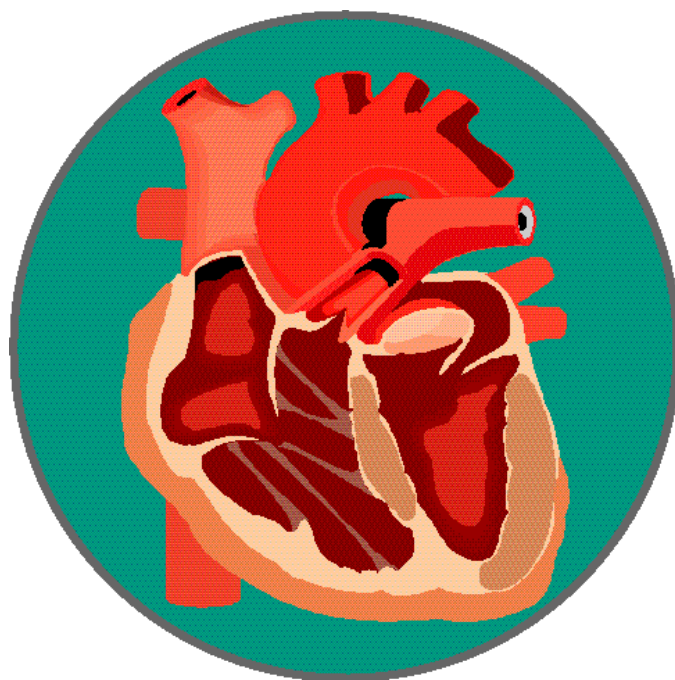


Ernst Bruckenberger

STATE OF CARDIAC SURGERY IN GERMANY 1996

9th Report of the Hospital Committee,
Working Group of Leading Health Officials,





9th Report on the State of Cardiac Surgery in Germany 1996

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Report no **9** analyses the situation of Cardiac Surgery in Germany 1996. Results from the Old Federal States (former Federal Territory including West Berlin) and the New Federal States (former German Democratic Republic including East Berlin) have been processed separately. Data collection took place in close collaboration with the Society for Thoracic and Cardiovascular Surgery and the Hospital Committee, supplemented by the author's own inquiries.

I wish to express my special gratitude for valuable cooperation to Professor Dr Polonius, Dortmund, President of the German Society for Thoracic and Cardiovascular Surgery, to Professor Dr Kalmar, Hamburg, Professor Dr Ulmer, Heidelberg, President of the German Society for Pediatric Cardiology, Professor Dr Meyer, Bad Oeynhausen and Dr Huber, Ärztekammer Nordrhein - Project Office, Quality Assurance in Cardiac Surgery (Chapter 8.0).

This is the second English Edition.

Abbreviations:

New Federal States: Sachsen (Saxony); Mecklenburg-Vorpommern, Brandenburg, Sachsen-Anhalt, Thüringen, former East Berlin

Old Federal States: Nordrhein-Westfalen, Bayern (Bavaria), Baden-Württemberg, Schleswig-Holstein, Niedersachsen, Hessen, Rheinland-Pfalz, Saarland, Berlin, Hamburg, Bremen

pmp: per million population
IHD: Ischemic Heart Disease
AMI: Acute Myocardial Infarction
CHD: Coronary Heart Disease
PCTA: percutaneous transluminal coronary angioplasty
LHC: left heart catheterisation
HLM: heart-lung machine

AGLMB: Arbeitsgemeinschaft der Leitenden Ministerialbeamten der Länder

SGB V: Sozialgesetzbuch V - Social Security Law relating to Health completely rewritten 1988 (amended annually)



1.0 Morbidity and Mortality of Acute Myocardial Infarction

1.1 Morbidity 1994

Diagnoses were collected for each patient at discharge after in-patient treatment in 1994 (legal provision in Krankenhausstatistikverordnung in conjunction with § 28 (2) of Krankenhausfinanzierungsgesetz - KHG). The main diagnosis is given the three digit code of the International Classification of Diseases, Injuries and Causes of Death, 9th Revision (ICD-9). The main diagnosis known at discharge was recorded. More recent data are not available.

703,996 (4.9 per cent) of 14,455,386 recorded in-patient hospital cases in 1994 related to ischemic heart disease (ICD 410-414). Included are 132,921 acute myocardial infarctions (ICD 410). In-patients discharged from hospitals are tabulated by Federal State where treatment occurred (Table 1).

Table 1: In-patient cases of ischemic heart disease in Germany 1994

State	Cases (ICD 410-414) per Federal State		Cases (ICD 410-414) per Federal State		ICD 410 (per cent) within ICD 410-414
	actual	per 100,000	actual	per 100,000	
	Saarland	14,058	1,297	2,134	
Bremen	8,017	1,179	1,318	194	16.44
Hamburg	21,923	1,285	3,305	194	15.08
Sachsen	33,644	734	8,825	193	26.23
Sachsen-Anhalt	22,487	815	5,293	192	23.54
Rheinland-Pfalz	35,669	903	7,157	181	20.07
Brandenburg	19,008	749	4,497	177	23.66
Nordrhein-Westfalen	180,894	1,015	31,365	176	17.34
Berlin	27,887	803	6,110	176	21.91
Thüringen	20,333	808	4,384	174	21.56
Niedersachsen	63,375	821	12,945	168	20.43
Mecklenburg-Vorpom.	14,164	773	2,985	163	21.07
Schleswig-Holstein	18,868	697	4,356	161	23.09
Hessen	60,146	1,006	8,989	150	14.95
Baden-Württemberg	63,378	617	13,576	132	21.42
Bayern	100,145	840	15,682	132	15.66
Germany	703,996	863	132,921	163	18.88

Source: Statistisches Bundesamt

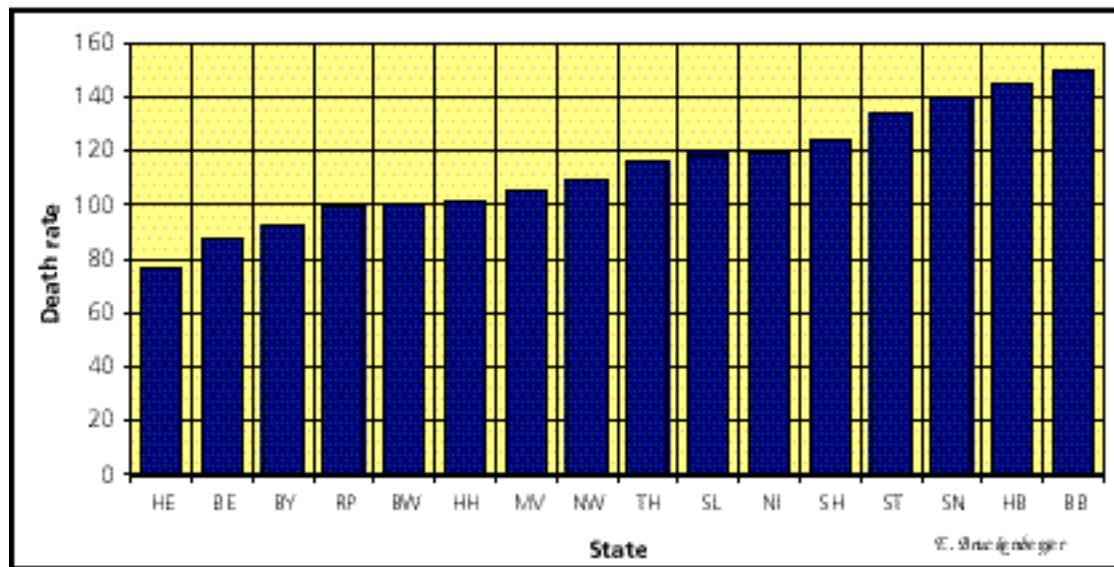
1.2 Mortality 1995

Diseases of the heart and circulation were the leading cause of death in Germany in 1995 (1994) with 429,407 (430,542) deaths amounting to 48.5 (48.7) per cent. The Old Federal States recorded 335,329 (334,751) deaths or 47.5 (47.6) per cent, the New Federal States 94,078 (95,791) or 52.8 (52.8) per cent. Of the 335,329 (334,751) deceased in the Old Federal States 67,975 (67,183) or 20.3 (20.1) suffered a fatal myocardial infarction; the corresponding figure for the New States was 19,764 (19,732) or 21.0 (20.6) per cent.

The death rate for acute myocardial infarction - number of deaths per 100,000 population was 102.3 in the Old Federal States in 1995 and 127.4 or 25 per cent higher in the New Federal States. The death rate for acute myocardial infarction has been declining in the Old Federal States for years. Inter-state discrepancies exist. In the former West, Bremen has the highest rate (144.3) as compared with the lowest rates in Hessen (76.3), Berlin (86.9) and Bavaria (91.8) - see Figure 1. Among the former Eastern States, Brandenburg has the highest (149.6) and Mecklenburg-Vorpommern the lowest rate (104.9).



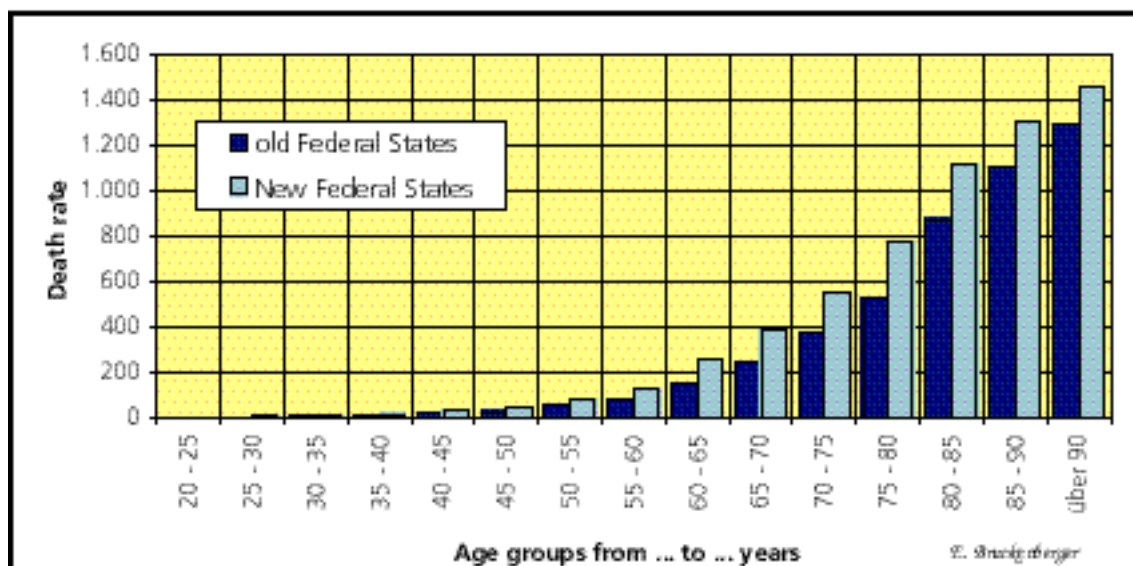
Figure 1 : Death Rate from AMI 1995



MV = Mecklenburg-Vorpommern, BY = Bayern, HE = Hessen, BW = Baden-Württemberg, SN = Sachsen, NW = Nordrhein-Westfalen, RP = Rheinland-Pfalz, BE = Berlin, BB = Brandenburg, TH = Thüringen, HH = Hamburg, HB = Bremen, ST = Sachsen-Anhalt, SL = Saarland, NI = Niedersachsen, SH = Schleswig-Holstein

Analysis by age group reveals a higher death rate from acute myocardial infarction (AMI) in 1995 for all age groups in the New Federal States as compared to the Old Federal States (Figure 2).

Figure 2: Death rate from AMI 1995, by age group



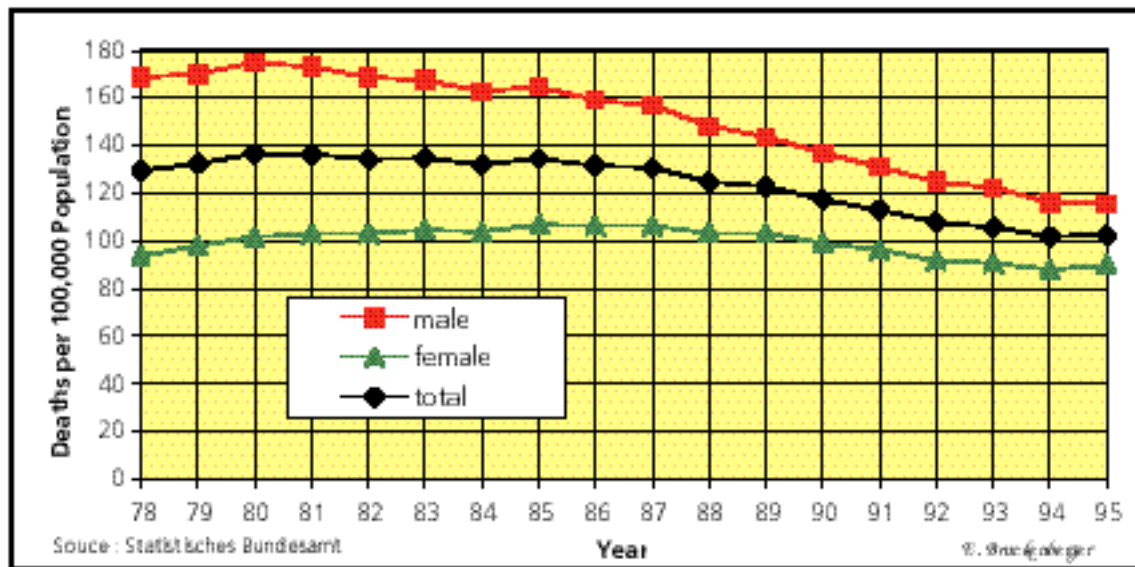
Source: Statistisches Bundesamt Wiesbaden, Fachserie 12, Reihe 4, Todesursachen



1.3 Evolution of Mortality

The death rate for acute myocardial infarction in men in the Old Federal States has been in decline since 1985. From 1990 to 1994, this applied to women also (Figure 3 and Table 2).

Figure 3: Evolution of Death Rate from AMI, 1978-1995



Tab. 2: Death Rate from AMI, Old Federal States, 1979-1995

Year	Deaths		Actual Deaths		Deaths per 100,000 population	
	actual	per 100.000 population	male	female	male	female
1979	81,121	132.0	49,701	31,420	169.9	97.9
1980	84,144	136.5	51,449	32,695	174.9	101.7
1981	84,122	136.3	51,043	33,079	173.0	102.8
1982	82,771	134.5	49,705	33,066	168.6	102.8
1983	82,646	134.8	49,113	33,533	167.3	104.6
1984	80,752	132.3	47,616	33,136	162.8	103.8
1985	82,026	134.4	48,056	33,970	164.7	106.7
1986	80,286	131.3	46,515	33,771	159.1	106.1
1987	79,754	130.2	45,986	33,768	156.8	106.3
1988	76,679	124.2	43,741	32,938	148.1	103.2
1989	76,193	121.6	42,954	33,239	143.7	103.3
1990	74,153	116.4	41,842	32,311	136.8	98.9
1991	72,423	112.3	40,674	31,749	131.0	96.2
1992	69,940	107.1	39,358	30,582	124.9	91.7
1993	69,486	105.7	39,004	30,482	122.3	90.6
1994	67,183	101.8	37,460	29,723	116.9	87.9
1995	67,975	102.5	37,521	30,454	115.5	89.7

Source: Statistisches Bundesamt Wiesbaden, Fachserie 12, Reihe 4, Todesursachen

Death rates from acute myocardial infarction in men and women are converging. Adaptation of risk factors due to adoption of male lifestyles and behavioral patterns seem to produce comparable outcomes.



Comparable figures for the New Federal States have been available since 1991 only. The death rate is increasing steadily in females since 1991 (Table 3).

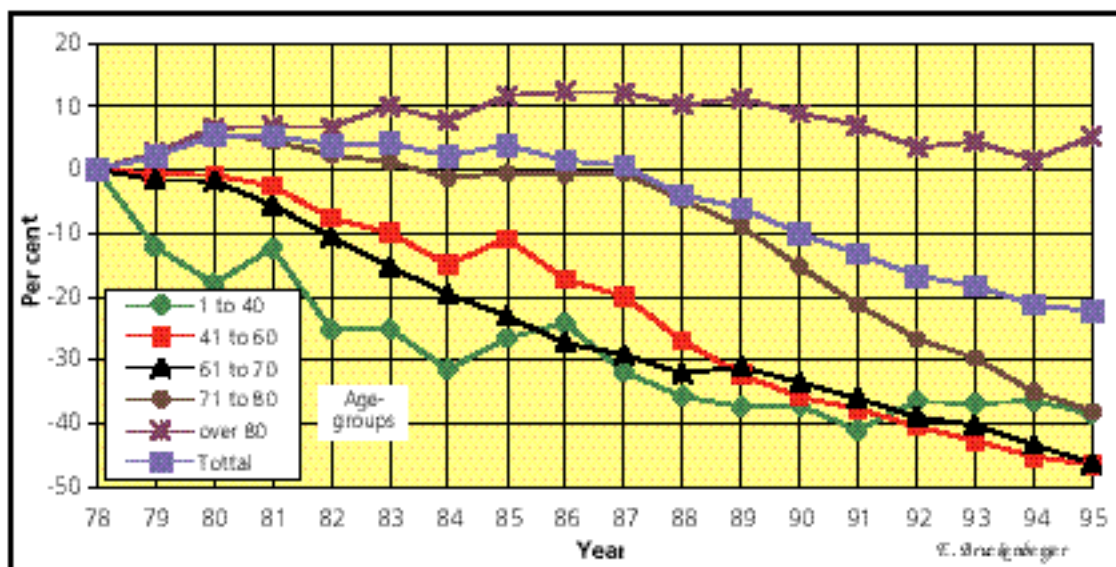
Tab. 3: Death rate from AMI, New Federal States, 1991-1995

Year	Deaths		Deaths		Deaths per 100,000 population	
	actual	per 100,000	male	female	male	female
1991	17.903	112,5	10.442	7.461	137,4	89,8
1992	18.218	115,8	10.553	7.665	139,8	93,7
1993	19.602	125,3	11.488	8.114	152,4	100,1
1994	19.732	126,8	11.508	8.224	153,0	102,3
1995	19.764	127,4	11.397	8.367	151,3	104,9

Source: Statistisches Bundesamt Wiesbaden, Fachserie 12, Reihe 4, Todesursachen

Analysis of death rate by age group confirms the observation that death from acute myocardial infarction has shifted to later life in the West - see Figure 4.

