

Research

Role of Radiological Technologists in the DORA Screening Programme

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Abstract:

Breast cancer is one of the most common malignant diseases among women worldwide and represents a major public health problem, with increasing incidence, particularly in developed countries, despite advances in diagnosis and treatment. Early detection through organized screening programs is crucial, as it significantly reduces breast cancer mortality and enables diagnosis at earlier, more treatable stages, thereby improving survival and quality of life. In Slovenia, the national breast cancer screening program DORA provides biennial mammography for women aged 50–69 and operates according to European quality guidelines, ensuring standardized procedures, quality control, and equitable access to screening services. Radiographers play a central role in the DORA program, as their professional responsibilities directly influence image quality, patient safety, diagnostic accuracy, and overall program effectiveness. Beyond the technical execution of mammography, radiographers are responsible for patient preparation, communication and psychological support, radiation protection, quality assurance, and continuous professional development, all of which are essential for the success of organized breast cancer screening.

Keywords: Breast cancer; Mammography; DORA screening program; Radiographer; Screening in Slovenia

1. Introduction

Breast cancer is one of the most common malignant diseases among women and represents a significant public health problem in Slovenia and worldwide (Sung et al., 2021; Zadnik et al., 2025). According to the World Health Organization (2026), breast cancer is the leading cause of cancer-related death among women in many countries, with incidence rising especially in developed countries. This increase is partly due to longer life expectancy, lifestyle changes such as diet and physical activity, and improved access to diagnostic procedures (Sung et al., 2021).

Despite advances in diagnosis and treatment, breast cancer continues to cause high morbidity and mortality, particularly when detected at later stages. Statistics from Slovenia indicate that approximately 1,500 to 1,600 women are diagnosed with breast cancer each year, mostly over the age of 50, while around 400 women die annually from the disease (Zadnik et al., 2025; Program DORA, Onkološki inštitut Ljubljana, 2019). These data highlight the need for effective preventive and screening measures. Early detection of breast cancer is crucial for reducing the impact of the disease, improving survival rates, and enhancing patients' quality of life. Organized mammography screening enables earlier detection of breast cancer and reduces breast cancer mortality, because tumors can be detected at earlier, more treatable stages. (Perry et al., 2008).

In modern healthcare systems, organized screening programmes are among the most important preventive measures for early detection of breast cancer. In Slovenia, this role is fulfilled by the national screening programme DORA, which offers women regular mammographic examinations every two years. The programme is designed according to European quality guidelines and is based on the principles of accessibility, professionalism, and safety (Jarm et al., 2021; Perry et al., 2008). DORA is not just a technical implementation of mammography; it is a comprehensive system that includes central management, systematic patient invitations, quality control, staff training, and multidisciplinary collaboration. In this context, radiographers play a key role, as their work directly impacts image quality, patient safety, diagnostic accuracy, and the overall success of the programme (Perry et al., 2008).

The aim of this article is to present the role of the radiographer in breast cancer screening programs, with a particular focus on the Slovenian DORA program. It will highlight the professional, technical, and ethical aspects of their work, describe their tasks, responsibilities, and challenges, and emphasize the importance of continuous education and professional development for ensuring a high-quality and effective screening program (ISRRT, 2018; ESR, 2019).

2. Breast cancer as a public health problem

2.1. Breast cancer worldwide

Breast cancer is one of the most common malignancies among women worldwide and represents a significant health burden. According to the World Health Organization (2026), breast cancer is the most frequently diagnosed cancer in women and one of the leading causes of cancer death globally. More than two million women are diagnosed each year, and over 680,000 die from the disease. Breast cancer incidence is increasing in many countries, particularly in developed nations, due to longer life expectancy, lifestyle changes, and improved access to diagnostics (Sung et al., 2021). Despite the rising incidence, mortality is gradually decreasing in many countries, mainly due to effective organized screening programmes and advances in treatment, including tailored surgical procedures, hormonal and targeted therapies, and combined treatment protocols (Smith et al., 2017). Early detection of breast cancer is crucial, as it improves the chances of cure and reduces the need for aggressive therapies. Statistical analyses show that five-year survival for women with early-stage breast cancer is significantly better than for those with advanced disease, confirming the importance of organized screening programmes (Smith et al., 2017; Perry et al., 2008).

