



State of Medical Mycology at German Academic Medical Centres: A Survey of the German-Speaking Mycological Society (DMYKG) and the Paul-Ehrlich-Society for Chemotherapy (PEG)

Andreas H. Groll¹  | Kathrin Gordon¹ | Dieter Buchheidt² | Birgit Willinger³  |
 Werner J. Heinz⁴  | Oliver Kurzai^{5,6} | Volker Rickerts⁷ | Oliver A. Cornely⁸ |
 The Medical Mycology at German Academic Medical Centers (MMGAMC) Study Group*

¹Infectious Disease Research Program, Center for Bone Marrow Transplantation and Department of Pediatric Hematology/Oncology, University Children's Hospital Münster, Münster, Germany

²Department of Hematology and Oncology, Mannheim University Hospital, Heidelberg University, Mannheim, Germany

³Division of Clinical Microbiology, Department of Laboratory Medicine, Medical University of Vienna, Vienna, Austria

⁴Department of Internal Medicine II, Caritas Hospital Bad Mergentheim, Bad Mergentheim, Germany

⁵Institute for Hygiene and Microbiology, University of Würzburg, Würzburg, Germany

⁶National Reference Center for Invasive Fungal Infections NRZMyk, Leibniz Institut für Naturstoff-Forschung und Infektionsbiologie - Hans-Knöll-Institut, Jena, Germany

⁷Unit 16, Mycotic and Parasitic Agents and Mycobacteria, Robert Koch Institute Berlin, Berlin, Germany

⁸Faculty of Medicine and University Hospital Cologne, Department I of Internal Medicine, Excellence Center for Medical Mycology (ECMM), Translational Research, Cologne Excellence Cluster on Cellular Stress Responses in Ageing-Associated Diseases (CECAD), and German Centre for Infection Research (DZIF) Partner Site Bonn-Cologne, University of Cologne, Cologne, Germany

Correspondence

Andreas H. Groll, Infectious Disease Research Program, Center for Bone Marrow Transplantation and Department of Paediatric Haematology/Oncology, Children's University Hospital, Albert-Schweitzer-Campus 1, Building A1, 48149 Münster, Germany.
 Email: grollan@ukmuenster.de

Funding information

The study was supported by internal funding through the Infectious Disease Research Program, Center for Bone Marrow Transplantation, UNIVERSITÄTSKLINIKUM MUNSTER Projekt DEAL and Department of Pediatric Hematology/Oncology, University Children's Hospital Münster

Abstract

Background: Little is known about the infrastructure to translate advances in the management of patients at risk to develop invasive opportunistic fungal diseases. To assess the current state of Medical Mycology support in Germany, we conducted a survey among all 36 academic medical centres.

Methods: The survey consisted of a 3-pages questionnaire sent out in the first half of 2019. Information included details of infrastructure, education and teaching; consultation services and interdisciplinary conferences; research activities and participation in network groups; radiology, microbiology and pharmacology support; publication activity; and European Confederation for Medical Mycology (ECMM) Excellence Center designation, if assigned.

Results: Information was returned from 24 centres (67%). Thirteen institutions (54%) reported an independent infectious disease, and two a separate Medical Mycology department (8%); a Medical Mycology working group was reported for nine institutions

*Please see Acknowledgements.

(38%). An infectious disease consultation service was existent in 16 institutions (67%) and a multidisciplinary conference in 13 (54%). Fifteen institutions reported a separate study office with activities in infectious disease studies (63%). Laboratory capability for fungal identification and susceptibility testing was confirmed by all 24 institutions; testing of galactomannan by 23 (96%), cryptococcal antigen by 21 (88%), β -D-Glucan by 9 (38%), and panfungal and *Pneumocystis* PCR by 21 and 22 (88% and 92%), respectively. Therapeutic drug monitoring of voriconazole was reported to be available in 15 (63%) institutions with a turnaround of ≤ 24 h during weekdays in 10 (42%). Two of the 24 University hospitals (8%) reported ECMM Diamond Excellence Status.

