Availability of Interventional Oncology in Germany in the Years 2018 and 2019 – Results from a Nationwide Database (DeGIR Registry Data)

Flächendeckende Versorgung mit radiologisch durchgeführten Verfahren zur interventionell-onkologischen Tumortherapie in Deutschland in den Jahren 2018 und 2019 dargestellt anhand der DeGIR-Registerdaten

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ABSTRACT

Objective Over the past few decades, radiology has established itself in tumor therapy through interventional oncology including innovative and efficient procedures for minimalinvasive treatment of various tumor entities besides the “classic” therapeutic options such as surgery, chemotherapy and radiotherapy.

Aim of this study was to evaluate the extent to which interventional oncology can provide nationwide care using the data from the register of the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR registry), which records radiological interventions as part of quality assurance.

Methods The numbers of interventions of participating clinics, which were recorded as part of module D (oncological procedures including TACE or other tumor-specific emboliza-

tion, ablation, percutaneous tumor therapy) and identified by the DeGIR registry between 2018 and 2019, were analyzed retrospectively. The collected intervention data were evaluated regarding federal states and 40 smaller regions (administrative districts and former administrative districts).

Results In 2018, 11 653 oncological interventions in 187 clinics were recorded by the DeGIR registry. In 2019, the number of participating clinics rose to 216 and the number of oncological interventions increased by 6 % to 12 323. The average number of oncological interventions per clinic decreased slightly from 62.5 (2018) to 57.1 (2019). The DeGIR requirement for being certified as a training center was met by 116 clinics in 2018 including 31 clinics with more than 100 interventions and 129 clinics in 2019 including 36 with more than 100 interventions. Oncological interventions have been performed in each of the 40 regions. An average of 599 interventions per region (standard deviation of 414) was recorded in the period between 2018 and 2019.

Conclusion Based on the distribution of the documented oncological interventions at federal state level as well as the district level, the supply of interventional tumor therapy depends on the geographical location. Therefore, the demand of oncological interventions might not be sufficiently covered in some regions.

Key Points:

- Interventional-oncological tumor therapies are performed throughout Germany
- Looking at the notable geographical differences, the need for interventional oncological procedures does not seem to be sufficiently met.
- In order to improve the comprehensive provision of oncological interventions, the training of interventional radiologists should be promoted further.

Citation Format

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ZUSAMMENFASSUNG

Ziel In den letzten Jahrzehnten konnte sich die Radiologie durch innovative sowie effiziente onkologische Interventionen neben den „klassischen“ Therapiemöglichkeiten wie Chirurgie, Chemotherapie und Strahlentherapie in der Tumortherapie etablieren. Mithilfe der Daten aus dem Register der deutschen Gesellschaft für interventionelle Radiologie und minimal-invasive Therapie (DeGIR-Register), welches im Rahmen der Qualitätssicherung radiologische Interventionen erfasst, soll evaluiert werden, inwieweit eine deutschlandweite, flächendeckende Versorgung durch interventionell-onkologische Verfahren zur Behandlung von Malignomen erreicht wird.

Material und Methoden Retrospektiv wurden alle Untersuchungszahlen der teilnehmenden Kliniken, welche im Rahmen von Interventionen des Moduls D (onkologische Verfahren inkl. TACE oder andere tumorspezifische Embolisationen, Ablationen, perkutane Tumortherapien) mittels DeGIR-Register zwischen 2018 und 2019 erfasst wurden, ausgewertet. Die erhobenen Interventionszahlen wurden nach Bundesländern sowie Regierungsbezirken aufgeschlüsselt.