2.2. Epidemiology of breast cancer in Slovenia

Slovenia is among the countries where breast cancer is the most common form of cancer in women. According to the Slovenian Cancer Registry, 1,510 individuals were diagnosed with breast cancer in 2022, including 1,502 women and 8 men. In the same year, 434 women and 6 men died from breast cancer. Breast cancer accounts for approximately 20% of all

new cancer cases among Slovenian women, consistent with data from the European Cancer Registry. Trends over recent decades show increasing incidence alongside improved five-year survival, partly due to early detection through screening programmes (Zadnik et al., 2025). Most breast cancer cases occur in women over 50, while the disease is rare among younger women (Program DORA, Onkološki inštitut Ljubljana, 2019). Mortality from breast cancer remains high, but the proportion of deaths is gradually decreasing, reflecting advances in diagnostics, better access to modern therapies, and the success of organized screening programmes such as DORA (iPAAC Joint Action, 2021; Zadnik et al., 2025).

3. Organized breast cancer screening programs

3.1. Purpose and objectives

Organized breast cancer screening programmes are designed for early detection in asymptomatic women. Early detection allows for increased chances of cure, reduced mortality, reduced need for aggressive treatment, and improved quality of life. The objective of screening programmes is to systematically and uniformly examine the target population, ensuring equal access to diagnostics and reducing the risk of late-stage detection (Perry et al., 2008).

3.2. Structure of organized screening

Organized screening programmes include central management and coordination, systematic patient invitations for screening, mammography with quality control, monitoring of results and follow-up procedures, and staff education and training. In Slovenia, this role is entrusted to the DORA program, which operates according to European quality guidelines and involves interdisciplinary collaboration among radiologists, radiographers, nurses, pathology laboratories, and screening organizers (Perry et al., 2008; ESR & EFRS, 2019).

4. National breast cancer screening program DORA

4.1. Establishment and organization

The national breast cancer screening programme in Slovenia, DORA, was introduced in 2008 to provide a systematic and effective approach to screening. Breast cancer has long been the most common cancer among women in Slovenia, with approximately 1,500–1,600 women diagnosed each year, mostly over the age of 50. This underscores the importance of organized preventive measures for early detection and successful treatment (Zadnik et al., 2025).

The DORA programme was developed based on recommendations from the European Commission for quality breast cancer screening and on experiences from other countries, which have shown that well-organized programmes significantly reduce breast cancer mortality and increase the proportion of early-stage detections (Perry et al., 2008). Following this model, the programme is centralized, with a semi-autonomous coordinating unit at the Institute of Oncology Ljubljana, where the multidisciplinary coordination team is based. Standard Operating Procedures (SOPs) and quality indicators are prepared by the advisory board and followed by all screening units (Jarm et al., 2021).

The programme is managed by the Institute of Oncology Ljubljana in close collaboration with the National Institute of Public Health (NIJZ) and the Ministry of Health, ensuring professional and administrative coordination nationwide. DORA operates through 16 healthcare providers, three additional locations managed by the Institute of Oncology Ljubljana, and three mobile units (Hertl et al., 2025).

Key principles of DORA include:

1. Central management, which ensures uniformity and transparency nationwide;
2. Standardized professional protocols, which guarantee reliable and comparable mammography examinations;
3. Regular quality control, including technical equipment checks, image analysis, and performance monitoring;
4. Systematic patient invitations, which increase participation and ensure regular screening.
5. Special attention is given to the standardization of procedures, including:

6. Technical quality of mammography images;
7. Staff competence;
8. Proper handling of positive results and follow-up diagnostics.

This organization allows for comparability of results nationally and within the EU, while ensuring equal access to early detection for all women, regardless of location or socioeconomic status (Perry et al., 2008). DORA is more than a technical screening programme; it represents a comprehensive public health system that combines modern technology, skilled personnel, education, and patient awareness. Its performance is evaluated through participation rates, quality indicators, early cancer detection, and long-term outcomes, including the expected impact on breast cancer mortality (Jarm et al., 2021; iPAAC Joint Action, 2021).

4.2. Target population and screening procedure

The target population for DORA consists of women aged 50–69, as this group has the highest risk of breast cancer and screening is effective for early detection (Program DORA, Onkološki inštitut Ljubljana, 2019). The Slovenian screening target group includes approximately 280,000 women. The programme was operating in all Slovenian screening regions by the end of 2017, while nationwide rollout was completed by the end of 2019 (Jarm et al., 2021). The participation rate between 2008 and 2020 was 74.0%, with approximately 600 breast cancers detected annually (iPAAC Joint Action, 2021). Each woman is invited for mammography every two years through a centralized registry (Jarm, 2018). Screenings are conducted in stationary facilities and mobile units, ensuring accessibility for women in remote areas. Mobile units are equipped with state-of-the-art digital mammography technology, providing the same high quality as clinical settings (Zadnik et al., 2025). Participation exceeds 70%, meeting European criteria for effective mortality reduction (Perry et al., 2008). Monitoring indicators such as positive result rates, additional examinations, and early tumor detection allow continuous programme improvement. The programme includes follow-up mechanisms for non-responding women, increasing overall participation and ensuring no population segment is missed (Perry et al., 2008).

