

# Whitepaper: Training in Diagnostic and Interventional Breast Radiology

## Whitepaper: Weiterbildung in der bildgebenden und interventionellen Mammadiagnostik

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### ABSTRACT

**Purpose** Breast imaging represents an integral part of radiology and is subject to strict quality controls. Regarding this, precise diagnostics including multimodal assessment by mammography, sonography, and MRI, including image-guided biopsy and localization procedures, is often decisive and must be performed by experts with profound knowledge and skills in all of these procedures.

However, due to numerous restructurings, breast imaging has been shifted more and more towards large, specialized centers, resulting in less patient exposition and training opportunities for radiologists in smaller sites. The following whitepaper summarizes the current circumstances and discusses opinions of the participating societies.

**Materials** Under the leadership of the German Roentgen Society (DRG) and with the participation of the DRG's AG Mammadiagnostik, the CAFRAD (Chefarztforum Radiologie), the KLR (Konferenz der Lehrstuhlinhaber für Radiologie e. V.), the DRG's Forum Junge Radiologie (FJR) and the Berufsverband der Deutschen Radiologen e. V. (BDR), possible solutions were discussed and consented for a structured training in breast radiology in the future.

**Results** In addition to the teaching provided at the primary workplace, qualified training should be ensured through flexible, multi-institutional, interdisciplinary, and cross-sectoral collaboration. Furthermore, the integration of online case collections and close cooperation with certified breast cancer centers and mammography screening units is recommended. It is indispensable that online courses and case collections adhere to the standards of the national societies and include a maximum of one third of the required cases.

**Conclusion** In order to provide training in breast radiology at a high professional level, a paradigm shift with closer cooperation of all participants is necessary. This includes close collaboration of the breast imaging societies with the federal medical associations to establish new teaching concepts like e-learning in the training schedule of radiologists.

### Key points

- Breast diagnostics is an integral part of radiology training.
- Due to recent restructurings, smaller training centers have difficulties in meeting the case numbers demanded by the Specialist Training Regulations (WBO). Improved integration of the new structures and their adaptation to the needs of education are necessary to guarantee standardized high-quality training of young radiologists.
- The integration of certified case collections enables quality-assured training, even across regions in online-based formats. In accordance with the “blended learning principle”, up to one-third of the required number of patient studies can be substituted with cases from a certified case collection.

- Legally secured short- and medium-term internships may complement training in radiology.

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## ZUSAMMENFASSUNG

**Hintergrund** Die Mammadiagnostik stellt einen integralen Bestandteil der Radiologie dar und unterliegt strengen Qualitätskontrollen. Dabei ist eine präzise Diagnostik durch multimodale Befunderhebung mittels Mammografie, Sonografie und MRT unter Einschluss bildgestützter Biopsie- und Markierungsverfahren oftmals entscheidend und muss durch Expert:innen mit Kenntnissen und Fertigkeiten in allen diesen Verfahren zusammengeführt werden. Aufgrund zahlreicher Veränderungen der Versorgungsstrukturen ist die Mammadiagnostik jedoch zunehmend in Richtung großer, spezialisierter Zentren verlagert worden, wodurch Engpässe im Rahmen der Weiterbildung in der Erlangung von Fallzahlen in der Breite der Weiterbildungsstätten entstehen. Das vorgelegte Whitepaper fasst zunächst die Rahmenbedingungen zusammen und stellt Positionen der beteiligten Fachgesellschaften dar.

**Methode** Unter Leitung der Deutschen Röntgengesellschaft (DRG) wurden mit Beteiligung von Vertreter:innen der AG Mammadiagnostik der DRG, des CAFRAD (Chefarztforum Radiologie), der KLR (Konferenz der Lehrstuhlinhaber für

Radiologie e. V.), des Forum Junge Radiologie (FJR) der DRG und des Berufsverband der Deutschen Radiologen e. V. (BDR) Lösungsansätze diskutiert und konsentiert, die in Zukunft für die Weiterbildung in der Mammadiagnostik bedeutend sein werden.