Ergebnisse Im Jahr 2018 wurden in 187 Kliniken 11 653 onkologische Interventionen im DeGIR-Register erfasst. 2019 stieg die Anzahl der teilnehmenden Kliniken auf 216 sowie die Anzahl der dokumentierten onkologischen Interventionen bei einem Zuwachs von 6 % auf 12 323. Bei der durchschnittlichen Anzahl der dokumentierten onkologischen Interventionen pro Klinik kam es zu einem leichten Rückgang von 62,3 (2018) auf 57,1 (2019). Als DeGIR-Ausbildungszentrum wurden 2018 116 Kliniken (31 mit mehr als 100 Interventionen) und 2019 129 Kliniken (36 mit mehr als 100 Interventionen) geführt. In allen aufgeschlüsselten Regionen wurden onkologische Interventionen dokumentiert. Insgesamt wurden durchschnittlich 599 Interventionen (Standardabweichung 414) im Zeitraum von 2018 bis 2019 pro Region erfasst.

Schlussfolgerung Die Verteilung der dokumentierten onkologischen Interventionen auf Bundeslandebene sowie innerhalb der aufgeschlüsselten Regionen zeigt eine geografisch unterschiedlich ausgeprägte Versorgung mit interventionellen Tumortherapien, sodass in einzelnen Regionen der Bedarf an interventionell-onkologischen Verfahren noch nicht ausreichend gedeckt sein könnte.

Introduction

Over the past 30–40 years, numerous innovative developments and improvements in interventional oncology have led to significant progress in tumor therapy. In the meantime numerous studies have shown the high effectiveness of interventional oncological procedures. This now concerns a wide range of techniques and their application in various tumor diseases and in different organs, such as the liver, kidney, lung or bone [1–3]. Thus, interventional oncological tumor therapy has been added to numerous current tumor therapy guidelines in addition to “classic” oncological therapy approaches such as surgery, chemotherapy and radiation therapy [4, 5]. Interventional tumor therapy uses local as well as locoregional methods based on image guidance utilizing embolization materials, chemotherapeutic agents, radionuclides or thermal energy applied via a transarterial or transcutaneous approach, among others. However, due to the very low systemic side effects after oncological interventions, in many cases these are not only used as competitive therapy methods, but can be combined with existing therapies [6]. For numerous indications, the utilization of interventional oncological procedures has evolved from a “salvage” option to the method of first choice. Especially for elderly, multimorbid patients for whom neither surgical nor systemic therapy is an option due to their general condi-

tion, interventional oncology opens up new opportunities for prolongation and improvement of quality of life, as in the past, only the "best supportive care" was available for these patients [7, 8].

However, in addition to the high effectiveness and acceptance of interventional oncological procedures, the availability of the procedure and the quality of its implementation also play a decisive role in practical patient care. In order to record these central elements in radiological interventions, the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR) transformed its decentralized data management, in existence since 1987, into a central registry for quality assurance in 2005, which has been supplemented by the entries of the German Society of Neuroradiology (DGNR) since 2012. Here, vascular and non-vascular interventions are divided into different modules: Module A (vasodilator and vascular reconstructive procedures); Module B (vaso-occlusive procedures); Module C (diagnostic punctures, drains, PTCD, TIPSS); Module D (oncological procedures including TACE or other tumor-specific embolizations, ablations, percutaneous tumor therapies); Module E (vascular neurointerventions), and Module F (neurovascular embolization treatments). Certification opportunities were created in the respective modules to document personal expertise. In addition, radiology departments can become certified as training centers.

The data collected from 2018 and 2019 of Module D (oncological procedures) will be used to show the extent to which interventional oncological tumor therapy is generally available in Germany and whether the average number of interventions performed per center indicates sufficient practical experience.

Materials and Methods

Data Collection

Browser-based software from samedi (samedi GmBH, Berlin, Germany) was used to gather data from the DeGIR registry for the years 2018–2019. All data on hospitals participating in the registry were blinded except for location. Based on the collected data, the number of interventional oncological tumor therapies grouped under Module D was used. In addition, the number of procedures performed per year was employed to verify which center could meet or already meets the DeGIR requirement to be a certified training center. The requirements for DeGIR certification of the center in Module D include the performance and documentation of at least 20 interventional oncological procedures per year and the presence of an interventional radiologist with DeGIR Level 2 certification in Module D [9]. Centers with particularly high numbers of procedures (at least 100 procedures per year) were characterized as "high volume".

