ORIGINAL ARTICLE

Guidelines or State Civil Codes in the Management of Femoral Neck Fracture?

An Analysis of the Reality of Care Provision in North Rhine-Westphalia

Rüdiger Smektala, Angelika Grams, Ludger Pientka, Ulrich Schulze Raestrup

SUMMARY

Introduction: This study analyzes healthcare management patterns in the German Federal State of North Rhine-Westphalia, with regard to time-to-surgery and operative technique in the management of femoral neck fracture.

Methods: Analysis of external quality assurance data relating to inpatient episodes of femoral neck fracture for North Rhine-Westphalia in the years 2004 and 2005. The study included data on 19 767 patients.

Results: More than half of patients receive surgery within 24 hours of hospital admission. Large regional differences exist in relation to the type and timing of surgery. Day of the week is a key determinant of the timing of surgery. Even younger patients, in whom the hip joint should be preserved, receive delayed surgery in some regions.

Discussion: Structured dialog with individual hospitals revealed the following causes for the differences in care provision: guideline recommendations and the recommendations of the Federal Office for Quality Assurance Ltd. (Bundesgeschäftsstelle Qualitätssicherung, BQS GmbH), are not accepted as the basis for practice in all quarters; in some areas the necessary staff to ensure timely surgery are lacking. This situation cannot be defended to a wider public, given the clear indications from international literature that a short time to surgery reduces postoperative mortality as well as the incidence of key complications, such as pressure sores, thromboembolisms and pneumonia.

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Key words: health services research, femoral neck fracture, time-to-surgery, operative technique, guidelines

Every year in Germany, 110 to 130 inhabitants per 100 000 suffer a femoral neck fracture. For people aged over 65, the annual incidence is 600 to 900 fractures per 100 000. Because of demographic developments, the number of femoral neck fractures will increase by 3% to 5% annually (1). The probability of this fracture is as high as 40% to 50% in very old people between 80 and 89 (2, 3).

Femoral neck fracture is the most frequent diagnosis on admission to hospital of people aged over 65. The treatment costs are about 2.5 billion euros per year (2). Depending on the diagnosis-related groups (DRG), the hospital proceeds per case are between 6410 and 6654 euros (4).

Only 50% of patients recover the socioeconomic status they had before the operation. Between 10% and 20% of patients require permanent care (5). The mortality in the first year after the femoral neck fracture is more than 20% to 30% above the mortality for a group of the same age without fractures (6).

Numerous international studies (*table 1*) have shown that there is a connection between a short time-to-operation and the resulting reduction in patient mortality, in comparison with a group of patients of the same age, but without femoral neck fracture (7, 8, 9, 10, 12, 14, 15, 16). There is a similar association for the postoperative complications decubitus, pneumonia, and thromboembolism (5, 7, 17, 18). There are only a few publications which dispute the connection between postoperative mortality and short time-to-operation (11, 13, 22).

Prior cardiac disease, dementia, male gender, and age are factors linked to an unfavorable prognosis and which cannot be affected by the doctor (14).

The central significance of the time-to-operation for the prognosis is linked to the pathophysiology of the immobilizing trauma. The fracture near the hip forces the patient to remain in bed. The patient then falls ill from the consequences of immobilization – pneumonia, thrombosis, urinary tract infection, and decubitus. The longer the immobilization, the greater is the risk of secondary diseases.

According to § 137 of the Ordinance on the Social Security Code (SGB V), all German hospitals are obliged to participate in "external comparative quality

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TABLE 1

Selective review of the literature: factors influencing mortality and complications after femoral neck fracture

Novack et al. 2007 (6)	Operation within two days decreases one-year mortality: conservatively treated femoral neck fractures
Barsoum et al. 2006 (7)	Operation within 48 hours decreases one-year mortality and postoperative complication rate
Gdolvich et al. 2004 (10)	Delaying the operation by more than 48 hours increases one-year mortality. Additional factors: male gender, cognitive performance, postoperative mobility, previous illness
McGuire et al. 2004 (12)	Delay of more than two working days increases 30-day mortality
Petersen et al. 2006 (14)	Cardiac decompensation, dementia, male gender, delayed operation, stroke, postoperative luxation of a prosthesis and perioperative fractures caused by the operation increase three-month mortality
Weller et al. 2005 (15)	Age and delay of more than one day for the operation increase hospital mortality, three-month mortality, and one-year mortality
Zuckerman et al. 1995 (16)	Operation within two calendar days reduces mortality in medically stable older patients with good cognitive performance before the accident, who could walk and who lived at home

