

## Development of Neurosurgery in Germany: Comparison of Data Collected by Polls for 1997, 2003, and 2008 Among Providers of Neurosurgical Care

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■ **OBJECTIVE:** To deduce structural trends in neurosurgery in Germany by comparison of data derived from polls conducted by the *Deutsche Gesellschaft für Neurochirurgie* (DGNC) in 1997, 2003 and 2008.

■ **METHODS:** The questionnaires of the different polls probed a comparable set of issues. The data from the responding sample were extrapolated to the nationwide average or sum and compared between the different time periods.

■ **RESULTS:** The number of identified neurosurgical departments increased from 146 to 201 during the years 1997–2008 largely as a result of the new foundation of numerous private groups. Nationwide total neurosurgical bed capacity and intensive care unit bed capacity increased modestly over the time period. The extrapolated total number of neurosurgical operations increased from 196,341 to 319,295. Although cranial and spinal neurosurgery remain the dominant subspecialties, the number of functional neurosurgical procedures and operations for pain increased more than proportionally. Outpatient procedures were established during the time period and corresponded in 2008 to a substantial proportion of the surgical volume. The total number of residents and board-certified neurosurgeons increased during the period 1997–2008 from 1513 to 1961. The proportion of residents decreased during 1997–2003 and then increased again.

■ **CONCLUSIONS:** The number of neurosurgical operations increased in Germany proportionally to the economic growth of other service branches over the time period. Private organizations developed more than neurosurgical departments at university and other general

hospitals. Work density measured as operations per physician increased during the period 1997–2008.

### METHODS

The *Deutsche Gesellschaft für Neurochirurgie* (DGNC) has been analyzing the structural framework of neurosurgery in Germany on a regular basis over the last 2 decades by polls addressing registered neurosurgical departments. The polls were conducted approximately every 5–6 years. The purpose of the poll for 2008 was primarily to achieve comparability with the previous polls for 1997 and 2003. The numbers of identified and addressed neurosurgical departments in 1997, 2003, and 2008 are given in **Table 1**.

The response rate was 31.8% for the 2008 poll. The poll of 1997 identified private groups incompletely, which began to form a significant force around that time. The mode of identifying and addressing the private groups differed in 2003 from the mode used in 2008. Lacking a comparable number of defined neurosurgical departments for 2003, calculation of reliable response rates was impossible. A response rate of 79.6% was calculated for 1997. The volume and the complexity of the questionnaires from 1997–2008 increased moderately as necessary to reflect changes in clinical practice.

For the actual analysis, the data of the 2008, 2003 and 1997 polls with regard to the number of available beds, the number of surgical procedures, and manpower were compared and stratified with regard to the type of neurosurgical units. Parameters of the earlier polls necessary for comparison that were not explicitly given in the earlier reports were calculated post hoc if the base data were included in the reports.

#### Key words

- Germany
- Manpower
- Neurosurgery
- Surgical volume

#### Abbreviations and Acronyms

**AIP:** *Arzt im Praktikum*  
**DGNC:** *Deutsche Gesellschaft für Neurochirurgie*  
**SBA:** *Statistisches Bundesamt*



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**Table 1.** Number of Identified and Addressed Neurosurgical Departments in 1997, 2003, and 2008

	University Departments			Nonuniversity General Departments			Private Groups		
	2008	2003	1997	2008	2003	1997	2008	2003	1997
	No. departments	34	37	35	99	97	92	68	60

Normalization of the data was achieved by extrapolation of the reported figures to all neurosurgical departments in Germany. As a statistical indicator for differences in numerical variables, the 95% confidence intervals of the 2008 poll were calculated because the original data sets of the earlier polls were unavailable for the current analysis. The number of neurosurgical departments at university hospitals and nonuniversity public hospitals in Germany is known. However, some uncertainty exists about the number of private groups because the database of the DGNC may be incomplete on these. Nevertheless, it can be assumed that trends about private groups represent the reality correctly, although absolute numbers may be incorrect.

## RESULTS

### Neurosurgical Bed Capacity

The data with regard to bed capacity, summarized in **Table 2**, show a small but steady decline of available bed capacity for the neurosurgical departments at university hospitals of 7.2% during the period 1997–2008. For public nonuniversity hospitals, the number of beds available to neurosurgery increased by 12.1% during 1997–2008. The average number of available beds per unit increased by 4.2%. The data suggest that the increase mainly occurred during 1997–2003. With regard to private groups, uncertainty with regard to the data quality precludes a meaningful statement.

Intensive care capacity increased modestly at university and public hospitals (**Table 3**). The increase is, however, within the 95% confidence range. The roughly 40% increase of the nationwide neurosurgical bed capacity during 1997–2008 in the nationwide extrapolation must be interpreted with caution.

### Neurosurgical Operating Room Capacity

Neurosurgical operating room capacities are presented in **Tables 4–6**. For 2003, only the total number of operations and the number of outpatient procedures were available for analysis. For 1997, there was no information with regard to outpatient surgery available. At that time outpatient neurosurgical operations were still quite rare and not a substantial consideration. The numbers of the 1997 report were taken as inpatient operations and total number.

It can be seen in **Table 6** that the number of operations increased in all hospital groups during the period 1997–2008. The steepest increase of the average number of operations per hospital or practice occurred with the private units. For 2008, more operations per unit were performed by private groups than by nonuniversity general hospitals. However, different nature and complexity of operations can be assumed.

**Table 6** also shows that, extrapolated to the entire group, the steepest increase in operations occurred among the private groups: >100% during 2003–2008 and >3600% during 1997–2003. The percentages are due to the increase in operations per unit as well as the increase in number of units. The university departments have

**Table 2.** Total number of Beds Available for Neurosurgeons (Normal Wards plus Intensive Care Units)

	University Departments			Nonuniversity General Departments			Private Groups		
	2008	2003	1997	2008	2003	1997	2008	2003	1997
	Maximum	123		98	86		86	32	
Minimum	30		30	13		15	5		
Average per unit	63.5	63.1	66.4	47.1	47.8	45.2	9.7	20.2*	
95% Confidence interval	8.1			4.8			7.60		
Nationwide extrapolation	2157	2207	2323	4661	4640	4159	661	537*	
								1028†	

\*Minimum calculation taking missing values as zero and assuming a pure outpatient department.

†Maximum calculation ignoring departments with a missing value.

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