser data regarding exclusions

	DRG-Report-Browser data with exclusions in €	theoretic revenue by additional charges in €	deviation in €	deviation in %
L60A	1400.08	1340.75	-59.33	-4.24%
L60B	1059.39	1073.29	13.90	+1.31%
L60C	351.67	355.97	4.31	+1.22%
L71Z	329.36	252.58	-76.78	-23.31%

Source: own.

#### 4. Discussion

This analysis has shown that the revenue is higher if dialysis services are part of the DRG. For decision makers it seems to be the better option to focus on dialysis-including DRGs. However, the influence of decision makers is very limited, due to the fact that the



principal diagnosis mainly determines the DRG. These facts and additional influencing factors induce special challenges for service providers. The following points name these challenges based on the mentioned results.

1. The analysis shows that the revenue per treatment is higher if dialysis services are billed through DRGs. This is mainly a result from the InEK calculation methodology. The DRG cost center “dialysis unit” includes overhead cost whereas the additional charges can be seen as marginal costs. Consequently, hospitals with a higher amount of dialysis treatments billed through DRGs will have higher average revenue per dialysis. Due to the fact of an ageing and multi-morbid patient structure it can be assumed that the renal disease will be mostly a secondary diagnosis. Under these circumstances the hospital has a high risk of reduced revenues per treatment.
2. In case of dialysis treatments included in the DRG we have to respect the internal case structure. We have seen the average time of hospitalization for all DRGs, the defined lower and upper bonds for deductions or increments for the DRG L60A and the average number of treatments given by G-DRG-Report-Browser. These Report-Browser data are average data from all calculation hospitals. Especially in hospitals of maximum treatment the average time of hospitalization and therefore the number of treatments per case can be higher. Thus, it can be assumed that for those hospitals the risk of generating a loss in case of DRGs including dialysis treatments will be higher. *Figure 1* shows the revenue of the DRG L60A, the calculated revenue of the cost center “dialysis unit” and the theoretic revenue of intermittent hemodialysis (performed at day 2, 4, 6, 9, 11, 13 (...) – three days per week) if they could be billed through additional charges (ZE01.01). It can be seen that the additional charge revenue is higher than the cost center “dialysis unit” revenue in case of 8 or more intermitted hemodialysis (from day number 18). As a consequence the risk arising from a high number of treatments is reduced in case of additional charges.

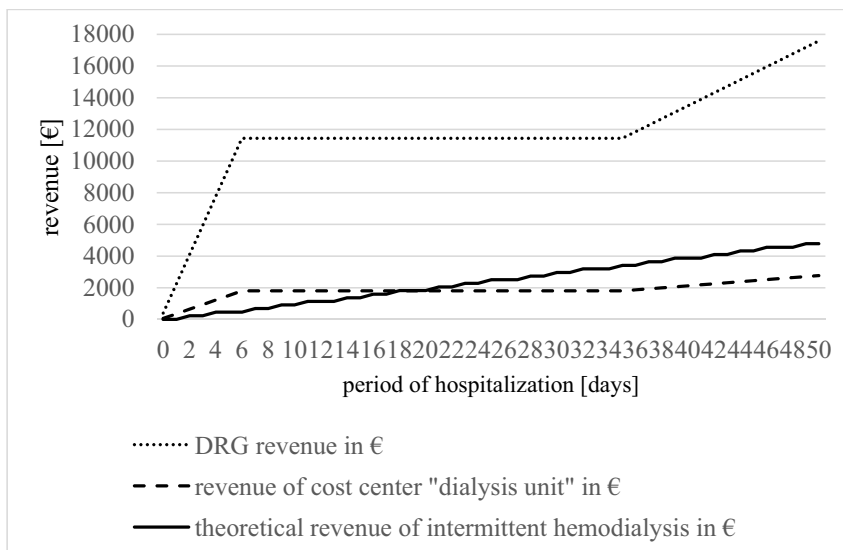


Figure 1. DRG L60A and additional charge ZE01.01  
Source: own.

3. Furthermore there is also a risk within the additional charges. As shown in *Table 5*, different dialysis treatments like intermitted hemodialysis with heparin or citrate, duration of 4 to 5 hours or extended up to 6 hours (with different OPS-codes 8-854.2, 8-854.3, 8-854.4, 8-854.5, 8-854.8) lead to the same additional charge (ZE01.01). Due to the fact that different treatment options cause different costs, the cost coverage within the additional charges is reduced in case of a higher amount of cost-intensive treatments. Previous analyses have shown that anticoagulation, vascular access, place of treatment (intensive care unit or dialysis unit) and patient conditions mainly influence the personnel time consumptions for nursing and medical service (Krohn, 2014, pp. 59-80). *Figure 2* presents a Monte-Carlo-Simulation of nursing processes in case of intermittent hemodialysis with heparin and shunt at a dialysis unit (log-normal distribution based own time measurement study). Furthermore, different material costs – especially for anticoagulation – have to be respected (Kribben *et al.*, 2005, pp. 356-363).

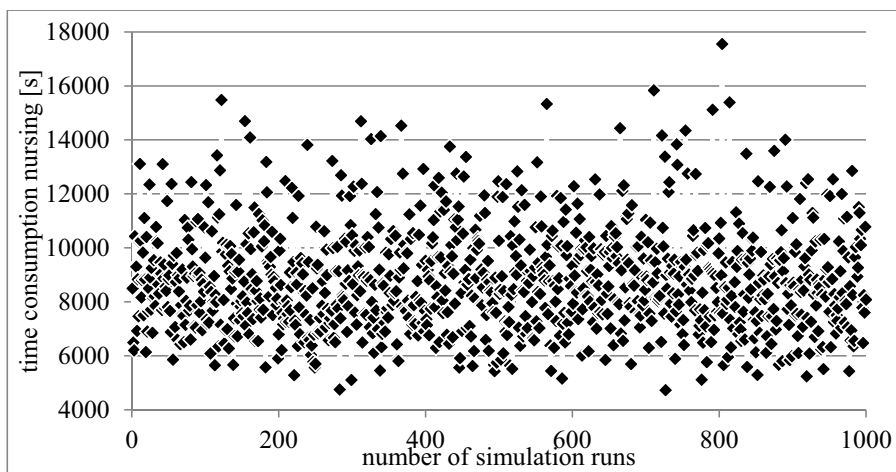


Figure 2. Simulation of personnel time consumptions – intermittent hemodialysis with heparin and shunt at dialysis unit, 4-5 hours

Source: own.

## Conclusion

It can be confirmed that fixed payments for medical treatments cause special challenges for hospitals and decision makers. In case of DRGs including dialysis and in case of additional charges the cost and revenue calculation has to be adapted to the changing patient structure over course of time. In the future a more detailed and not only a direct costing based calculation of additional charges seems to be useful.

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