assurance." Data collection is based on the electronic recording instruments developed by the Federal Office for Quality Assurance (BQS, Bundesgeschäftsstelle für Qualitätssicherung). Evaluation of the results is the duty of the state offices. If there are unusual statistical features, they perform a so-called structured dialog with the hospitals. Using this procedure, about 51 000 femoral head fractures per year are documented in Germany. This includes about 11 600 in North Rhine-Westphalia, or about 22% of the total. The current basis for the BQS is that all patients with femoral neck fracture should be operated on without delay. As many as 15% of the patients may be operated on later than 48 hours after admission to hospital, thus allowing for the heterogeneity of this group of patients (case mix).

There is also a guideline (level of evidence S1) from the German Society for Accident Surgery (DGU, Deutsche Gesellschaft für Unfallchirurgie) for the treatment of femoral neck fracture. This lays down that osteosynthesis should be performed as an emergency operation, particularly in children. If the hip joint is to be treated with an endoprosthesis, this operation must be performed as soon as possible, as an urgent indication (18). The instructions on the method of operation are as follows. For younger patients, every effort should be made to maintain the hip joint by osteosynthesis. For older patients, the hip joint should be replaced by an endoprosthesis. Neither the guideline nor current publications give a specific transitional age for these two options.

Methods

The present study examines the data sets on fractures near the hip joint in the Federal State of North Rhine-Westphalia for 2004 (specification 7.0) and for 2005 (specification 8.0), taken from "External Comparative Quality Assurance" in accordance with § 137 SBG V Module 17n1. The inclusion criteria are:

- The presence of medial or lateral femoral neck fracture classified according to Garden
- Care in general surgery, general surgery specializing in accident surgery, accident surgery, orthopedics or orthopedics specializing in surgery (specialized department key).

In addition, the patient must be at least 20 years old and the department providing healthcare must have had at least 10 such cases within two years. The data sets from departments with accident healthcare and from departments with general surgery specializing in accident surgery were combined to form the accident surgery group. The data sets from departments for orthopedics and from departments with orthopedics specializing in surgery were combined to form the orthopedics group. The general surgery departments formed their own group.

The data were evaluated with the programs SPSS 12.0 and Excel 2003 and displayed graphically. The maps were generated with MapInfo 5.5.

Results

19 747 patients were included in the investigation. Most patients were treated in general surgery departments (9639). 9267 patients were treated in departments specializing in accident surgery. Only 841 patients received care in orthopedic departments. 4.4% of patients were given primary conservative treatment. The most frequent fracture type was dislocated femoral neck fracture of Garden type 3 (57.5%).

Operative procedure and time-to-operation

2743 patients (13.9%) were treated with osteosynthesis. 16 985 patients (85.9%) were given an endoprosthesis (table 2). Only 39 patients (0.2%) were given another operative procedure. The dominant operative procedure in the endoprostheses was the dual head prosthesis (55.6%). The orthopedic specialists

TABLE 2

Operative procedure and time-to-operation: age-dependence of operative procedures

