ORIGINAL ARTICLE

Spontaneous Pneumothorax

Epidemiology and Treatment in Germany Between 2011 and 2015

Jost Schnell, Aris Koryllos, Alberto Lopez-Pastorini, Rolf Lefering, Erich Stoelben

SUMMARY

Background: Few reliable data are available on the epidemiology and treatment of spontaneous pneumothorax. We studied the sex and age distribution, frequency of hospitalization, mortality, and conservative versus surgical care of this condition in Germany in order to draw well-founded conclusions about its in-hospital diagnosis and treatment.

Methods: Data from all patients aged 10 or older who were hospitalized in the period 2011–2015 with a main discharge diagnosis of pneumothorax of neither traumatic nor iatrogenic origin were retrieved from the German Federal Statistical Office. Because of their source, all data were based on case numbers rather than patient numbers.

Results: During the period of the study, there were 52 738 admissions with the main diagnosis of spontaneous pneumothorax, corresponding to an annual frequency of hospitalization of 14.3 per 100 000 persons per year (95% confidence interval, 14.0 to 14.5). Men were more frequently affected than women. The lethality and in-hospital mortality of this condition ($\leq 0.08\%$ and $\leq 0.3\%$, respectively) were low among persons aged 15 to 45, but markedly higher in persons over age 90 (9.4% and 15.9%, respectively). The frequency of accompanying pulmonary diagnoses also rose with age. Computerized tomography (CT) was performed in 38.9–54.6% of hospitalizations, depending on age. Monitoring on an intensive care unit was carried out in 36% of cases. More than one-quarter of cases involved surgical treatment.

Conclusion: The danger to life and the likelihood of an accompanying pulmonary diagnosis are both low up to age 45. Treatment on an intensive care unit and computerized tomography of the chest should be performed only for strict indications in patients under age 45. The pathophysiological basis of the differing patterns of illness depending on age and sex requires further investigation.

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Data on spontaneous pneumothorax are scarce. Only 2 studies with larger study populations are available: one from England ($n = 22\,749$) (1), the other from France ($n = 59\,637$) (2).

While in primary spontaneous pneumothorax, by definition, no underlying pulmonary disease can be identified, the causative condition is known in secondary spontaneous pneumothorax. In 90% of patients with primary spontaneous pneumothorax, however, emphysematous lesions, such as bullae or vesicles, are found (3, 4). Secondary spontaneous pneumothorax more commonly affects the elderly and is most frequently observed in patients with chronic obstructive pulmonary disease (COPD), but also with interstitial lung disease, pneumonia, malignancies, and other disorders (5). Eighty-five percent of spontaneous pneumothorax cases are primary and 15% secondary (2).

The aim of this study is to provide insights into the epidemiology and management of spontaneous pneumothorax in Germany, in particular with regard to the frequency of hospitalization, lethality, computed tomography (CT) investigations and treatment provided, from which recommendations for diagnosis and management can be derived. Since a clinical practice guideline of the German societies of thoracic surgery, pneumology, internal medicine and the German Society of Radiology (DRG, *Deutsche Röntgengesellschaft*) shall be completed and published this year, it will be possible to assess its impact on the diagnosis and management of pneumothorax by undertaking a further analysis of the data of the German Federal Statistical Office in a few years' time.

Methods

From the German Federal Statistical Office, we retrieved all cases with pneumothorax (ICD J93) as the primary diagnosis at discharge from continuous inpatient hospital care for the period from 2011 to 2015, regardless of the number of specialist departments involved, and broken down by 5-year age cohorts and sex. In case of pneumothorax recurrence, multiple references were possible. All patients age 10 years and older were included in the study; the cases of patients older than 90 years were assigned to an old-age cohort. Patients with traumatic (ICD S27.0) and iatrogenic pneumothorax (ICD J95.80) were not included in this study. To identify secondary spontaneous pneumothorax, we also included the relevant codable pulmonary

Department of Pneumology, Cologne Merheim Hospital, Kliniken der Stadt Köln, Cologne, Germany: Dr. med. Schnell, Dr. med. Koryllos, Dr. med. Lopez-Pastorini, Prof. Dr. rer. medic. Lefering, Prof. Dr. med. Stoelben

