

# Current situation of allergological health care at German hospitals

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## Summary

**Background:** Allergic medical care in Germany is organized on an interdisciplinary basis. An overview of the current care situation is necessary to manage and improve interdisciplinary cooperation.

**Methods:** Between January and February 2022, questionnaires were sent online and by mail to chief physicians of inpatient clinical departments to which most allergological diseases are assigned (dermatology, otorhinolaryngology [ENT], pulmonology, pediatrics, environmental/occupational medicine, gastroenterology; n = 899).

**Results:** The response rate was 52.1%. Allergology departments of dermatology, ENT and pulmonology were predominantly located in metropolitan areas (> 100,000 inhabitants), whereas responses of pediatric departments were mostly from smaller towns. 76.8% of the respondents reported existing interdisciplinary treatment plans with other specialties. Pediatric and pulmonology clinics stated disproportionately few interdisciplinary treatment concepts with dermatology and ENT clinics, especially in smaller cities with < 100,000 inhabitants. Diagnosis and therapy of allergic rhinitis were performed in particular by the departments of ENT, asthma mainly by the pulmonology departments. Care of other allergological diseases was most frequently reported by chief physicians of dermatology and pediatrics.

**Conclusions:** In metropolitan areas, participating departments provide allergology care in a cooperative manner. A large spectrum of care is covered in cooperation with dermatological clinics. In more rural areas, cooperation is rarer; here, mainly pediatric departments provide allergological care, which may explain the more limited range of services compared to metropolitan areas.

## INTRODUCTION

Allergies are among the most common diseases in Germany, with almost one in five people suffering from at least one form of allergic condition.<sup>1</sup> This high prevalence is associated with a distinct socio-economic burden caused by both direct and indirect costs,<sup>2,3</sup> so there has recently been a political demand for a “General Concept on the Prevention and Treatment of Allergies”.<sup>4</sup> This general concept should also contain improvements in training and continuing education. Compared to other European countries, Germany has a high number of physicians with allergological training. In 2021, a total of 7,247 active physicians with the additional designation “Allergology” were registered at the Medical Councils, with 1,255 of these (17.3%) working in hospitals.<sup>5</sup> However, allergology is not categorized as an independent medical specialty in Germany, though it is in twelve other European countries.<sup>6</sup> Even before the new continuing education regulations model for the additional designation “Allergology” was established, which in future will dispense with set training times altogether, Germany had the shortest allergology training times in comparison with other European countries.<sup>6,7</sup>

The German Society for Allergology and Clinical Immunology (Deutsche Gesellschaft für Allergologie und klinische Immunologie, DGAKI) has defined improved patient care as one of their goals. They are of the opinion that there are structural problems in allergological care in Germany.<sup>8</sup> These structural problems were addressed during the opening event of the 14<sup>th</sup> German Allergy Conference in Hannover in 2019, using insect venom allergy as an example. Although anaphylaxis caused by insect venom can be treated very effectively by allergen-specific immunotherapy (AIT) in more than 90% of cases, only about 10% of affected patients actually did receive this treatment.<sup>8,9</sup> The indication for AIT in patients with grade II anaphylaxis and above, with proven sensitization against the anaphylaxis-inducing insect venom, is, however, clearly stated in the relevant guideline.<sup>10,11</sup> Additional difficulties arise from the fact that care for allergic patients is divided between heterogeneous medical specialties, and the contents of continuing education are usually organ-specific.<sup>12</sup>

The prerequisite for adequate allergological care, especially in view of the ever-increasing need, consists of well-founded allergological training and a balanced, interdisciplinary organization of out-patient and in-patient care.<sup>13,14</sup> A proper database, however, is currently lacking. In 2021, the DGAKI founded a task force intended to optimize the field of allergology in Germany and support a political realignment. This study was initiated by the task force. The aim is to provide a detailed overview of interdisciplinary out-patient and in-patient allergological care in German hospitals.