		Age: ≤ 65 years				Age: ≥ 65 years		
		< 24 h	24–48 h	> 48 h	Total	< 24 h (%)	24–48 h (%)	> 48 h (%)
General surgery	Osteosynthesis	404	51	22	477	84.7	10.7	4.6
	Endoprosthesis	222	133	99	454	48.9	29.3	21.8
	Other	0	3	1	4	0.0	75.0	25.0
	Total	626	187	122	935	67.0	20.0	13.0
Accident surgery	Osteosynthesis	546	60	23	629	86.8	9.5	3.7
	Endoprosthesis	281	149	105	535	52.5	27.9	19.6
	Other	4	1	1	6	66.7	16.7	16.7
	Total	831	210	129	1170	71.0	17.9	11.0
Orthopedics	Osteosynthesis	8	7	1	16	50.0	43.8	6.3
	Endoprosthesis	37	26	24	87	42.5	29.9	27.6
	Other	0	0	0	0			
	Total	45	33	25	103	43.7	32.0	24.3
Other specialized departments	Osteosynthesis	958	118	46	1122	85.4	10.5	4.1
	Endoprosthesis	540	308	228	1076	50.2	28.6	21.2
	Other	4	4	2	10	40.0	40.0	20.0
	Total	1502	430	276	2208	68.0	19.5	12.5
		Age: ≥ 65 years				Age: ≥ 65 years		
		< 24 h	24–48 h	> 48 h	Total	< 24 h (%)	24–48 h (%)	> 48 h (%)
General surgery	Osteosynthesis	513	162	129	804	63.8	20.1	16.0
	Endoprosthesis	4306	2166	1408	7880	54.6	27.5	17.9
	Other	6	6	8	20	30.0	30.0	40.0
	Total	4825	2334	1545	8704	55.4	26.8	17.8
Accident surgery	Osteosynthesis	525	166	98	789	66.5	21.0	12.4
	Endoprosthesis	4338	1794	1169	7301	59.4	24.6	16.0
	Other	5	1	1	7	71.4	14.3	14.3
	Total	4868	1961	1268	8097	60.1	24.2	15.7
Orthopedics	Osteosynthesis	10	11	2	23	43.5	47.8	8.7
	Endoprosthesis	383	207	124	714	53.6	29.0	17.4
	Other	0	1	0	1	0.0	100.0	0.0
	Total	393	219	126	738	53.3	29.7	17.1
Other specialized departments	Osteosynthesis	1048	339	229	1616	64.9	21.0	14.2
	Endoprosthesis	9027	4167	2701	15 895	56.8	26.2	17.0
	Other	11	8	9	28	39.3	28.6	32.1
	Total	10 086	4514	2939	17 539	57.5	25.7	16.8
		All ages				All ages		
		< 24 h	24–48 h	> 48 h	Total	< 24 h (%)	24–48 h (%)	> 48 h (%)
General surgery	Osteosynthesis	917	213	129	1281	71.6	16.6	10.1
	Endoprosthesis	4528	2299	1408	8334	54.3	27.6	16.9
	Other	6	9	8	24	25.0	37.5	33.3
	Total	5451	2521	1545	9639	56.6	26.2	16.0
Accident surgery	Osteosynthesis	1071	226	98	1418	75.5	15.9	6.9
	Endoprosthesis	4619	1943	1169	7836	58.9	24.8	14.9
	Other	9	2	1	13	69.2	15.4	7.7
	Total	5699	2171	1268	9267	61.5	23.4	13.7
Orthopedics	Osteosynthesis	18	18	2	39	46.2	46.2	5.1
	Endoprosthesis	420	233	124	801	52.4	29.1	15.5
	Other	0	1	0	1	0.0	100.0	0.0
	Total	438	252	126	841	52.1	30.0	15.0
Other specialized departments	Osteosynthesis	2006	457	275	2738	73.3	16.7	10.0
	Endoprosthesis	9567	4475	2929	16 971	56.4	26.4	17.3
	Other	15	12	11	38	39.5	31.6	28.9
	Total	11 588	4944	3215	19 747	58.7	25.0	16.3

avored total endoprosthesis (58.1%). Monopolar prostheses were only rarely used (6.4%) (*table 3*).

Regional differences: operative method

There were major differences in the healthcare procedures employed in the different districts and independent cities in North Rhine-Westphalia (*figure 1*). Although the dual head prosthesis was the preferred operative procedure in North Rhine-Westphalia as a whole (*table 3*), there were some districts in which total endoprostheses were mostly used. There were similar findings for monopolar prostheses. While the overall value for this technique was only 6.4%, there were regions in which the monopolar prosthesis was the most frequently used implant. In one district, it reached 45.4% of the total.

These differences can be seen even more clearly in *figure 2*. In patients under 65 years, the hip joint should be maintained, so that osteosynthesis is performed. There are independent cities and districts in which it is attempted to implement this approach and 70.0% to 80.0% of patients are given osteosynthesis. This is much lower in other regions, so that only every fifth patient is given an operation to retain the joint. Osteosynthetic healthcare provision ranges between 19.0% and 78.6%.