TABLE 1

Surgical treatment 2011–2015 with the primary diagnosis of pneumothorax (J93)*

Operation	n 2011–2015	Total PD J93 n = 52 738 share (%)	Age 10–40 y n = 24 914 share (%)	Age 40–70 y n = 17 317 share (%)	> age 70 y n = 10 507 share (%)	p
Atypical resection	13 610	25.8	33.5	23.9	10.7	<0.001
– Stapler use in atypical resection	4017	7.6	9.4	7.5	3.7	<0.001
Pleurectomy	11 403	21.6	27.8	20.0	9.5	<0.001
Pleurodesis	5714	10.8	9.9	12.2	10.7	<0.001
– Poudrage	2054	3.9	2.3	5.2	5.5	<0.001
– Instillation	1240	2.4	1.9	3.2	1.9	<0.001
Reoperation	2024	3.8	1.8	5.6	5.8	<0.001

* Differentiation into 3 age groups: 10–40 years, 40 to 70 years, older than 70 years; calculation of p values using the chi-square test for all age group comparisons; PD, primary diagnosis; y, years

secondary diagnoses: COPD (J44), interstitial pulmonary disease (J84), pneumonia (J18), and lung cancer (C34).

In addition, we included deaths related to the primary diagnoses as well as data, coded using the Operation and Procedure Code (OPS), on radiological CT investigations, inpatient monitoring, tube thoracostomy, thoracentesis, and surgical treatment with atypical pulmonary resection, pleurectomy and pleurodesis.

Furthermore, cause-of-death data for pneumothorax (ICD J93) were retrieved from the cause-of-death statistics (6) of the German Federal Statistical Office for the period from 2011 to 2015.

For the diagnosis „spontaneous pneumothorax“, frequency of hospitalization, disease-specific mortality, in-hospital mortality, and lethality were calculated (see *eBox* for details).

The chi-square test was used to compare the frequencies of the surgical procedures listed in *Table 1* between the various age groups.

Results

Number of inpatient cases, sex distribution, frequency of hospitalized cases

From 2011 to 2015, altogether 52 738 patients aged 10 years and older with spontaneous pneumothorax as the primary diagnosis received inpatient treatment.

The female-to-male sex ratio was 1 to 3.2. In relation to the total population (7), the calculated annual frequency of hospitalized cases with spontaneous pneumothorax was 14.3/100 000 (95% confidence interval (CI) [14.0; 14.5]; for male patients 22.2/100 000 [21.8; 22.7]; for female patients 6.7/100 000 [6.4; 6.9]).

Unlike in women, spontaneous pneumothorax followed a bimodal age distribution in men with one marked peak in the 20–25 years age group and a second minor peak around 70 to 75 years of age (*Figure 1*). Unfortunately, it was not possible to calculate the recur-

rence rate in Germany from the data we were able to access; in the French study (2), the recurrence rate was 26.5%.

Mortality, lethality and death rates

Based on the cause-of-death statistics, disease-specific mortality for spontaneous pneumothorax is 0.094/100 000 population annually in Germany, with a lethality of 0.7%. Overall, lethality increased 117.5-fold in the age group ≥ 90 years (9.4%) from age 10–45 years (0–0.08%) (*eTable 1*).

When evaluating the patients who died in hospital (in-hospital mortality), it should be borne in mind that patients with pneumothorax as the primary diagnosis not necessarily died of this condition. Similar to the distribution in lethality, the number of deaths with pneumothorax as the primary diagnosis showed an increase beyond age 45 (*Figure 2* and *eTable 1*). In the age group 15–20 years, 0.06–0.32% of patients with pneumothorax died in hospital, while it were 11–15.9% in the age cohorts 80 years and older.