Analysis of Coverage

The participating centers were initially classified according to federal state. A further subdivision was made into 40 smaller regions in order to obtain a more detailed overview of the distribution of the individual centers. For regional distribution, the federal states were again divided into existing government districts as well as former government districts. States that were never subdivided into government districts were still included as federal states. Consequently the following breakdown resulted: Arnsberg, Berlin, Brandenburg, Braunschweig, Bremen, Chemnitz, Darmstadt, Dessau, Detmold, Dresden, Düsseldorf, Freiburg, Gießen, Halle, Hamburg, Hanover, Karlsruhe, Kassel, Koblenz, Cologne, Leipzig, Lüneburg, Magdeburg, Mecklenburg-Vorpommern, Middle Franconia, Münster, Lower Bavaria, Upper Bavaria, Upper Franconia, Upper Palatinate, Rhine-Hesse-Palatinate, Saarland, Schleswig-Holstein, Swabia, Stuttgart, Thuringia, Trier, Tübingen, Lower Franconia, Weser-Ems.

The German Federal Statistical Office provided the data regarding the number of hospitals available at the federal and state levels in 2018 and 2019, as well as population data [10]. The oncological centers were recorded and their breakdown by federal state was based on the annual reports of the certified oncological centers of the German Cancer Society from 2018 and 2019 [11].

In order to obtain an impression of the discrepancies between interventional oncological tumor therapies actually performed in Germany and the interventions voluntarily recorded in the DEGIR registry, the number of ablations performed in 2019 as recorded in the DeGIR registry was compared with the number documented in the German hospital directory using the corresponding operation and procedure code (OPS) for ablations (liver, kidney, lung as well as bone) [12].

Statistics and Creation of Graphics

Descriptive statistics were developed using R Statistics (R version 3.5.3 – "Great Truth"). Calculation of the correlation coefficient was performed using PPMCC. The graphics were created using the following software: Creative Commons Attribution 3.0 License (www.geonames.org), Geojson Germany (https://github.com/isellsoap/deutschlandGeoJSON). Participating centers were grouped at the municipal level in the graphs, so one point may correspond to multiple centers in some cases.

Basic data:

© EuroGeographics (2013) European Boundary Map 2013 at 1:3000 000 scale

© GeoBasis-DE / BKG (2018) Germany administrative boundaries 2017 at 1:250 000 scale

© GeoBasis-DE/BKG (2018) WebAtlasDE Genesis Online; data license dl-de/by-2–0), Folium/Geopandas/Shapely/Python (map creation).

Results

In 2018, 187 hospitals reported oncological interventions in Module D of the DeGIR registry on a voluntary basis. The number of participating hospitals increased to 216 in 2019. With a total number of 1925 (2018) as well as 1914 (2019) hospitals in Germany, oncological interventions can thus be documented at 9.7 % (2018) as well as 11.2 % (2019) of hospitals. Compared to the oncology centers certified by the German Cancer Society (118 hospitals in 2018 and 120 hospitals in 2019), oncological interventions were documented in significantly more hospitals. A total of 11,653 oncological interventions were recorded in 2018 and

12,323 oncological interventions were documented in 2019, an increase of 6 %. At the same time, however, the average number of oncological interventions per hospital decreased by 8 %, from 62.3 in 2018 to 57.1 in 2019 (▶ **Fig. 1a, b**). Regarding the comparability between the interventions surveyed in the DGIR registry and the interventions actually performed in Germany, the number of surveyed ablations in the DeGIR registry for 2019 was 2250 and 2388 performed ablations in the German hospital registry, which corresponds to a difference of 5.8 %.

A sufficient number of oncological interventions to achieve certification as a DeGIR training center in Module D was achieved by 116 clinics in 2018 and 129 clinics in 2019. The number of high-volume centers rose from 31 hospitals in 2018 to 36 in 2019.