Figure 4: Evolution of Death rate from AMI, Old Federal States, by age groups



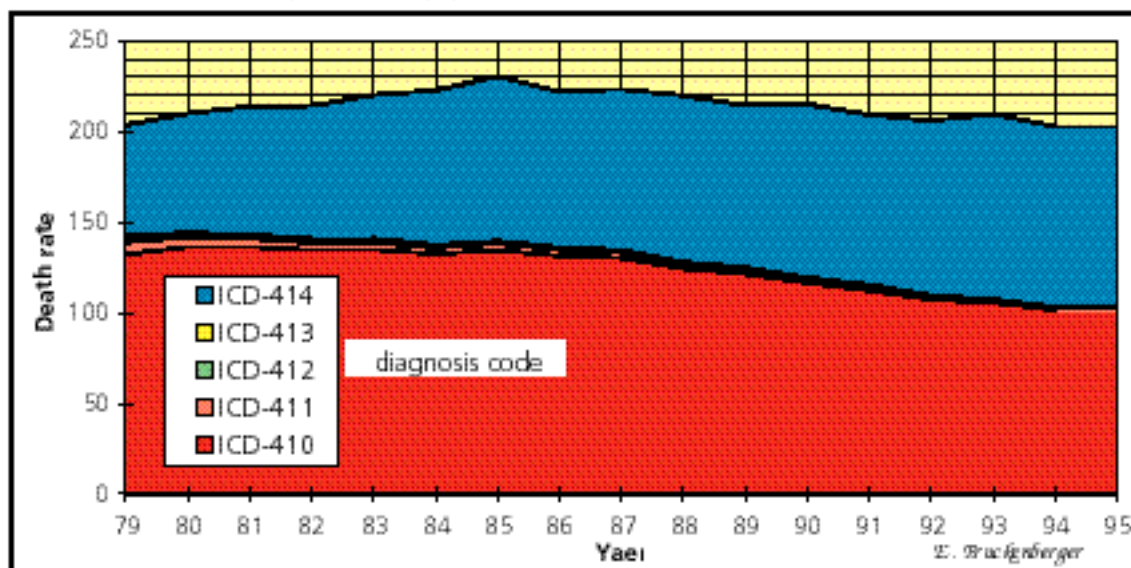
Source: Statistisches Bundesamt Wiesbaden, Fachserie 12, Reihe 4, Todesursachen

The death rate from AMI for age groups 41 to 60 and 61 to 70 has declined by about 45 per cent since 1978; the decline in death rate for age group 71 to 80 is about 30 per cent. Patients up to 40 and over 80 years of age experienced roughly the same death rate since 1992.

Figure 5 shows little overall change in deaths from ischemic heart diseases (ICD 410 to 414) since 1979. The death rate from acute myocardial infarction (ICD 410) has declined while deaths from chronic ischemic heart disease (ICD 414) increased markedly. This is but one example of change due to medical progress with financial consequences.

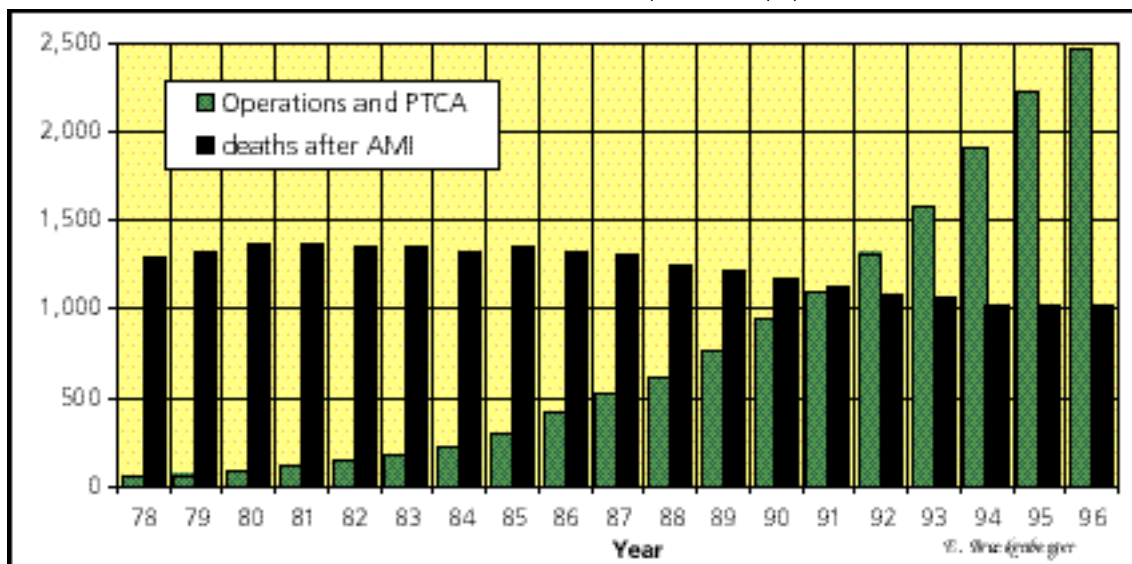


Figure 5: Evolution of Death rate from ischemic heart disease per 100,000 population: Old Federal States, 1978-1995



The extent of therapeutic interventions aimed at infarct prevention such as open heart surgery and percutaneous transluminal coronary angioplasty (PCTA) has multiplied in the former West from 3,142 in 1978 to 163,271 (including an estimated 107,000 PCTAs) in 1996 in the former West. The rate of interventions (operations and PCTA) per million population rose from 51 to 2,459 (see Figure 6). The number of deaths from AMI per million population declined from 1,294 to 1.021 (estimate) in the same period.

Figure 6: Coronary Heart Diseases in the Old Federal States, 1978-1996
Interventions and Deaths after AMI per million population



Source: Statistisches Bundesamt Wiesbaden Fachserie 12, Reihe 4: Todesursachen; Hospital Committee Federal States' Working Party, and own estimate for 1996



2.0 Cardiology

2.1 Cardiologists in Germany, 1996

There were 1.034 cardiologists on contract to Social Security in Germany as of 31 December, 1996. On average, one cardiologist was on contract for about 79,000 population, range from about 40,000 to 150,000 people per cardiologist. The City States of Bremen, Hamburg, and Berlin had the highest relative density of cardiologists, and the New Federal States of Brandenburg and Mecklenburg-Vorpommern had the lowest density of cardiologists (see Table 4 and Figure 7). All New Federal States have caught up markedly.

According to the latest statistics on Health Professionals ("Berufe des Gesundheitswesens"), a total of 1,780 cardiologists were active in Germany on 31st December 1995; 1,148 worked in hospitals. An additional 194 cardiologists were active in pediatrics, 134 working in hospitals. The highest density of cardiologists is found in Hamburg, Bavaria and Saarland.

Figure 7: Cardiologists on Contract with Social Security in Germany, 31 December 1996





Tab. 4: Cardiologists in Germany

	Cardiologists on Contract *	Total Active Cardiologists **	Population per Cardiologist on Contract	Population per Active Cardiologist
Bremen	17	20	39,925	33,937
Hamburg	38	76	44,961	22,481
Berlin	64	74	54,177	46,856
Saarland	19	36	57,006	30,087
Bayern	171	432	70,261	27,812
Baden-Württemberg	129	276	80,186	37,478
Schleswig-Holstein	34	32	80,312	85,331
Nordrhein-Westfalen	221	361	81,034	49,608
Sachsen-Anhalt	31	56	88,112	48,776
Hessen	68	120	88,474	50,135
Niedersachsen	88	62	88,581	125,728
Thüringen	28	76	89,167	32,851
Sachsen	51	122	89,357	37,354
Rheinland-Pfalz	43	10	92,634	398,328
Mecklenburg-Vorpommern	15	***	121,372	***
Brandenburg	17	27	149,736	94,278
Germany	1,034	1,780	79,189	46,001

* Bundesarztregister 31 December 1996

** Statistisches Bundesamt Wiesbaden 31 December 1995

*** no data

Ernst Bruckenberger

2.2 Active Left Heart Catheter Laboratories, early 1997

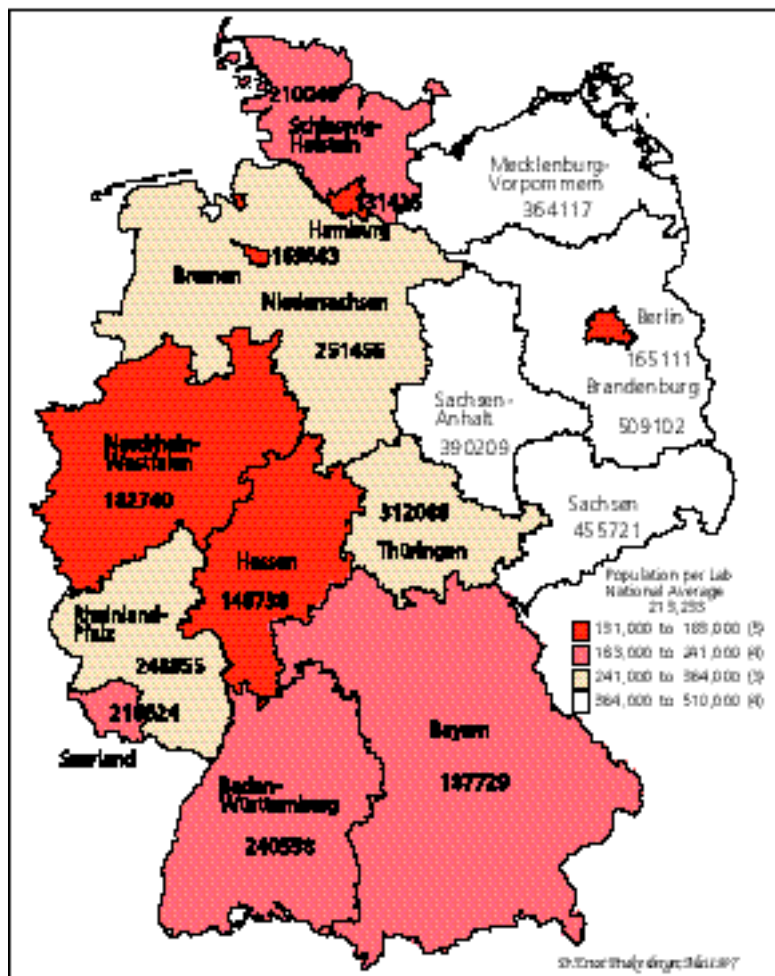
The Hospital Committee of AGLMB surveyed catheter laboratories in hospitals and practices as of 1st January 1997 (see Table 5). Active laboratories which lack recognition under § 122 SGB V are included, recognised laboratories which were not yet active are discounted. Germany thus had 384 Left Heart Catheter Laboratories for adults and children in function on 1st January 1997. With few exceptions, these installations have accredited status under § 122 SGB V. A further 38 laboratories have been accredited but were not functioning at the time of survey.

Tab. 5: : Active Left Heart Catheter Labs (adult & children) 1 January 1997

State	Number of Labs			population per lab
	Hospital 1)	Office 1)	total	
Hamburg	9	4	13	131,425
Hessen	31	10	41	146,738
Berlin (gesamt)	19	2	21	165,111
Bremen	3	1	4	169,683
Nordrhein-Westfalen	87	11	98	182,740
Bayern	59	5	64	187,729
Schleswig- Holstein	12	1	13	210,046
Saarland	5	0	5	216,624
Baden-Württemberg	40	3	43	240,558
Rheinland-Pfalz	13	3	16	248,955
Niedersachsen	30	1	31	251,456
Thüringen	8	0	8	312,086
Mecklenburg-Vorpommern	5	0	5	364,117
Sachsen-Anhalt	6	1	7	390,209
Sachsen	7	3	10	455,721
Brandenburg	5	0	5	509,102
Germany	339	45	384	213,233

1) by location (not by ownership)

Figure 8: Population per Active Left Heart Catheter Lab, early 1997



Source: State Survey Hospital Committee, AGLMB

The national average was one active left heart catheter laboratory per 213,000 population at the beginning of 1997. The ratio was 194,000 : 1 in the Old Federal States and 368,000 : 1 in the New States. The highest density (131,000 population per left heart catheter laboratory) was recorded in Hamburg (see Table 5).

2.3 Left heart catheterisations and PCTA in 1995 and 1996

1995

According to the State Survey by the AGLMB Hospital Committee and from own estimates, a total of 397,810 left heart catheterisations were performed on adults in 341 Catheter Laboratories in Germany in 1995. The PCTA total was 108,991 (see Table 6). There is a marked 15 per cent increase in invasive diagnostic procedures and a 26 per cent increase in interventional therapy over the previous year.

An additional 2,017 thrombolytic interventions and 16,343 electrophysiological investigations were recorded in 1995. Thus, altogether 521,045 interventions were performed by the 341 active left heart catheter laboratories. This translates to an average of 1,528 procedures per laboratory.

**Tab. 6:** Left Heart catheterisations and PCTA, by State (adults) 1995

State	LHC total	LHC pmp	PTCA total	PTCA pmp
Hamburg	15,687	9,185	5,071	2,969
Saarland	7,487	6,904	3,085	2,845
Hessen	37,206	6,191	15,182	2,526
Bremen	4,845	7,128	1,508	2,218
Mecklenburg-Vorpommern	7,315	4,012	3,868	2,122
Berlin	20,663	5,952	6,902	1,988
Nordrhein-Westfalen	104,536	5,842	26,292	1,469
Bayern	64,878	5,409	16,262	1,356
Rheinland-Pfalz	16,579	4,168	4,339	1,091
Baden-Württemberg	43,507	4,216	11,066	1,072
Niedersachsen	30,079	3,866	6,855	881
Sachsen	16,275	3,564	3,920	858
Sachsen-Anhalt	9,039	3,300	1,401	512
Schleswig- Holstein	8,424	3,091	1,372	503
Thüringen	6,477	2,587	1,087	434
Brandenburg	4,813	1,893	781	307
Germany	397,810	4,862	108,991	1,332
Germany 1994	345,776	4,241	86,488	1,061

Source: State Survey Hospital Committee, AGLMB

The average number of left heart catheterisations for adults was 1,167 per laboratory in 1995. This excludes other invasive and interventional (PCTA) procedures. Certain accredited locations with one or more left heart catheter laboratories score in marked excess of, or much below, the average.

In 1995, the number of left heart catheterisations per million population ranged from 1,893 in Brandenburg (New State) to 9,185 in Hamburg.

An average 320 PCTA were performed per left heart catheterisation laboratory in 1995. The range was 307 pmp in Brandenburg to 2,969 pmp in Hamburg.

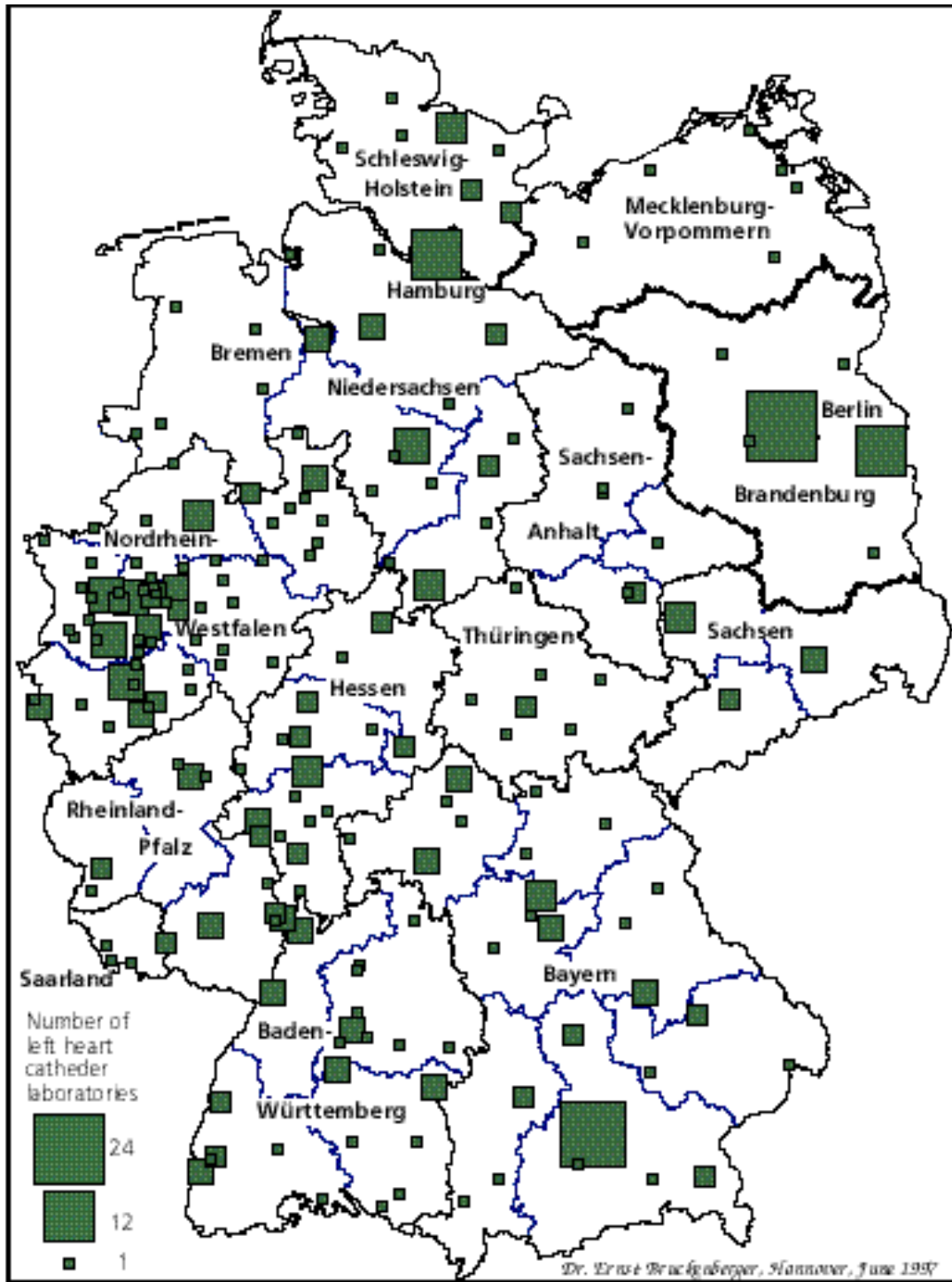
This comparison of left heart catheterisation and PCTA between Federal States does not take into account patient movement across statelines as in urban centers such as Hamburg, Bremen and Berlin which cover a larger area. The comparative figures therefore do not reflect the actual interventional penetration for the respective population. The relative small number of interventions in the New Federal States reflects an enormous need to catch up.