## METHODS

The “Qualitate-GER study” is an anonymized, questionnaire-based, cross-sectional study which was conducted in Germany during January and February 2022. The questionnaire was designed with the support of representatives from the medical specialties involved. It was then distributed by mail to the heads of all specialized medical departments caring for allergy patients (dermatology, ENT, pulmonology, pediatrics, environmental/occupational medicine, gastroenterology) listed in the German Hospital Registry as having at least ten in-patient beds ( $n = 899$ ). An additional online link to the questionnaire was made available via the e-mail distribution list of the respective medical associations. The questionnaires (paper and online version) were prepared via RedCAP (Research Electronic Data Capture, Vanderbilt University, Nashville, USA), and the paper questionnaires sent back were digitalized with the same tool. The response rate was 52.1% (468 out of 899).

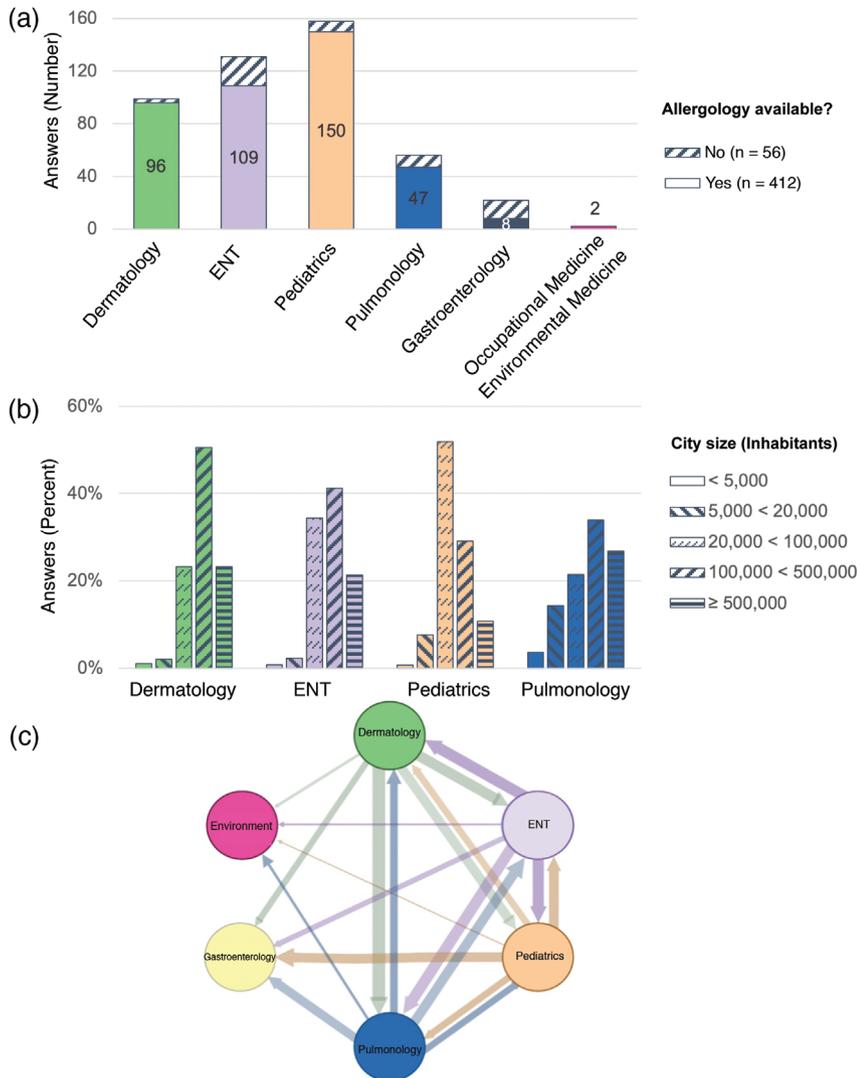
The questionnaire covered all relevant aspects of allergological care in German hospitals and contained six chapters: General information, diagnostics, treatment, digital approaches in medical care, barriers to allergological care, and opinions.