Care Situation

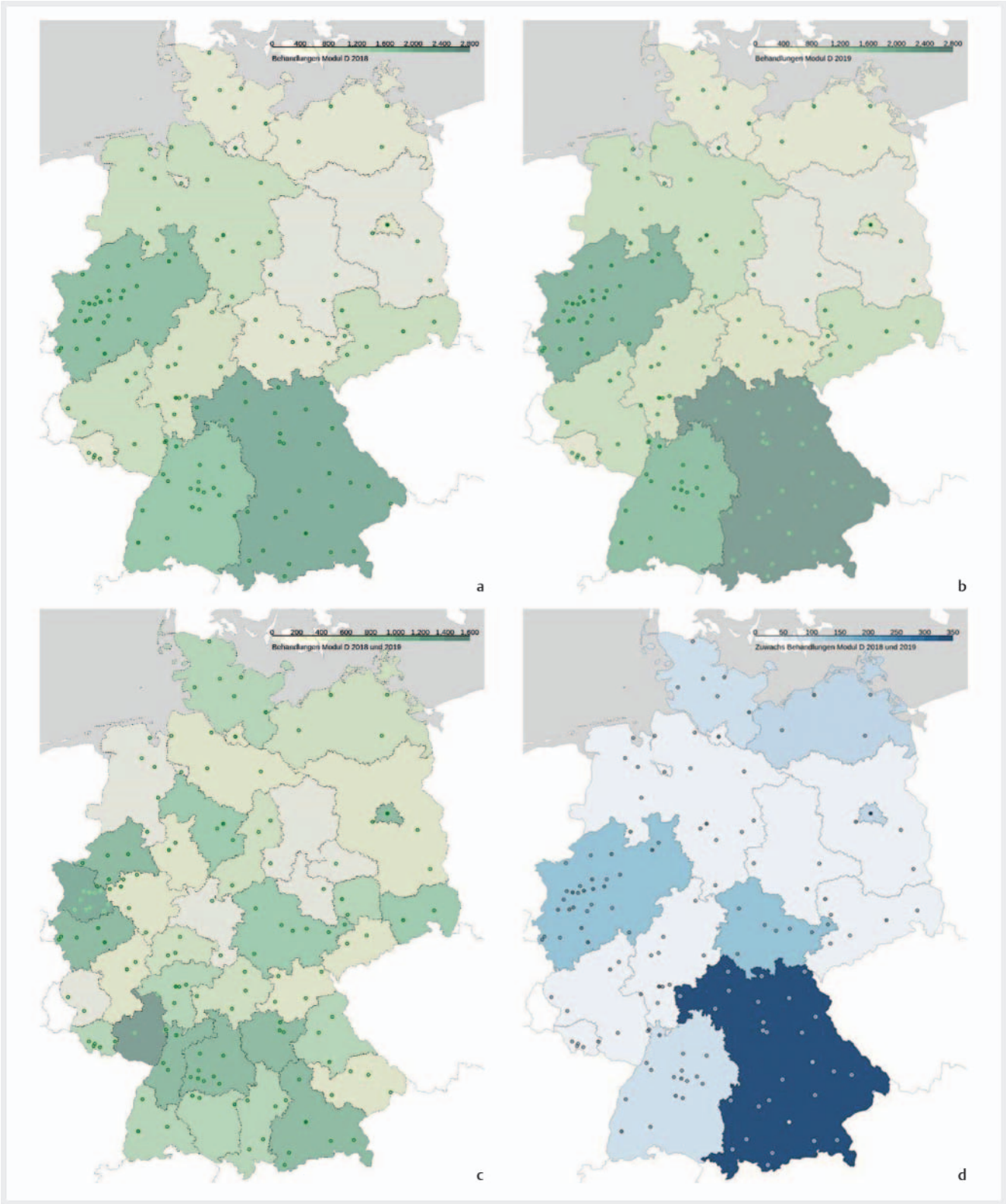
Interventional oncological tumor therapies from Module D were performed in all states as well as separately listed regions. However, there were some significant regional differences in the recording of the interventions performed. The mean value of documented oncological interventions from 2018 to 2019 per region was 599 interventions (standard deviation 414). The lowest number of oncologic interventions was documented in the Bremen region (n = 17), and the highest number was documented in the Rheinhessen-Pfalz region (n = 1499) (▶ **Fig. 1c, d**).