1996

Returns for 1996 are not yet complete. A realistic estimate yields about 440,000 left heart catheterisations and about 122,000 PCTAs nationwide. This means a 11 (12) per cent increase over 1995.

The following figure locates left heart catheter laboratories active in Germany at 1st January 1997.

Figure 9: Location of Left Heart Catheter Laboratories, 1-1-1997



Source: State Survey Hospital Committee, AGLMB

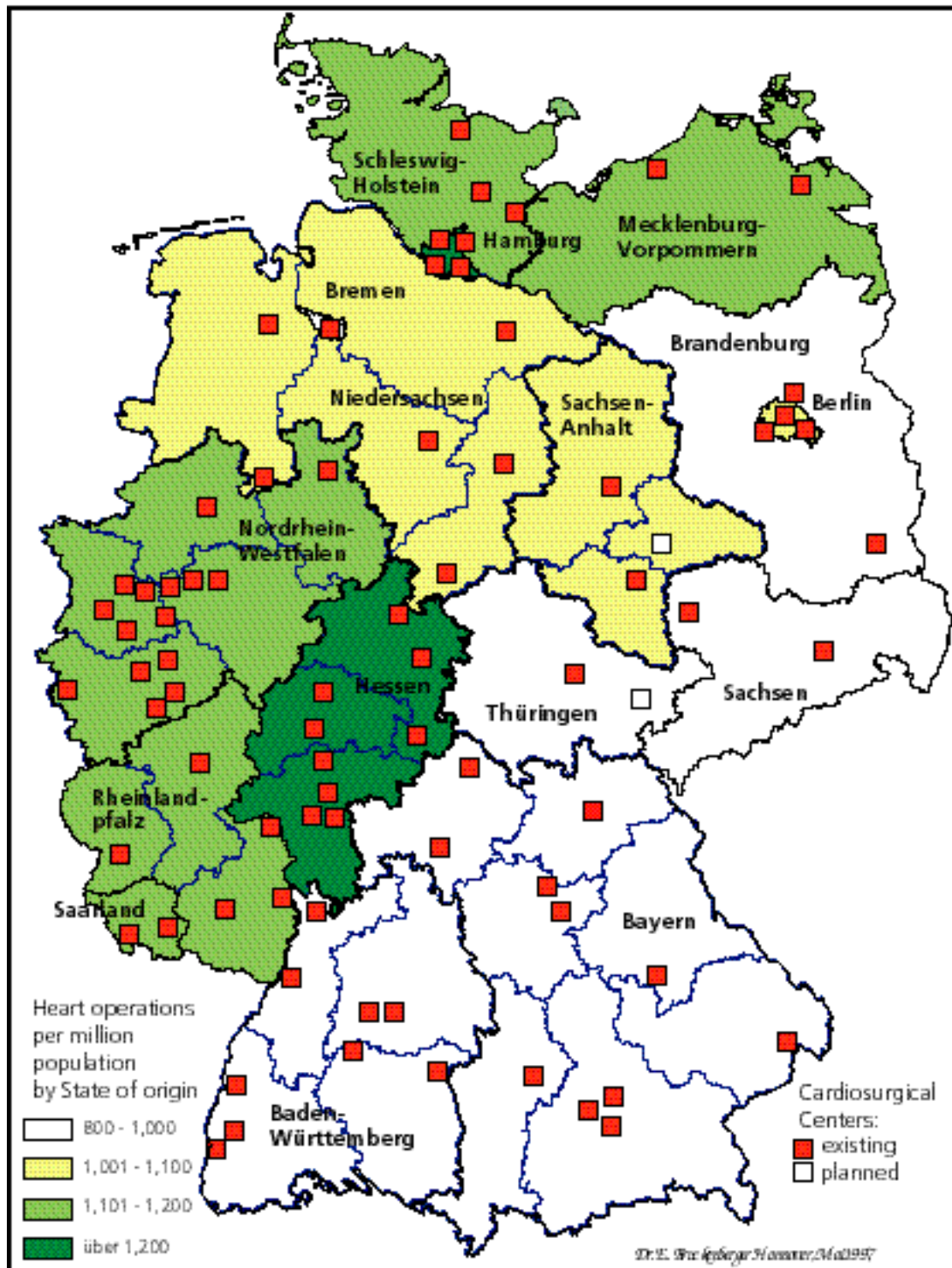


3.0 Cardiac Surgery

3.1 Cardiosurgical Centers

Figure 10 locates cardiosurgical centers in 1996

Figure 10: Location of Cardiosurgical Centers 1996



Source: State Survey Hospital Committee, AGLMB



A total of 77 Cardiosurgical centers were active in Germany in 1996. Sixty-seven centers were located in the Old Federal States and 10 in the New States. For location see Figure 10. The "CardioClinics" in Hamburg, Frankfurt am Main and Köln were not on contract with Social Security and have not been accredited within hospital planning.

In the Old Federal States, one new center opened in 1996:

- **Bayreuth**, Cardiosurgical Center (Klinikum Bayreuth).

In the New Federal States, no additional Cardiosurgical Center opened in 1996.

3.2 Cardiosurgical Centers and Left Heart Catheter Laboratories

Of 384 left heart catheter laboratories for adults active on 1st January 1997 in Germany, 141, or 36 per cent, were directly connected to the existing 77 Cardiosurgical Centers. More than one left heart catheter laboratory is available at 51 Cardiosurgical Centers in the Old Federal States; 12 centers have access to three catheter laboratories each. Of the 10 Cardiosurgical Centers in the New States, 4 have more than one catheter laboratory (Table 7).

Table 7: Cardiosurgical Centers and Left Heart Catheter Labs (Adults) - 1/1, 1997

number off cardiosurgical centers (CC)	number of catheter labs. Old Federal States		number of cardiosurgical centers (CC)	number of catheter labs. New Federal States	
	per CC	total		per CC	total
4	0	0	0	0	0
12	1	12	6	1	6
39	2	78	3	2	6
12	3	36	1	3	3
67		126	10		15

Source: State Survey Hospital Committee, AGLMB

3.3 Open Heart Procedures

In 1996, the 76 Cardiosurgical Centers performed 87.372 open heart procedures (1995 = 78,184). The 67 centers in the Old Federal States accounted for 74.800 (69,398) operations, and the 10 centers in the New Federal States for 12.572 (8,786). The Old Federal States had 1,126 (1,051) open heart procedures per million population and the New Federal States 814 (566).

The average workload was 1.116 (1,029) procedures per center in the Old States, range 241 (177) to 3,795 (3,713). The average workload per cardiosurgical center in the New Federal States was 1.257 (878) open heart procedures, range 660 (155) to 2.827 (2,116).

In the Old Federal States, 20.9 per cent of centers performed up to 700 procedures in 1996; 28.4 per cent of centers performed between 701 and 1,000 procedures and 43.3 per cent of centers performed between 1,001 and 2,000 open heart procedures per year. More than 2,000 procedures have been performed in five centers with 4 centers exceeding 3,000. In the New Federal States, 50 per cent of open heart procedures have been performed in centers doing between 701 and 1000 cases. Two centers performed more than 2,000 open heart procedures (see Table 8 and Figure 11).

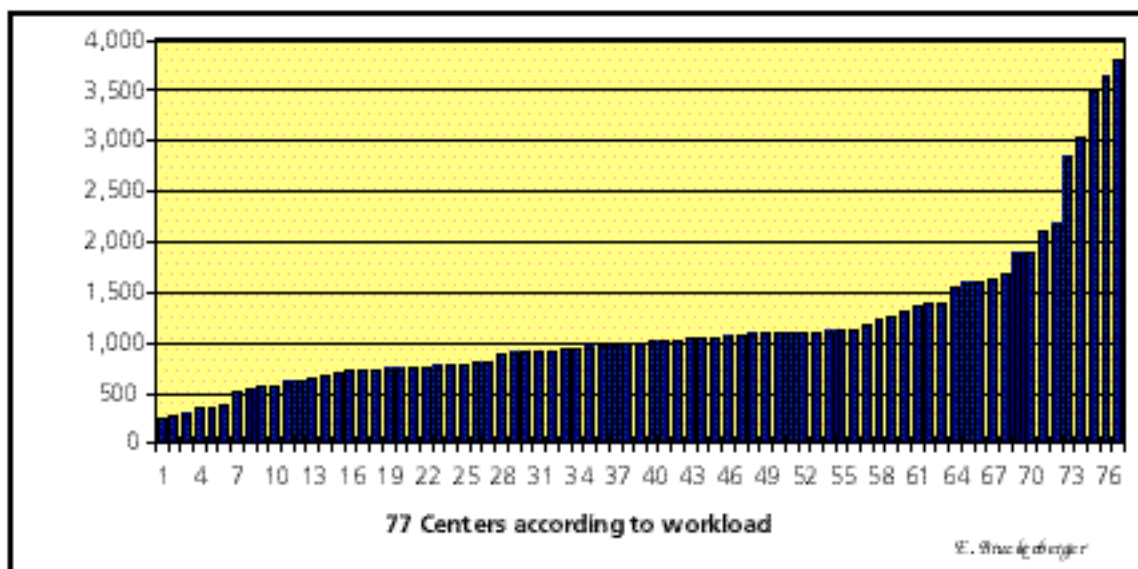


Table 8: Workload of cardiosurgical centers 1996

Open Heart Procedures	number of centers, Old Federal States		number of centers, New Federal States	
	total	per cent	total	per cent
to 400	6	9.0	0	0.0
401 to 700	8	11.9	1	10.0
701 to 1,000	19	28.4	5	50.0
1,001 to 2,000	29	43.3	2	20.0
2,001 to 3,000	1	1.5	2	20.0
over 3,000	4	6.0	0	0.0
all centers	67	100.0	10	100.0

Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

Figure 11: Workload of cardiosurgical centers, 1996



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

Minor variations remain between Old and New Federal States regarding the type of operation. Coronary procedures account for 75.2 per cent of interventions in the Old States and for 76.5 per cent in the New States (see Table 9). The relative amount of valvular surgery is higher, and procedures for congenital defects and other operations are less frequently performed in the New Federal States. A few centers performing congenital heart surgery do so to a greater extent (see Figure 12). Only 6 centers did more than 200 such procedures.

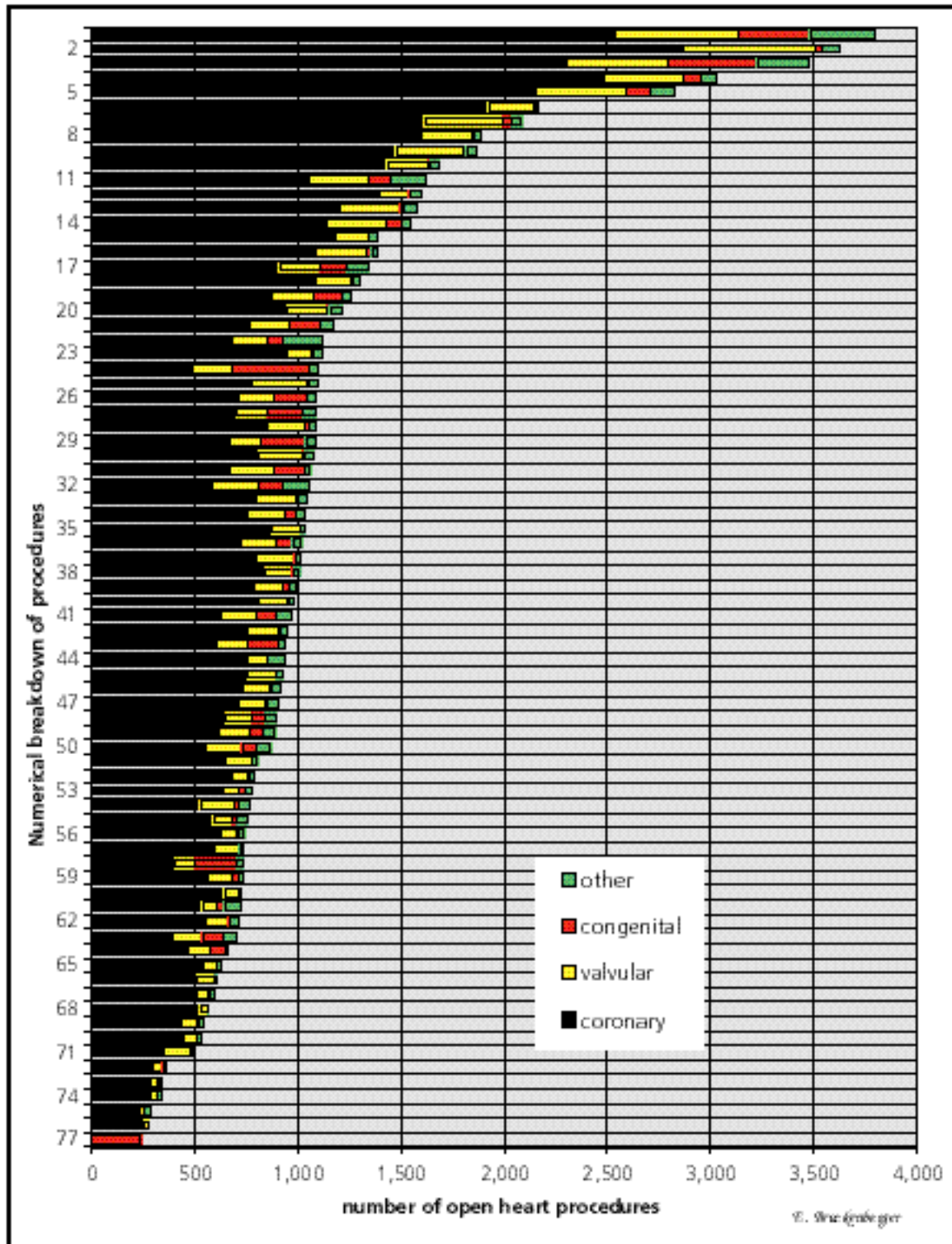
Table 9: Distribution of heart operations 1996

type of procedures	operations Old Fed. States		operations New Fed. States	
	actual	per cent	actual	per cent
Valvular	11,096	14.8	2,019	16.1
coronary	56,271	75.2	9,617	76.5
congenital	4,157	5.6	488	3.9
other	3,276	4.4	448	3.6
total	74,800	100.0	12,572	100.0

Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery



Figure 12: Type of Operation, by Center, 1996



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery



As regards first and repeat operations, there are only minor differences between cardiosurgical centers in the Old and New Federal States (Table 10). More than 90 per cent of procedures were first operations both in Old and New Federal States.

Table 10: first and repeat operations, 1996

type	procedures Old Fed. States		procedures New Fed. States	
	total	per cent	total	per cent
first operation	69,249	92.6	11,988	95.4
second operation	4,932	6.6	515	4.1
third operation	522	0.7	64	0.5
multiple	97	0.1	5	0.0
total	74,800	100.0	12,572	100.0

Source: State Survey Hospital Committee, AGLMB
with Society for Thoracic and Cardiovascular Surgery

A total 6,956 emergency operations (Quadra definition) was performed in German cardiosurgical centers in 1996. Of these, 6,221 or 8.3 per cent of open heart procedures were done in the Old Federal States and 753 or 5.8 per cent of procedures in the New States (Table 11). Emergency procedures following PTCA accounted for 16.1 and 11.6 per cent.

Table 11: Emergency Operations 1996

operation	Old Federal States		New Federal States	
	total	per cent	total	per cent
open heart procedures	74,800	100.0	12,572	100.0
emergencies	6,221	8.3	735	5.8
emergencies after PTCA	1,035	16.6	85	11.6

Source: State Survey Hospital Committee, AGLMB
with Society for Thoracic and Cardiovascular Surgery

The rate of emergency procedures varies widely between centers. Table 12 gives an overview. About 40 per cent of Cardiosurgical centers performed not more than 50 emergency procedures each.

Table 12: Emergency Rate in Cardiosurgical Centers, 1996

number of emergencies	number of heart centers Old Federal States		number of heart centers New Federal States	
	total	per cent	total	per cent
1 to 50	27	40.3	4	40.0
51 to 100	19	28.4	3	30.0
101 to 200	14	20.9	3	30.0
over 200	7	10.4	0	0.0
total	67	100.0	10	100.0

Source: State Survey Hospital Committee, AGLMB
with Society for Thoracic and Cardiovascular Surgery



3.4 Heart transplants

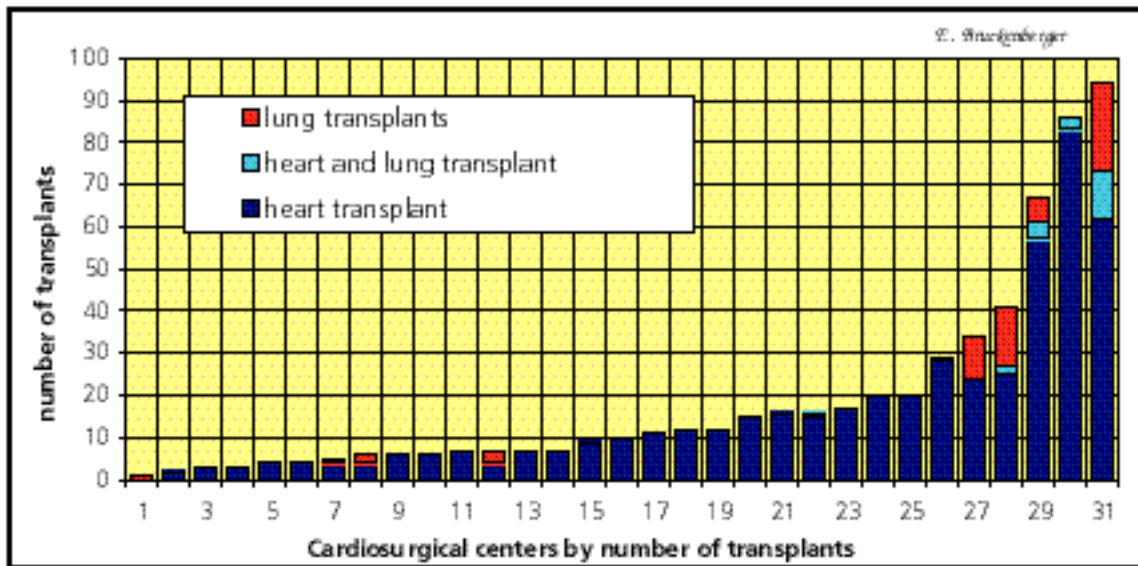
The number of transplants increased from 521 in 1995 to 577 in 1996. Of the total (adults and children), 497 were heart transplants; 440 were performed in the Old and 57 in the New Federal States. An additional 21 heart and lung transplants plus 58 lung transplants were done in the Old Federal States. One heart-and-lung transplantation was done in the New Federal States. Transplantations were done at 31 of 77 cardiosurgical centers (Table 13).