Conclusions: The results of this survey document the continuing need to improve the availability of specialised Medical Mycology support in German academic medical centres.

KEYWORDS

infections, mycoses, patient care, research, teaching

1 | INTRODUCTION

Invasive opportunistic fungal diseases have emerged as important cause of morbidity and mortality in immunocompromised and severely ill patient populations¹ with an estimated annual incidence of between 18,000 and 36,000 cases in the German population.² The situation is further aggravated by the increasing occurrence of resistance in important fungal pathogens and the global spread of a new fungal pathogen, *Candida auris*.³ During the past two decades, considerable advances have been made in our general understanding of fungal pathogens and in the prevention, diagnosis and treatment of invasive fungal diseases.³ Apart from an increased knowledge of fungal biology, the human mycobiome and the interactions with the human host, several new antifungal agents have been developed with approved indications for treatment and for prophylaxis in high-risk patients.³⁻⁶ Refined imaging methods and antigen- and molecular-based laboratory diagnostics have become available for diagnosis and response evaluation,⁷ and definitions of fungal diseases and response criteria in clinical trials have been elaborated.^{8,9} At the same time, through the initiative of leading international societies, guidelines have been developed on the diagnosis, treatment and prevention of nearly all forms opportunistic invasive fungal diseases,¹⁰⁻¹² and there is an overall greater awareness of the issue of fungal infections as evidenced by the emergence of major public support groups¹³ and the recognition of fungal diseases by the World Health Organization (WHO) as a worldwide threat to human health and physical well-being.¹⁴

However, given all the progress made in recent years, little is known about the currently existing infrastructure to translate these advances to the benefit of patients. In order to explore the current state of Medical Mycology support in Germany, we conducted a standardised survey among all 36 German academic University Medical Centers.

2 | METHODS

The survey was conceived by the leadership of German-Speaking Mycological Society (DMYKG)¹⁵ and the Section of Antifungal Chemotherapy of the Paul-Ehrlich-Society for Chemotherapy (PEG)¹⁶ at a think-tank meeting conducted in Berlin upon invitation of the German Consiliary Laboratory for Cryptococcosis and Rare Systemic Mycoses located at the Robert Koch Institute (RKI).¹⁷ The aim of this meeting was to define the state of laboratory-based fungal diagnostics in Germany, and to discuss existing challenges and perspectives for the future. The survey was developed after the meeting by four participants (AHG, DB, OK and OAC) and reviewed and approved by the leadership of both societies.

German academic medical centres were identified through an Internet search by the listing of the Association of University Medical Centers in Germany.¹⁸ For contact, personally known individuals working at the 36 German University Medical Centers registered at that time in Clinical Microbiology and/or Infectious Diseases and being members of either the PEG and/or the DMYKG were selected. In cases where no contact person could be identified, the website of the respective institution was searched and individuals with responsibilities in both disciplines identified and contacted.

The survey consisted of a three-page structured questionnaire (Table S1) and was sent out by email together with an invitation letter explaining the project and the questionnaire in February 2019. In cases of missing response, contact persons were contacted by telephone as feasible and electronic reminders were sent out up to three times until June. Information from the returned questionnaires was transferred into a central database which was closed in early September 2019. The information collected was restricted to adult medicine and included details of academic infrastructure, education and teaching, consultation services and interdisciplinary conferences, research activities and participation in network groups,

radiology, microbiology and pharmacology support, publication activity and European Confederation for Medical Mycology (ECMM) Excellence Center designation. Results were extracted from the database and analysed in a descriptive manner.