IBM SPSS Statistics (28.0.0.0) was used for analysis of the data, the alpha error was set at 0.05. The Kruskal-Wallis test was used for group comparisons. Over- or underrepresentation of medical specialties was identified via  $\chi^2$  test. The post-hoc analyses were performed via Bonferroni adjustment of the p values.

The study was performed according to the principles of the Helsinki Declaration and the guidelines for Good Clinical Practice. It was approved by the ethics committees of the Hannover Medical School (Medizinische Hochschule Hannover, No. 10036\_BO\_K\_2021) and the University Medical Center Göttingen (No. 25/11/21 Ü). The survey was registered at the DRKS before initiation (DRKS00026677). All participants gave their written consent for an anonymous analysis of the information and the exchange of data between the university hospitals involved.

## RESULTS

Altogether, 468 department heads answered the survey – 189 via digital exchange and 279 via paper mail (Figure S1). 412 of the participants stated that allergological care was offered at their department (Figure 1a). The highest number of responses was received from pediatric units ( $n = 150$ ). At 60.1%, these were mainly situated in smaller towns with a population of less than 100,000 (Figure 1b, Table S1). The catchment area of the pediatric units was significantly smaller than that of other departments (Figure S2). High response rates were also seen from dermatological



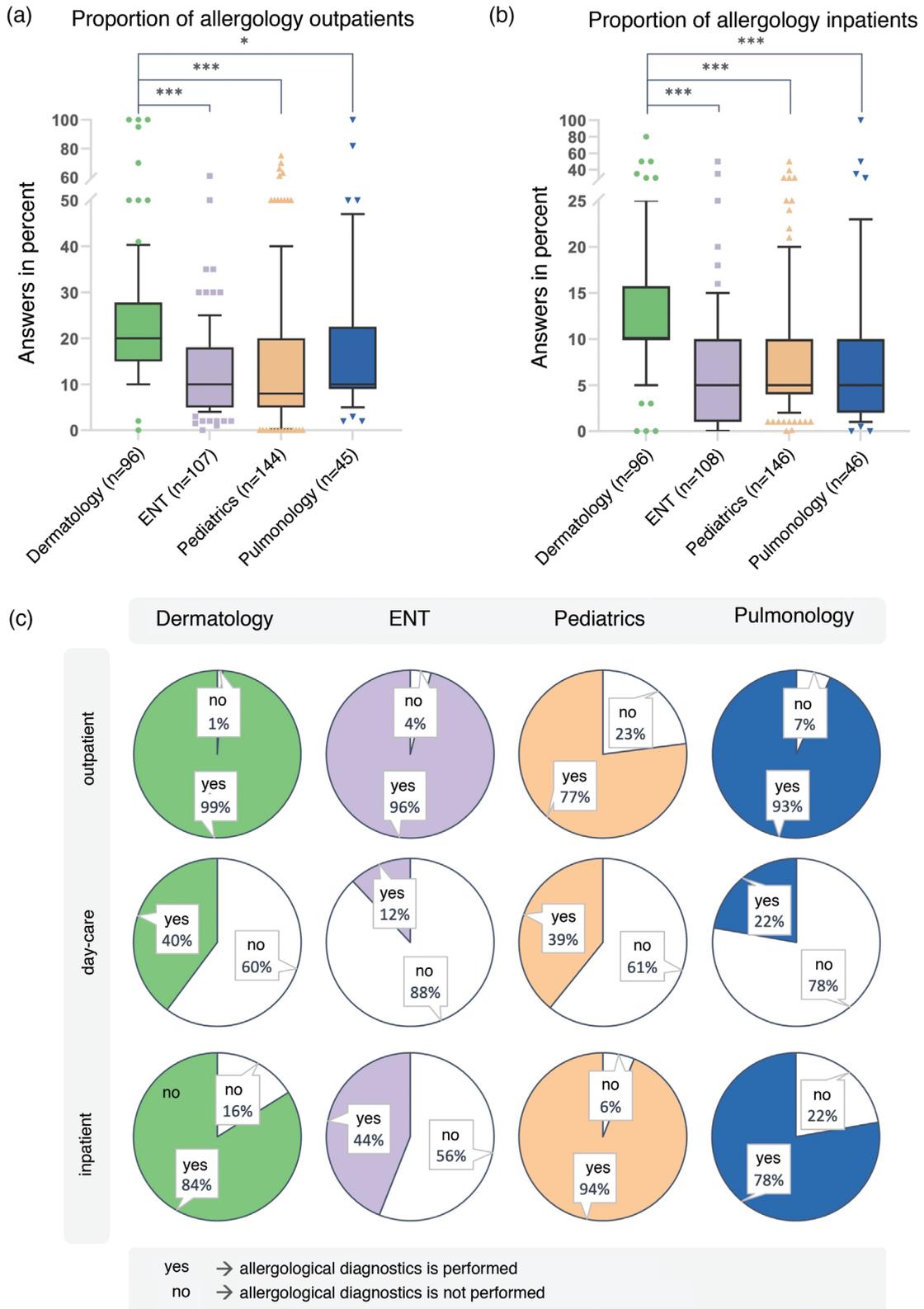
**FIGURE 1** Distribution, focus and interactions of the different specialties. (a) Allergology activity of the department surveyed (n = 468). (b) Number of residents at the department site (n = 393). Responses from the specialty groups of occupational and environmental medicine and gastroenterology are included in the total numbers but not shown separately because of small group size. (c) Frequency of cooperation among departments. The thickness of the arrows corresponds to the answers in percent.