Table 13: Cardiosurgical centers performing heart transplants 1996

State	Location
Berlin/West	Berlin, Deutsches Herzzentrum
Nordrhein-Westfalen	Bad Oeynhausen, Herzzentrum NRW
Bayern	München, Uni-Klinik Großhadern
Niedersachsen	Hannover, Medizinische Hochschule
Schleswig-Holstein	Kiel, Uni-Klinik
Nordrhein-Westfalen	Münster/Westfalen, Uni-Klinik
Hessen	Gießen, Uni-Klinik
Sachsen-Anhalt	Halle, Uni-Klinik
Baden-Württemberg	Heidelberg, Uniklinik
Nordrhein-Westfalen	Köln, Uni-Klinik
Sachsen	Dresden, Herz- und Kreislaufzentrum
Sachsen	Leipzig, Herzzentrum-Leipzig GmbH
Bayern	Regensburg, Uni- Klinik
Hamburg	Hamburg, Uniklinik Eppendorf
Bayern	München, Deutsches Herzzentrum
Hessen	Frankfurt/Main, Uni-Klinik
Hessen	Fulda, Städtische-Kliniken
Bayern	Würzburg, Uni-Klinik
Berlin/Ost	Berlin, Uni-Klinik (Charite)
Niedersachsen	Göttingen, Uni-Klinik
Rheinland-Pfalz	Mainz, Uni-Klinik
Baden-Württemberg	Bad Krozingen, Herz-Zentrum
Baden-Württemberg	Freiburg, Uniklinik
Nordrhein-Westfalen	Essen, Uni-Klinikum
Saarland	Homburg, Uni-Kliniken d. Saarlandes
Nordrhein-Westfalen	Aachen, Technische Hochschule
Rheinland-Pfalz	Kaiserslautern, Städtische-Kliniken
Hessen	Bad Nauheim, Kerckhoff-Klinik
Nordrhein-Westfalen	Düsseldorf, Uni-Klinik
Baden-Württemberg	Tübingen, Uni-Klinik
Nordrhein-Westfalen	Dortmund, Städtische-Kliniken

The number of transplants done in 1996 in the 31 centers varied widely. Twenty-three centers performed less than 20 and only 2 centers did more than 80 transplantations (Figure 13).

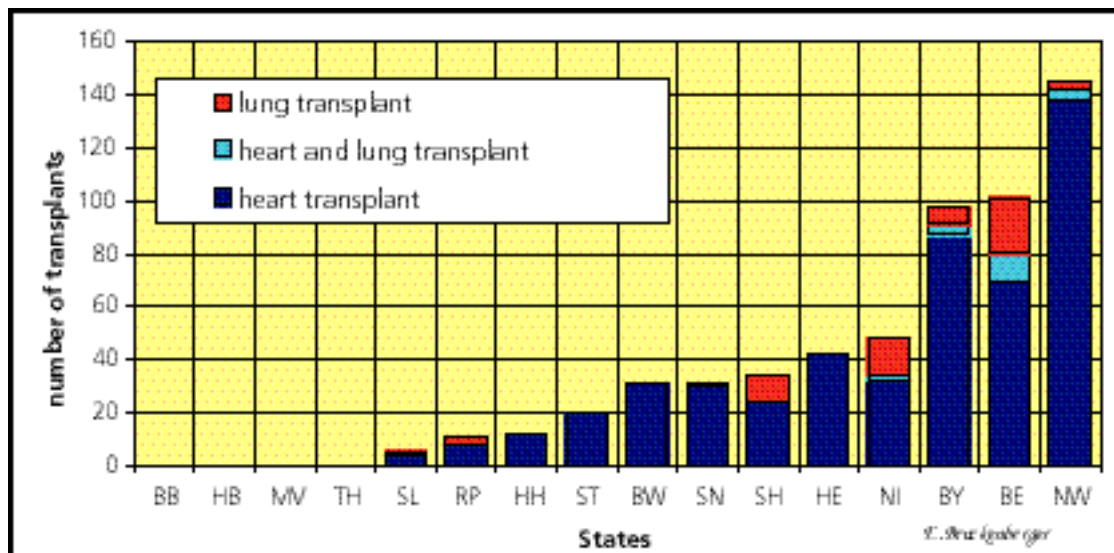
Figure 13: Transplants by Center, 1996



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

By far the most transplants were done in Nordrhein-Westfalen, Berlin and Bavaria. No transplants were performed in Brandenburg, Bremen, Mecklenburg-Vorpommern and Thüringen (Figure 14). Lung transplants were mainly done in Berlin, Niedersachsen and Schleswig-Holstein.

Figure 14: Transplants by State, 1996



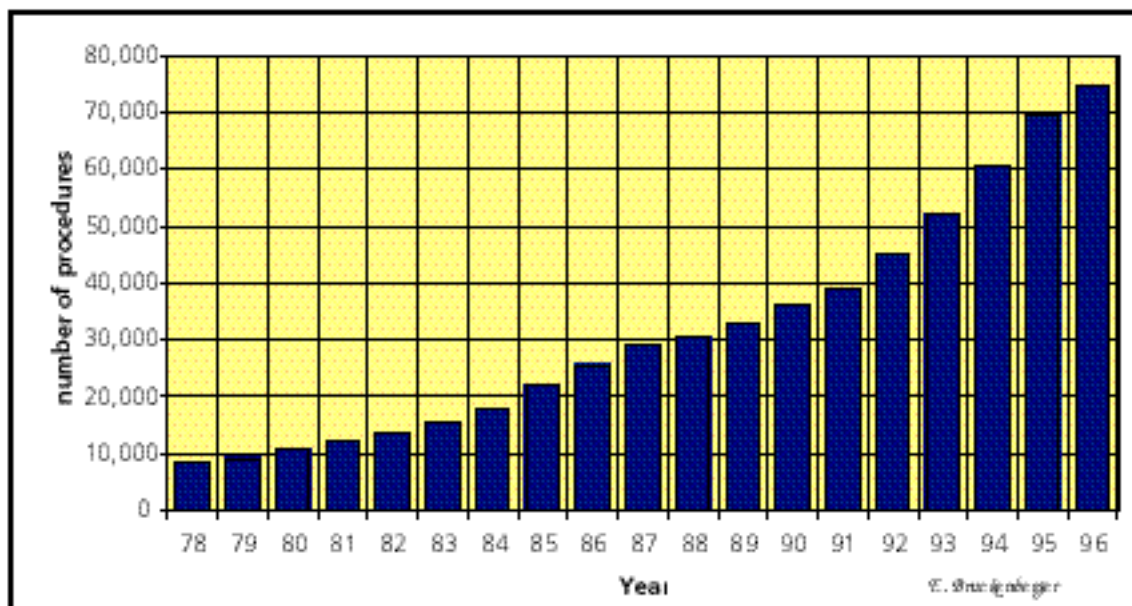
Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery



3.5 Evolution of open heart surgery since 1978

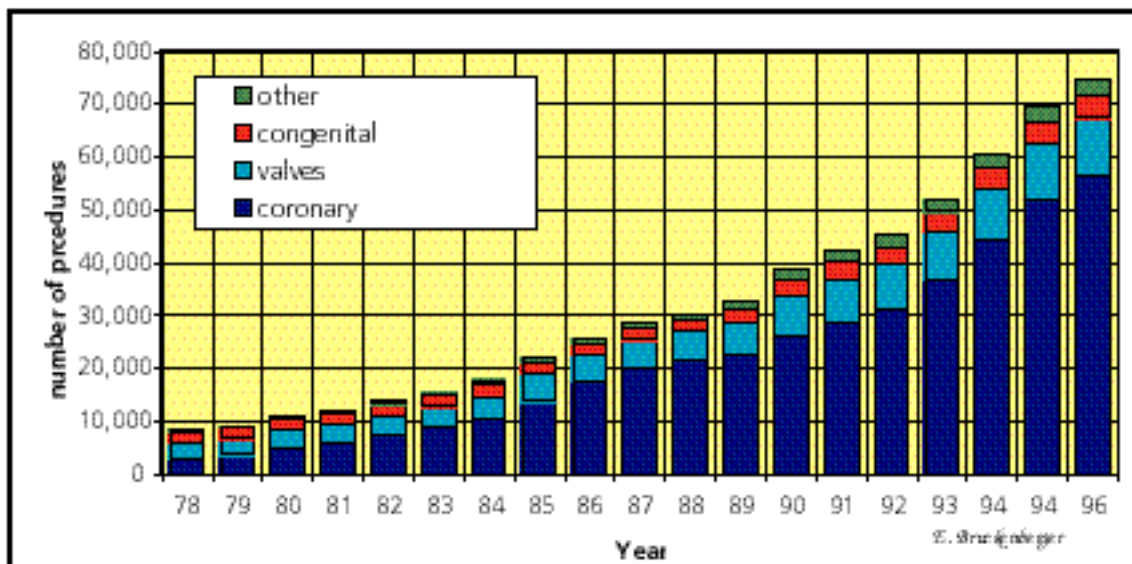
From 1978 to 1996, the number of open heart procedures rose from 8,365 to 74,800 in the Old Federal States (Figure 15). This is an increase from 136 to 1,126 operations per million population.

Figure 15: Evolution of open heart surgery, Old States



Source: State Survey Hospital Committee, AG LMB with Society for Thoracic and Cardiovascular Surgery

Figure 16: Evolution of heart operation by type, Old States



Source: State Survey Hospital Committee, AG LMB with Society for Thoracic and Cardiovascular Surgery

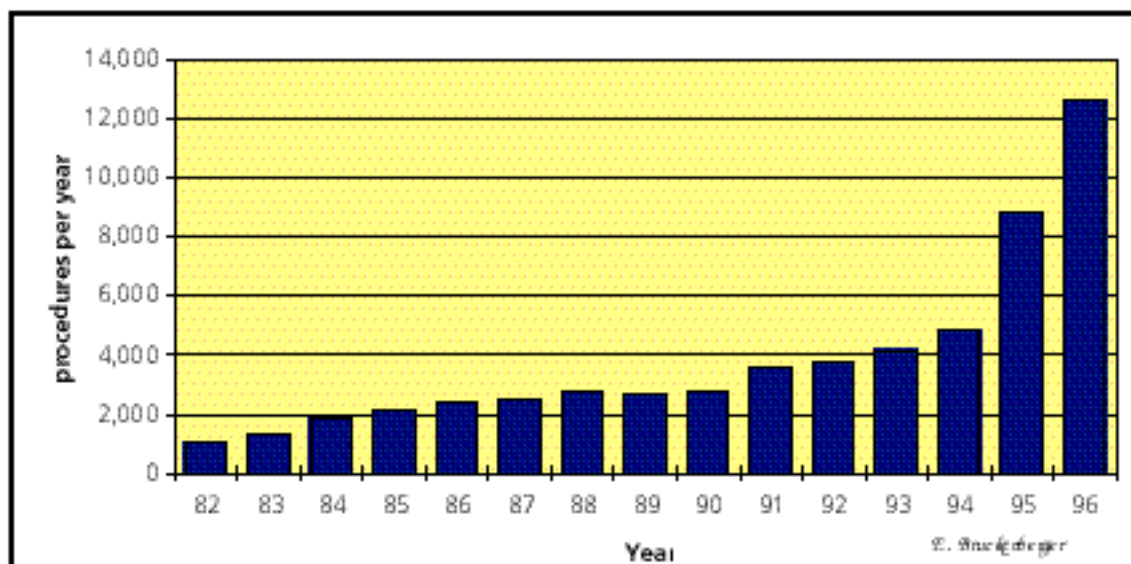
Different rates of growth apply to type of operation in the Old Federal States from 1978 to 1996. The number of coronary cases increased 19fold from 3,042 to 56,271. Valvular procedures increased from 2,955 to 11,096 (x3.5), procedures for congenital malformations from 2,089 to 4,157 (x2). Other open heart procedures (including cardiac transplants) multiplied by 14 from 239 to 3,276 (see Table 14 and Figure 16). Coronary procedures exceeded by far.

Table14: Evolution of Open Heart Surgery, by type, Old States

Year	Open Heart Procedures	type			
		coronary	valves	congenital	other
1978	8,325	3,042	2,955	2,089	239
1979	9,042	3,612	3,056	2,108	266
1980	10,680	4,887	3,397	2,075	321
1981	12,001	5,899	3,560	2,169	373
1982	13,671	7,287	3,788	2,126	470
1983	15,213	8,911	3,775	2,064	463
1984	17,699	10,458	4,237	2,259	745
1985	21,875	13,678	5,271	2,268	658
1986	25,471	17,489	5,216	2,027	739
1987	28,476	19,959	5,453	2,016	1,048
1988	30,270	21,363	5,801	2,270	836
1989	32,786	22,484	6,308	2,409	1,585
1990	38,783	26,137	7,461	3,311	1,874
1991	42,291	28,528	8,226	3,548	1,989
1992	45,178	31,338	8,330	3,362	2,148
1993	51,911	36,833	9,170	3,594	2,314
1994	60,491	44,307	9,819	3,723	2,642
1995	69,398	52,129	10,423	3,994	2,852
1996	74,800	56,271	11,096	4,157	3,276

Between 1982 and 1996 the number of open heart procedures in the New Federal States increased from 1,083 to 12,572 (Figure 17). The rate per million population rose from 65 to 814 open procedures. By comparison, this rate was 1,126 pmp for the Old Federal States in 1996 which is 38 per cent higher than in the former East (New Federal States).

Figure 17: Evolution of Open Heart Surgery, New Federal States



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery
 K.-F. Lindau "Gegenwärtiger Stand der Herzchirurgie in der DDR und Ausblick", The Cardiovascular Surgeon,
 No 4, Vol 38, August 1990



3.6 Age Distribution of Patients

Differences in the age distribution of patients treated in centers in the Old and New Federal States have disappeared over the past few years (Table 15, Figure 18).

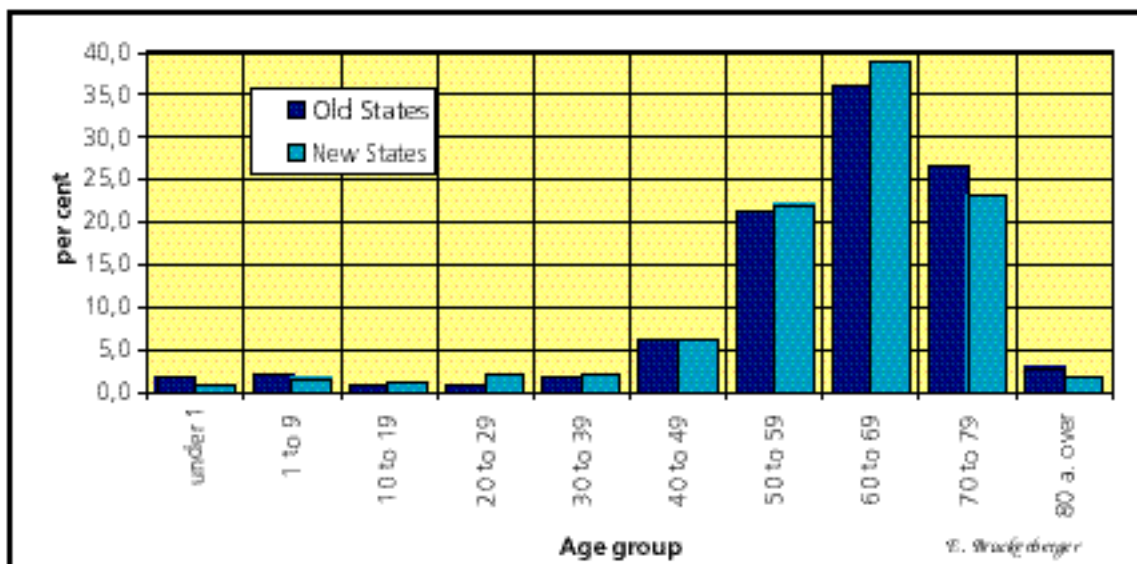
Centers in the Old Federal States did 65.5 per cent of open heart procedures on patients over 60 years of age in 1996. In 1993, the percentage was 58.8 per cent. Centers in the New Federal States had a rate of 63.9 per cent of patients over 60 year old in 1996 (from 45.8 per cent in 1993). In the general population, persons over 60 years of age account for 20.7 per cent in the Old and 19.3 per cent in the New Federal States.

The majority of heart operations were done for patients aged 60 to 69 years. This group accounted for 36.1 per cent of the operations in the Old and 38.9 per cent in the New Federal States.

Table 15: Age Distribution of Patients, 1996

age group	Old Federal States		New Federal States	
	actual	per cent	actual	per cent
under 1	1,339	1.8	99	0.8
1 to 9	1,628	2.2	195	1.6
10 to 19	558	0.7	143	1.1
20 to 29	594	0.8	278	2.2
30 to 39	1,335	1.8	259	2.1
40 to 49	4,560	6.1	790	6.3
50 to 59	15,843	21.2	2,774	22.1
60 to 69	26,976	36.1	4,893	38.9
70 to 79	19,806	26.5	2,919	23.2
80 and over	2,161	2.9	222	1.8
total	74,800	100.0	12,572	100.0

Figure 18: Age Distribution of Patients, 1996



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

3.7 Waiting List

12,616 patients were registered for open heart surgery in Germany in 1996. The waiting list shrank marginally from the previous year. Patients listed in the Old Federal States totalled 9,952 and in the New Federal States 2,664 (Table 16). Despite 38,418 additional open heart procedures in Germany since 1992, the waiting list did not change much, but waiting time was greatly reduced.