Time-to-operation

There are also major regional differences in the time-to-operation (*e-table*). There were some districts and cities in which almost 80.0% of patients received healthcare within the first 24 hours. On the other hand, there were regions in which only 35.0% of patients were treated within 24 hours. There does not appear to be any differences between urban and rural areas in this respect. Thus there are districts in metropolitan areas in which patients have to wait for long periods for healthcare and there are rural areas in which immediate care is ensured.

Differences between regions in speed of care

Figure 3 shows the healthcare situation for all patients with femoral neck fracture in North Rhine-Westphalia for different days of the week. The figure shows the number of patients admitted on each day and the number operated on the same day. Although the proportion of patients admitted hardly decreases during the weekend, the proportion of operated patients clearly decreases on Saturdays and Sundays. Most femoral neck operations are performed on Mondays.

The situation is similar for patients under 65 years of age, for whom maintenance of the hip joint with osteosynthesis is desirable (*figure 4*). Operations were much rarer during the weekend.

Frequency of operations

Figure 5 illustrates the probability of an operation in different regions, for the working days and for the two days of the weekend. As the femoral neck fracture requires an emergency operation, the operation frequency should be independent of the day of the week. As the frequency of admission is almost constant (*figure 3*), the operation volume for each week day should be 14.2%. The means for working days and weekend days would then be the same and the columns in *figure 5* would be of the same height.

However, the results make it clear how uneven the healthcare situation is in the different regions. Although there are some cities and districts in which the probability of an operation is the same during the week and during the weekend, the map shows that there are also regions in which fracture operations are rarely performed during the weekend. There was one department in which the frequency of operations was almost the same during the week and during the weekends, with a difference of only 1.3% in favor of the working days. In contrast, this difference was 18.2%

TABLE 3

Operative procedure for femoral neck fracture

Operative Procedure	Specialized department			
	General surgery (%)	Accident surgery (%)	Orthopedics (%)	Total (%)
DHS, angular nail plate	2.50	2.89	0.58	2.60
Intramedullar stabilization	0.53	0.36	0.35	0.44
Screw insertion	10.30	12.05	3.82	10.84
TEP	19.27	25.72	58.05	23.98
Monopolar femur head prosthesis	5.21	7.35	9.27	6.39
Dual head prosthesis	61.95	51.49	27.69	55.55
Other	0.25	0.14	0.23	0.20
Total	100.00	100.00	100.00	100.00
Number of patients (n)	9639	9265	863	19 767

DHS = dynamic hip screw; TEP = total endoprosthesis

FIGURE 1

Endoprosthesis treatment in the healthcare of femoral neck fracture, use of dual head prostheses, monopolar femoral head prostheses and total endoprostheses (TEP) in North Rhine-Westphalia (type of endoprosthesis healthcare, North Rhine-Westphalia 2004–2005); (the abbreviations correspond to the car number plates in North Rhine-Westphalia).

in one department in which the operations were almost exclusively performed during the week.

If these results are regarded in the context of the rate of provision of healthcare, the following conclusion can be drawn. If a patient has an accident during the weekend, the probability of being operated on during the day of admission is different in different regions.

Discussion

The present article considers two related issues:

- the type of operative procedure selected (osteosynthesis or endoprosthesis) and
- the time-to-operation.

These two issues cannot be separated, as the guideline demands that osteosynthesis should be performed very rapidly (within hours of admission) and the endoprosthesis must be "urgently" implanted. The reason that a specific interval for osteosynthesis is important is that the risk of loss of the hip joint is lower, the more rapidly the fracture is stabilized by operation (20, 21, 22).

The selection of the suitable endoprosthesis depends on the age of the patient. The monopolar prosthesis can be used in very old patients who are hardly still mobile. This replaces the femur head, but can damage joint cartilage (24). Total endoprostheses replace the whole joint and should be given to younger

FIGURE 2

Regional differences in the attempt to maintain the hip joints of younger patients (under 65 years of age) by osteosynthesis (proportion of femoral neck fractures treated osteosynthetically, patients ≤ 65 years, North Rhine-Westphalia 2004–2005)

FIGURE 3

Day of the week analysis: admissions and operations for femoral neck fracture; distribution over the days of the week (all specialized departments; day of admission/day of operation)

active patients with symptomatic coxarthrosis even before the femoral neck fracture (5). The bipolar head replacement in the dual head prosthesis is self-aligning and spares the joint. Many surgeons consider that this is suitable for both groups of patients and this is why this prosthesis is most frequently used. Implantation of a total endoprosthesis is accompanied by major intraoperative blood loss and a high postoperative rate of luxation (25).