Secondary spontaneous pneumothorax

Among the pulmonary secondary diagnoses relevant to secondary spontaneous pneumothorax (*eTable 2*), COPD (J44) tops the list with 8563 cases (16.2%), followed by pneumonia (J18) with 2262 cases (4.3%), lung cancer (C34) with 1625 cases (3.1%), and interstitial pulmonary disease (J84) with 1229 cases (2.3%). In the age distribution of the aggregated pulmonary secondary diagnoses, a peak around age 70–80 is observed; in spontaneous-pneumothorax patients younger than age 45, the mentioned secondary diagnoses occur only rarely (*Figure 3*).

Computed tomography diagnosis

In 52 738 cases of spontaneous pneumothorax, altogether 24 842 chest CT scans (47.1%) with and without contrast

were performed (eTable 3). The age distribution (Table 2) showed that CT scans were indicated in 38.9% of younger patients up to age 40, in 54.3% in the middle and in 54.6% in the higher age groups.

Tube thoracostomy und thoracentesis

During the period studied, altogether 40 039 tube thoracostomies were performed in patients with pneumothorax as the primary diagnosis (eTable 3). Either a small-bore chest tube (OPS 8–144.1 or OPS 8–144.2; n = 5658 [14.1%]) or a large-bore chest tube/open surgical technique (OPS 8–144.0 or OPS 5–340.0; n = 34 381 [85.9%]) was used. Of the 52 738 cases with spontaneous pneumothorax included, up to three quarters underwent tube thoracostomy (multiple coding per inpatient stay possible). No less than 24% of hospitalized pneumothorax cases did not require tube thoracostomy. Thoracentesis, which can only be entered once per inpatient hospital stay, was coded in 1168 cases (2.2% of all cases).

Monitoring of patients

Intensive care monitoring was undertaken in 18 980 cases (36% of all cases). In the 10-to-40 years age group, 7520 intensive care unit stays were identified (30% of cases in this age group) (eTable 3).

Surgical treatment

During the period from 2011 to 2015, altogether 30 727 surgical procedures, including atypical pulmonary resection, pleurectomy and pleurodesis, were coded in various combinations together with the primary diagnosis of spontaneous pneumothorax. This total does not reflect the number of operated patients. The share of chest surgeries in hospitalized cases is at least 25.8% (13 610 cases), based on the most frequent coding of an individual surgical procedure.

Thoracoscopic atypical pulmonary resection and pleurectomy were performed in 87% and 88% of cases, respectively, while open surgical procedures were performed in 13% and 12%, respectively. Pleurodesis was performed as an open surgical procedure in about 7% of cases.

Table 1 and eTable 4 provide a breakdown of the surgical procedures performed:

- Atypical pulmonary resection was performed in 13 610 cases, accounting for 25.8% of all hospitalized cases with spontaneous pneumothorax. In the age group 10–40 years (33.5%), surgical procedures were more frequently performed compared with the age group 70 years and older (10.7%; $p < 0.001$). In 29.5%, surgical staplers were used intraoperatively.

- Pleurectomy was performed in 11 403 cases (21.6% of all cases with spontaneous pneumothorax), in the younger age group significantly more frequently compared with the older age group (27.8% vs. 9.5%, respectively).

- With 5714 cases (10.8%), comparatively few patients were treated with pleurodesis. In about one third of all pleurodesis cases, a subgroup treated with talc

FIGURE 1

Number of cases with the primary diagnosis of pneumothorax

Age- and sex-differentiated number of inpatient cases with pneumothorax (J93) as the primary diagnosis during the period from 2011 to 2015. (Age cohorts from 10–15 to 90 years and older)

poudrage pleurodesis (spraying talc powder into the pleural space to induce aseptic pleuritis) was reported; this technique was less commonly used in the younger age group (2.3% of all cases with pneumothorax) than in the middle (5.2%) and older age groups (5.5%).

- Altogether 2024 cases (3.8%) were coded as reoperations

Discussion

The aim of this study was to provide insights into the epidemiology and management of pneumothorax in Germany based on an analysis of current data from the Federal Statistical Office.

The strengths and limitations of this study

The key strength of this study lies in the availability of a great quantity of pneumothorax-related data. The German Federal Statistical Office records all hospitalized cases of pneumothorax. Consequently, only cases of pneumothorax diagnosed and treated exclusively in an outpatient setting were not included in this study. According to the authors' experience, these are only sporadic cases with acute spontaneous pneumothorax because once diagnosed in an outpatient setting the majority of patients is referred to the nearest acute care hospital given the uncertainty about the risk the patient is exposed to.