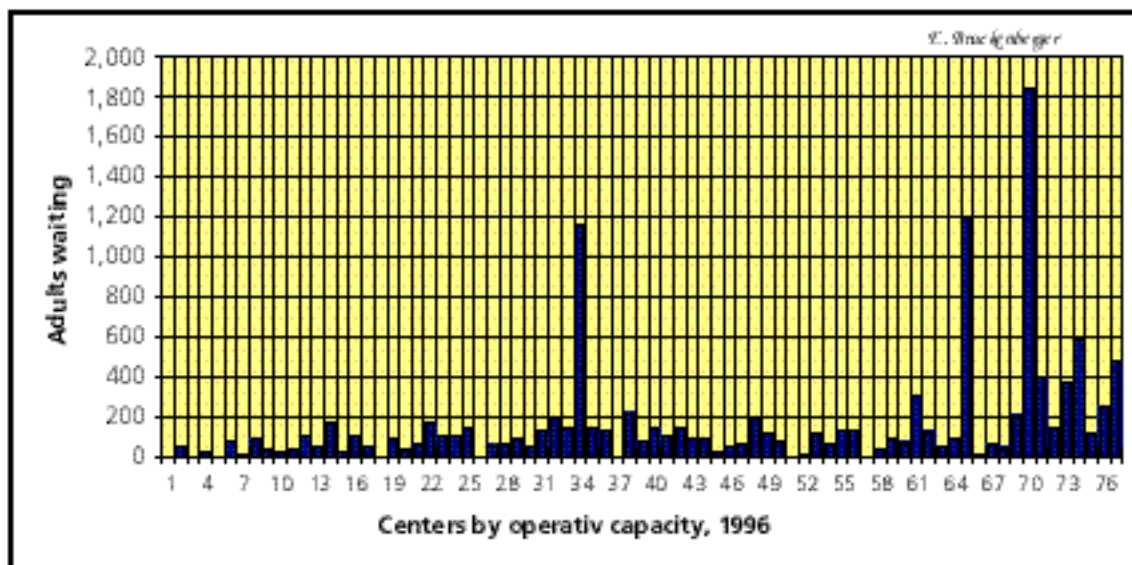
Table 16: Waiting List for Heart Operations, 1996

Patients	Old Federal States		New Federal States	
	actual	per cent	actual	per cent
Children	868	8.7	58	2.2
Valvular (adults)	1,571	15.8	500	18.8
Coronary (adults)	7,062	71.0	2,006	75.3
Other (adults)	451	4.5	100	3.8
total	9,952	100.0	2,664	100.0

Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

The waiting list for adults (see above) accounted for 13 per cent of annual capacity in cardiosurgical centers in the Old Federal States and for 21 per cent of annual capacity in the New Federal States in 1996. Waiting lists differ widely between centers. Waiting lists often relate to attraction, patient preference and cooperation between cardiologists and heart surgeons rather than operating capacity per center (Table 19). Multiple referrals may distort the figures.

Figure 19: Waiting list (adults) by center, 1996



Source: State Survey Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery



3.8 Number of procedures per Center

Table 17 gives the number of open heart procedures performed in 1996 by State. On average, 1,135 heart procedures were done per center in Germany. In 1991 the average was 798.

Table 17: Open Heart Procedures per center, by State, 1996

State	Cardiosurgical centers	open heart procedures	
		in State	per center
Sachsen	2	4,406	2,203
Thüringen	1	2,087	2,087
Berlin	3	5,010	1,670
Bremen	1	1,384	1,384
Niedersachsen	6	7,349	1,225
Nordrhein-Westfalen	15	18,071	1,205
Hessen	9	10,171	1,130
Bayern	11	12,341	1,122
Baden-Württemberg	9	10,060	1,118
Schleswig- Holstein	3	2,838	946
Hamburg	4	3,518	880
Brandenburg	2	1,758	879
Sachsen-Anhalt	2	1,612	806
Rheinland-Pfalz	5	3,817	763
Saarland	2	1,498	749
Mecklenburg-Vorpommern	2	1,452	726
Germany	77	87,372	1,135

Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

3.9 Patient movement between Federal States

The Annual State Survey done jointly by the AGLMB Hospital Committee and the Society for Thoracic and Cardiovascular Surgery included the referral basis of the 77 Cardiosurgical Centers. This part of the survey allows calculation of heart operations performed for the population of each State irrespective of surgical center location.

Patient movement between Federal States (Table 18) is a reflection of planning of cardiosurgical centers across state lines at the federal level (§ 6 (2) of Federal Hospital Law, KHG) and explains the varying density of centers between Federal States.

Tab. 18: Patient movement between Federal States (open heart procedures) 1996

Treatment center by State	Patients' residence by Federal State																	total
	SH	HH	NI	HB	NW	HE	RP	BW	BY	SL	BE	BB	MV	SN	ST	TH	SO	
Schleswig-Holstein	2,018	89	126	20	13	10	2	10	11	2	6	18	506	0	5	0	2	2,838
Hamburg	972	1,912	501	14	13	7	0	5	0	1	0	8	61	0	7	0	17	3,518
Niedersachsen	38	20	5,624	31	1,220	90	9	12	19	0	43	5	5	12	118	87	16	7,349
Bremen	0	7	751	570	29	0	0	0	0	0	1	7	5	0	10	0	4	1,384
Nordrhein-Westfalen	6	10	674	17	16,775	53	315	36	31	5	6	2	4	4	7	5	121	18,071
Hessen	6	8	387	10	1,735	6,545	629	119	271	14	8	3	3	37	32	319	45	10,171
Rheinland-Pfalz	4	2	4	0	44	392	2,917	364	24	43	0	1	2	1	1	1	17	3,817
Baden-Württemberg	6	6	83	2	489	82	293	8,709	267	6	50	16	2	6	11	10	22	10,060
Bayern	11	11	17	2	253	117	33	757	10,610	3	15	2	0	67	4	270	169	12,341
Saarland	0	1	9	0	7	5	253	23	0	1,175	3	0	0	1	0	0	21	1,498
Berlin	23	20	113	5	66	27	22	30	39	1	3,473	790	86	67	163	28	57	5,010
Brandenburg	0	0	0	0	0	0	0	0	0	0	188	1,419	19	119	10	3	0	1,758
Mecklenburg-Vorpommern	1	0	1	0	0	0	0	0	0	0	1	17	1,418	2	2	0	10	1,452
Sachsen	1	5	4	0	27	8	6	7	10	1	1	97	5	3,270	738	222	4	4,406
Sachsen-Anhalt	0	0	6	0	1	0	0	1	0	0	1	15	3	3	1,576	0	6	1,612
Thüringen	0	0	0	0	2	2	0	1	3	0	2	2	10	326	253	1,486	0	2,087
Procedures total	3,086	2,091	8,300	671	20,674	7,338	4,479	10,074	11,285	1,251	3,798	2,402	2,129	3,915	2,937	2,431	511	87,372

Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery



More than 90 per cent of the resident population were cared for in-state in Bayern, Berlin, Hamburg and Saarland in 1996. A relatively high proportion of residents went out-of-state in 1996 for their open heart procedures from Rheinland-Pfalz, Niedersachsen and Schleswig-Holstein due in part to geographic location.

Table 19: Treatment by location, 1996 - totals

State	in-State procedures		out-of-State procedures for residents (excluding operations abroad)	procedures for residents total (excluding operations abroad)
	total	procedures for resident population		
Nordrhein-Westfalen	18,071	16,775	3,899	20,674
Bayern	12,341	10,610	675	11,285
Baden-Württemberg	10,060	8,709	1,365	10,074
Niedersachsen	7,349	5,624	2,676	8,300
Hessen	10,171	6,545	793	7,338
Rheinland-Pfalz	3,817	2,917	1,562	4,479
Sachsen	4,406	3,270	645	3,915
Berlin	5,010	3,473	325	3,798
Schleswig-Holstein	2,838	2,018	1,068	3,086
Sachsen-Anhalt	1,612	1,567	1,370	2,937
Thüringen	2,087	1,486	945	2,431
Brandenburg	1,758	1,419	983	2,402
Mecklenburg-Vorpommern	1,452	1,418	711	2,129
Hamburg	3,518	1,912	179	2,091
Saarland	1,498	1,175	76	1,251
Bremen	1,384	570	101	671
Germany	87,372	69,488	17,373	86,861

Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

Open heart surgery per million population 1996 ranges from 859 for residents of Saxony to 1,224 for residents of Hamburg (Table 20). More than 1,200 operations per million (pmp) were performed for the population of 2 Federal States; between 1,100 and 1,200 operations pmp were done in 8 Federal States; between 1,000 and 1,100 in 3 Federal States and between 800 and 1,000 in the other 6 Federal States. The highest number of out-of-state heart operations per million population was done for residents of Sachsen-Anhalt followed by Rheinland-Pfalz, Mecklenburg-Vorpommern and Schleswig-Holstein in 1996.

**Table 20:** Treatment location by Federal State 1996, per million population

State	procedures in-state		procedures out-of-state for residents <small>excluding operations abroad</small>	total procedures for residents <small>excluding operations abroad</small>
	total	for residents		
Hamburg	2,059	1,119	105	1,224
Hessen	1,691	1,088	132	1,220
Mecklenburg-Vorpommern	798	779	391	1,169
Saarland	1,383	1,085	70	1,155
Nordrhein-Westfalen	1,009	937	218	1,154
Schleswig-Holstein	1,039	739	391	1,130
Rheinland-Pfalz	958	732	392	1,124
Berlin	1,445	1,002	94	1,095
Sachsen-Anhalt	590	574	502	1,075
Niedersachsen	943	721	343	1,065
Bremen	2,039	840	149	989
Baden-Württemberg	973	842	132	974
Thüringen	836	595	379	974
Brandenburg	691	557	386	944
Bayern	1,027	883	56	939
Sachsen	967	718	142	859
Germany	1,067	849	212	1,061

Source: State Survey, Hospital Committee, AGLMB
with Society for Thoracic and Cardiovascular Surgery

The average number of open heart procedures for German residents was 1.061 per million population in 1996 (1995 = 953). Open heart operations performed in foreign countries have not been included because of incomplete information.

For residents of the New Federal States, a total of 2,799 open heart procedures were done in 1996 at cardiosurgical centers in the Old Federal States including Berlin. Of these, 1,134 were performed in Berlin, 529 in Schleswig-Holstein, 394 in Hessen, 343 in Bavaria and 227 in Niedersachsen. Thus, the average capacity of three cardiosurgical centers in the Old Federal States has been made available to patients from the New Federal States.





4.0 Pediatric Cardiology and Pediatric Cardiosurgery

4.1 Pediatric Cardiology

Successful pediatric heart surgery relies on direct cooperation with a unit for pediatric cardiology since intensive postoperative care of neonates and infants needs special skills. Thorough experience in anesthesia is another requirement.

The German Society for Pediatric Cardiology (author: Professor Dr Meyer, Department of Pediatric Cardiology, Heart Center of Nordrhein-Westfalen at Bad Oeynhausen) analysed investigations done at 31 catheter laboratories. An average of 190 right heart catheterisations (including descending aorta via patent ductus arteriosus) was performed per laboratory in 1996, range 8 to 604 catheterisations. An average of 172 left heart catheterisations was performed per center; about half of these were done via pre-existing shunts (patent foramen ovale, atrial septal defect, ventricular septal defect). For the remainder (excluding one per cent transeptal procedures), the approach was generally via the femoral artery. The number of left heart catheterisations varied from 4 to 483 per center.

Age of pediatric patients who underwent cardiac catheterisation: about 12.6 per cent neonates up to one month old (including premature births); 24.7 per cent infants (age 1 month to 1 year), 52.4 per cent children (1 to 16 years) and 9.4 per cent adolescents (over 16 years).

As expected, congenital cardiac malformations accounted for 90.9 of diagnoses; cardiomyopathies made up 1.8 per cent, acquired heart defects 1.1 per cent; the remainder related to other diagnoses.

Heart catheterisations preceded "corrective surgery" in 43.3 per cent and palliative operations in about 8.3 per cent. The remainder was performed to clarify diagnosis (17.3 per cent) or for postoperative assessment (13.4 per cent). Therapeutic catheterisations (balloon dilatation, balloon septostomy, electrotherapy and occlusion of vessels) was done in 23.9 per cent of cases. General anesthesia was used in 21.8 per cent of cases, the remainder receiving sedation only. The mean duration of catheterisation (patient stay in catheter laboratory) was 114 minutes.

Venous or arterial cut-down was necessary in rare cases (about 1.1 per cent). Complications were led by arrhythmias generally limited to the investigation. Bleeding, thrombosis, etc occurred in rare instances; these were either self-limiting or needed anticoagulation.

One particular development merits attention: therapeutic interventions performed by pediatric cardiologists during catheterisation. These include balloon atrioseptostomy, balloon dilatation of stenotic valves, occlusion of vessels and occlusion of atrial and ventricular septal defects.

4.2 Evolution of Pediatric Heart Surgery

Before the advent of coronary revascularisation, surgical repair of congenital cardiac malformations was a central task in cardiac surgery. Because of the high risk of open heart surgery in infants and neonates at that time, these procedures were postponed to a later age. Since the 1980s there have been enormous improvements in heart-lung machines, anaesthesia, operative technique and intensive care, and these have made corrective surgery in the first 12 months of life feasible, even for complex malformations.

Taking into account the diversity and complexity of cases, a pediatric heart surgeon needs long-term practice and cooperation with experienced pediatric cardiologists and anesthetists to reach and maintain performance at top international standard.

Cardiac surgery for infants and children differs greatly from cardiac surgery for adults especially in pre- and postoperative management and operative procedures. The organs and vessels of infants and neonates require special techniques. Progress in heart surgery allows early corrective operations in many complex congenital malformations.

Corrective operations done in neonates and young infants have replaced palliative procedures. There is general agreement that congenital malformations should be corrected as early as possible. The operative risk does not exceed the adult level, thanks to improved operative technique and better postoperative management. Cumulative mortality



ty and complications occurring between palliative and corrective surgery have been reduced. Only some 25 Cardiosurgical Centers in Germany will meet the special requirements to care for a greater number of infants and children.

4.3 Open Heart Surgery in Children 1996

A total of 3,962 open heart operations were performed on infants, children and adolescents in Germany in 1996. Quite a few congenital heart conditions (about 30 per cent) are treated by first or repeat operation after 20 years of age. Of 3,524 operations performed in the Old Federal States, 1,339 were for patients up to 1 year of age; 1,628 for patients aged 1 to 9 years and 558 for patients aged 10-19 years. In the New Federal States, the corresponding figures are 99, 195 and 143 operations (Table 21). Not included are operations for children done abroad (e.g. England and Monaco).

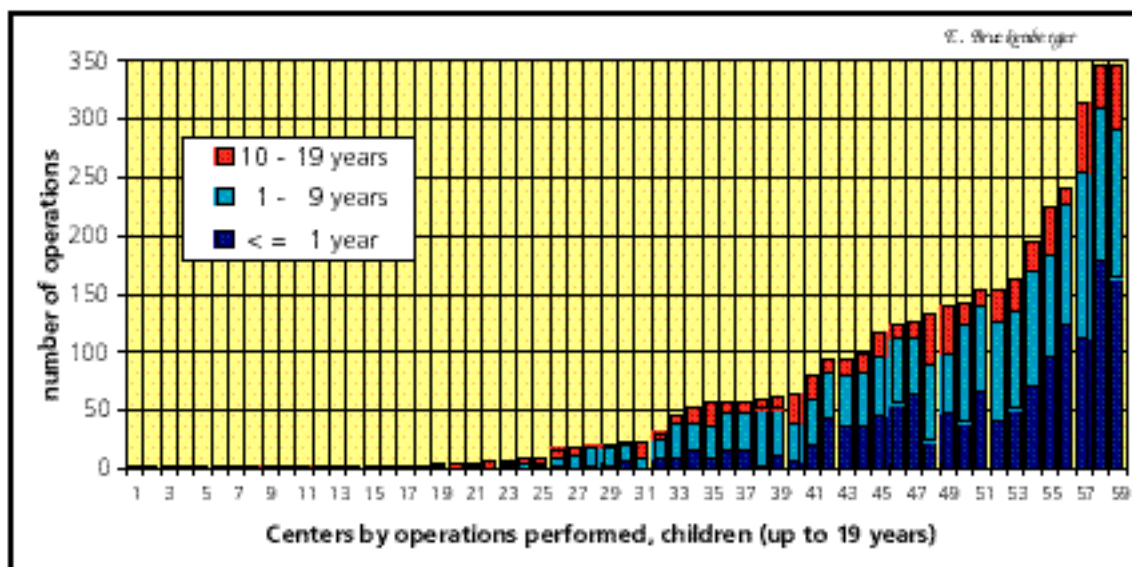
Table 21: Heart operations for infants, children and adolescents, 1995

Age group	Old Federal States		New Federal States		Germany	
	total	per cent	total	per cent	total	per cent
under 1	1,339	38.0	99	22.7	1,438	36.3
1 to 9	1,628	46.2	195	44.6	1,823	46.0
10 to 19	558	15.8	143	32.7	701	17.7
total	3,525	100.0	437	100.0	3,962	100.0

Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

Open heart interventions for infants up to 1 year of age were done at 34 centers, for children aged 1 to 9 years at 41 centers and for patients aged 10 to 19 years at 59 cardiosurgical centers in 1996 (Figure 20). Patients of all age groups were solely treated at centers which also performed operations on neonates.

Figure 20: open heart procedures for infants, children and adolescents, 1996



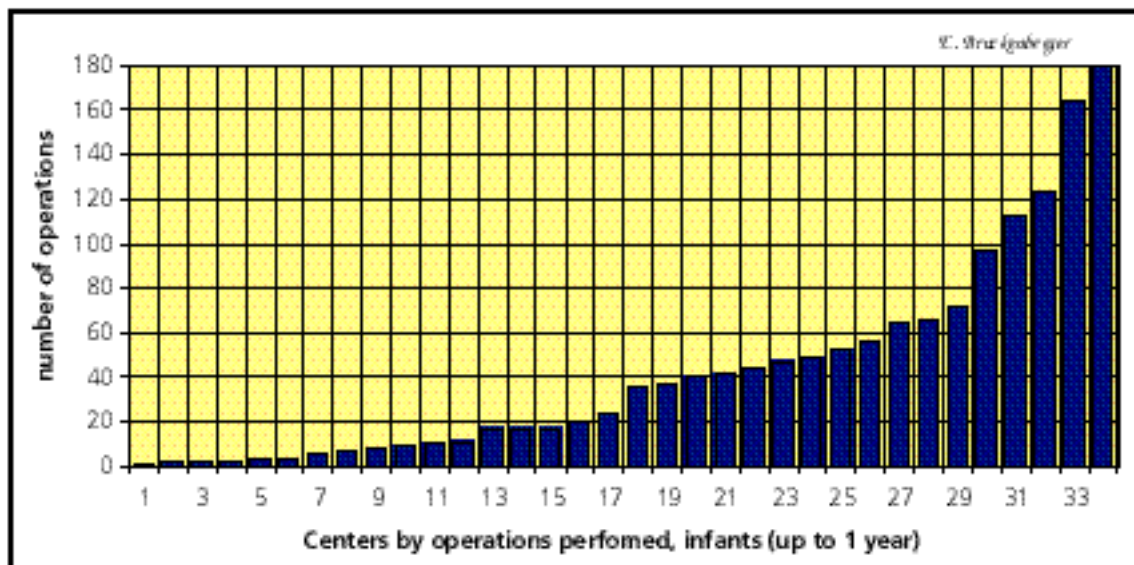
Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

About 74 per cent of 3,962 open heart procedures were performed at only 15 of 77 cardiosurgical centers. These centers also treated the majority of patients in each age group: 82 per cent up to 1 year, 70 per cent age 1 to 9 and 64 per cent age 10 to 19. Heart surgery for the very young is centralised in a small number of centers.



