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Physician's perspectives on skin prick testing and allergy diagnostics in Germany

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Summary
Purpose Novel technologies standardising the testing process of immediate hypersensitivities have been developed and validated in recent years. Meanwhile, challenges with regard to availability of testing agents and shortage of trained personnel have increased. Novel technologies could fight these challenges, but their distribution is at present not known. The current survey, conducted by the German Society for Allergology (AeDA), aimed to assess current practices of allergy diagnostics in Germany.
Methods Members of AeDA were invited to complete an online questionnaire to obtain information on their perspectives on allergy testing and diagnostics.
Results A total of 150 allergologists from different disciplines treating patients with allergy completed the questionnaire. This survey revealed that twice as many skin prick tests (SPT; 21.2 tests/week) compared to serum specific immunoglobulin E tests (IgE; 10.4 tests/week) are being performed. Nasal allergen provocation tests are being performed in 56.0% of hospitals and physicians' offices. An individual standard allergen panel for SPT is applied in 78.0% of testing cases. Methods used to perform a read out of SPT are variable with measurement of the longest wheal diameter being used most frequently (68.0%), followed by a qualitative evaluation (46.6%) or the longest wheal diameter including pseudopods (34.4%). In all, 66% of allergologists indicated that a device that automating the SPT process would be valuable for clinical practice.
Conclusion Skin prick tests and serum IgE tests are still the cornerstones in the diagnostic work-up of immediate-type allergies. Variability in the execution of skin prick tests exists between different hospitals and physicians' offices in Germany. Inconsistent availability of testing reagents was considered most problematic for maintaining allergy diagnostics in Germany. A majority of allergologists are open to evaluating tools that may contribute to standardize skin prick tests.

Supplementary Information The online version of this article (https://doi.org/10.1007/s40629-024-00297-6) contains supplementary material, which is available to authorized users.

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Introduction

Almost 20% of German adults are affected by at least one allergic disease, according to an analysis of the lifetime prevalence by the Robert Koch Institute [1]. Traditionally, multiple testing methods are available on demand and represent the current standard of care in allergy clinics [2]. Reimbursement of allergy diagnostics in the German public health system requires a stepwise use of the here-mentioned methods. Skin prick test (SPT) and serum-specific immunoglobulin E (IgE) test are both commonly used for the initial evaluation of immediate hypersensitivity in patients with suspected inhalant allergy [3], whereas allergen challenge tests, commonly by nasal allergen provocation, prove the clinical relevance of a sensitization demonstrated by skin test and/or allergen-specific IgE. Recent changes in the market authorization process of allergy diagnostic agents, however, impact the availability and portfolio of diagnostic allergen extracts, posing a threat to the use of SPT for the more complex allergy cases [4]. Interestingly, a recent study investigated the impact of either using only SPT or specific IgE on the occurrence of missed allergy diagnoses. Omitting SPT resulted in significantly more missed allergy diagnoses to aeroallergens such as house dust mite, birch pollen, grass pollen and cat, compared to omitting specific IgE analysis [5].

Over the past few years, novel technologies have been evaluated to improve different aspects of the allergy diagnosis process. An automated skin prick test device showed less intrasubject variability, compared to the conventional SPT procedure and thereby contributes to standardization of the testing process [6, 7]. A scanner that takes images of the skin reactions and as such digitizes the test results focuses on the read out process [8]. Therefore, the standard routine diagnostic procedures used to determine a patient's sensitization status may become more efficient over the next decade. While specialized and experienced personnel are of critical importance in the allergy clinic, shortage of labor could be addressed with more efficient work flows, automation and digitization.

In this study, we conducted an online survey to capture the perspectives of allergy specialists on several aspects of the allergy diagnosis process among members of the German Society for Allergology (Ärzteverband Deutscher Allergologen [AeDA]).

Methods

An online questionnaire (Table S1 in the Online Appendix) was sent by email to all members of AeDA (N= 1012), thus, allergy specialists with different backgrounds and subspecialties and different level of experience, in May 2023. After 2 weeks, a reminder to complete the questionnaire was sent. The questionnaire was answered in an anonymous manner and consisted of 14 items. Items addressed the individual background and experience, volume and spectrum of allergy diagnostics, structure of skin prick testing, grading of current challenges in skin prick testing as well as interest and potential of digitization and automation in skin prick testing.

Results

Study population

A total of 150 (15%) allergy specialists completed the survey. Various disciplines and subspecialties were represented, including ear–nose–throat surgeons (47%), dermatologists (23%), pneumologists (15%), pediatricians (11%) and general practitioners (4%; Table 1). The average experience of the respondents was 22.1 years.

Allergy tests

According to the survey, twice as many skin prick tests (21.2 tests/week) are performed on a weekly basis compared to serum specific IgE testing (10.4 tests/week; Table 2).