3 | RESULTS

The survey was completed and returned for 24 of the 36 academic medical centres (67%) after a median of two invitations (range, 1–4). Thirteen of the 24 centres (54%) reported the existence of an independent Infectious Disease department, and two that of an independent Medical Mycology department separate from Medical Microbiology (8%); an Infectious Disease and a Medical Mycology working group were reported for 19 and nine institutions (79% and 38%, respectively). With consideration of all adult medicine departments, an Infectious Disease trained Department Head was present in 18 (75%), and some form of an Infectious Disease training program in 16 (67%) centres. An Infectious Disease consultation service was reported by all 24 institutions with availability 24 h on seven days per week in seven (29%), and a telephone hotline and Internet presence devoted to Infectious Diseases were mentioned in 11 and 14 centres (46% and 58%), respectively. Thirteen institutions (54%) had a multidisciplinary Infectious Disease conference regularly scheduled at least once per month (Table 1).

Research activities in Medical Mycology were stated by 11 institutions (46%; clinical microbiology, $n = 6$; epidemiology, $n = 7$; clinical, $n = 6$; pharmacology, $n = 2$). Nineteen centres (79%) reported participation in clinical industry-sponsored Infectious Disease research; 12 (50%) had a working cooperation with a Clinical Trial Department (ZKS, Zentrum für klinische Studien) and 15 (63%) had access to support by a clinical study office within their department. Participation in study networks of professional societies was reported by most centres with variable distribution as to the specific medical societies, ranging from 38% to 67%. Local research cooperations included, in descending order, microbiology, basic research, pathology, pharmacology and radiology (58% to 33% of centres, respectively). Eighteen

centres (75%) reported scientific publications in Medical Mycology with a median of 18 publications during the five-year period between 2014 and 2018 (Table 2).

Local, in-house laboratory capability for fungal identification and fungal susceptibility testing (method not specified) offered in most instances by the Medical Microbiology departments was confirmed by all 24 institutions; testing of galactomannan was reported to be available in 23 (96%), of cryptococcal antigen in 21 (88%), of β -D-Glucan in nine (38%) and of panfungal and *Pneumocystis jirovecii* PCR in 21 and 22 centres (88% and 92%), respectively. Therapeutic drug monitoring (TDM) of voriconazole was available in 15 (63%) institutions with a turnaround of ≤ 24 h during weekdays in 10 (42%). In-house capacities for computed tomography (CT) and magnetic resonance imaging (MRI) were stated to be existent in all but one institution. Two of the 24 University medical centres (8%; one centre with a separate Medical Mycology department) reported ECMM Diamond Excellence status (Table 3).

4 | DISCUSSION AND CONCLUSIONS

Considering the limitations inherent to data capture by means of a questionnaire and the coverage of only two thirds of the existing academic University Medical Centers, the results of this survey show the inconsistent establishment of Infectious Disease departments and Training Programs at German University Medical Centers, a low number of specialised Medical Mycology departments, but an encouraging number of clinical or laboratory-based Medical Mycology working groups with research activities in this field. While Infectious Disease consultation services seem to exist in all institutions, their continuous availability is limited similar to the frequency of regularly scheduled multidisciplinary Infectious Disease conferences. Along with the advent of matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry (MALDI-TOF-MS), identification of fungal pathogens with subsequent susceptibility testing are available at all institutions, and modern antigen- and molecular-based laboratory diagnostic and appropriate imaging studies in the majority of them.

TABLE 1 Institutional structure, training, consultation service and conferences in the 24 centres

	Number (n) ^a	%
Infectious Disease Department	13	54
Medical Mycology Department	2	8
Infectious Disease Working Group	19	79
Medical Mycology Working Group	9	38
Infectious Disease- trained Department Head	18	75
Infectious Disease Training Program offered	16	67
Infectious Disease consultation service	24	100
24 h/7 days	7	29
Telephone hotline	11	46
Internet presence	14	58
Multidisciplinary Infectious Disease conference	13	54

^afor analysis, a response of 'no' and 'unknown' was considered as one category.