This study is limited by restrictions imposed by data protection rules: It cannot be distinguished between new cases and recurrences; information about diagnostic parameters and procedures cannot be attributed to specific patients. Consequently, detailed statements regarding the following parameters cannot be made:

FIGURE 2

Percentage share of pneumothorax deaths in the total number of inpatient cases with pneumothorax as the primary diagnosis 2011–2015 (in-hospital mortality), age-differentiated (age cohorts from 10–15 to 90 years and older)

- Rehospitalization
- Patient transfer from a general hospital to a specialist hospital
- Pneumothorax recurrence
- Differentiation between primary and secondary spontaneous pneumothorax
- Combination of surgical procedures.

Not least, data quality is as good as the coding quality in the various hospitals. This also applies to the documentation quality in the cause-of-death statistics.

Epidemiology

The sex-specific results on the frequency of hospitalized cases with pneumothorax as the primary diagnosis, including the sex ratio (1 : 3.2; female to male) are in line with the results of Bobbio et al. (2) (1 : 3.3 female to male) and Gupta et al. (1) (1 : 2.7 female to male). In men, a bimodal age distribution was found, consistent with the findings of the study of Gupta et al. (1). The pathophysiology underlying this difference in sex-specific distribution, especially among young patients, is still not understood. That differences in smoking habits between men and women (8), which are discussed as a potential cause, play a role is not supported by current statistics of the Robert Koch Institute (9).

The diagram of secondary pneumothorax with pulmonary secondary diagnoses (Figure 3) indicates that starting from age 45 years, the incidence of pneumothorax is more and more determined by underlying pulmonary conditions. These findings support the threshold of age 50 years, pragmatically set in the guideline of the British Thoracic Society (BTS) (10),

beyond that every spontaneous pneumothorax in patients with a significant smoking history is classed as secondary.

Lethality and in-hospital mortality are clearly age-dependent. In the age group 15–40 years, 0.06 to 0.32% of the patients hospitalized with pneumothorax as the primary diagnosis die in hospital, compared to 8–18% in the age group 70–95 years. A similar difference is found for lethality: 0.02–0.07% and 1.5–9% of cases, respectively. In-hospital mortality has to be greater than lethality because deaths due to other diseases in patients with the primary diagnosis spontaneous pneumothorax J93 are added to the deaths caused by pneumothorax. Our results suggest that in the younger age group spontaneous pneumothorax does not constitute the same vital threat it clearly represents in the higher age group. This should be considered in and communicated to young patients in particular to alleviate any unnecessary fears.

Computed tomography investigations

Chest CT scans are performed in the younger age group in 38.9%, in the middle in 54.3% and in the older age group in 54.6% of cases with spontaneous pneumothorax (Table 2). The authors think that chest CT scans are performed too frequently in the younger age group (age 10–40 years). The current BTS guideline (10) recommends the use of CT scans in unclear cases, such as cases with minor pneumothorax hardly visible in chest radiographs or in complex cases with additional soft-tissue edema, pulmonary disease or unsuccessful tube thoracostomy. In a current review, CT scans are recommended for special queries only and not for the standard diagnostic workup (11). In our study, the coded pulmonary secondary diagnoses which may represent indications for a CT scan account for at most 5.8% among patients younger than age 40 (Figure 3, eTable 2). Rates of 4.9 to 16.7% of complex cases are reported in the literature (12–14). A preoperative CT scan did not improve the outcome of thoracoscopic surgery in patients with primary spontaneous pneumothorax (15, 16). The extent of the expansion of the pneumothorax revealed by chest radiography already allows to assess the frequency of recurrence and the incidence of prolonged air fistula, as prospectively demonstrated by Sayar et al. (17). Furthermore, the high radiation dose (18) and the minor threat to the patient's life should be taken into account. Altogether, these various aspects appear to justify a strict indication for CT in the younger age group which could reduce the current frequency of CT scans by half.