The total of 1,438 open heart procedures for infants up to 1 year including premature births were performed at 34 out of 77 cardiosurgical centers in Germany in 1996; case-load ranged from 1 to 179 (Figure 21). 75 per cent of operations in this age group were performed at 12 centers only. There were only 4 centers performing more than 100 operations. In view of quality assurance, this merits critical attention.

Figure 21: open heart procedures for infants up to 1 year, 1999

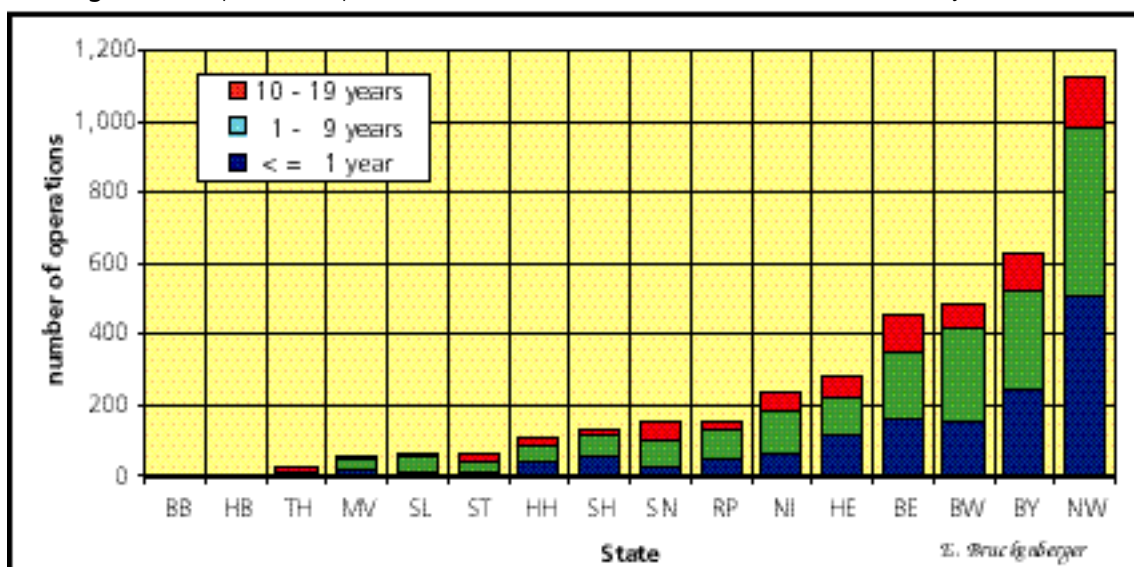


Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

Nine centers, namely Cologne (Köln), Bad Oeynhausen, Münster, Berlin (Deutsches Herzzentrum, Charité), Gießen, München-Großhadern, Leipzig and Dresden performed a total of 40 heart transplants, 8 heart and lung transplants and 5 lung transplants for children in 1996.

The distribution of open heart procedures for infants, children and adolescents by Federal State is given in Figure 22. The highest absolute number were performed in Nordrhein-Westfalen, followed by Bavaria, Baden-Württemberg and Berlin.

Figure 22: open heart operations with HLM for infants, children and adolescents, by state, 1996



Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

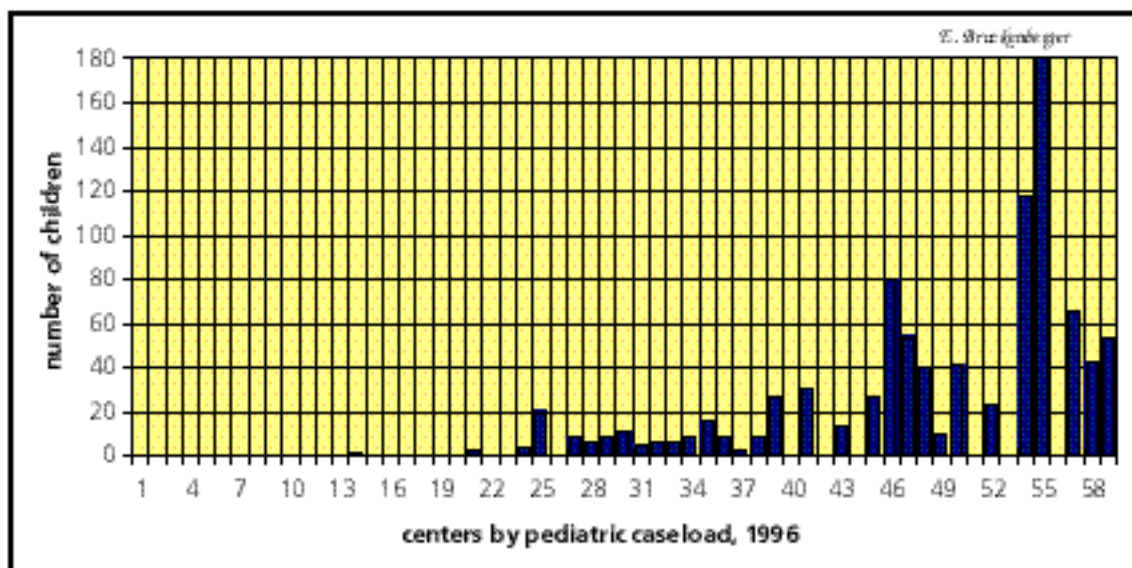


4.4 Waiting List

The pediatric waiting list (infants, children and adolescents) numbered 868 patients for centers in the Old Federal States and 58 in the New Federal States. This represents about 25 and 13 per cent of operative capacity in 1996. The waiting list shrank from the preceding year. Pediatric "Waiting Lists" can be taken as "booking lists" for optimum time of intervention.

Pediatric waiting lists by center differ widely, as is also true of adults (Figure 23). Two cardiosurgical centers report a waiting list, but performed no open heart procedures on children in 1996.

Figure 23: Pediatric waiting list, by center, 1996



Source: State Survey, Hospital Committee, AGLMB with Society for Thoracic and Cardiovascular Surgery

4.5 Concentration of Pediatric Heart Surgery y

The German Society for Pediatric Cardiology estimates that about 6,000 to 8,000 children (depending on actual number of births) are born annually with congenital heart malformations in Germany. About 30 per cent of these children do not need an operation, are inoperable or can be treated by catheter intervention. Possibly 4,500 need open heart surgery and some may need several operations as they grow up. The proportion of additional operations is estimated at about 30 per cent. The total number of open heart operations done on infants, children and adults in Germany does not reflect the severity of malformations or the range of surgical tasks. Experts rate about 75 per cent of operations for congenital cardiac malformations as difficult because of very young age and complex conditions. High performance in pediatric heart surgery depends on sound infrastructure in pediatric cardiosurgery and cardiology and demands that the number of complex open heart operations performed every year must not drop below a certain minimum.

Coronary surgery for adults is essentially a routine procedure. For medical and economic reasons, the quality of pediatric heart surgery in Germany will not be improved by country-wide establishment of new centers. This is a consequence of the wide range of congenital malformations and the rising complexity of surgical interventions. Preference should be given to relieving staff shortages and increasing operative capacity in those pediatric cardiosurgical centers which perform relatively more operations. A pediatric cardiosurgical center should perform a minimum of 200 to 300 open heart operations per year for medical, economic and quality reasons. At present, 7 centers meet this goal and 6 others attain the above minimum. A further 15 centers perform pediatric cardiosurgery.



The German Society for Thoracic and Cardiovascular Surgery and the German Society for Pediatric Cardiology propose the following "**Requirements for a Pediatric Cardiosurgical Program**":

- A department of pediatric cardiology which performs diagnostic and therapeutic catheterisations regularly.
- A postoperative intensive care unit specifically tailored to pediatric patients and managed jointly by pediatric cardiologists and pediatric cardiac surgeons.
- A 24-hour-service for emergency operations, i.e. more than one experienced pediatric cardiac surgeon.
- Full adherence to quality assessment programs in heart surgery and pediatric cardiology.

For medical and economic reasons, the following targets are set:

- A) Minimum number of operations: total of 150 open heart operations; out of these, 60 operations in infants (up to 1 year of age) and neonates desirable.
- B) Target number of more than 200 open heart procedures including 100 operations in infants (up to 1 year of age) and neonates.

A survey of existing Centers is being undertaken at present to guide concentration. The German Society for Thoracic and Cardiovascular Surgery is to publish a list of these centers in a "Heart Guide" 1997.

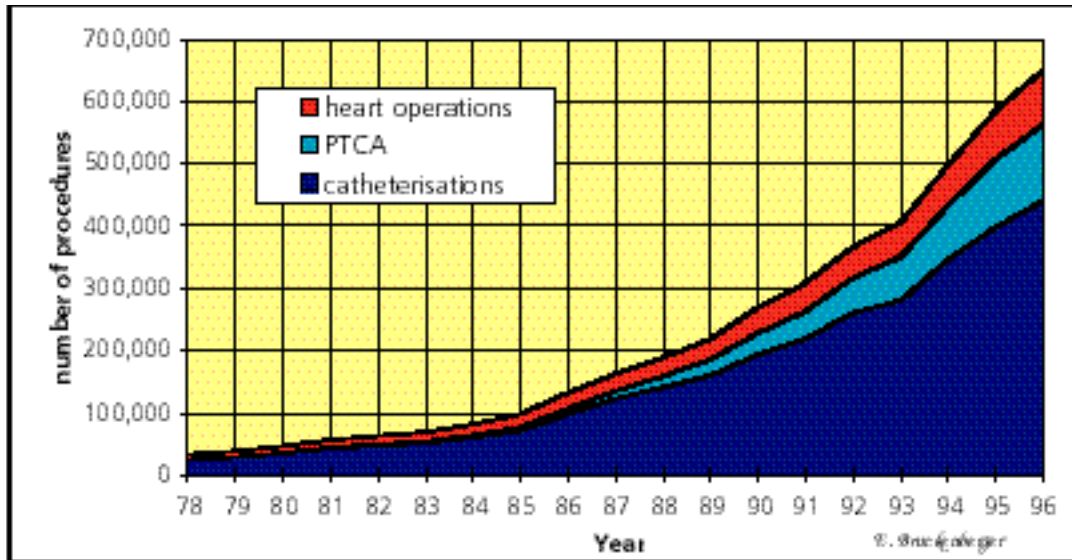




5.0 Evolution of Diagnostic and Therapeutic Interventions*

Diagnostic and therapeutic interventions to combat myocardial infarction have seen unabated growth since 1978. The number of open heart procedures has increased tenfold (from 8,365 to 87,732); the number of left heart catheterisations 18fold (from 24,281 to 440,000), and the number of PCTA 1.220fold (from 100 to 122,000) - see Figure 24.

Figure 24: Evolution of diagnostic and therapeutic interventions Old States, 1978-1996*



Source: State Survey, Hospital Committee, AGLMB

It is open to doubt whether this enormous growth reflects medical indications only. Part of the evolution may stem from the system. The Commission on Clinical Cardiology warns of excessive capacity in left heart catheterisation in the Old Federal States. Yet it is the physician or cardiologist who orders left heart catheterisation and PCTA and sets the demand.

The demand for coronary heart operations has not been reduced by PCTA. Expectations to the contrary proved unfounded. A familiar experience has been repeated:

The number of investigations or interventions generated by a new procedure exceeds the number of obsolete investigations and interventions which are discarded; however, this often means a reduced burden to patients concerned.

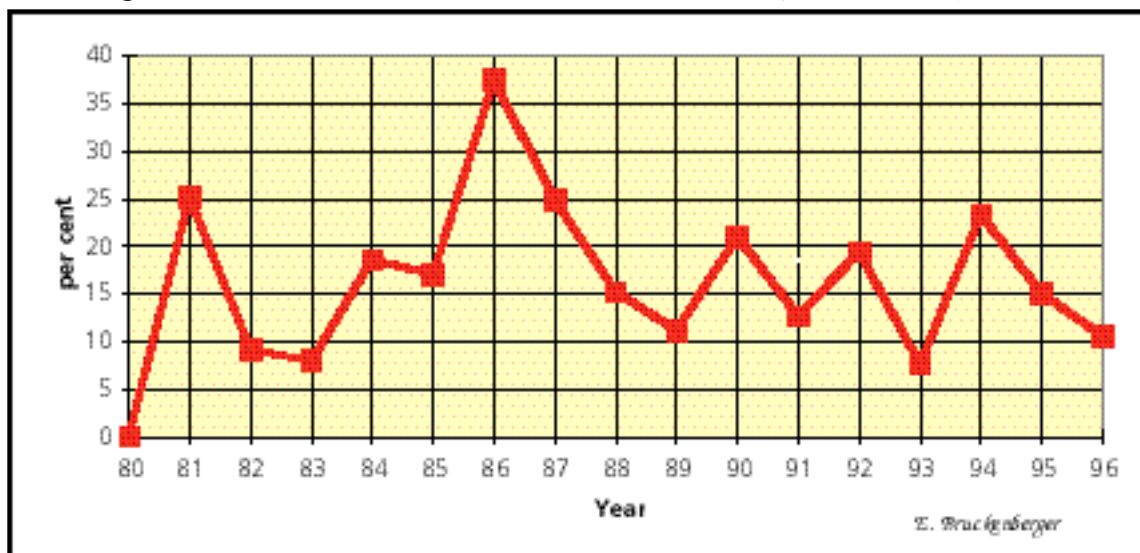
Left heart catheterisation is a reliable diagnostic procedure and PCTA is an effective, essential and gentle method of intervention. Coronary heart surgery may be postponed but is eventually required in some cases. Time gained by PCTA can improve patient survival.

*until 1989: Old Federal States only, from 1990 Old and New Federal States.



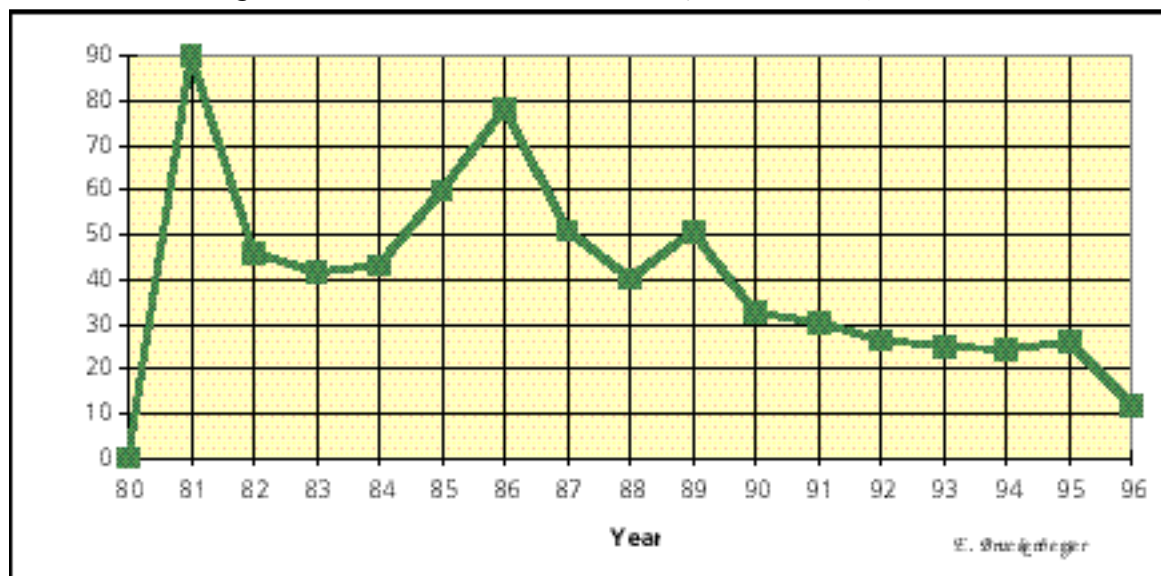
The annual growth rate for left heart catheterisations, with three exceptions, exceeded 10 per cent since 1980; since 1990, the average growth rate is 16 per cent.

Figure 25: Growth Rate of Left Heart Catheterisation in Germany 1980 to 1996 (per cent)*



By comparison, the annual growth rate for PTCA from 1980 to 1996 was considerably higher. From 1980 to 1989 the rate never was below 40 per cent. From 1990 to 1995, PTCA grew by 33 to 26 per cent. In 1996 the PTCA growth rate slowed down to 12 per cent for the first time.

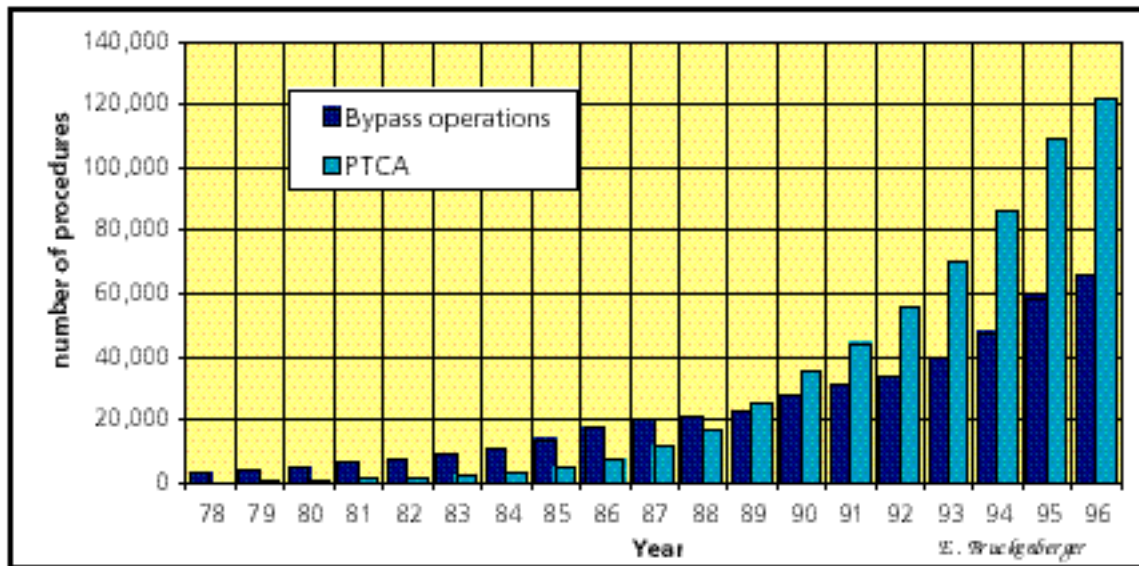
Figure 26: Growth Rate of PTCA in Germany, 1980 to 1996 (per cent)*



*until 1989: Old Federal States only, from 1990 Old and New Federal States.