TABLE 2 Mycology research activities, clinical trial infrastructure, participation in study networks and local project cooperations in the 24 centres

	Number (n) ^a	%
Mycological research activities (clinical/laboratory)	11	46
Industry-sponsored infectious disease research	19	79
Cooperation with Clinical Research Department ^b	12	50
Access to a departmental study office	15	63
Participation in study networks		
DMYKG	11	46
PEG	11	46
ECMM	9	38
Fungiscope [®] registry	16	67
AGIHO	11	46
Local research cooperations:		
Microbiology	14	58
Pharmacology	9	38
Pathology	10	42
Radiology	8	33
Basic research	11	46
Publications in Medical Mycology 2014-2018	18	75%
	<i>Median 19, R 1-130</i>	

Abbreviations: AGIHO, Working Group Infections in Hematology and Oncology by the German Society for Hematology and Oncology (DGHO); DMYKG, German-speaking Mycological Society; ECMM, European Congregation for Medical Mycology; PEG, Paul-Ehrlich Society for Chemotherapy.

^afor analysis, a response of 'no' and 'unknown' was considered as one category.

^bZentrum für Klinische Studien (ZKS).

Nevertheless, there are apparent deficits in the availability and practical usefulness of TDM that is strongly recommended during treatment with certain antifungal agents.

Although the fact that the questionnaire was not returned for all centres limits the validity of the data, a final response rate of 67% is quite acceptable for a voluntary survey¹⁹ and it remains open whether no response after three reminders reflects disinterest in the topic, lack of time, information overflow or selective networking. Further limitations of the study were the lack of inclusion of paediatric medicine and unavoidable, no consideration of structural changes potentially implemented after 2019 in the wake of the COVID-19 pandemic.

Despite all potential limitations, the results of the survey indicate the continuing need to strengthen Infectious Disease in German academic medicine and to improve the availability of multidisciplinary expert mycological support.^{20,21} Diagnosis, management and control of Infectious Diseases are not limited to laboratory diagnostics,

TABLE 3 Diagnostic laboratory and further diagnostic capabilities in the 24 centres

	Number (n) ^a	%
Fungal identification and resistance testing	24	100
<i>Galactomannan antigen</i>	23	96
<i>Cryptococcal antigen</i>	21	88
<i>Beta-D-Glucan</i>	9	38
<i>Panfungal PCR</i>	21	88
<i>Pneumocystis PCR</i>	22	92
<i>Pneumocystis IFT</i>	16	67
TDM of voriconazole available	15	63
turnaround of ≤24 h during weekdays	10	42
CT/MRI capabilities in-house	23	96
Designation as ECMM Center	2	8

Abbreviations: CT, computed tomography; ECMM, European Congregation for Medical Mycology; IFT, immunofluorescence test; MRI, magnetic resonance imaging; PCR, polymerase chain reaction; TDM, therapeutic drug monitoring.

^afor analysis, a response of 'no' and 'unknown' was considered as one category.

hospital hygiene and antimicrobial stewardship measures but requires a holistic multidisciplinary approach delivered by a physician that has direct patient contact and responsibility. As stated by others, strengthening academic Infectious Diseases in Germany requires the long-overdue formal establishment of a subspecialty of Infectious Diseases in Internal Medicine and Pediatrics by the Federal Chamber of Physicians and the creation of academic positions in University Medicine to bolster research and teaching.²² In this respect, we are pleased to communicate that, as a first and essential step, the Federal Chamber of Physician has approved a separate 72 months specialty training in internal medicine and Infectious Diseases at its 124th Annual Meeting from 4 May to 5 May 2021.²³

Apart from stronger support and recognition of the National Reference Centers at the Leibniz Institute for Natural Product Research and Infection Biology and the University of Würzburg, as well as the two consiliary laboratories at the Robert Koch Institute and the Charite University Berlin^{17,24,25} and strengthening the networking among experts, current avenues to enhance Medical Mycology support for academic centres and patients include the ongoing ECMM initiative to elaborate guidelines for diagnosis and management of fungal diseases, the creation of formally audited ECMM Excellence Centers and the ECMM Expert Consultation Service for medical centres.^{10,26,27} It is to be hoped that these initiatives will lead to improved delivery of Medical Mycology support and ultimately, improved prevention and management of invasive fungal diseases in immunocompromised and severely ill patients.