4.3. Program objectives

The main objectives of DORA are:

1. Reducing breast cancer mortality: Early tumor detection increases treatment success and reduces deaths (Zadnik et al., 2025).
2. Increasing early-stage detection: Early cancer detection improves prognosis, reduces the need for aggressive treatment, and enables tracking of tumors ≤ 2 cm or without lymph node involvement (Jarm et al., 2021).
3. Ensuring equal access: Screenings are available regardless of residence, social, or economic status, which is crucial for fairness and public health effectiveness (Perry et al., 2008).
4. Additionally, DORA promotes awareness and informed participation through personal invitations, information leaflets, reminders, and direct communication with eligible women (Jarm et al., 2021).
5. Continuous monitoring, quality indicator analysis, and strategy adaptation allow DORA to remain dynamic, integrate new technologies, respond to epidemiological trends, and meet the needs of the target population (Jarm et al., 2021; iPAAC Joint Action, 2021).

5. Radiographer as a professional profile

A radiographer is a higher-education healthcare professional who combines technical knowledge with medical expertise. Education covers radiological technology, anatomy, pathology, physiology, and radiation protection, enabling safe and high-quality diagnostic procedures such as mammography (ISRRT, 2018). Radiographers' work requires a high level of professional responsibility, precision, and ethical conduct. Every image must meet strict quality standards, as technical errors can affect diagnostics and patient health. In screening programmes like DORA, this is especially important, as early detection is crucial for thousands of women (ISRRT, 2018).

5.1. Radiographer's responsibilities in DORA

Radiographers play a key role in DORA, influencing mammography quality, patient safety, and programme effectiveness. Their responsibilities include patient preparation, performing mammography, radiation protection, communication, psychological support, quality monitoring, multidisciplinary collaboration, and continuous professional development (Hertl et al., 2025).

5.2. Patient reception and preparation

The first contact between the patient and the radiographer is crucial for the successful performance of the examination and for ensuring a positive patient experience. The radiographer welcomes the patient, verifies her identity, and collects relevant information such as age, medical history, previous procedures, and the presence of breast implants or wounds (Perry et al., 2008). The radiographer then explains the entire mammography procedure, including the expected duration, the positions the patient will need to assume, and what she can expect during image acquisition. This approach helps reduce uncertainty and fear, which may otherwise affect the patient's cooperation and, consequently, the quality of the images (Hertl et al., 2025).

It is also important for the radiographer to review any previous mammographic images, as this allows for comparison and improves diagnostic accuracy. This reduces the risk of false findings and enables earlier detection of potential changes (Perry et al., 2008). During patient reception, the radiographer must also provide reassurance and emotional support, especially if the patient is undergoing her first mammography or has previously received positive findings. This includes a brief supportive conversation, during which the patient can express any concerns or fears. Such a personalized approach increases patient trust and cooperation, which is directly reflected in the quality of the examination (Whelehan et al., 2013).

5.3. Mammography execution

Mammography requires precision and technical expertise. Radiographers are responsible for correct patient positioning to achieve optimal image quality, selecting technical parameters (kV, mA, exposure time, filters), and adapting procedures to individual patients (considering age, breast size, implants, and previous surgeries). Image quality largely depends on the radiographer's expertise; poor images can result in misdiagnosis or repeat scans, increasing radiation exposure and reducing programme effectiveness. Radiographers identify artifacts or errors and make necessary adjustments. They also consider patient comfort and pain sensitivity, ensuring both technical quality and a positive experience (Perry et al., 2008).

5.4. Communication and psychological support

An empathetic approach by the radiographer is crucial in reducing patients' stress and discomfort. For many women, mammography can be an unpleasant and sometimes frightening experience; therefore, effective communication is essential for their cooperation and for obtaining high-quality images. The radiographer explains to the patient the course of the examination, its duration, how and when the results will be communicated, and the subsequent steps in the case of a positive finding. In addition to providing this information, the radiographer offers psychological support, helps reduce fear related to the disease and potential procedures, and ensures that the patient feels safe and respected. A good relationship between the radiographer and the patient increases trust and regular participation in the screening programme, which is essential for the effectiveness of early breast cancer detection (Whelehan et al., 2013).

The radiographer also monitors the emotional state of patients, identifies those who are particularly anxious or distressed, and, when necessary, provides more detailed explanations or calming communication. This approach is not only ethically important but also directly influences the technical quality of the examination, as a relaxed patient can be positioned more easily and correctly (ESR & EFRS, 2019).