departments (74%, n = 99), ENT (63%, n = 131), and pulmonology (61%, n = 56). Departments for pulmonology as well as those for dermatology and ENT were mainly situated in towns with a population of more than 100,000 (percentage of replies from towns with a population of > 100,000: pulmonology 60.7%; dermatology: 73.7%, ENT: 62.6%) (Figure 1b, Table S1). The number of replies from occupational and environmental medicine units (n = 2) and gastroenterology units (n = 22) were too small for meaningful statistical analysis. These two groups will therefore not be listed separately in the subsequent analyses.

The percentage of allergological patients in out-patient and in-patient care was significantly higher in dermatological units as compared with all other medical specialties (Figure 2a, b). Whereas 84% of the dermatological departments offered both out-patient and in-patient diagnostic procedures for allergy patients, 23% of the pediatric units did not offer any out-patient allergological diagnostics (Figure 2c). Six percent of the pediatric units did not offer in-patient allergological care. On the other hand, the per-

centage of ENT and pulmonology units without in-patient allergological diagnostics was quite high at 56% and 22%, respectively. Day-care diagnostics were mainly offered in the dermatological and pediatric units (40% and 39%), but much less frequently in pulmonology (22%) or ENT (12%). The number of allergological full-time jobs was significantly higher in dermatology than in ENT, pulmonology, and pediatrics (Figure S2).

Nine out of twelve specified diseases were much more frequently addressed in dermatological units as compared with the other specialties (Table S2). The exceptions were (1) allergic asthma, which was mainly treated in pediatric and pulmonology units, (2) allergic rhinitis as a typical ENT domain, and (3) eosinophilic esophagitis, which was usually diagnosed and treated in pediatric units (due to the small sample size, gastroenterological units were not included in the analysis). Hereditary angioedema was most frequently treated in dermatological and ENT units. Pediatrics units also offered a broad range of services, with eight out of the twelve specified diseases being treated in these departments.



**FIGURE 2** Care of allergology patients. (a) Proportion of allergy patients in the surveyed hospitals among all outpatients and (b) among all inpatients, each by specialty. Significances calculated using Kruskal-Wallis tests. \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; and \*\*\* for  $p < 0.001$ . (c) shows the response frequency to the question in which setting diagnostics are performed in the clinic (outpatient vs. day-care vs. inpatient).