In the older age group, however, CT scans can help to better identify any underlying pulmonary disease which is important as in this patient population secondary spontaneous pneumothorax is more common. Pulmonary secondary diagnoses were found in the age group 40–70 years in 9–63% and in the age group older than 70 years in 40–66% of patients (Figure 3, eTable 2).

Inpatient care/surgical treatment

Noteworthy is the fact that younger patients are frequently admitted to intensive care units—about 30% of patients in the age group 10–40 years. This practice is not in line with the likelihood of life-threatening complications in patients of this age group as discussed above. While physicians may see a high need for monitoring after tube thoracostomy or in patients requiring oxygen therapy, the authors are of the opinion that in these young patients ICU monitoring is only justified in cases with respiratory compromise (tension pneumothorax, reexpansion edema). If the reason for admitting these patients to an intensive care unit is the better equipment and higher level of staff qualification available there, this can be resolved by the use of mobile pumps and the provision of additional training.

In our study, the exact share of operated patients with pneumothorax as the primary diagnosis cannot be determined. Bobbio et al. (2) report an overall share of 24% in their study; in our study, the shares of atypical pulmonary resection, pleurectomy and pleurodesis were 25.8%, 21.6% and 10.8%, respectively. Since in most cases these three surgical procedures are performed in combination, it can be expected that the total number is only slightly higher than that of atypical resection and consequently only slightly higher than that reported by Bobbio et al.

Despite clear advantages and the availability of established minimally invasive techniques (19, 20) along with a slightly increased risk of recurrence (21), approximately 12% of operations are still performed using open surgical techniques. This could be due to surgeons having a personal preference for open procedures in certain situations, such as recurrence or adhesions, or to intraoperative conversion from minimally invasive techniques to thoracotomy.

Analyzing the age distribution, it is striking that older patients received surgical treatment significantly less often than younger patients, mainly due to their increased surgical risk. Apart from extrapulmonary comorbidities, there are types of secondary pneumothorax where, according to Ichinose et al. (5) und Nakajima et al. (22), caution should be exercised when deciding to operate. Isaka et al. (23) identified old age as a risk factor by itself. However, this cautious approach to surgical treatment may contribute to the higher mortality in older patients:

- On the one hand, complications are prevented by the shorter period of immobility after surgical fistula closure compared with non-surgical management, especially in patients with indwelling chest tube over a prolonged period of time;
- on the other hand, recurrence rates are lower after surgical treatment (10).

This explains the more frequent use of poudrage pleurodesis as a lower-risk surgical procedure in older patients compared to younger patients, demonstrated in our study

FIGURE 3

Number of cases with the primary diagnosis of pneumothorax

Number of primary diagnoses of pneumothorax (J93) and number of aggregated pulmonary secondary diagnoses of COPD (J44), interstitial pulmonary disease (J84), pneumonia (J18), lung cancer (C34), 2011–2015, age-differentiated (age cohorts from age 10–15 to 90 years and older)
SD, secondary diagnosis

TABLE 2

Age distribution of chest CT scans with primary diagnosis of pneumothorax (J93) from 2011 to 2015

Age (years)	Number of J93 2011–2015	Number of chest CTs 2011–2015	Percentage of chest CTs (%)
10–40	24 914	9700	38.9
40–70	17 317	9401	54.3
>70	10 507	5741	54.6

CT, computed tomography

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Conflict of interest

The authors declare no conflict of interest.

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KEY MESSAGES

- Age- and sex-specific analyses showed that hospitalizations with spontaneous pneumothorax as the primary diagnosis were most common among young male adults.
 - In 10–40-year-old patients with a primary diagnosis of pneumothorax, intensive care is initiated in 30% of cases, even though their condition is rarely life-threatening.
 - Likewise, the rate of CT scans for pneumothorax is high (38.9%) among 10–40-year-old patients, despite the fact that the rate of pulmonary secondary diseases is low in this age group. Thus, the associated radiation exposure should be taken into account when making the decision whether or not a CT scan is indicated.
 - The primary treatment of pneumothorax is tube thoracostomy; thoracentesis alone plays virtually no role in Germany.
 - In about one quarter of hospitalized cases, pneumothorax is treated surgically.
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Corresponding author