Figure 27: PCTA and coronary procedures in Germany, 1978-1996*

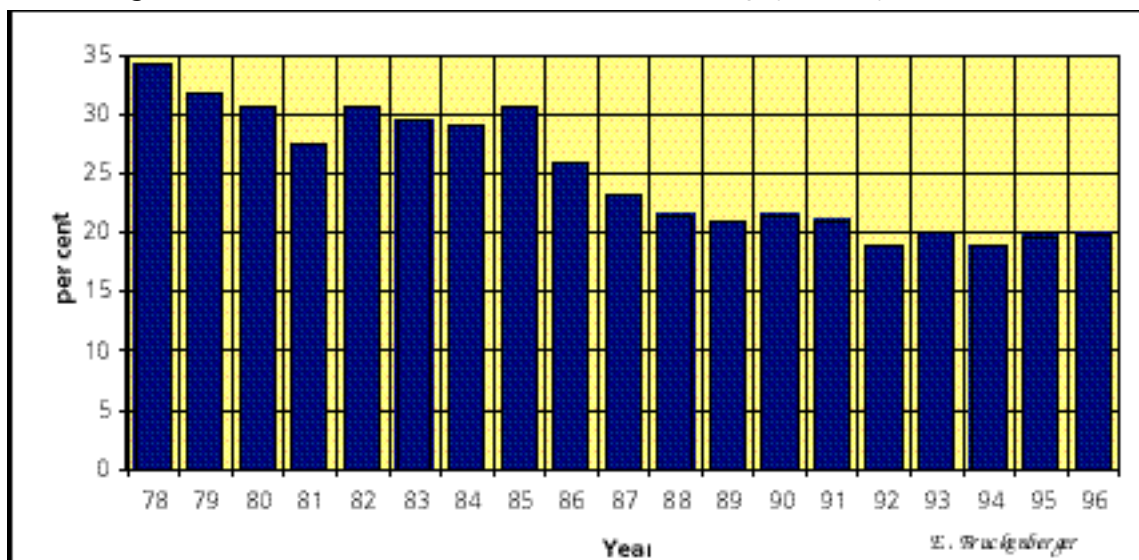


Source: State Survey, Hospital Committee, AGLMB and own estimates

Back in 1978, only 3 per cent of invasively treated patients in the Old Federal States underwent PCTA, and 97 per cent had coronary operations. The ratio was reversed in 1989 when the number of PCTAs exceeded the number of coronary operations for the first time. In 1996, an estimated 122,000 PCTAs exceeded 65,888 coronary heart operations by 85 per cent (Figure 27). This tendency is reinforced by second and third PCTAs.

The national average of left heart catheterisations showing an indication for surgery sank from about 34 per cent in 1978 to about 21 per cent in 1988 and has remained almost stable. In 1996, the rate was 20 per cent.

Figure 28: Left heart catheterisations with indication for surgery Germany, 1978 - 1996*



Source: State Survey, Hospital Committee, AGLMB and own estimates

* until 1989: Old Federal States only; from 1990 Old and New Federal States





6.0 Expansion of Facilities

6.1 Expansion in the Old Federal States (former West)

A further 26 left heart catheter laboratories were accredited but not yet operative as of 1st January 1997. Left heart catheterisations done at these new installations will be additive and are likely to increase demand for coronary operations. The cardiosurgical center at **Bayreuth** started operations in 1996, and no further cardiosurgical centers are planned. The need for operative centers in the Old Federal States has been met. Once the out-of-state operations for residents of the New States can be done in-state, the corresponding operation capacity of 3,500 procedures may be set free.

6.2 Expansion in the New Federal States (former East)

Complementary cardiological units and out-patient facilities are needed in conjunction with planning and building of new cardiosurgical centers in the New Federal States. To match the actual density of left heart catheterisation laboratories in the West, an additional 43 catheter laboratories would be required in the New Federal States on top of the 42 existing. Twelve installations were accredited at the beginning of 1997, but are not yet active.

2,799 patients from the New Federal States (excluding East Berlin) equivalent to the capacity of three cardiosurgical centers underwent operations in the Old Federal States in 1996. Only two further surgical centers are planned, in **Coswig** and **Jena**. When completed, a total of 12 cardiosurgical centers will be available in the New Federal States. To attain about 1,100 heart operations per million population, some centers would have to perform much more operations than before, or two to three more regional cardiosurgical centers will be needed.





7.0 New Billing System from 1996

Until 1995 hospitals billed open heart procedures by charging a special rate per operation plus a general per diem. Both rates were negotiated separately for each cardiosurgical center between the contracting parties (Hospital and Health Funds) and licensed by the State authority.

From 1996, the reimbursement system was changed to differential rates. Nation-wide Global Payment (**Fallpauschalen**) and Special Rates (**Sonderentgelte**) came into force on 1 January 1996 for many surgical interventions including heart operations. All-inclusive global payment covers all hospital services with respect to one specific in-patient case. Special rates (Sonderentgelte) cover cost for specified services, namely operations. The actual level of compensation (in Deutschmarks) is negotiated at state level for all hospitals; the relative amount of compensations (in points) is laid down in the Federal Regulation on Hospital Charges (Bundespflegesatzverordnung). Services not covered by Global Payment and Special Rates are to be negotiated within individual hospital budgets and split into basic hospital charges (**Basispflegesatz**) and special service charges (**Abteilungspflegesatz**) (per diems) in defined hospital departments (e.g. oncology, nephrology, cardiology).

Case definitions for cardiac and thoracic surgery and obstetrics have been developed with medical specialist societies and professional associations. Calculations and recommendations were presented in 1992 at the Federal Ministry of Health to Specialist Medical Societies and professional organisations.

Points are given to determine the relative distance between compensations. The actual value per point (in Deutschmarks) is to be negotiated at state level by Health Funds' organisations. Uniform calculation of global payment can lead to differences in patient selection between centers which may be unacceptable on medical and economic grounds.

Experience with the new system of compensation includes:

- medically unfounded referral practices between hospitals which increase length of stay and cost and may impair early medical rehabilitation;
- billing practices contrary to law, e.g. acute in-patient hospital treatment in institutions of rehabilitation.

Intelligent solutions are required to overcome sectoral thinking in the present system. Seamless transition of patients from cardiosurgical centers to rehabilitation facilities is a major goal.

The Fifth Amendment to the Federal Regulation on Hospital Charges (Bundespflegesatzverordnung) aims at separate global payments for acute and postacute in-patient treatment in cardiosurgery. The draft amendment (dated 20 June 1997) states:

„The practice of in-patient referral and discharge from hospital of cardiosurgical patients renders previous calculations (procedures; time spent in hospital) inappropriate. Patients are referred to other in-patient hospitals or discharged between the 7th and 10th postoperative day, while the Global Payment calculation counted 17 to 26 postoperative days.

Calculations based on hospital practice in selected centers in 1992/93 are outdated in 1996. Two types of management emerged: centers sending a majority of patients back to referring hospitals within two weeks after surgery and centers undertaking complete care until discharge to home or to rehabilitation.

The amended definition of cardiosurgical global payment (Fallpauschalen) tailors payment A from admission to the cardiosurgical center until wound healing (i.e., removal of sutures) which usually coincides with discharge from the cardiosurgical ward or referral to another setting.

Phase A includes preoperative services, the operation, intensive care, postoperative care on the ward up to wound healing, any repeat operations such as removal of hematomas, repeat thoracotomies, fixation of the sternum etc. The maximum length of stay, as covered by global payment, will be defined and shall state the maximum of days covered in intensive care.



A second Global payment applies for aftercare from wound healing to discharge from an accredited hospital (§ 108 SGB V). Phase B includes services from wound healing to discharge or referral for rehabilitation. Phase B ends where existing Global Payment ends today.

Global payment for transplant services (Fallpauschalen 9.14 and 9.15 = heart and lung transplant) are not affected since patients generally receive complete care in the transplant center.

Redefined global payment will limit reimbursement to phase A payment for cardiosurgical centers that discharge or relocate patients early after operation. Phase B payment can be claimed if the cardiosurgical center actually undertakes services beyond the time of wound healing.

A hospital treating a patient after wound healing can only claim phase B payment. If a patient proceeds directly into an center for rehabilitation (§ 111 SGB V), phase B payment cannot be claimed.

For aftercare in phase B a minimum length of stay shall be instituted; this should cover 50 to 60 percent of the calculated average.”



8.0 Quality assurance

8.1 Adult cardiosurgical procedures

A Federal League to implement quality assurance in heart surgery came into being 1991. The German Hospital Federation, top Health Insurers organisations, the Federal Chamber of Doctors and the Society for Thoracic and Cardiovascular Surgery are represented. The League cooperates to implement quality assurance at the federal level for all cardiosurgical institutions in Germany as set out in Federal Law relating to Health Insurance (§ 137 SGB V). The Federal League aims at nation-wide coverage of all cardiosurgical centers to assess, secure and improve, where necessary, quality of care in cardiosurgery. All German cardiosurgical centers did participate in 1996.

The scheme is based on standardised collection of structural and procedural data from all open-heart coronary and valvular procedures including operations for aneurysms in patients aged 16 years or older. After collection, verification and central analysis, processed data are sent to cardiosurgical centers for critical appraisal. The individual centers receive their specific results set against the national results for procedures. Processed data are made available to the Expert Commission for review. The Expert Commission reports findings and conclusions annually or upon request to the Federal Board of Trustees on Cardiac Surgery (Bundeskuratorium Herzchirurgie) which acts as supervisor for the four partners.

The Office for data collection and processing is in Düsseldorf (Ärztekammer Nordrhein). A major activity is data collection and data processing. Direct contact is maintained with all cardiosurgical centers.

In 1991, the League reckoned with 43 cardiosurgical centers and about 35,000 open heart procedures; about 50,000 open heart procedures were anticipated until the end of the decade. A total of 76 cardiosurgical centers took part in 1996. One additional center specialises in pediatric heart surgery.

A total of 72,426 interventions from these 76 centers have been documented in 1996 (1995 = 60.596).

Up to 205 questions per procedure have to be answered by trained medical documentary assistants or by doctors. Additional questions relate to patient status on postoperative day 30.

Congenital valvular defects subjected to corrective or palliative surgery as well as arterial procedures such as carotid operations may be included into the national program for quality assurance in the future (see 8.2). The Society for Thoracic and Cardiovascular Surgery also wishes to include heart transplantation, pacemaker and cardioverter implantations.

Operations registered in 1996 range from isolated procedures such as coronary or valvular surgery (over 86 per cent) to combined operations such as coronary and valvular procedures (about 14 per cent). A total of 225 different constellations can be assessed.

Upon completion of this report, no evaluation is available for the 1996 interventions. The report will be presented at the 9th meeting of the Advisory Committee in October 1997. The range of interventions and the apparent diversity of affiliation in cardiosurgical centers does preclude a simple ranking of centers. Differences in case mix as to risk and severity between centers is a factor. Risk adjustment and standardisation are still required.

The League partners were determined to continue and expand quality assurance in cardiosurgery when they met in June 1997. The renewed contract is ready for signature.



8.2 Pediatric Heart Surgery

A model program for a study in quality assurance in pediatric surgery received funding by the Federal Minister of Health from 1 September 1993 to 31 July 1996. The project examined tools for data collection and measures to assess and assure quality in pediatric heart surgery which could be implemented in clinical routine as directed by Federal Law (Amendments to §§ 135-137 SGB V). Since 1 August 1996, the pilot project is receiving continued support by a League (Förderungsgemeinschaft) including the Federal Ministry of Health, the Working Party for the Advancement of Quality Assurance in Medicine, Köln, the German Heart Foundation, Frankfurt am Main, and the Federal Association of Pediatric Heart Patients, Aachen.

The brochure "Quality Assessment in Pediatric Cardiology, German Society of Pediatric Cardiology, supported by the Federal Minister of Health, 1996" summarises:

„A distinction between main defect and leading haemodynamic defect was introduced to allow comparative representation and evaluation of procedures. At term, the project will document and assess congenital defects in a quality relevant way, once difficulties in data collection and data assessment are overcome. After project completion, the specialist society's diagnostic and therapeutic standards can be put up for discussion. Quality deficiencies will be classified. Risk adjustment within each program will allow precise classification of center performance. Shortcomings will be addressed stepwise by anonymous SCORE notification, disclosure of deficiencies, and visits. The project aims at quality improvement; eventually, centers should perform in the upper third of standard deviation of the overall average. Implementation of quality assurance procedures in the centers necessitated intensive on-the-spot training which was time-consuming. Centers must be compensated for their effort.“

The project office is at the Ärztekammer Nordrhein in Düsseldorf that also acts as contractor for the quality assurance project in adult cardiac surgery. The two specialist societies concerned in management of pediatric patients with congenital heart defects, the German Society of Pediatric Cardiology and the German Society for Thoracic and Cardiovascular Surgery, are set to connect and unify their projects in quality assurance. Some proposals have been discussed and agreed upon in principle during the 8th meeting of the Federal Committee on Quality Assurance in Cardiac Surgery. Early planning and consultation are underway so that Quality assessment programs in pediatric cardiology and pediatric heart surgery may be integrated from 1998. A public meeting on "Quality Assurance in Pediatric Cardiology - present and future" will be held jointly by the League partners, the specialist societies, the Health Insurers, the German Hospital Association, the Federal Chamber of Doctors and the Federal Ministry of Health (Köln, Bundesärztekammer, 1 October 1997).



9.0 Medical Rehabilitation

The system of in-patient rehabilitation of patients with cardiovascular conditions has proved viable over the last two decades. However, diagnostic and therapeutic progress and questions of cost make for a critical appraisal. Facilities must adjust to changing needs. The following points merit attention:

- (1) Closer connection between in-patient hospital treatment (§ 39 SGB V) and medical rehabilitation (§ 40 SGB V) will make more economical and more effective use of existing facilities.
- (2) Better coordination between in-patient and rehabilitation facilities will greatly shorten the time spent in acute care and in rehabilitation.
- (3) Rehabilitation should include somatic and psychosocial aspects and health education (secondary prevention) as of equal importance along drugs, interventions and surgical procedures.
- (4) These structural improvements contribute to Quality Assurance.

In early 1996, Germany had 122 contract institutions for medical rehabilitation offering continuing treatment for diseases of the heart and circulation.

The highest number of rehabilitation hospitals (AHB Kliniken) was in Federal States Hessen, Baden-Württemberg, Nordrhein-Westfalen, and Bayern. The City States of Hamburg and Bremen had no such institutions (Table 22, Figure 29).

In terms of residents per facility, the highest density is found in Federal States Hessen, Schleswig-Holstein and Thüringen; Berlin has one such institution only, and Sachsen-Anhalt has 2.

Table 22: Rehabilitation centers for continuing treatment of diseases of heart and circulation

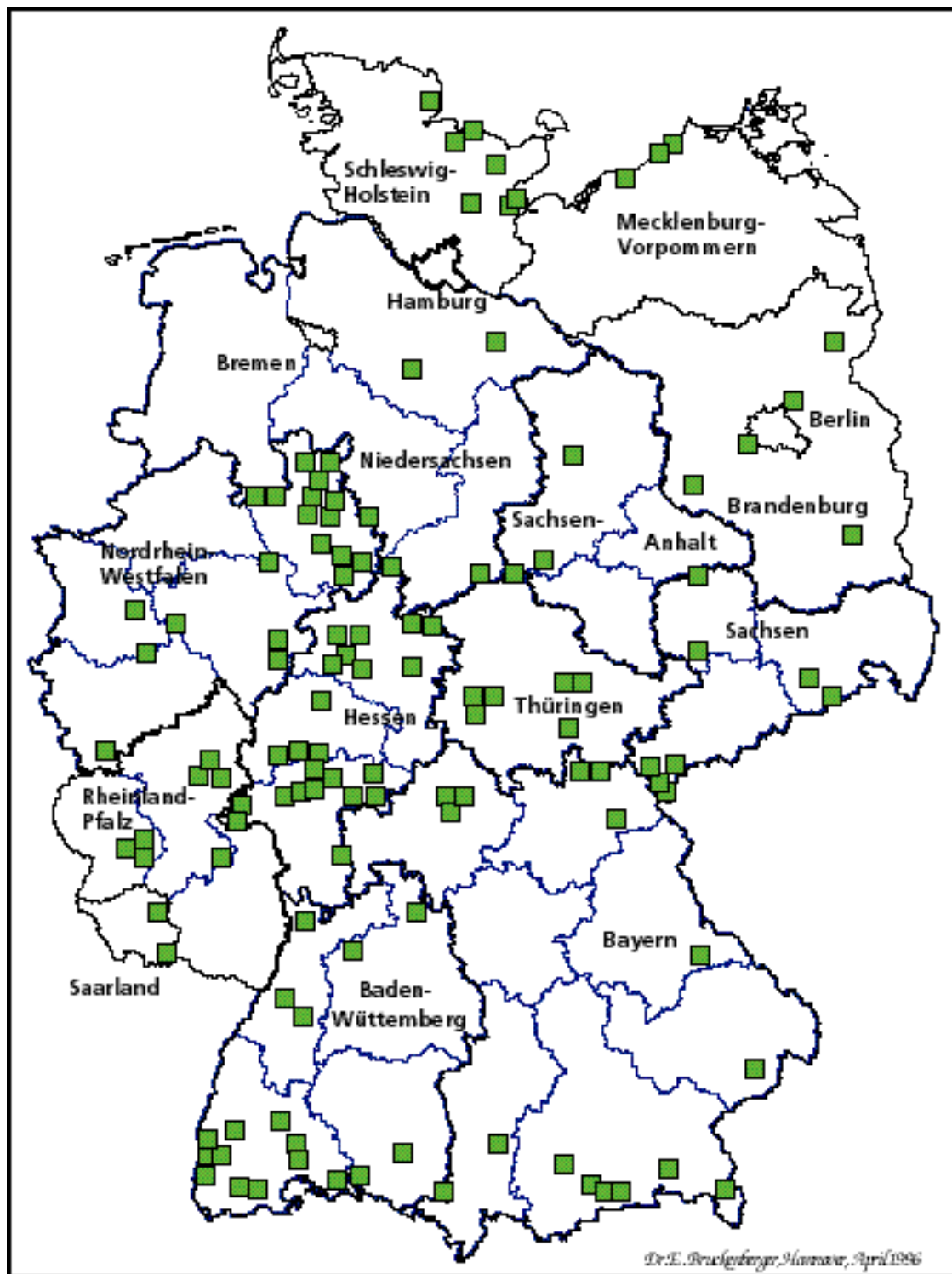
	number of centers	residents per center
Baden-Württemberg	19	544,422
Bayern	15	800,978
Berlin	1	3,467,322
Brandenburg	4	636,378
Bremen	0	0
Hamburg	0	0
Hessen	24	250,677
Mecklenburg-Vorpommern	3	606,862
Niedersachsen	6	1,299,192
Nordrhein-Westfalen	17	1,053,440
Rheinland-Pfalz	7	569,040
Saarland	2	541,560
Sachsen	8	569,651
Sachsen-Anhalt	2	1,365,732
Schleswig-Holstein	7	390,085
Thüringen	7	356,669
Germany	122	671,161

E. Bruckenberg

Far-reaching changes are expected in the rehabilitation industry due to amended legislation relating to employment (Beschäftigungsförderungsgesetz) and to Social Security contributions (Beitragsentlastungsgesetz).