**TABLE 1** Allergic diagnostics. Group comparison by Chi<sup>2</sup> test; post-hoc analysis (Bonferroni adjusted). Shown in green = significantly higher than statistically expected. Orange background = significantly lower than statistically expected. Responses from the occupational and environmental medicine and gastroenterology specialty groups are included in the total numbers but not shown separately due to small group size.

	Dermatology (n = 90)	ENT (n = 108)	Pediatrics (n = 150)	Pulmonology (n = 46)	Total (n = 394)
Body plethysmography	23 (25.6%)	17 (17.3%)	122 (81.9%)	44 (97.8%)	206 (53.9%)
Intradermal skin test	87 (96.7%)	42 (42.4%)	52 (34.9%)	21 (46.7%)	202 (52.7%)
Epicutaneous testing	90 (100.0%)	33 (33.3%)	30 (20.1%)	16 (36.4%)	169 (44.2%)
Prick test	89 (98.9%)	96 (95.0%)	115 (77.2%)	41 (91.1%)	341 (88.6%)
Prick-to-prick test	85 (94.4%)	35 (35.4%)	87 (58.4%)	25 (55.6%)	232 (60.6%)
Provocation test	87 (96.7%)	83 (83.0%)	122 (82.4%)	41 (91.1%)	333 (86.9%)
Rhinomanometry	42 (46.7%)	96 (96.0%)	27 (18.2%)	21 (46.7%)	186 (48.6%)
Specific IgE	89 (98.9%)	89 (89.9%)	146 (98.0%)	44 (97.8%)	368 (96.1%)
Spirometry	33 (36.7%)	46 (42.6%)	132 (88.0%)	42 (91.3%)	253 (64.2%)
Other diagnostic tests	56 (62.2%)	38 (38.4%)	38 (25.5%)	24 (53.3%)	156 (40.7%)

Interdisciplinary approaches were established at 76.8% of the participating departments. 86.7% of the dermatological units indicated that interdisciplinary cooperation with other units was firmly established, which was more than at ENT units (75.5%), pediatric units (75.0%), and pulmonological units (68.2%) (Figure 1c, Figure S3a). However, only 37.9% of the pediatric units and 22.2% of the pulmonological units in smaller towns stated that they had established interdisciplinary cooperations with dermatological units (Figure S3b). On the other hand, both specialties had quite frequent cooperations with gastroenterological units (65.5% and 44.4%, respectively) in smaller towns.

Waiting times for an appointment for the initial presentation of a patient for elective allergological diagnostics at the participating departments were significantly longer in dermatological units (on average 3.51 months) than in ENT units (1.70 months), pediatric units (1.9 months), and pulmonological units (1.53 months) (Figure S4).

The diagnostic methods available were markedly different for the different medical specialties (Table 1). More than 90% of the clinical heads of dermatological units indicated that allergological skin tests were performed at their department (skin prick test, prick-to-prick test, intradermal skin test, epicutaneous tests). Allergological tests of the lower airways (spirometry, body plethysmography) were most frequently performed at pulmonological departments. ENT departments performed rhinomanometry tests more than twice as frequently as any other medical specialty. Provocation testing as well as serological diagnostics of specific IgE were broadly utilized in all specialties.

Dermatological departments performed significantly more provocations than any other specialty (Figure S5a) and covered provocations with the largest number of allergens (Table 2a). In particular, provocation testing with medications was mostly performed at dermatological departments. Sting provocation in patients with insect venom allergies were generally not performed frequently

(14.4%), but most frequently in dermatological units (25.0%). On the other hand, aeroallergens such as plant pollen and dust mites were more frequently utilized in ENT units. Provocation with food allergens was frequently performed in both dermatological and pediatric departments (Table 2a). There were also marked differences regarding the manner of application used for provocation (Table 2b). Contingent on the allergens used for provocation, dermatological and pediatric units frequently offered in-patient provocations (92.2% and 74.3%), while provocations in ENT and pulmonological units were mostly performed as an out-patient procedure (72.0% and 77.8%) (Figure S5b).