Dr. med. Jost Schnell
Lungenklinik Köln-Merheim
Lehrstuhl für Thoraxchirurgie der Universität Witten-Herdecke
Kliniken der Stadt Köln
Ostmerheimer Str. 200,
51109 Köln, Germany
schnellj@kliniken-koeln.de

Supplementary material

eReferences:
www.aerzteblatt-international.de/ref4417

eTables:
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Supplementary material to:

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eBOX

Methods used to calculate the statistical parameters

The frequency of hospitalized cases with spontaneous pneumothorax was calculated by dividing the number of inpatient cases with the primary diagnosis of pneumothorax (each in total and differentiated between male and female) by the sum of the respective annual average population according to the German Federal Statistical Office for the period from 2011 to 2015. It is reported per 100 000 population. Due to the possibility of multiple hospitalization events per year and the fact that it was not possible to differentiate between primary event and recurrence, the use of the term „incidence“, describing the number of new cases occurring within a specified period of time, was avoided.

Disease-specific mortality rate was calculated by dividing the number of deaths due to pneumothorax during the period from 2011 to 2015 by the sum of the respective annual average population according to the German Federal Statistical Office for the period from 2011 to 2015. It is an annual rate averaged over a period of 5 years and reported per 100 000 population.

Lethality was calculated by dividing the number of deaths due to pneumothorax from the cause-of-death statistics for the period from 2011 to 2015 by the number of inpatient cases with pneumothorax as the primary diagnosis for the period from 2011 to 2015. Thus, lethality here refers to a 5-year period. It is reported as a percentage value.

In-hospital mortality was calculated by dividing the number of deaths with pneumothorax as the primary diagnosis during the period from 2011 to 2015 by the number of inpatient cases with pneumothorax as the primary diagnosis during the period from 2011 to 2015. However, the cause of death was not necessarily pneumothorax. It refers to this 5-year period and is reported as a percentage value.

eTABLE 1

Age-differentiated number of inpatient cases with primary diagnosis of pneumothorax (J93) 2011–2015*

Age in years	Number of J93 total	Number of J93 female	Number of J93 male	Number of J93 as cause of death	Lethality (%) J93	Number of deaths J93	In-hospital mortality (%) J93
10–14	327	88	239	0	0	2	0.61
15–19	4923	547	4376	1	0.02	5	0.10
20–24	6403	1003	5400	1	0.02	4	0.06
25–29	6063	1131	4932	1	0.02	5	0.08
30–34	4362	1047	3315	1	0.02	4	0.09
35–39	2836	906	1930	2	0.07	9	0.32
40–44	2622	873	1749	2	0.08	8	0.31
45–49	2944	1014	1930	3	0.10	25	0.85
50–54	2920	886	2034	6	0.21	60	2.05
55–59	2937	828	2109	11	0.37	86	2.93
60–64	3081	887	2194	15	0.49	151	4.90
65–69	2813	766	2047	23	0.82	157	5.58
70–74	3457	781	2676	50	1.45	271	7.84
75–79	3042	737	2305	54	1.78	286	9.40
80–84	2170	501	1669	65	3.00	239	11.01
85–89	1317	448	869	62	4.71	181	13.74
90 and older	521	211	310	49	9.40	83	15.93
Total	52 738	12 654	40 084	346	0.70	1576	3.00

* including number of deaths with primary diagnosis of pneumothorax 2011–2015; frequency of pneumothorax (J93) as cause of death from the cause-of-death statistics 2011–2015; calculated lethality (%); in-hospital mortality (%) for 2011–2015