**Ergebnisse** Neben der etablierten Weiterbildung an der primären Weiterbildungsstätte soll durch flexible einrichtungs-, fachdisziplin- und sektorenüberschreitende Weiterbildungs-k Kooperationen sowie Integration von Fallsammlungen und engerer Zusammenarbeit von Weiterbildungsstätten mit Brustzentren und Mammografiescreening-Einheiten eine qualifizierte Weiterbildung sichergestellt werden. Unverzichtbar ist, dass Kurse und Fallsammlungen in Kooperation mit den wissenschaftlichen Fachgesellschaften und in Einklang mit deren Standards erstellt werden, insbesondere wenn die Bearbeitung solcher Fallsammlungen anteilig auf die Weiterbildung angerechnet werden soll. Der Schwerpunkt der Weiterbildung muss weiterhin in der Patientenversorgung erfolgen. Maximal ein Drittel der in der Muster-Weiterbildungsordnung (M-WBO) geforderten Fälle sollen durch ein Training anhand einer zertifizierten Fallsammlung möglich sein.

**Schlussfolgerungen** Um die Weiterbildung in der Mammadiagnostik weiterhin auf hohem fachlichem Niveau zu gewährleisten, ist ein Paradigmenwechsel mit einer engeren Zusammenarbeit aller Beteiligten sowie Offenheit von Landesärztekammern und Fachgesellschaften für neue Weiterbildungskonzepte notwendig.

## Rationale

For decades now, imaging and interventional procedures have played a prominent role in the screening, treatment planning, and follow-up care of breast cancer, the most common malignant tumor in women.

Mammography-based screening for women at normal risk of developing breast cancer is now established in developed countries, resulting in a 20 % reduction in mortality as proven in studies [1, 2]. In Germany, mammography screening has been performed nationwide since 2005. Multimodal findings derived from various imaging procedures (mammography, ultrasound, MRI), including image-guided biopsy and marking procedures, are crucial for precise diagnosis as well as for treatment planning; this information needs to be brought together by experts with knowledge and skills in all of these procedures. Besides routine screening, these procedures are also used in the curative setting, especially in symptomatic women, in screening of high-risk patient cohorts, and in follow-up care after breast cancer treatment. This makes breast diagnostics an integral part of radiology.

In order to meet the requirements of a population-based screening program as well as providing adequate curative breast diagnostics and assuring quality of care in breast centers, modern breast diagnostics are subject to stringent standards relating to structure, process, and outcome quality. With regard to curative

mammography in certified breast centers, quality assurance measures include participating in the case collection reviews of the Associations of Statutory Health Insurance Physicians, and/or a requirement for each reporting physician to perform at least 500 mammograms per year. This ensures both a high quality standard and continuous development of knowledge beyond specialist training.

Having screening in the outpatient sector performed by radiology practices and medical centers with a focus on breast health has led to the development of increasing competency at these facilities. The high qualification requirements, with regular training and vetting of radiologists involved in mammography screening, as well as the high volume of mammography and ultrasound examinations and interventions performed for screening and diagnostics, have led to an increasing concentration of specialist expertise at screening units over the past 15 years or so. Many screening radiologists deal almost exclusively with breast diagnostics. In addition, for many patients who have undergone treatment for breast cancer, it is quite logical to have follow-up diagnostics performed at or in conjunction with the institution where their disease was first diagnosed and treated. As a result, patients are increasingly moving away from practices that are not involved in screening and hospitals that do not have certified breast centers.

In the context of specialist training, this has contributed to a drop in case numbers in the inpatient, outpatient, and curative settings. This is especially true for hospitals that do not have a breast cancer center. Moreover, the requirements for certified breast cancer centers with regard to the volume of mammography examinations can often only be met through additional qualification or quality assurance measures and/or collaboration with other institutions. Some large hospitals now also have declining numbers of examinations in breast diagnostics; as a consequence, they may no longer be able to comply with the guideline figures set out in the Specialist Training Regulations (WBO).

This inevitably conflicts with the goal of providing high-quality continuing education and training for all medical professionals; in the long term, it even jeopardizes the assurance of high quality that has previously been achieved in the screening units, because most young professionals continue to receive their specialist training in hospitals. The challenges outlined above can only be overcome by adopting suitable approaches to ensure the ongoing delivery of education.