Of the respondents, 56% reported to perform nasal provocation tests in their clinical practice.

Furthermore, 78% (117/150) of specialists use an individual standard allergen panel (SAP) for skin prick tests. In total, 32 different allergens are part of at least 1 of the allergen panels, with a large variation ranging from grass pollen being part of all SAP to Botrytis being part of 4 SAPs. The tested top 10 allergens (from 1–10) are the following: grass pollen, birch pollen, *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, cat, mugwort pollen, hazel pollen, dog, alternaria and alder pollen (Fig. 1).

Diagnostic allergens are ordered from a variety of suppliers (Fig. 2): Allergopharma GmbH & Co.

Table 1 Representation of specialisms among survey respondents

Disciplines	% of respondents
Ear–nose–throat surgeons	47
Dermatologists	23
Pneumologists	15
Pediatricians	11
General practitioners	4

Table 2 Allergy testing in German physicians' offices and hospitals

	Allergy testing (*n*/week)
Skin prick test (tested patients/week)	21.2
Standard allergen panel (%)	78.0
Serum specific IgE (tested patients/week)	10.4

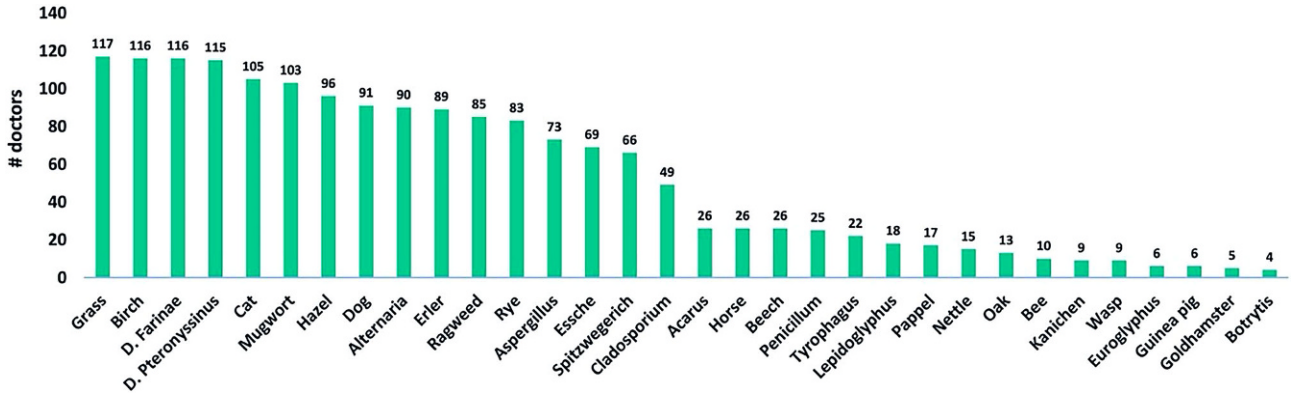
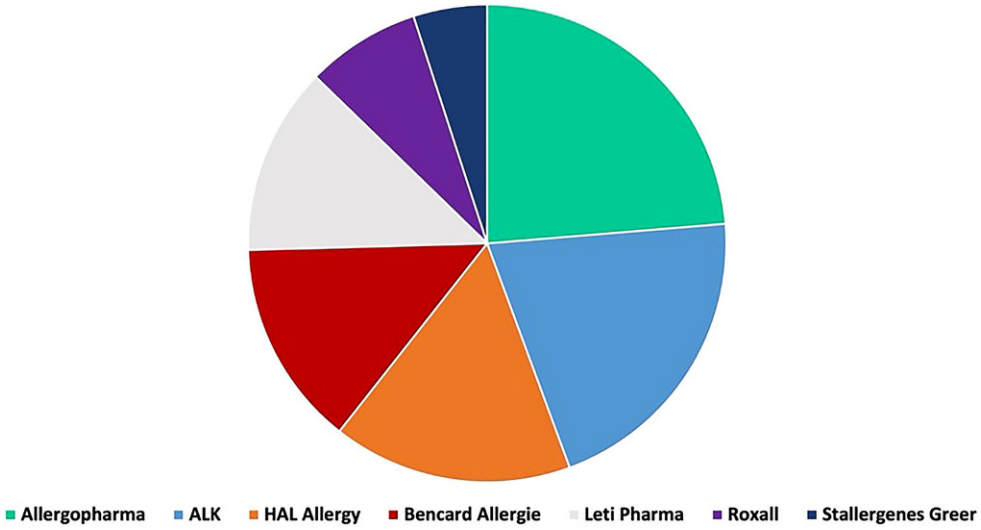


Fig. 1 Allergens included in the standard allergen panel. *Number sign (#)* number

Fig. 2 Source of allergy tests in German physicians' offices and hospitals



KG (Reinbek, Germany), ALK-Abellò Arzneimittel GmbH (Hamburg, Germany), HAL Allergie GmbH (Düsseldorf, Germany), Bencard Allergie (München Germany), LETI Pharma S.L.U(Tres Cantos, Spain), ROXALL Medizin GmbH (Ostensteinbeck/Hamburg, Germany, Stallergenes GmbH (Kamp-Lintfort, Germany).