Allergen-specific immunotherapy (AIT) constitutes the only causal treatment for allergic diseases. We found that a large percentage of the units offer both initiation and maintenance AIT (Figure 3). There were, however, discrepancies regarding the range of allergens (Table 3). AIT with insect venom allergens was most frequently offered by dermatological departments, as well as AIT with aeroallergens such as grass and tree pollens and dust mites. Immunotherapies with mold allergens were most frequently performed by ENT units. There is currently only one drug approved for food AIT which can be used in children and adolescents aged 4–17. This type of AIT was consequently performed mostly in pediatric units (28.7%).

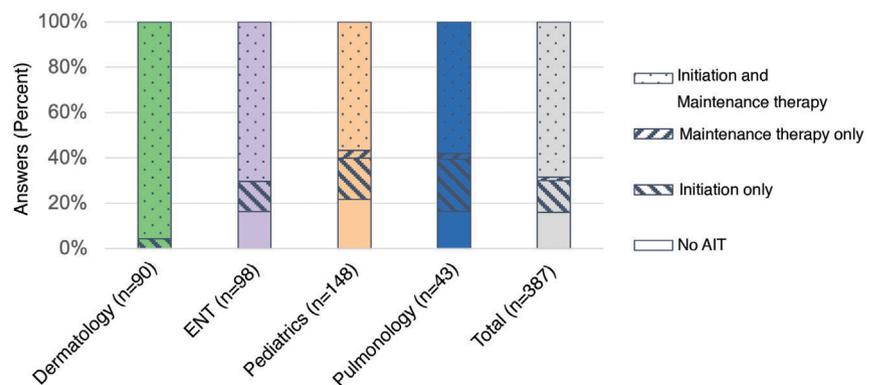
The responding units reported extremely varying levels of active participation in clinical studies (Figure S6). Dermatological units were the only specialty where more than half participated in clinical studies (66.7%), followed by pulmonology (41.9%). The diseases investigated in the clinical studies corresponded to the expected treatment focuses regarding frequency and distribution. Studies on atopic dermatitis were frequently performed by dermatological units, studies on allergic rhinitis in ENT units, and on food allergies and allergic asthma in pediatric units. The latter was also investigated in pulmonological units (Figure S6).

**TABLE 2** Provocation tests. (a) Provoked allergens and (b) mode of application of allergens in provocation tests. Group comparison by Chi<sup>2</sup> test; post-hoc analysis (Bonferroni adjusted). Green background = significantly higher than statistically expected. Orange background = significantly lower than statistically expected. Responses from the occupational and environmental medicine and gastroenterology specialty groups are included in the total numbers but not shown separately due to small group size.

	Provocation allergen	Dermatology (n = 96)	ENT (n = 109)	Pediatrics (n = 150)	Pulmonology (n = 47)	Total (n = 410)
Medications	Antibiotics	83.3%	11.0%	44.0%	25.5%	41.5%
	Aspirin	77.1%	54.1%	18.0%	48.9%	44.6%
	Local anesthetics	86.5%	9.2%	18.0%	21.3%	32.0%
	Other medications	77.1%	3.7%	26.0%	19.1%	31.5%
Aeroallergens	Pollen	33.3%	67.9%	32.0%	44.7%	42.7%
	Dust mites	38.5%	71.6%	36.0%	42.6%	46.1%
Food	Food	72.9%	14.7%	85.3%	19.1%	55.4%
	Insect venom	25.0%	5.5%	13.3%	19.1%	14.4%
	Other	13.5%	10.1%	10.7%	31.9%	13.7%
	None	1.0%	10.1%	8.0%	21.3%	9.0%