In this whitepaper, we first summarize the existing framework for specialist training in imaging and interventional breast diagnostics. We then go on to formulate the positions of German radiology on breast diagnostics case collections, training courses, and internships in the context of specialist training, from the perspective of the German Roentgen Society (DRG) and the Berufsverband der Deutschen Radiologen e. V. (BDR). Finally, we highlight perspectives that will be significant in the future for specialist training in breast diagnostics.

This whitepaper was prepared by the Breast Diagnostics Working Group of the DRG, CAFRAD (Chefarztforum Radiologie), the KLR (Konferenz der Lehrstuhlinhaber für Radiologie e. V.), the DRG Young Radiology Forum (FJR), and the Berufsverband der Deutschen Radiologen e. V. (BDR).

## Breast Diagnostics in the Specialist Training Curriculum of the DRG

In addition to the Model Specialist Training Regulations (M-WBO), a specialist training curriculum for radiology was established for the first time in 2021; this was developed by the management board of the Young Radiology Forum (FJR) and the FJR Specialist Training Task Force, in cooperation with working groups of the German Roentgen Society, the German Society for Interventional Radiology and Minimally Invasive Therapy, the Society for Pediatric Radiology, the German Society for Neuroradiology, the Academy for Continuing Medical Education in Radiology, and the management board of the German Roentgen Society [3]. The specialist training curriculum was developed with reference to the European training curriculum [4] as well as the existing M-WBO of the German Medical Association [5], in the aim of preparing physicians for specialist practice. It comprises specialist learning objectives for imaging in differential diagnostics and interventional radiology, as well as learning objectives relating to cooperation and communication. In contrast to the WBO, the specialist training curriculum of the FJR is not mandatory. It is intended to provide guidance on training for both trainees and potential exam candi-

dates, and to define requirements for specialist knowledge. This curriculum expressly “neither affects nor supplements the content of the specialty training regulations issued by the State Chambers of Physicians” [3].

In terms of content, the specialist training curriculum for radiology is organized according to organ systems and corresponds to the requirements of the M-WBO. The curriculum also includes separate modules on the topics of “scientific work and teaching”, “IT”, “communication and interdisciplinary collaboration”, “radiation protection”, and “technology”. The learning objectives were divided into “cognitive and methodological competences” (knowledge) and “practical competence” (skills and experience). Each organ system is dealt with in a module, with learning objectives that have been developed in cooperation with the relevant working groups of the German Roentgen Society. Cross-references to other overarching modules are intended to optimize networked learning and facilitate a holistic understanding of how different organ systems work together; where applicable, these appear underneath the individual learning objectives.

Module 12 deals with breast diagnostics. The learning objectives were formulated and revised by the Specialist Training Curriculum Task Force of the FJR, in cooperation with the management board of the DRG Breast Diagnostics Working Group. Under the umbrella term “cognitive and methodological competences”, learning objectives that must be achieved in order to attain the status of a specialist physician have been compiled for the subfield of breast diagnostics. In addition to basic knowledge of breast anatomy and physiology, these include knowledge of imaging and multimodal breast diagnostics, including determining the indication for imaging and minimally invasive diagnostics, performing the imaging technique, and monitoring medical quality when delegating to non-medical staff, as well as the topics of breast cancer and breast cancer screening, clinical management in breast diagnostics, and a basic knowledge of breast interventions.

The umbrella term “practical competence” comprises the learning objectives that address practical skills and experience. These include learning objectives with a focus on patient management, basic skills in breast findings, and interventional breast diagnostics. The trainee should be able to perform the expected skills independently, at least under supervision.

In any case, depending on the focus of individual specialist training facilities, in-depth training in individual modules is also available, and the proposed learning objectives serve merely as an optional aid to orientation.