Reading skin prick tests

We next asked specialists about the methods used to read the SPT. Most specialists use the longest wheal diameter (68.0%, 102/150), a qualitative evaluation (46.6%, 70/150) or the longest wheal diameter including pseudopods (34.4%, 51/150; Fig. 3). A negligible proportion of 1.3% (2/150) of respondents use the perpendicular wheal diameter as an outcome.

Barriers to allergy testing

When asking to rank a series of perceived barriers in allergy testing, the unstable availability of allergens was scored highest in 54.6% of respondents, followed by the decreasing number of available allergens (14.6%) and the fact that there is no or insufficient personnel to perform the SPT (8.7%). 22.0% of respondents indicated to see no barriers to allergy testing.

Automated skin prick test

Finally, we evaluated the readiness of specialists to use a device that automates the SPT process and digitize the test results: 66% of specialists scored 51 or above on a visual analogue scale from 0 (not at all valuable) to 100 (extremely valuable; median with interquartile range: 80 [28.8–90]; Fig. 4).

Asking to rank potential benefits of an automated device, reduced time for execution of the test (42.6%) and more reproducible results (30.7%) were ranked highest. This was followed by a digital record of the results (14.0%), reduced cost per test (10.0%) and artificial intelligence (AI)-assisted read out of the results (2.6%).

Discussion

Novel technologies to support the allergy diagnostic process are gradually finding their way into daily clin-

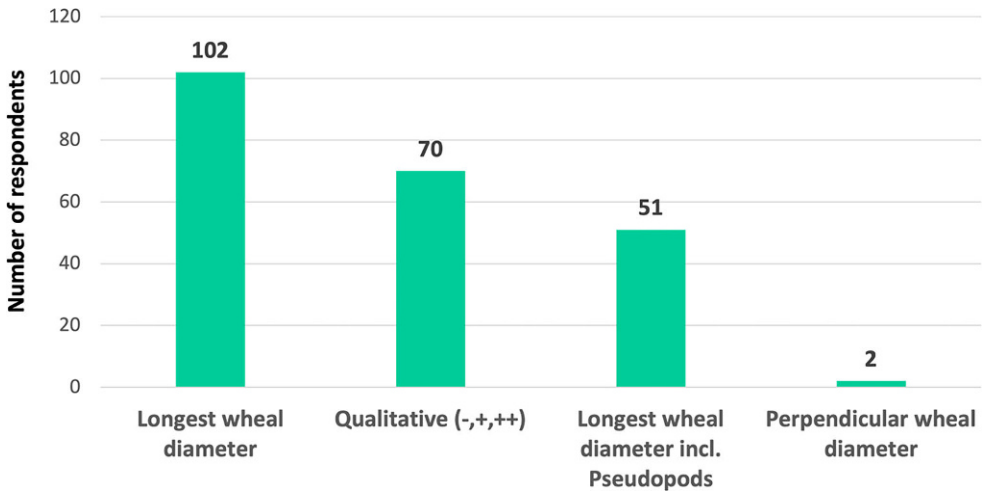


Fig. 3 Techniques for quantifying skin prick test (SPT) results. *incl*. including