Type of application (provocation)	Dermatology (n = 96)	ENT (n = 109)	Pediatrics (n = 150)	Pulmonology (n = 47)	Total (n = 410)
Conjunctival	18.8%	18.3%	5.3%	14.9%	12.9%
Inhalation	4.2%	8.3%	14.7%	68.1%	16.8%
Intranasal	29.2%	75.2%	34.7%	44.7%	44.6%
Intravenous	51.0%	4.6%	16.7%	12.8%	21.0%
Oral	87.5%	37.6%	86.0%	38.3%	67.3%
Subcutaneous	85.4%	18.3%	26.0%	23.4%	37.3%

**FIGURE 3** Allergen-specific immunotherapy. Response to the question whether the surveyed department performs allergen-specific immunotherapy (AIT) (n = 387). Responses from the occupational and environmental medicine and gastroenterology specialty groups are included in the total but not shown separately due to small group size.



**TABLE 3** Allergens used for allergen-specific immunotherapy. Allergens for which specific immunotherapy is offered (by specialty group). Group comparison using Chi<sup>2</sup> test; post-hoc analysis (Bonferroni adjusted). Green background = significantly higher than statistically expected. Orange background = significantly lower than statistically expected. The responses of the specialty groups occupational and environmental medicine and gastroenterology are included in the total numbers but not shown separately due to small group size.

	Dermatology (n = 96)	ENT (n = 109)	Pediatrics (n = 150)	Pulmonology (n = 47)	Total (n = 402)
Insect venom	91.7%	29.4%	70.0%	53.2%	62.2%
Grass pollen	85.4%	70.6%	59.3%	61.7%	68.9%
Tree pollen	84.4%	68.8%	55.3%	51.1%	65.4%
Dust	75.0%	69.7%	52.7%	55.3%	62.9%
Food	17.7%	5.5%	28.7%	8.5%	17.4%
Molds	27.1%	45.9%	13.3%	19.1%	26.1%

## DISCUSSION

As opposed to most other European countries, allergological care in Germany is not organized as a distinct medical specialty. Thus in 2014, the professional societies DGAKI, German Society of Dermatology (Deutsche Dermatologische Gesellschaft, DDG) and German Respiratory Society (Deutsche Gesellschaft für Pneumologie, DGP) founded the Comprehensive Allergy Center network (Netzwerk interdisziplinärer allergologischer Referenzzentren) with the aim of improving interdisciplinary care for allergy patients. In 2020, German Society of Oto-Rhino-Laryngology, Head and Neck Surgery (Deutsche Gesellschaft für HNO-Heilkunde, Kopf- und Hals-Chirurgie, DGHNO-KHC) joined the initiative. Meanwhile, ten centers in Germany and Austria have been established and certified (please consult <https://dgaki.de/cac/> for more information).

Our study has shown that interdisciplinary approaches are established practice in 76.8% of all departments involved in allergological care. This can be interpreted as a sign of comprehensive cooperation between those working in the cross-sectional specialty of allergology.

One interesting aspect of this study was that physicians employed in pediatric or pulmonological units reported less frequently existing interdisciplinary treatment concepts with other departments than those from dermatological or ENT units.

An analysis according to town size showed that especially pediatric and pulmonological units in smaller towns (population < 100,000) rarely reported established cooperation concepts. The heads of pulmonological units in larger towns (population > 100 000) reported three times as many cooperations with dermatological colleagues than those in smaller towns. Breaking down the locations of the participating units according to the size of the town confirmed a lack of cooperation partners from the fields of dermatology and ENT in smaller towns. Comparing the different specialties, however, the diagnostic and therapeutic range of services at pediatric units in smaller towns proved especially diverse. Thus, allergological care shows clear differences between larger towns (with interdisciplinary cooperation being more common) and smaller towns (usually offered within the primary specialty). Looking at multidisciplinary care concepts in other European countries, most approaches are disease-based, such as for example asthma bronchiale care in Finland.<sup>15</sup> Basic strategies for launching multidisciplinary care concepts on an international footing and for a larger number of diseases are currently not established. It is essential to use evidence-based methods so these concepts can be developed for the various local conditions.<sup>16</sup>

We found some differences between the relative percentages of allergological patients compared with the total number of patients, depending on the respective specialties. Dermatological units had higher percentages of both in-patient and out-patient allergy patients. It should be noted, however, that only relative case numbers were inves-

tigated in this study. Due to the total number of cases in the various hospitals and specialties, the true proportion in allergological care may differ significantly from the numbers found in this study.