## Organization of Specialist Training in Imaging and Interventional Breast Diagnostics

Specialist Training in radiological breast diagnostics is regulated by two separate legal frameworks. Under the German Medical Association, which is the national federal body, formal requirements for obtaining the title “Specialist in Radiology” are regulated by the specialist training regulations (WBO) of the respective State Chambers of Physicians. The WBO of the individual State Chambers of Physicians are essentially based on the Model Specialist Training Regulations (M-WBO), which are decided on by the man-

agement board of the German Medical Association based on resolutions made at the German Medical Assembly (Deutsche Ärztag), and recommended to the State Chambers of Physicians for adoption. The second legal framework concerns protection against damage from ionizing radiation. These regulations are based on the radiation protection legislation (currently: Radiation Protection Act (*Strahlenschutzgesetz*) [6]; formerly: Atomic Energy Act with the administrative regulations of the current Radiation Protection Ordinance (*StrSchV*), or the former X-Ray Ordinance (*RöV*)), and the specialist guidelines derived from these regulations. In contrast to the WBO, this legal framework is unified at the federal level, and is also implemented under federal supervision.

In the M-WBO of 2018, in the version of 25 June 2022 [5] that is current at the time of writing this publication, radiologists are expected, under the section “*Breast Imaging*”, to demonstrate the practical ability to “*determine the indication, perform the imaging technique, and present the findings for all imaging and image-guided interventional (...) procedures on the breast*”; it provides a guideline figure of 1,500 imaging examinations, although, as in the previous WBO, no specification is made as to the modalities. The guideline number of imaging examinations has been reduced by 500 compared to previous versions of the M-WBO. Additional qualification in non-radiological disciplines (i. e., gynecology), as provided for in the previous M-WBO (specialized radiological diagnostics: breast) is no longer envisaged in the new M-WBO. All 17 State Chambers of Physicians have implemented the M-WBO under their own terms with regard to the guideline number of examinations. Three WBOs provide for additional qualification (in the field of gynecology), specific to the state in question, under the heading “Specialized radiological diagnostics of the breast”. The states in question are the federal states of Baden-Württemberg and Berlin, as well as the state of Lower Saxony where, as a special case, the additional qualification for mammography stipulated in the old WBO continues to apply for a temporary period. Guideline figures for the additional training in mammography vary between 0 (!) and 500 examinations.

The “Guideline on Specialist Skills and Knowledge in Radiation Protection in the Operation of X-Ray Facilities in Medicine or Dentistry” issued by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) [7], which is valid at the time of writing this publication, defines 500 documented examinations over a minimum period of 12 months as the minimum requirement for the acquisition of expertise in the field covered by the section *X-Ray 3.4 Breast*. For specialist training in radiology with the minimum numbers specified above, the section *X-Ray 3.4 Breast* forms part of the expertise covered under the section *X-Ray 1 Overall field of radiological diagnostics including computed tomography (CT)*. Usually, the State Chambers of Physicians require physicians to have acquired the expertise stipulated in the *X-Ray 1* section before they are granted the specialist title.

The requirements of the chamber-specific WBOs and the federal guideline on specialist knowledge in radiation protection are implemented in hospitals, medical practices, and medical centers, in which specifically designated persons are authorized to provide continuing education or specialist training in radiation protection. With regard to teaching of the breast-specific content of the WBO

and the specialist guideline, various options are implemented depending on the structure of the facility and volume of examinations:

- Specialist training in breast diagnostics provided solely at the primary specialist training institution.
- Specialist training through rotation, temporary assignment to different positions, or internships in a unit that performs a sufficient volume of breast diagnostics services, i. e., in another clinical department (for example, specialist training in sonography at a women’s health clinic with the corresponding division of work between radiology and gynecology), another hospital, another medical practice or medical center, or in the context of diagnostics in a mammography screening unit. However, during the screening process, only specially trained and duly certified physicians may collect the findings.
- Mixed models (specialist training provided partly at the primary specialist training institution, and partly at another institution).
- Making up the guideline number of examinations through instructed and supervised completion of case collections (either internally at the specialist training institution or as part of a training course).

The WBO allows for some flexibility in specialist training, as the guideline number of examinations can be achieved via a free mix of modalities. The target number of examinations can also be achieved through trainees being actively involved in documented second opinion findings. By actively involving trainees in the preparation and running of multidisciplinary boards on breast diagnostics, in which the relevant findings from imaging examinations performed outside of the facility are usually discussed, examination numbers at certified breast centers can be further boosted if external imaging is documented as secondary findings performed under supervision.