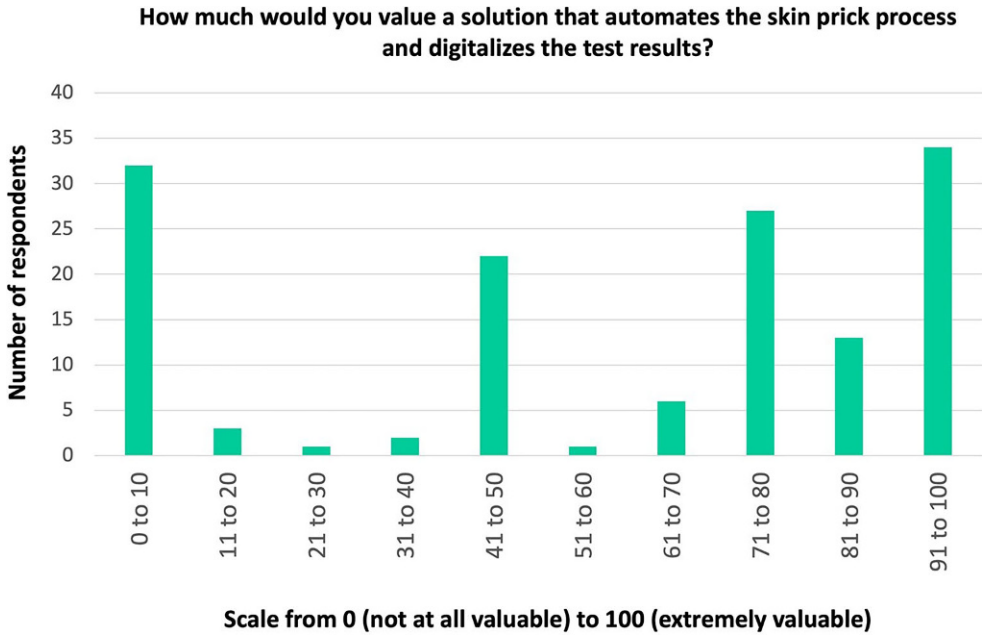


Fig. 4 Need for an automated and digitized skin prick test

ical practice [9]. Therefore, we took the opportunity to better understand the allergy testing processes in real-life, potential barriers to allergy testing and perspectives of allergy specialists towards automated skin prick testing.

Despite concerns related to the availability of skin prick test allergen extracts, we observed in this survey that still twice as many skin prick tests are compared to blood tests. A previous European survey showed similar results with SPT being performed in 90.3% of inhalant allergy cases and almost 65.2% of the total allergy cases [10].

Three quarters of physicians reported to use an individual standard allergen panel for testing. The panels are diverse, with the listed top 20 allergens being used in 80% of physicians' offices. The Ga²len consortium previously investigated what should be the minimum number of inhalant allergens to be tested in Europe. Overall, more than 95% of sensitized subjects could be identified with 8 allergens [11]. When looking at the country level, up to 13 allergens (in Germany: 11 allergens) were needed to identify all sensitized subjects. However, to also include allergens that affect 1–2% of the patients across Europe in routine clinical practice, a panel of 18 allergens (cat, dog, Grass mix, *Ambrosia*, *Alternaria*, *Parietaria*, *Cladosporium herbarum*, *Aspergillus fumigatus*, Birch, Hazel, Alder, *Blatella*, *Dermatophagoides pteronyssinus*, *Dermatophagoides farina*, Olive, Cypress, Plane, *Artemisia*) was suggested [12].

Despite European guidelines being available and recommending to measure the longest wheal diameter for the read out of SPT, 68% of physicians report doing so. Alternative methods include the measurement of the longest wheal diameter taking into account pseudopodia, qualitative interpretations of the test result or the measurement of the perpendicular wheal diameter. These results show that in the real-

world practice, a variety in SPT read out methods is applied, which may contribute to reduced comparability.

Physicians seem to be most concerned about the continuous availability of allergen test extracts in their offices. To a lesser extent no or insufficient personnel to perform SPT was reported as a barrier in allergy testing. Indeed, numbers obtained from the German Paul-Erlich-Institut (PEI) showed a reduction by half of test allergens with marketing authorization between 2010 and 2019 [13]. A call to action and recovery plan was proposed by the European Academy of Allergy & Clinical Immunology (EAACI) in 2020 and since then EAACI has been looking for possible solutions together with other scientific societies and national and European authorities [4].

Over time, only minor changes or improvements to SPT have been implemented. SPT was first reported in 1959 and is still the mainstay diagnostic procedure for the diagnosis of immediate allergic diseases since the presence and degree of cutaneous reactivity is a surrogate marker for sensitization within target organs [4]. However, considerable variability in SPT results exists, which is mainly driven by the use of different devices or different operators performing SPT [14, 15]. The use of a novel device for automated skin prick tests (S.P.A.T., Hippo Dx, Aarschot, Belgium) showed to reduce intrasubject variability of SPT results as well as to improve consistency of SPT to common inhalant allergens [6, 7]. In the current survey, 66% of respondents indicated that a solution automating the SPT process and digitizing the test results could be of value to their offices. The potential time and labor savings for execution of the SPT and the more reproducible results were listed highest as potential benefits of an automated solution.

This survey has also some limitations. A response rate of 15% was achieved, which may have led to responder bias. The results from the survey are the personal opinions of a selection of physicians and are therefore subjective. Despite these limitations, the survey provides us with a substantial sample size and an overview of current practices in the allergy testing and diagnosis landscape in Germany.

In conclusion, skin prick tests and serum IgE tests are still the cornerstones in the diagnostic work up of allergies. Variability in the execution of skin prick tests exists between different hospitals and physicians' offices in Germany. A majority of allergologists are open to evaluating tools that may contribute to standardize skin prick tests.

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S. Gorris and S.F. Seys are employees and shareholders of Hippocreates BV, Aarschot, Belgium. W. Wehrmann and I. Casper declare that they have no competing interests.

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