Figure 29: Location of rehabilitation centers for Diseases of heart and circulation - 1966



Source: AHB Register of Social Security (Old Age Insurance)



A total of 1,398,955 in-patient courses of medical rehabilitation were given in 1994. Social Security - Old Age Insurance paid for 902,032 of these (64.5 per cent); Health Insurance paid for 388,796 (27.8 per cent) and Accident Insurance for 80,639 (5.8 per cent). The remaining 27,528 (1.9 per cent) were for War Victims and Welfare recipients.

In-patient medical rehabilitation in 1994 focussed on musculoskeletal disorders in 40.3 per cent followed by diseases of the heart and circulation in 14.7 per cent and psychiatric disorders in 10.5 per cent. Hospital admissions in 1994 were led by diseases of the heart and circulation with 15.8 per cent, neoplastic diseases in 11.3 per cent and intoxications in 10.8 per cent (Table 23). More recent data were not available.

Table 23: in-patient medical rehabilitation and in-patient hospital admissions in Germany

ICD group	Diagnosis	rehabilitations 1994		hospital admissions 1994	
		absolut	%	absolut	%
001-139	Infectious and parasitic disease	5,584	0.4	278,570	1.9
140-239	neoplasia	114,918	8.2	1,635,505	11.3
240-289	metabolic and blood disorders	49,755	3.6	511,688	3.5
290-319	psychiatric illness	146,341	10.5	726,962	5.0
320-389	nervous disorders	30,683	2.2	868,343	6.0
390-459	diseases of circulation	206,089	14.7	2,288,764	15.8
460-519	respiratory diseases	84,296	6.0	981,089	6.8
520-579	digestive disorders	25,085	1.8	1,453,380	10.1
580-629	genitourinary disorders	10,339	0.7	1,082,795	7.5
630-676	complications of pregnancy	0	0.0	1,069,938	7.4
680-709	skin diseases	19,502	1.4	227,534	1.6
710-739	musculoskeletal disorders	564,038	40.3	991,636	6.9
740-759	congenital disorders	6,377	0.5	114,135	0.8
760-779	perinatal disorders	0	0.0	132,186	0.9
780-799	symptoms and unclassified affections	18,539	1.3	353,467	2.4
800-999	without diagnosis	117,449	8.4	1,563,076	10.8
	Ohne Diagnoseangaben	0	0.0	176,318	1.2
	Summe	1,398,995	100.0	14,455,386	100.0

Source: Statistisches Bundesamt Wiesbaden





10.0 Cardiology and Cardiac Surgery in Europe

This comparison is based on the Report by Professor Felix Unger, Salzburg (F. Unger, "Cardiac Interventions in Europe 1995, Open Heart Surgery, PCTA, Cardiac Catheterisation", Report of the European Heart Institute, Academia Scientiarum et Artium Europaea).

With 4,647 left heart catheterisations per million population, Germany by far led the list in Europe in 1995, followed by Belgium (4,266 pmp), Iceland (3,838 pmp), Switzerland (3,321 pmp), and Austria with 738 pmp (see Table 25). The European average was 1,873 left heart catheterisations pmp.

Germany also took the lead in PCTA with 1,352 interventions per million population in 1995, followed by Iceland (1,308), Belgium (1,143), Switzerland (963), the Netherlands (871) and Austria (738). The European average was 486 PTCA pmp.

Table 24 gives the ten European states with the highest number of open heart operations per million population. Germany had the lowest percentage of left heart catheterisations leading to an operation (21 per cent) - see Table 24.

Tab. 24: Left Heart Catheterisations leading to an operation

Country	operations per cent	open heart procedures		left heart catheterisations	
		total	ppm	total	ppm
Finland	61	4,982	985	8,178	1,616
Sweden	52	8,733	1,005	16,847	1,939
Norway	39	3,846	894	9,757	2,269
France	37	38,000	661	102,000	1,775
Netherlands	32	14,148	926	44,000	2,880
Belgium	27	11,574	1,152	42,660	4,266
Switzerland	27	6,258	898	23,150	3,321
Austria	26	6,149	770	23,969	3,000
Iceland	24	243	935	998	3,838
Germany	21	78,184	961	378,000	4,647

A total of 498 cardiosurgical centers were active in 35 European States in 1995. The 498 cardiosurgical centers performed 291,306 heart operations in 1994. The European average was 569 heart operations per million population. Marked differences exist:

Heart operations per million population	
more than 800	Belgium, Sweden, Finland, Germany, Iceland, Netherlands, Switzerland, Norway
800 - 569	Austria, France, Denmark, Ireland, Great Britain
569 - 200	Greece, Italy, Spain, Czech Republic, Portugal, Hungary, Slovenia, Poland, Lithuania
200 - 100	Bulgaria, Slovakia, Yugoslavia, Estonia, Cyprus, Croatia
less than 100	Latvia, Romania, Albania



Tabelle 25: Heart operations and investigations in Europe

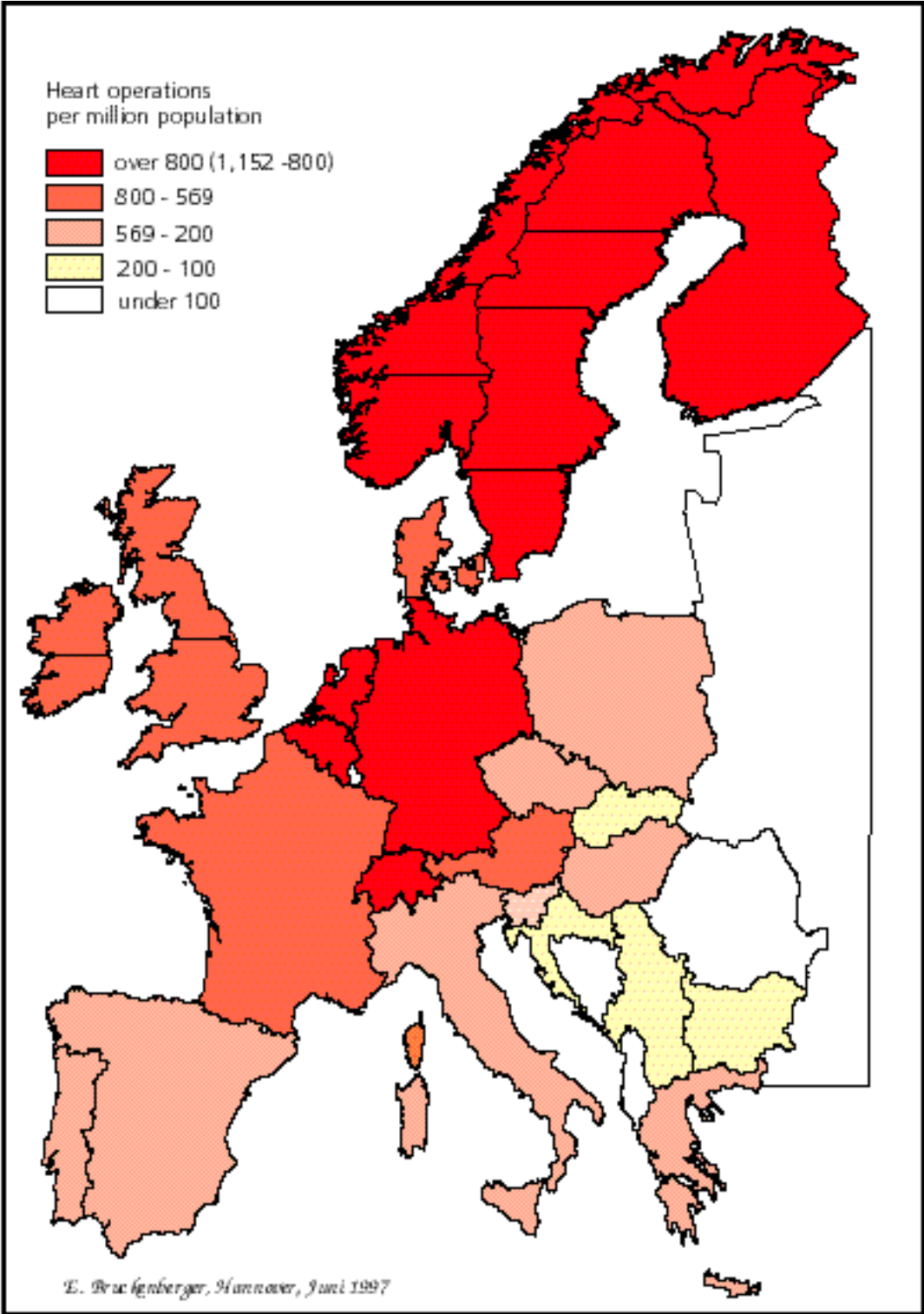
Country	int. code	population in millions	open heart procedures		left heart catheterisations		PTCA's	
			total	ppm	total	ppm	total	ppm
Belgium	B	10.05	11,574	1,152	42,660	4,266	11,486	1,143
Sweden	S	8.69	8,733	1,005	16,847	1,939	4,832	556
Finland	SF	5.06	4,982	985	8,178	1,616	1,804	357
Germany	D	81.34	78,184	961	378,000	4,647	110,000	1,352
Iceland	IS	0.26	243	935	998	3,838	340	1,308
Netherlands	NL	15.28	14,148	926	44,000	2,880	13,311	871
Switzerland	CH	6.97	6,258	898	23,150	3,321	6,713	963
Norway	N	4.30	3,846	894	9,757	2,269	3,145	731
Austria	A	7.99	6,149	770	23,969	3,000	5,898	738
France	F	57.47	38,000	661	102,000	1,775	34,000	592
Denmark	DK	5.17	3,235	626	6,691	1,294	1,560	302
Ireland	IRL	3.53	2,147	608	7,976	2,259	1,063	301
United Kingdom	GB	57.92	35,000	604	80,000	1,381	17,344	299
Greece	GR	10.37	5,300	511	10,000	964	2,000	193
Italy	I	57.12	28,500	499	86,000	1,506	12,600	221
Spain	E	39.48	15,551	394	57,773	1,463	12,359	313
Czech Republic	CZ	10.30	4,008	389	9,500	922	3,000	291
Portugal	P	9.84	3,678	374	8,689	883	1,513	154
Hungary	H	10.21	3,519	345	7,062	692	1,032	101
Slovenia	SLO	1.94	525	271	1,087	560	267	138
Poland	PL	38.30	9,478	247	14,500	379	2,875	75
Lithuania	LT	3.71	844	227	4,900	1,321	150	40
Bulgaria	BG	8.89	1,700	191	0	0	0	0
Slovak Republic	SK	5.31	937	176	1,449	273	208	39
Fed.Rep.of Yugoslavia	YU	10.57	1,859	176	4,593	435	410	39
Estonia	EE	1.55	264	170	692	446	62	40
Cyprus	CY	0.73	119	163	1,601	2,193	99	136
Croatia	HR	4.51	570	126	2,547	565	206	46
Latvia	LV	2.61	220	84	1,143	438	77	30
Romania	RO	22.76	900	40	3,726	164	299	13
Albania	AL	3.39	93	27	140	41	9	
Bosnia a. Herzegovina	BIH	4.38	0	0				
Liechtenstein	FL	0.03	0	0	0	0	0	0
Luxembourg	L	0.40	0	0	0	0	0	0
Macedonia	MAC	2.08	0	0				
Malta	M	0.36	0	0	0	0	0	0
Monaco	MC	0.03	742	0			260	
SanMarino	RSM	0.02	0	0				
European mean		512.92	291,306	569	959,628	1,873	248,922	486

Source: F. Unger, "CARDIAC INTERVENTIONS IN EUROPE 1995, OPEN HEART SURGERY, PTCA, CARDIAC CATHETERISATION", Report of the European Heart Institute, Academia Scientiarum et Artim Europaea

States of the European Community display a North-South gradient in number of open heart procedures (Figure 30).



Figure 30: Open heart procedures in Europe - 1995







11.0 Appendix

11.1 References

Cardiosurger y

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1	Baden-Württemberg	Bad Krozingen, Herz-Zentrum	Dr. Eschenbach u. Dr. Tollennaere
2	Baden-Württemberg	Freiburg, Uniklinik	Prof. Dr. Fr. Beyersdorf
3	Baden-Württemberg	Heidelberg, Uniklinik	Prof. Dr. S. Hagl
4	Baden-Württemberg	Karlsruhe, Karlsruhe GmbH	Dr. H. Posival
5	Baden-Württemberg	Lahr, Deutsches Herzzentrum Baden	PD Dr. J. Ennker
6	Baden-Württemberg	Stuttgart, Robert-Bosch-Krankenhaus	Prof. Dr. K. Hellberg
7	Baden-Württemberg	Stuttgart, SANA Herzchirurgische Klinik	Prof. Dr. J. Rein
8	Baden-Württemberg	Tübingen, Uni-Klinik	PD Dr. Ziemer
9	Baden-Württemberg	Ulm, Uniklinik	Prof. Dr. A. Hannekum
10	Bayern	Augsburg, Zentralklinikum	Prof. Dr. E. Struck
11	Bayern	Bad Neustadt/Saale, Klinik	Prof. Dr. R. Hacker, Dr. Fasol
12	Bayern	Bayreuth, Klinikum Bayreuth	Dr. G. Friedel
13	Bayern	Erlangen, Uni-Klinik	Prof. Dr. J. v. d. Emde
14	Bayern	München, Deutsches Herzzentrum	Prof. Dr. H. Meisner
15	Bayern	München, Krankenhaus Bogenhausen	Prof. Dr. B. M. Kemkes
16	Bayern	München, Uni-Klinik Großhadern	Prof. Dr. B. Reichart
17	Bayern	Nürnberg, Klinikum Nürnberg Süd	Prof. Dr. J. v. d. Emde
18	Bayern	Passau, Klinikum Passau	PD Dr. P. Eigel
19	Bayern	Regensburg, Uni-Klinik	Prof. Dr. D. Birnbaum
20	Bayern	Würzburg, Uni-Klinik	Prof. Dr. O. Elert
21	Berlin/West	Berlin, Havelklinik	Dr. Jaabari
22	Berlin/West	Berlin, Deutsches Herzzentrum	Prof. Dr. R. Hetzer
23	Bremen	Bremen, Zentral-KH Links der Weser	Prof. Dr. K. Leitz
24	Hamburg	Hamburg, AK St. Georg	Prof. Dr. J. Ostermeyer
25	Hamburg	Hamburg, CardioClinic *	Prof. Dr. H. J. Krebber
26	Hamburg	Hamburg, Albertinen-Krankenhaus	Prof. Dr. N. Bleese
27	Hamburg	Hamburg, Uniklinik Eppendorf	Prof. Dr. P. Kalmar
28	Hessen	Bad Nauheim, Kerckhoff-Klinik	Prof. Dr. W. P. Klöveckorn
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33	Hessen	Gießen, Uni-Klinik	Prof. Dr. F. W. Hehrlein
34	Hessen	Kassel, Städt. Klinikum	Dr. H. Sons
35	Hessen	Marburg, Uni-Klinik	Prof. Dr. R. Moosdorf
36	Hessen	Rotenburg a. d. F., Herz-u. Kreislauf-Zentr.	PD Dr. H. Oster
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44	Nordrhein-Westfalen	Bad Oeynhausen, Herzzentrum NRW	Prof. Dr. R. Körfer
45	Nordrhein-Westfalen	Bochum, BG-KA Bergmannsheil	Prof. Dr. Laczkovics
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55	Nordrhein-Westfalen	Münster/Westfalen, Uni-Klinik	Prof. Dr. H. H. Scheld
56	Nordrhein-Westfalen	St. Augustin, Johanniter-Kinder-Klinik	Dr. A. E. Urban
57	Nordrhein-Westfalen	Wuppertal, Städtische Kliniken	Prof. Dr. C. Minale
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59	Rheinland-Pfalz	Koblenz, Bundeswehrzentralrankenhaus	Prof. Dr. Ch. Weinhold
60	Rheinland-Pfalz	Ludwigshafen, Städt. Kliniken	Prof. Dr. W. Saggau
61	Rheinland-Pfalz	Mainz, Uni-Klinik	Prof. Dr. H. Oelert
62	Rheinland-Pfalz	Trier, Krankenhaus d. Barmherzigen Brüder	Dr. V. Müller
63	Saarland	Völklingen, Kreiskrankenhaus	Dr. H. Isringhaus
64	Saarland	Homburg, Uni-Kliniken d. Saarlandes	PD Dr. H.-J. Schäfers
65	Schleswig-Holstein	Bad Segeberg, Seeberger Kliniken	Dr. R. Semmler
66	Schleswig-Holstein	Kiel, Uni-Klinik	Prof. Dr. D. Regensburger
67	Schleswig-Holstein	Lübeck, Uni-Klinik	Prof. Dr. Sievers

* Cardiosurgical center without contract to social security and not included in hospital planning



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4	Mecklenburg-Vorpommern	Rostock, Uni-Klinik	Prof. Dr. K. Emmrich
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7	Sachsen	Dresden, Herz-Kreislaufzentrum e.V.	Prof. Dr. St. Schüller
8	Sachsen-Anhalt	Halle, Uni-Klinik	Prof. Dr. Zerkowski
9	Sachsen-Anhalt	Magdeburg, Uni-Klinik	Prof. Dr. Chr. Huth
10	Thüringen	Bad Berka, Zentralklinikum	Dr. C. Torka

Source: Länderumfrage des Krankenhausausschusses der AGLMB

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