## Breast Diagnostics Case Collections

The case collections available to date have mostly been produced through the efforts of individual specialist training institutions, and are therefore only available locally. They are not subject to any higher quality control, and recognition in the context of specialist training is usually dependent on personal agreements. For example, after individual consultation, case collections can also be counted in the context of specialist training at mammography screening reference centers.

Triggered mainly by the COVID-19 pandemic, increasing digitalization in radiology is evident not only in terms of diagnostic possibilities, but also plays an increasingly important role in specialist training. This development has continued even after the repeal of the infection protection measures, with a high level of acceptance of both purely online formats and hybrid formats in continuing education and training. While courses for students were switched to an online format early on in the context of the pandemic, and this has been partially retained, the benefits of digitalization in terms of continuity can also be transferred to the specialist training of trainees. This enables standardized training concepts to be implemented at a high quality level regardless of

place and time, for example in the form of case collections. These may focus on different aspects at different time points during the training process. If put in place early, they enable independent learning with a focus on problem-solving. By reflecting on mistakes and working them out at their own pace, trainees are given the opportunity to develop their own clinical approach. At an advanced stage in specialist training, case collections offer an opportunity to consolidate existing knowledge as well as the possibility of parallel processing for clinical use, especially in the case of primarily online formats [8, 9]. In addition, case collections offer controlled exposure to relatively rare but relevant differential diagnoses, which helps to expand the trainee's specialist skills.

Once a case collection of this kind has been created and professionally reviewed, it represents a quality-assured supplement to specialist training which is relatively economic in terms of time and human resources, especially if central access can be provided online across the different regions in the case of digital formats. Certified case collections should not make up more than one third of the required number of cases according to the WBOs. Practical interventional experience as well as interaction with teachers, which is difficult to deliver in digital form, should be provided through on-site training or in combination with complementary in-person training courses. In principle, this combination of educational methods is referred to as the “blended learning” model [10].

Similarly, complementary hands-on courses can help trainees to develop their skills in greater depth.

The Breast Diagnostics Working Group of the DRG has defined the following quality assurance criteria for case collections of this kind:

#### Professional requirements:

- The cases must be prepared such that they can be worked through independently by a trainee. If necessary, explanations adapted to the level of specialist training should be added.
- Each case must include a medical history specifying the patient's age, symptoms, and, if applicable, the clinical examination findings, as well as the patient's personal history or history of risk.
- The cases must be obtained from curative mammography or from screening (including high-risk screening) and prepared according to specialist standards.
- With regard to the desired pathologies, rare cases should also be included.
- The current BI-RADS catalog (currently in the 5<sup>th</sup> edition) serves as a basis for structured reporting, and the spectrum should be covered.
- A multimodal approach is desirable.

#### Technical requirements:

- The case images should be provided in DICOM format. If it is not possible to pseudonymize ultrasound examinations in DICOM format for technical reasons, in order to assure data protection, they must be added to the platform in JPEG format with the patient data concealed.
- One case deals with only one patient, but can include several examinations.
- The creator's copyright on the publication must be demonstrated in each case.

Requirements with regard to quality assurance:

- Histological confirmation or a minimum follow-up of two years must be available for all of the findings collected.
- The case collection must state how the cases have been divided according to the individual categories of the BI-RADS catalog.
- The case collection must be certified by the DRG in accordance with publicly available criteria.
- On completion of the case collection, a certificate is issued. The number of patient cases actually worked through is recorded through so-called “digital footprinting” and certified on the certificate.
- It is recommended to supplement the case collection with a presentation on the basics of the currently applicable BI-RADS catalog.

A case collection with 500 cases and an integrated module on the basics of multimodal breast diagnostics has been available on the DRG teaching and learning platform, named “conrad”, since November 2021; this case collection was professionally designed by the Institute of Diagnostic and Interventional Radiology of the University Hospital Würzburg [11]. Working through this case collection is recognized by the Bavarian State Chamber of Physicians as part of the specialist training at the Institute for Diagnostic and Interventional Radiology of the University Hospital Würzburg, and further recognition may be granted on request. Ongoing efforts are being made to extend recognition across different regions.