The external quality assurance describes the health-care situation in a single federal state. The statements

about the differences in health care provision apply to the districts and independent cities in North Rhine-Westphalia. The published results are the subject of a structured dialog in the context of external quality assurance in module 17/1 "Fractures near the Hip" in North Rhine-Westphalia. The most important aspect of the evaluation was the time-to-operation. According to the current BQS concept, almost half of the departments in North Rhine-Westphalia fail to fulfill the instruction of the BQS. The BQS instruction is only fulfilled by all hospitals taken together in four federal states. The reasons for this health care behavior are discussed in the structured dialog. Firstly, the hospitals give medical reasons for the delays in health care. For example, patients are admitted with abnormalities in coagulation and some doctors consider that this prevents immediate operation. Secondly, legal arguments are given which prevent rapid operation. For example, patients are not capable of giving consent and relatives or legal authorities cannot be reached. Nevertheless, this group of patients is allowed for in the BQS concept, according to which 15% of all patients are not operated on, as immediate operation is prohibited for medical reasons.

In the opinion of the North Rhine-Westphalia Task Force on Quality assurance, the decrease in operations during the weekend is an important factor leading to delay in the operation for many patients. The doctors and departments asked about this mentioned reasons related to organization and personnel. Others doubted the BQS instruction or the guideline and questioned the connection between time-to-operation and the rates of complications or mortality. This is justified by the lack of figures for Germany. It is indeed true that external quality assurance has failed to find an association between time-to-operation and postoperative mortality on the basis of German figures. The reason for this is that the observations of German external quality assurance end with the completion of inpatient treatment in the hospital providing healthcare. In contrast, the international studies have observed the patients prospectively in the first years after treatment for femoral neck fracture (8, 14). Nevertheless, the German figures for the observational period of the time in hospital – which moreover has been continuously decreased in recent years – are providing initial evidence for a lower rate of postoperative complications at shorter time-to-operation (17).

This study is devoted to the healthcare situation for femoral neck fracture in North Rhine Westphalia, the largest German federal state. The results are discussed in a purely descriptive manner, which is certainly a deficiency. Nevertheless, some preliminary evaluations have shown that analytical evaluations using binary logistic regression models – such as the performance of an operation within 24 hours or 48 hours – are not influenced by the population density in the districts, the hospital density or the age of the patients. Only the gender distribution had a slight, but negligible, effect. Because of the lack of specificity, risk

FIGURE 4

Day of the week analysis for patients aged up to 65: admissions and operations for femoral neck fracture; distribution over the days of the week (all specialized departments; day of admission, day of operation)

adjustment for comorbidities using the ASA classification was not performed. However, further evaluations should consider the possibility of adjustment for secondary diagnoses. As however the time-to-operation is a process indicator, mainly used to assess the attainment of a quality goal, the current differences in healthcare provision within North Rhine-Westphalia can be illustrated and evaluated on a descriptive basis.

Résumé

If one accepts the significance of a short time-to-operation – currently laid down by the BQS as 48 hours (10, 14) – for the prognosis of femoral neck fracture, the conclusion is inescapable that the healthcare situation in North Rhine-Westphalia must be changed, as half of the departments fail to fulfill the instructions of the BQS. There is extensive evidence in the current literature to support this connection. It would be expedient to perform a healthcare research study over different sectors, to provide prospective information on this numerically important group of patients.

Conflict of interest statement

The authors declare that there is no conflict of interest in the sense of the guidelines of the International Committee of Medical Journal Editors.