We also found that dermatologists reported the highest average number of allergen provocations. In our survey, we did not differentiate the number of provocations according to indication and form of application. In retrospect, this would have been desirable due to the heterogeneity of provocation testing. Nasal provocation, for example, is extremely different from (insect) sting provocation regarding effort and risk. We suggest that any potential financial influence of the DRG system on allergological care should also be critically discussed.<sup>17</sup> The number of provocations, with comparatively little remuneration, has decreased in the last few years. However, the prevalence of underlying allergies and thus the need for such investigations has not diminished at all.<sup>18</sup> In addition to our study data, there is a trend towards decreasing diagnostics and treatment despite increasing prevalence also in the out-patient sector.<sup>9</sup> Due to a low response rate, gastroenterology was underrepresented in our study.

We need broad and reliable care for patients with allergies in Germany, both on a qualitative and a quantitative basis. Physicians with allergological training offer most of the day-to-day care in their practices. Specialized allergological care as offered by the interdisciplinary units in Comprehensive Allergy Centers (CAC) cannot, however, fulfill the current need. Our study has shown signs of this, seen for example in long waiting times, especially in dermatological units. One possible explanation might be that dermatological units treat a broader spectrum of allergies, so there are more patients and longer average waiting times. We should, however, also keep in mind that there are more full-time positions for allergology in dermatological units as compared with other specialties (Figure S2). Possibly, the increased demand cannot be compensated adequately by the increased number of full time positions.

It is essential that physicians should be suitably trained to offer allergological care as a broad cross-sectional specialty in their practices to ensure adequate care for allergy patients, and it is also essential that institutions (usually hospitals) are available to care for allergy patients with complex and difficult-to-treat disease. Our study did not investigate physicians in practices. We do know, however, that the number of physicians practicing allergology is currently decreasing, which of course will aggravate the deficit of adequate care for allergy patients in the future.<sup>9</sup> It is also highly likely that a reduction of allergological care in specialized units may in future lead to a lack of training opportunities.

A lot of content on allergology is already contained in the specialized training frameworks for various specialties (including Internal Medicine, Pediatrics, ENT, Dermatology, Occupational Medicine).<sup>7</sup> This, however, does not cover the whole spectrum of allergology as an interdisciplinary field, so allergology has been established as an additional

designation in Germany for decades. Since 2018, the currently valid continuing education regulations model of the German Medical Association considers allergology a designation purely requiring extra-occupational training without defined occupational training periods. Meanwhile, most state medical associations have implemented this regulation, except for Baden-Württemberg where a one-year advanced training period is still obligatory, and Niedersachsen where it is voluntary. Purely extra-occupational training is not considered adequate by the scientific AWMF societies for allergology (DGAKI, GPA), the Medical Association of German Allergists (Ärzteverband deutscher Allergologen, AeDA) or the scientific societies from the fields of dermatology and pulmonology. These experts are of the opinion that physicians in advanced training may not gain sufficient experience with complex or difficult-to-treat allergological conditions through extra-occupational training.<sup>19</sup>

In summary, our study shows that at this point in time, the various medical specialties involved in allergological care can still offer a broad spectrum of services in diagnostics and treatment. It is essential to maintain this level of service and, in view of the high prevalence of allergies, to support a further expansion especially of interdisciplinary cooperation.

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## CONFLICT OF INTEREST

None.

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