6. Quality assurance and radiation protection

Radiographers ensure image quality and patient safety by regularly calibrating and maintaining equipment, complying with national and European standards, and

monitoring technical parameters to achieve optimal image quality with minimal radiation dose. Radiation protection follows the ALARA principle (As Low As Reasonably Achievable) (ZVISJV-1, 2018). Radiographers also oversee protective equipment and document radiation exposure. Internal quality controls and image reviews ensure that every image is diagnostically useful, requiring accuracy and systematic attention (ESR & EFRS, 2019).

6.1. *Quality assurance in DORA*

Quality is essential for program effectiveness, as accurate mammograms enable early detection. Quality assurance includes:

1. Equipment and image checks: Regular technical inspections and calibration, verifying contrast, sharpness, and positioning. Poor images are identified and repeated (ESR & EFRS, 2019).
2. Image quality analysis: Internal and external audits, comparison, repeat statistics, technical parameter review, and pathology detection. Radiographers directly influence these analyses (Hertl et al., 2025).
3. Continuous education: Training and workshops on new technologies, standards, and patient safety (ISRRT, 2018).
4. Systematic indicator monitoring: Participation, early tumor detection, and additional exams are tracked, with radiographers assisting in data collection and analysis (Hertl et al., 2025; Perry et al., 2006).

7. **Ethical and legal aspects**

Radiographers' work is guided by ethical and legal standards to ensure patient safety, confidentiality, and rights:

1. Equipment and image checks: Regular technical inspections and calibration, verifying contrast, sharpness, and positioning. Poor images are identified and repeated (ESR & EFRS, 2019).
2. Image quality analysis: Internal and external audits, comparison, repeat statistics, technical parameter review, and pathology detection. Radiographers directly influence these analyses (Hertl et al., 2025).
3. Continuous education: Training and workshops on new technologies, standards, and patient safety (ISRRT, 2018).
4. Systematic indicator monitoring: Participation, early tumor detection, and additional exams are tracked, with radiographers assisting in data collection and analysis (Hertl et al., 2025; Perry et al., 2008).

8. **Challenges and future developments**

DORA continues to evolve, presenting new challenges and opportunities:

1. Technological advancement: Future developments in DORA include the potential expansion of tomosynthesis and artificial intelligence, which may require updates to protocols and additional professional training (iPAAC Joint Action, 2021; Hertl et al., 2025).
2. Increasing number of screenings: High participation increases workload and requires effective time management while maintaining quality (Hertl et al., 2025; Zadnik et al., 2025).
3. Continuous professional development: Ongoing training ensures adherence to best practices (ISRRT, 2018; ESR & EFRS, 2019).
4. AI integration: AI may assist in image analysis, but radiographers remain essential for quality imaging, safety, and interdisciplinary collaboration (ESR & EFRS, 2019).
5. Interdisciplinary skills: Modern radiographers combine technical knowledge, communication skills, quality assurance, and teamwork, contributing to safe and high-quality patient care (Perry et al., 2006; ESR & EFRS, 2019).

DORA is not just a screening programme but also an opportunity for professional development, with radiographers playing a pivotal role in early detection and quality healthcare (Hertl et al., 2025).

9. Discussion and conclusion

Radiographers are indispensable in DORA, as their professional work directly affects image quality, patient safety, and early detection outcomes. Their role goes beyond technical execution to include patient preparation, optimal imaging, radiation safety, psychological support, and multidisciplinary collaboration. DORA exemplifies a systematic public health intervention, where central management, standardized protocols, quality monitoring, and high participation rates achieve the goals of reducing mortality, enabling early detection, and ensuring equitable access. Radiographers play a key role in realizing these objectives in practice (Perry et al., 2008; Jarm et al., 2021; Hertl et al., 2025).

Future challenges such as digital tomosynthesis, artificial intelligence, and advanced diagnostics will further transform radiographers' roles, requiring ongoing education, protocol adaptation, research involvement, and the development of communication and psychological skills (Smith et al., 2017; ISRRT, 2018). Ethical and legal conduct, including adherence to ethical principles, data protection, and informed consent, strengthens trust and participation in DORA (Perry et al., 2008). Maintaining high programme quality depends on the integration of expertise, technology, organization, and the human factor. Radiographers connect all these elements, ensuring effective and safe programme operation (ISRRT, 2018). Continued investment in education, quality assurance, and new technologies may help maintain high screening standards and support the long-term effectiveness of the DORA programme (Jarm et al., 2021; Hertl et al., 2025).

In conclusion, radiographers are not merely technical operators but are a cornerstone of DORA, whose contribution to early detection is vital for the health of Slovenian women. DORA demonstrates how coordinated collaboration among professionals, technology, and public health organization can lead to measurable improvements in breast cancer control (Jarm et al., 2021).

Conflicts of Interest: The authors declare no conflict of interest.

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