ACKNOWLEDGEMENTS

The authors acknowledge the essential contribution of the following collaborators of the Medical Mycology at German Academic

Medical Centres (MMGAMC) Study Group (in alphabetical order): Sören L. Becker, Homburg; Christoph Berg, Tübingen; Gerlinde Egerer, Heidelberg; Helmut Fickenscher, Kiel; Beatrice Grabein, München; Beate Gruener, Ulm; Susanne Hauswaldt, Lübeck; Jürgen Held, Erlangen; Winfried Kern, Freiburg; Hans-Jürgen Laws, Düsseldorf; Thomas Lehrnbecher, Frankfurt; Christoph Lübbert, Leipzig; Peter Rath, Essen; Bernd Salzberger, Regensburg; Enrico Schalk, Magdeburg; Stefan Schwartz, Berlin; Gerda Silling, Aachen; Christoph Spinner, München; Maria Vehreschild, Frankfurt; Marie von Lilienfeld-Toal, Jena; Michael Weig, Göttingen.

CONFLICTS OF INTEREST

OAC reports grants and personal fees from Actelion, Amplyx, Astellas, Basilea, Cidara, Da Volterra, F2G, Gilead, MedPace, Merck/MSD, Pfizer, Scynexis; grants from DFG (German Research Foundation), German Federal Ministry of Research and Education, Immunic, Janssen, Medicines Company, Melinta Therapeutics; personal fees from Allegra Therapeutics, Al-Jazeera Pharmaceuticals, Biocon, Biosys, CoRe Consulting, Entasis, Grupo Biotoscana, IQVIA, Matinas, Menarini, Molecular Partners, MSG-ERC, Mylan, Nabriva, Noxxon, Octapharma, Paratek, PSI, Roche Diagnostics, Seres, Shionogi; others from Wiley (Blackwell); outside the submitted work. Other authors: None to be declared.

AUTHOR CONTRIBUTIONS

Andreas H. Groll: Conceptualization (lead); Data curation (lead); Formal analysis (lead); Funding acquisition (lead); Investigation (lead); Methodology (lead); Project administration (lead); Resources (lead); Software (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing-original draft (lead); Writing-review & editing (equal). **Kathrin Gordon:** Conceptualization (equal); Data curation (supporting); Formal analysis (supporting); Funding acquisition (equal); Investigation (equal); Methodology (equal); Project administration (lead); Resources (equal); Software (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing-original draft (supporting); Writing-review & editing (supporting). **Dieter Buchheidt:** Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Validation (supporting); Writing-review & editing (supporting). **Birgit Willinger:** Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Validation (supporting); Writing-review & editing (supporting). **Werner J. Heinz:** Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Validation (supporting); Writing-review & editing (supporting). **Oliver Kurzai:** Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Validation (supporting); Writing-review & editing (supporting). **Volker Rickerts:** Conceptualization (lead); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting);

Validation (supporting); Writing-review & editing (supporting). **Oliver A. Cornely:** Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Project administration (supporting); Validation (supporting); Writing-original draft (equal); Writing-review & editing (supporting). **Sören L. Becker:** Investigation (supporting). **Christoph Berg:** Investigation (supporting). **Gerlinde Egerer:** Investigation (supporting). **Helmut Fickenscher:** Investigation (supporting). **Beatrice Grabein:** Investigation (supporting). **Beate Grüner:** Investigation (supporting). **Susanne Hauswaldt:** Investigation (supporting). **Jürgen Held:** Investigation (supporting). **Winfried Kern:** Investigation (supporting). **Hans-Jürgen Laws:** Investigation (supporting). **Thomas Lehrnbecher:** Investigation (supporting). **Christoph Lübbert:** Investigation (supporting). **Peter Rath:** Investigation (supporting). **Bernd Salzberger:** Investigation (supporting). **Enrico Schalk:** Investigation (supporting). **Stefan Schwartz:** Investigation (supporting). **Gerda Silling:** Investigation (supporting). **Christoph Spinner:** Investigation (supporting). **Maria Vehreschild:** Investigation (supporting). **Marie von Lilienfeld-Toal:** Investigation (supporting). **Michael Weig:** Investigation (supporting).