On average, 291 oncological interventions per million population were performed in Germany in 2018 and 2019 (SD 184), with a median of 269, a minimum of 25 in Bremen, and a maximum of 773 in Saarland (▶ **Fig. 2, 3**). A correlation between the number of oncological interventions and the number of oncological clinics (oncological centers) certified by the German Cancer Society per state could not be demonstrated (correlation coefficient r = –0.001). There was also no correlation of oncological interventions with the 17 Comprehensive Cancer Centers (organ cancer centers of university hospitals) recognized by the German Cancer Aid (DKH) (correlation coefficient r = 0.049).

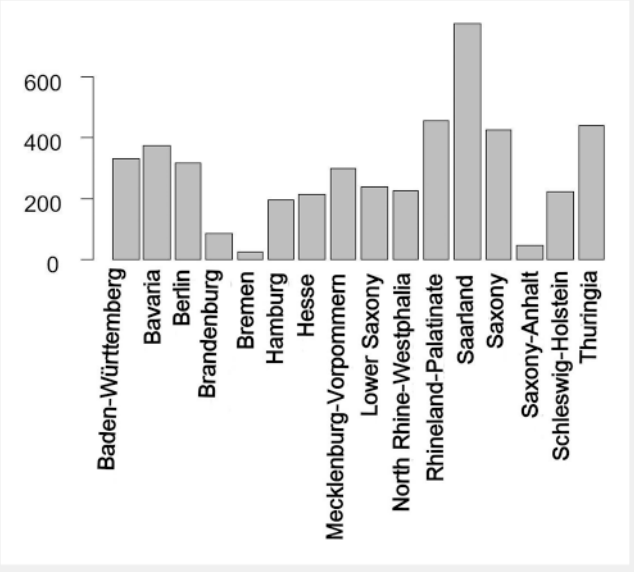
Discussion

The COVID pandemic has once again demonstrated the importance of comprehensive coverage. In addition to the necessary provision of sufficient vaccination capacity by private practice physicians, it is also essential to provide comprehensive coverage in the oncological field, since these diseases do not allow any postponement of therapy.