A key point of the requirements of the Bavarian State Chamber of Physicians is that trainees should not incur personal fees through their participation in the program, and that a relevant proportion of the specialist training should continue to be provided on-site through personal contact at the specialist training institution. In addition, with a “blended learning” model, there is the possibility for remote attendees to interact directly with the speakers at an in-person event.

## Specialist Training Collaborations

The BDR has long called for potential collaborations under the WBO to be defined in order to cover content that specialist training institutions are unable to offer in individual cases or to an adequate extent (cooperative education model), and to extend the authorization for providing specialist training to include this model. The State Chamber of Physicians of Schleswig-Holstein accepts collaborations of this kind, and has set out the relevant requirements in a technical note [12]. It distinguishes between internships and rotations. In the case of internships, trainees work at another institution for a maximum period of three months, without the host institution necessarily having to have its own specialist training authorization. This means that knowledge of mammography can also be imparted, for example, in the context of diagnostics performed in screening units or reference centers, even if these facilities do not have authorization to provide specialist training for the entire specialty. In the case of internships, the trainee's primary training institution bears responsibility for the specialist training, and confirms that it has been accomplished on the basis of an internship certificate.



In the case of rotations, on the other hand, specialist training takes place over a period of more than three months at a cooperating facility which must have physicians who are authorized to provide specialist training.

In both cases, cooperation agreements must be concluded for this purpose and submitted to the State Chambers of Physicians so that the training hours and case numbers are accepted when the trainee applies for approval to sit the examination to qualify as a specialist. These cooperation agreements must, in particular, specify the institution in which the trainee is employed during the rotation or internship, and must ensure that there is adequate liability insurance covering this period and the trainee's specialist training activities.

The BDR offers assistance in finding suitable cooperation partners and drafting the cooperation agreement. Proposed models for the necessary cooperation agreements are also available from the DRG (e. g., the DeGIR model contract).

Criteria agreed upon by the DRG and the BDR for specialist training internships in breast diagnostics are listed below.

Criteria for specialist training internships in breast diagnostics:

- Conclusion of an internship/cooperation agreement.
- Recommended duration: 3 months.
- Internship facilities should be authorized to provide specialist training\*, i. e., they should be either:
  - Radiology departments in clinics/breast centers with high case numbers or medical practices offering curative breast diagnostics, or
  - Screening units.
- For internships in screening units: trainees must participate in diagnostics, with documented case numbers.
- For internships in screening units and in breast centers: participation and documented active presentation of findings at interdisciplinary case conferences, with documentation of the numbers of the cases discussed.
- Where specific case numbers are certified according to the WBO or specialist guidelines, it must be verified that the interns presented their own findings under supervision (and performed examinations in the case of ultrasound).

## Continuing Education and Training Courses

Traditional courses in breast diagnostics serve to supplement on-site training and certified case collections at a regional and trans-regional level. These are organized by the scientific societies or through a professional organizer. In recent years there has been increasing development of online models in this area, often enabling participants to benefit from flexibility in terms of time and location. Educational courses in breast diagnostics essentially serve the following purposes, depending on which stage of training phase they are designed for:

- Preparatory instruction and systematics of imaging and interventional breast diagnostics,

- Interactive training on breast imaging findings and learning the diagnostic algorithms,
- Deepening and reinforcing the trainee's existing knowledge shortly before sitting the examination to qualify as a specialist.

Systematic courses can also include cases prepared for educational purposes that can be discussed interactively, as well as case collections enabling the acquisition of the minimum case numbers required under the WBO.

Another opportunity for continuing education and training is offered by the European Society of Breast Imaging (EUSOBI), which mainly offers courses relating to a particular modality. However, the EUSOBI courses differ greatly with regard to the proportion of individual work on cases versus attendance of frontal lectures.

Recognition of the abovementioned events has so far only been possible in the form of CME points, provided that the organizer has applied to the relevant State Chamber of Physicians for the recognition of CME points. The recognition of practical case numbers in the context of the WBO is at the discretion of the respective State Chamber of Physicians, on application by the course participants. Which courses will be recognized by the chambers, as well as the maximum number of individual cases that may be recognized, should be clarified in advance on submission of the course program.