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

ORCID

Andreas H. Groll  <https://orcid.org/0000-0003-1188-393X>

Birgit Willinger  <https://orcid.org/0000-0001-7921-5749>

Werner J. Heinz  <https://orcid.org/0000-0002-7833-9202>

REFERENCES

1. Brown GD, Denning DW, Gow NA, Levitz SM, Netea MG, White TC. Hidden killers: human fungal infections. *Sci Transl Med*. 2012;4(165):165rv13.
2. Ruhnke M, Groll AH, Maysen P, Ullmann A, Mendling W, Hof H, Denning DW. Estimated burden of fungal infections in Germany. *Mycoses*. 2015;58(Suppl 5):22-28.
3. von Lilienfeld-Toal M, Wagener J, Einsele H, Cornely OA, Kurzai O. Invasive fungal infections. *Dtsch Arztebl Int*. 2019;116(16):271-278.
4. Cole DC, Govender NP, Chakrabarti A, Sacarlal J, Denning DW. Improvement of fungal disease identification and management: combined health systems and public health approaches. *Lancet Infect Dis*. 2017;17(12):e412-e419.
5. McCarthy MW, Kontoyiannis DP, Cornely OA, Perfect JR, Walsh TJ. Novel agents and drug targets to meet the challenges of resistant fungi. *J Infect Dis*. 2017;216(suppl_3):S474-S483.
6. Perfect JR. The antifungal pipeline: a reality check. *Nat Rev Drug Discov*. 2017;16(9):603-616.
7. White LP, Price JS. Recent advances and novel approaches in laboratory-based diagnostic mycology. *J Fungi (Basel)*. 2021;7(1):41.
8. Donnelly JP, Chen SC, Kauffman CA, et al. Revision and update of the consensus definitions of invasive fungal disease from the European Organization for Research and Treatment of Cancer and the Mycoses Study Group Education and Research Consortium. *Clin Infect Dis*. 2020;71(6):1367-1376.
9. Segal BH, Herbrecht R, Stevens DA, et al. Defining responses to therapy and study outcomes in clinical trials of invasive fungal diseases: Mycoses Study Group and European Organization for