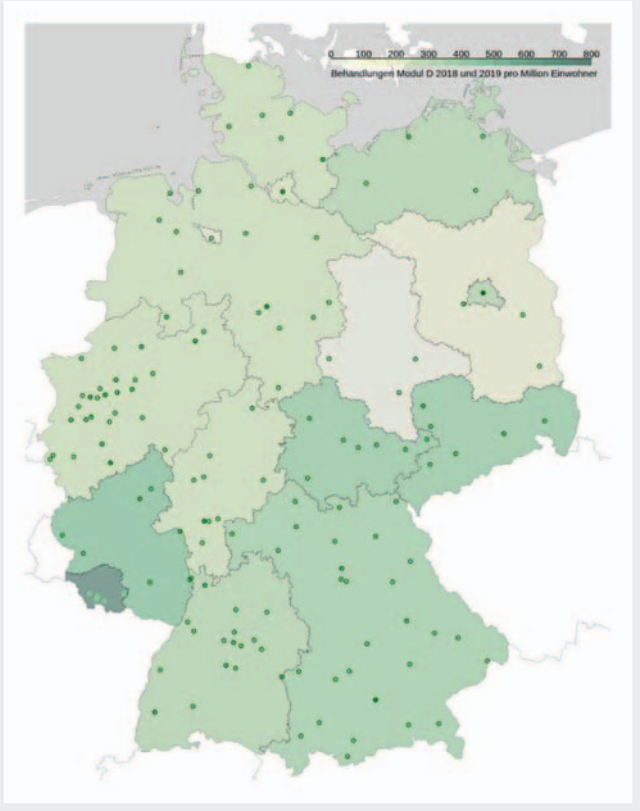
Minimally invasive interventional oncological procedures have increasingly become common alongside the standard therapeutic procedures of surgery, oncology and radiotherapy [13–15]. In patients in a general state of health suitable for therapy, they represent a complementary, although in some cases also competitive, therapeutic approach and, particularly in multimorbid patients, are often one of the last options before the decision is made to provide best supportive care [13, 16, 17]. In practical patient care, however, in addition to the evidence-based therapy recommendation, the availability of the intended procedure is often a decisive criterion for optimal therapy tailored to the patient. Here, especially with regard to the increasing number of guidelines recommending interventional oncological tumor therapy depending on the tumor entity and stage, it becomes apparent that there is a need for an assessment regarding the presence of universal coverage of oncological interventions [18]. This is all the more true as oncological therapies are increasingly performed on an outpatient basis, which optimally requires care close to home. In addition to the widespread availability of evidence-based therapeutic methods, the recording and monitoring of the quality of a therapeutic procedure is becoming increasingly important. For example, the German Cancer Society requires an established quality management system as part of its certification as an oncology center [19]. In interventional radiology, quality assurance in Germany is carried out by the DeGIR quality registry as well as by a modular training program with different certification levels. Here, a distinction is made between certification for individuals and centers. Two levels of certification are offered to individuals: DeGIR Level 1, which certifies a basic qualification in interventional radiology, and DeGIR Level 2, which demonstrates specialization in interventional radiology/neuroradiology and is divided into modules from the DeGIR registry. These modular certificates for DeGIR Level 2 could be earned by 2020 by meeting the minimum numbers for interventions (100 interventions performed in the desired module) and at least 30 CME points after passing a combined DeGIR written and oral specialty examination. Since 2021, DeGIR has cooperated with the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) and conducts a separate specialty examination according to UEMS standards together with CIRSE. As a result, all examinees automatically also acquire a European Intervention Certificate with international UEMS recognition [9]. Furthermore, clinics can be certified as a DeGIR center or DeGIR training center in the various modules, depending on the prerequisites. The results of the analysis of Module D oncological interventions from the 2018 and 2019 DeGIR Quality Assurance Registry suggest geographic variation in the provision of interventional oncological tumor therapies. These are carried out both at the state and regional level throughout Germany, although there are some significant differences among the individual regions. The low percentage of 9.7 % and 11.2 %, respectively, of hospitals performing oncological interventions compared to the total number of hospitals in Germany shows that the necessary expertise required for such procedures remains an obstacle to implementing them in hospitals without a designated oncology focus. Making the issue more difficult, in many smaller hospitals, radiology departments have been replaced by collaboration with radiology practices that do not offer interventional therapies. Another reason for the rather low percentage of hospitals with interventional oncological tumor therapies is the small patient population. With respect to the total number of tumor patients, only a few are eligible to benefit from oncological interventions, as these interventions are mostly used in patients with oligometastasis or less common primary tumors, such as hepatocellular carcinoma (HCC). However, when comparing the number of hospitals performing oncological interventions with the number of certified oncology centers, it is seen that significantly more hospitals (58.4 % and 80 %, respectively) can offer oncological interventions. The strict requirements for certification primarily forms the basis for the low number of certified oncology



▶ **Fig. 1** **a** Map with absolute figures per federal state in 2018; **b** Map with absolute figures per federal state in 2019; **c** Summarized absolute figures from 2018 and 2019 for administrative districts; **d** Relative changes between 2018 and 2019 shown in blue with white areas for minor changes or negative development. © Statistical Federal Republic and State Offices, Germany, 2021. This work is licensed under the data license Germany - Version 2.0 (www.govdata.de/dl-de/by-2–0)



▶ **Fig. 2** Number of interventions from 2018 and 2019 standardized to one million inhabitants. The red line shows the standardized value of the Federal Republic from 2018 and 2019.