eTABLE 2

Age-differentiated number of pulmonary secondary diagnoses*

Age in years	Number of SD J44 COPD	Number of SD J18 pneumonia	Number of SD J84 interstitial pulmonary disease	Number of SD C34 lung cancer	Number of pulmonary SD total	Share (%) of pulmonary SD in PD J93
10–14	0	9	4	0	13	4.0
15–19	24	44	47	0	115	2.3
20–24	23	62	62	1	148	2.3
25–29	31	87	72	2	192	3.2
30–34	41	75	73	1	190	4.4
35–39	52	62	43	8	165	5.8
40–44	110	68	48	17	243	9.3
45–49	307	98	73	68	546	18.5
50–54	531	134	76	119	860	29.5
55–59	893	188	85	188	1354	46.1
60–64	1204	189	123	274	1790	58.1
65–69	1240	199	90	228	1757	62.5
70–74	1549	273	153	306	2281	66.0
75–79	1189	280	136	240	1845	60.7
80–84	829	252	86	124	1291	59.5
85–89	424	171	48	38	681	51.7
90 and older	116	71	10	11	208	39.9
Total	8563	2262	1229	1625	13 679	26.0

*COPD (J44), pneumonia (J18), interstitial pulmonary disease (J84), lung cancer (C34) with primary diagnosis of pneumothorax (HD J93) and share (%) of pulmonary secondary diagnoses in inpatient cases with primary diagnosis of pneumothorax, 2011–2015

COPD, chronic obstructive pulmonary disease; PD, primary diagnosis; SD, secondary diagnosis

eTABLE 3

Age-differentiated number of chest investigations and treatments* in inpatients with primary diagnosis of pneumothorax 2011–2015

Age in years	Number of chest CTs (with contrast)	Share (%) of CTs with contrast in total CTs	Number of intensive care treatments	Share (%) monitoring with J93	Number of tube thoracostomies	Number of thoracenteses
10–14	88 (18)	20.5	153	36.0	190	7
15–19	1623 (371)	22.9	1525	46.8	3198	66
20–24	2445 (676)	27.6	1899	31.0	4682	74
25–29	2416 (661)	27.4	1754	30.0	4534	72
30–34	1839 (596)	32.4	1357	28.9	3315	57
35–39	1289 (439)	34.1	832	31.1	2201	34
40–44	1281 (488)	38.1	850	29.3	2060	48
45–49	1515 (660)	43.6	1075	32.4	2280	48
50–54	1566 (763)	48.7	1105	36.5	2301	53
55–59	1664 (842)	50.6	1244	37.8	2259	69
60–64	1782 (882)	49.5	1344	42.4	2520	97
65–69	1593 (773)	48.5	1266	43.6	2241	77
70–74	1977 (960)	48.6	1583	45.0	2807	121
75–79	1704 (801)	47.0	1301	45.8	2378	120
80–84	1170 (529)	45.2	963	42.8	1712	101
85–89	675 (273)	40.4	537	44.4	1036	93
90 and older	215 (95)	44.2	192	40.8	325	31
Total	24 842 (9827)	39.6	18 980	36.0	40 039	1 168

*Number of chest CT scans (with contrast); share (%) chest CTs with contrast in total chest CTs; number of intensive care treatments absolute and proportionally (%), number of tube thoracostomies and thoracenteses; CT, computed tomography

eTABLE 4

Number of surgical procedures in inpatients with the primary diagnosis of pneumothorax 2011–2015, age-differentiated

Age in years	Number of atypical resections	Number of stapler use cases	Number of pleurectomies	Number of pleurodeses	Number of poudrage pleurodeses	Number of pleurodeses by instillation	Number of reoperations
10–14	82	14	54	19	1	76	2
15–19	1631	410	1365	469	82	85	0
20–24	2167	615	1830	564	134	102	0
25–29	2067	592	1680	599	142	84	7
30–34	1488	440	1241	471	106	70	183
35–39	904	261	754	353	108	62	252
40–44	817	225	705	329	118	76	231
45–49	832	265	693	366	143	73	204
50–54	761	232	630	345	134	93	128
55–59	664	209	532	346	147	101	141
60–64	597	210	496	372	181	101	151
65–69	475	151	420	362	183	112	112
70–74	507	180	437	427	227	91	126
75–79	335	127	304	336	167	67	130
80–84	199	56	174	217	115	37	116
85–89	71	24	75	111	52	9	121
90 and older	13	6	13	28	14	1	120
Total	13 610	4017	11 403	5714	2054	1240	2024