- Research and Treatment of Cancer consensus criteria. *Clin Infect Dis*. 2008;47(5):674-683.
10. Cornely OA, Lass-Flörl C, Lagrou K, Arsic-Arsenijevic V, Hoenigl M. Improving outcome of fungal diseases - guiding experts and patients towards excellence. *Mycoses*. 2017;60(7):420-425.
 11. European conference on infections in leukaemia. Publications. Available at: <http://www.ecil-leukaemia.com/publications.htm>. Accessed May 23, 2021.
 12. Infectious Disease Society of America: practice guidelines. Available at: https://www.idsociety.org/practice-guideline/practice-guidelines/#/date_na_dt/DESC/0/+/. Accessed May 23, 2021.
 13. Global Action Fund for Fungal Infections (GAFFI): our vision - a world free from death and suffering caused by fungal disease. Available at <https://www.gaffi.org/>. Accessed May 23, 2021.
 14. United Nations Global Marketplace: support the development of the WHO fungal priority pathogens list of public health importance. Request for Proposals (RFP) Bid Reference AMR/GCP/2020/8. Available at <https://www.ungm.org/Public/Notice/115405/>. Accessed May 23, 2021.
 15. Deutschsprachige Mykologische Gesellschaft e.V. (DMYKG). <https://www.dmykg.de/>. Accessed May 23, 2021.
 16. Paul-Ehrlich-Gesellschaft für Chemotherapie e.V. (PEG) - Sektion Antimykotische Chemotherapie. <https://www.p-e-g.org/sektion-antimykotische-chemotherapie.html>. Accessed May 23, 2021.
 17. Konsiliarlabor für Kryptokokkose und seltene Systemmykosen. Robert Koch Institut (RKI), Berlin: [https://www.rki.de/Content/Infekt/NRZ/Cryptococcus/Cryptococcus_node.html;jsessionid=88C6E41A953BDDFDCC9E4D7A395D1B69.internet111](https://www.rki.de/DE/Content/Infekt/NRZ/Cryptococcus/Cryptococcus_node.html;jsessionid=88C6E41A953BDDFDCC9E4D7A395D1B69.internet111). Accessed May 23, 2021.
 18. Verband der Universitätsklinika in Deutschland (VUD): Übersicht der Universitätsklinika in Deutschland. <https://www.uniklinika.de/die-deutschen-universitaetsklinika/uebersicht-der-universitaetsklinika/>. Accessed January 17, 2019.
 19. QuestionPro: Rücklaufquoten bei Online-Umfragen: Definition, Berechnung, Einfluss-parameter & Best Practices. <https://www.questionpro.group/responsequote-ruecklaufquote-online-umfrage/>. Accessed May 23, 2021.
 20. Ben-Ami R, Halaburda K, Klyasova G, Metan G, Torosian T, Akova M. A multidisciplinary team approach to the management of patients with suspected or diagnosed invasive fungal disease. *J Antimicrob Chemother*. 2013;68(suppl 3):iii25-iii33.
 21. Janssen NAF, Brüggemann RJM, Reijers MH, et al. A multidisciplinary approach to fungal infections: one-year experiences of a center of expertise in mycology. *J Fungi (Basel)*. 2020;6(4):274.
 22. Walger P, Faetkenheuer G, Herrmann M, Liese J, Mertens T. Infektionsmedizin: Klinische Expertise fördern. *Dtsch Arztebl*. 2017;114:A-948/B-793/C-775.
 23. 124. Ärztetag (Online) 04. bis 05.05.2021. Beschlussprotokoll. <https://www.bundesaeztekammer.de/aerztetag/124-deutscher-aerztetag-2021-als-online-veranstaltung/beschlussprotokoll/>. Accessed 23 May, 2021.
 24. Nationales Referenzzentrum für Invasive Pilzinfektionen (NRZMyk), Institut für Hygiene und Microbiologie, Universität Würzburg. <https://www.nrz-myk.de/home.html>. Accessed May 23, 2021.
 25. Nationales Konsiliarlabor für Dermatophyten, Institut für Mikrobiologie und Infektionsimmunologie, Charité Universitätsmedizin Berlin. https://imh.charite.de/leistungen/konsiliarlabor_dermatophyten/. Accessed May 23, 2021.
 26. Hoenigl M, Gangneux JP, Segal E, et al.; European Confederation of Medical Mycology (ECMM). Global guidelines and initiatives from the European Confederation of Medical Mycology to improve patient care and research worldwide: new leadership is about working together. *Mycoses*. 2018;61(11):885-894.
 27. Koehler P, Denis B, Denning DW, et al.; European Confederation of Medical Mycology (ECMM). European confederation of medical mycology expert consult-an ECMM excellence center initiative. *Mycoses*. 2020;63(6):566-572.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Groll AH, Gordon K, Buchheidt D, et al; The Medical Mycology at German Academic Medical Centers (MMGAMC) Study Group. State of Medical Mycology at German Academic Medical Centres: A Survey of the German-Speaking Mycological Society (DMYKG) and the Paul-Ehrlich-Society for Chemotherapy (PEG). *Mycoses*. 2021;64:1177-1182. <https://doi.org/10.1111/myc.13346>