For the recognition of courses in the context of the WBO, certain requirements are supposed to be met: the group size should allow for participants to receive personal support and properly address questions concerning the cases, and the courses should be interactive. Cases should be in digital format and should be presented according to the criteria for case collections outlined above. Monitors with sufficient screen resolution should be available to the participants (ideally these should be radiology monitors) in order to simulate a real-life working situation. The trainees should work through the cases independently and then discuss them with the supervisors.

## Perspectives

Over the past 15 years or so, there has been a significant increase in the diagnostic quality of imaging and interventional breast diagnostics due to technical advances, a high degree of standardization, and an increasing concentration of expertise in specialized units (especially screening units and certified breast cancer centers). This has an impact, among other things, on staff development and filling of senior specialist positions in radiology units in the curative setting as well as in screening units. The changes in patient numbers due to the concentration of competence at particular facilities require a paradigm shift in radiology training. Going forward, there will be fewer and fewer specialist training institutions able to offer traditional education that meets the requirements with regard to the stipulated training content and case numbers. This applies to breast diagnostics as well as some other subspecialties of radiology. Health policy efforts to rearrange the landscape by allowing certain services to be provided only by certain service providers, in the interests of achieving

\* As determined in consultation with the relevant State Chamber of Physicians; in some cases, this may include facilities that are not authorized as providers of specialist training.

better management of care, especially in the hospital sector, will only continue to lead to the increasing concentration of breast diagnostics at certain institutions.

In order to adopt a “new way of thinking” for specialist training in breast diagnostics, there needs to be a collaboration between providers of specialist training, including State Chambers of Physicians, professional associations, mammography screening units, organizers of educational courses, and, of course, the trainees themselves; this collaboration must be focused on outcomes and able to go beyond the traditional approaches. In particular, the following will be required in order to achieve the necessary paradigm shift in radiology training in breast diagnostics:

- Willingness of providers to cooperate flexibly so as to deliver specialist training collaboratively across different institutions, disciplines, and sectors. This also requires the willingness of employers, such as teaching hospitals, to provide funding and leave of absence so as to enable their employees to go on courses and complete internships. The funding of such courses and internships must be seen as a joint responsibility that should not be attributed solely to the trainee’s primary specialist training institution.
- Willingness of more mammography screening units to actively participate in specialist training, not least in order to generate their own future medical talent. As in other areas of medical education, financial support from the associations of statutory health insurance physicians would be desirable. In this case, it would be useful, for example, to set up rotation sites according to the abovementioned criteria.
- Closer collaboration on specialist training in breast diagnostics between mammography screening units and breast cancer centers.
- Significantly increased willingness of the State Chambers of Physicians to accept new forms of specialist training (also in the form of model trials), as described in this whitepaper. This applies in particular to the acceptance of case collections as making a substantial contribution to the guideline figures on case numbers set out in the WBO, as well as recognition of shorter specialist training internships.
- Closer cooperation between course organizers and creators of case collections, with a willingness to agree on standards developed by the scientific professional society.

This whitepaper describes possible actions aimed at achieving the necessary paradigm shift in specialist training for breast diagnostics. Actively implementing these actions will ensure that radiological care with imaging and interventional breast diagnostics can continue to be provided at a high qualitative and quantitative level in the future. This will make it possible to meet future challenges, in particular the increasing volume of services in radiological breast diagnostics due to the planned expansion of the screening eligibility age, and the generation change that is taking place in breast center radiology clinics and in senior positions at many mammography screening units.

In the coming years, the content of breast diagnostics will continue to evolve. The value of procedures such as tomosynthesis, MR mammography, and artificial intelligence in mammography screening is the subject of intensive research. Today, therapeutic

advances have already had an impact on imaging and interventional breast diagnostics, which are increasingly personalized, specialized, and predominantly multimodal. This development will continue. Overall, in future there will be more work in the field of breast radiology, not less. The radiology sector is called on to act now to modernize specialist training, so as to create the conditions that give the next generation of radiologists the tools they need to ensure that radiology continues to make an important contribution to the diagnosis and treatment of breast cancer.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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