▶ **Fig. 3** Summarized figures from 2018 and 2019 per federal state per one million inhabitants. © Statistical Federal Republic and State Offices, Germany, 2021. This work is licensed under the data license Germany - Version 2.0 (www.govdata.de/dl-de/by-2–0)

centers compared to hospitals with oncological interventions. Among other things, the requirements of the German Cancer Society for certification as an oncology center include the following in many areas, such as for certification as a visceral oncology center and the presence of an interventional radiology department. Explicitly required here is at least one specialist in radiology with proof of DeGIR/DGNR Level 2 certification [19]. This requirement, along with the increasing number of oncological interventions from 2018 to 2019 (6 %), again highlights the importance of interventional radiology in modern tumor therapy. Analogous to the German Cancer Society, certification for quality assurance is also carried out by DeGIR/DGNR. In 2018 and 2019, more than half of the hospitals (62 % and 59.7 %, respectively) met the requirement of at least 20 oncological interventions performed per year. As high-volume centers, 16.5 % and 16.6 % of the hospitals performed more than 100 oncological interventions. This high percentage of certified or certifiable hospitals suggests a high quality standard of interventions performed and which could support high-quality training of radiologists in interventional oncological procedures [20]. In particular, the training of board-certified interventional radiologists may promote the further dissemination of interventional oncological tumor therapies in the future, since this is still necessary due to geographical differences in availability described above, which in some cases show a significant drop in such services in structurally poorer regions. This is also shown by the absolute distribution of oncological interventions performed in 2018 and 2019, as the mean value of documented interventions per admionistrative district was 599. Individual districts (Bremen (17), Dessau (38), Halle (28) as well as Magdeburg (43)) were more than one standard deviation (414) below the mean. To avoid bias in results due to regions with different population densities, oncological interventions in 2018 and 2019 were standardized to one million population at the state level. Here, too, Brandenburg (85), Bremen (25) and Saxony-Anhalt (49) deviated by more than one standard deviation (184) from the mean value of 291. Similar regional variations could already be found in the study on vaso-occlusive measures, which was also based on the DeGIR quality registry data [21]. An acceptable correlation that the increased incidence of certified oncology centers leads to an increase in oncological interventions could not be demonstrated. Likewise, the converse assumption that the increase in other treatment options in designated oncology centers could primarily result in fewer oncological interventions could not be demonstrated in the absence of a correlation between interventions per state and the presence of comprehensive cancer centers. The reasons for these sometimes considerable variances remain unclear. The main cause of uncertainty in the interpretation of the data is means of collection. The recording of performance figures based on the DeGIR quality registry is carried out on a voluntary basis or as part of the certification process. For example, it is conceivable that clinics with low intervention numbers and no prospect of certification may decline to enter their interventions in the quality registry because of the lack of incentive and increased time required. In particular, the similar distribution of regional differences with respect to the provision of interventional procedures in the current study and the DeGIR study on vaso-occlusive procedures suggests a systemic error [21]. With regard to the similar distribution of regional differences in the two studies, it would

also be conceivable that individual high-volume centers do not participate in data collection and that this leads to significant distortions of the collected data in structurally poor regions with low hospital density. Due to the anonymity of the data collected, this could unfortunately not be investigated in greater detail. However, this distribution phenomenon could also be explained by general regional differences in terms of hospital density, geographic location, and different care structures [21]. However, the fact that the data collected provide a reliable overview of the current supply situation with oncological interventions shows that the difference between the ablations recorded in the DeGIR registry and the ablations performed according to the German hospital registry – 5.8 % – is rather small.

Conclusions

A Germany-wide provision of interventional oncological tumor therapies could be demonstrated based on the data of the DeGIR quality registry. However, there are significant geographical differences in this care, so that it can be assumed that the need for interventional oncological procedures is not yet adequately met in individual regions. Therefore, the training of interventional radiologists working in oncology should be further advanced, and interventional radiologists should be supported or further trained to be able to offer oncological procedures. In order to be able to assess the availability situation regarding interventional procedures even more precisely in the future, all interventions performed should be recorded in the DeGIR quality registry, if possible.

Conflict of Interest

The authors declare that they have no conflict of interest.

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