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FIGURE 5

Average percentage operation frequency; analyzed by the working days (Monday to Friday) or weekends (Saturday and Sunday) (all patients, North Rhine-Westphalia 2004–2005)

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E-TABLE

Time-to-operation of a femoral head fracture

District code	Number plate	Op/district	< 24 h (%)	24–48 h (%)	> 48 h (%)	Graph
05111	D	722	58.2	24.1	17.7	
05112	DU	629	51.2	32.8	16.1	
05113	E	844	43.0	29.9	27.1	
05114	KR	349	52.1	32.1	15.8	
05116	MG	338	59.2	24.9	16.0	
05117	MH	207	38.6	48.3	13.0	
05119	OB	262	37.4	37.0	25.6	
05120	RS	122	60.7	32.8	6.6	
05122	SG	232	72.4	12.1	15.5	
05124	W	406	43.3	34.7	21.9	
05154	KLE	277	51.6	35.7	12.6	
05158	ME	458	55.2	25.5	19.2	
05162	NE	347	58.2	28.2	13.5	
05166	VIE	235	59.1	23.8	17.0	
05170	WES	583	64.2	18.9	17.0	
05313	AC-Stadt	240	66.7	15.4	17.9	
05314	BN	474	55.7	29.7	14.6	
05315	K	977	60.3	23.3	16.4	
05316	LEV	225	46.7	30.7	22.7	
05354	AC-Kreis	178	63.5	24.2	12.4	
05358	DN	420	68.6	16.7	14.8	
05362	BM	489	48.5	26.2	25.4	
05366	EU	229	40.2	38.4	21.4	
05370	HS	200	23.0	49.0	28.0	
05374	GM	372	49.7	31.7	18.5	

E-TABLE (continued)

Time-to-operation of a femoral head fracture

District code	Number plate	Op/district	< 24 h (%)	24–48 h (%)	> 48 h (%)	Graph
05378	GL	231	54.1	28.1	17.7	
05382	SU	337	59.3	25.5	15.1	
05512	BOT	142	46.5	33.1	20.4	
05513	GE	355	62.3	21.4	16.3	
05515	MS	416	82.7	10.8	6.5	
05554	BOR	370	52.2	33.2	14.6	
05558	COE	204	63.2	27.5	9.3	
05562	RE	716	67.0	19.6	13.4	
05566	ST	406	59.6	20.9	19.5	
05570	WAF	252	78.6	10.3	11.1	
05711	BI	484	53.9	26.0	20.0	
05754	GT	308	76.6	13.3	10.1	
05758	HF	363	67.8	18.7	13.5	
05762	HX	247	69.6	22.3	8.1	
05766	LIP	343	75.8	9.3	14.9	
05770	MI	435	60.7	27.4	12.0	
05774	PB	235	64.3	25.1	10.6	
05911	BO	431	66.8	24.8	8.4	
05913	DO	563	38.7	36.1	25.2	
05914	HA	256	56.6	30.5	12.9	
05915	HAM	225	86.7	8.0	5.3	
05916	HER	185	70.3	16.8	13.0	
05954	EN	360	65.3	16.7	18.1	
05958	HSK	345	62.3	25.5	12.2	
05962	MK	452	65.3	20.1	14.6	
05966	OE	144	59.7	26.4	13.9	
05970	SI	301	47.5	33.2	19.3	
05974	SO	361	65.1	23.0	11.9	
05978	UN	465	73.5	13.8	12.7	

D, Düsseldorf; DU, Duisburg; E, Essen; KR, Krefeld; MG, Mönchengladbach; MH, Mülheim an der Ruhr; OB, Oberhausen; RS, Remscheid; SG, Solingen; W, Wuppertal; KLE, Kleve; ME, Mettmann; NE, Neuss; VIE, Viersen; WES, Wesel; AC-Stadt, Aachen City; BN, Bonn; K, Cologne; LEV, Leverkusen; AC-District, Aachen District; DN, Düren; BM, ErftDistrict; EU, Euskirchen; HS, Heinsberg; GM, Oberbergischer District; GL, Rheinisch-Bergischer District; SU, Rhein-Sieg District; BOT, Bottrop; GE, Gelsenkirchen; MS, Münster; BOR, Borken; COE, Coesfeld; RE, Reck-lingshausen; ST, Steinfurt; WAF, Warendorf; BI, Bielefeld; GT, Gütersloh; HF, Herford; HX, Höxter; LIP, Lippe; MI, Minden-Lübbecke; PB, Paderborn; BO, Bochum; DO, Dortmund; HA, Hagen; HAM, Hamm; HER, Herne; EN, En-nepe-Ruhr District; HSK, Hochsauerland District; MK, Märkischer District; OE, Olpe; SI, Siegen-Wittgenstein; SO, Soest; UN, Unna .