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The Concerning Lack of Mammography in the Early Detection of Breast Cancer in Romania

A Cross-Sectional Analysis of 2,500 Patients Diagnosed with Breast Cancer

Alexandru Blidaru[1,2], Maria-Teodora Popa[1,2]*, Octav Ginghină[1,2], Bogdan Severus Gașpar[1,3], Teodora-Mihaela Peleașă[1,2], Mihaela Năstase[1,2], Andreea Preda[1,2], Cristian Bordea[1,2]

[1]Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
[2]Department of Surgical Oncology, Prof. Dr. Al. Trestioreanu, Institute of Oncology, Bucharest, Romania
[3]Department of General Surgery, Clinical Emergency Hospital Bucharest, Romania

***Corresponding author:**
Maria Teodora Popa, MD
Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
Department of Surgical Oncology
Prof. Dr. Al. Trestioreanu Institute of Oncology, Bucharest, Romania
Șos. Fundeni, 252, 022328
Bucharest, Romania
E-mail: maria-teodora.popa@drd.umfcd.ro

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Rezumat

Lipsa îngrijorătoare a utilizării mamografiei în depistarea precoce a cancerului mamar în România. Studiu observațional transversal pe un lot de 2.500 de paciente

Introducere: Cancerul mamar este cea mai frecventă boală neoplazică în rândul femeilor şi totodată una dintre principalele cauze de mortalitate la nivel mondial. Screeningul mamografic reduce semnificativ mortalitatea prin cancer mamar prin depistarea precoce a bolii. Un program de screening organizat consituie o strategie eficientă ce determină reducerea mortalității şi îmbunătățirea calității vieții pacientelor. În prezent, România nu dispune de un sistem de screening funcțional, bazat pe invitație activă, sistematizată, iar datele naționale privind utilizarea mamografiei sunt limitate şi insuficient caracterizate.
Materiale şi Metode: A fost analizată o cohortă de 2500 de femei cu vârste cuprinse între 40 şi 90 de ani diagnosticate cu neoplasm mamar. Studiul s-a desfăşurat în 4 centre medicale din Bucureşti, România: Institutul Oncologic Prof. Dr. Alexandru Trestioreanu, Spitalul Medicover Pipera, Clinica Profmedica şi Clinica CIB Medical, în perioada iunie-decembrie 2025. Informațiile privind efectuarea examenelor mamografice anterior momentului diagnosticului au fost obținute prin susținerea unui interviu structurat, ulterior validat prin consultarea documentelor medicale. Variabilele socio-demografice analizate au fost: vârsta, diomiciliul şi nivelul educațional. Au fost stabilite doua categorii în funcție de statusul mamografic anterior diagnosticului: paciente care nu au efectuat nici o mamografie şi paciente care au efectuat cel puțin o mamografie pe parcursul vieții până la depistarea cancerului. În cazul pacientelor incluse în ce-a de-a doua categorie, a fost înregistrat şi analizat intervalul de timp dintre cea mai recentă mamografie şi momentul diagnosticului.
Rezultate: În total, 76% dintre pacientele studiate nu au efectuat nicio examinare mamografică înainte de stabilirea diagnosticului. Dintre pacientele care au efectuat cel puțin o mamografie, în 37.3% din cazuri, intervalul de timp scurs de la ultima mamografie a fost mai mare de 4 ani. Prin cumularea acestor două subgrupuri, s-a constatat ca 85% dintre pacientele diagnosticate cu cancer mamar, nu au avut o evaluare mamografica recentă, în ultimii 4 ani, care ar fi putut depista boala mai devreme.
Concluzii: Acest studiu evidențiază utilizarea redusă a mamografiei în procesul de

depistare precoce a neoplasmului mamar în Romania prin controale periodice, în cadrul unui screening oportunistic. De aceea, majoritatea cazurilor sunt diagnosticate în momentul apariției semnelor şi simptomelor. Acest fapt demonstrează lipsa de informare a populației generale despre beneficiile unui diagnostic precoce. Din totalul de 2500 de femei cu neoplasm mamar intervievate, 76% nu au efectuat nicio examinare mamografică de-a lungul vieții. În plus, 85% dintre acestea nu au efectuat nicio mamografie în ultimii 4 ani înainte de diagnostic. Dezvoltarea şi consolidarea unor inițiative de informare şi educație medicală sunt esențiale pentru creşterea participării şi pentru îmbunătățirea nivelului de înțelegere populațional a beneficiilor depistării precoce a acestei patologii. Dar chiar folosit pe o scară mai largă, screeningul oportunistic nu poate avea un impact semnificativ la nivel populațional. Reducerea mortalității prin cancer mamar prin diagnostic precoce se poate realiza numai prin implementarea unui program național de screening.

Cuvinte cheie: cancer mamar, mamografie, screening, screening oportunistic, diagnostic precoce

Abstract

Background: Breast cancer is the most common malignancy among women and represents a leading cause of worldwide cancer-related mortality. Mammographic screening substantially reduces breast cancer-specific mortality by enabling its early detection. Organized mammographic screening is recognized as the most effective strategy for early detection, mortality reduction, and for improving quality of life. Romania currently lacks an organized, functional, invitation-based system. National data regarding the utilization of mammography remain limited and poorly characterized.
Materials and Methods: A cohort of 2,500 women aged 40-90 years diagnosed with breast cancer was analyzed. The study was conducted in four medical centers in Bucharest, Romania: the Prof. Dr. Alexandru Trestioreanu Institute of Oncology, Medicover Pipera Hospital, Profmedica Clinic, and CIB Medical Clinic, between June and December 2025. Information regarding mammographic examinations performed prior to diagnosis was obtained through a structured interview and subsequently validated by reviewing medical records. The sociodemographic variables analyzed included age, place of residence, and educational level. Patients were categorized into two groups according to their pre-diagnostic mammography status: those who had never undergone mammography in their lifetime and those who had undergone at least one mammographic examination prior to breast cancer detection. For patients in the latter group, the interval between the most recent mammography and the time of diagnosis was recorded and analyzed.
Results: Overall, 76% of the patients had not undergone any mammographic examination prior to diagnosis. Among those who had undergone at least one mammography, 37.3% had their most recent examination more than four years before diagnosis. When these two subgroups were combined, it was found that 85% of patients diagnosed with breast cancer had not received a recent mammographic evaluation within the four years preceding diagnosis that might have enabled earlier detection of the disease.
Conclusion: This study highlights the limited use of mammography for the early detection of breast cancer in Romania through periodic examinations within an opportunistic screening setting. Consequently, most cases are diagnosed only after the onset of signs and symptoms. This finding reflects insufficient public awareness of the benefits of early detection of this disease. Among the 2,500 women with breast cancer who were interviewed in this study, 76% had never undergone a mammographic examination in their lifetime. Moreover, 85% had not undergone any mammography within the four years preceding diagnosis. The development and consolidation of public information and medical education initiatives are essential to increase participation and improve population-level understanding of the benefits of early detection for breast cancer. However, even when it is widely implemented, opportunistic screening alone is unlikely to achieve a meaningful population-level impact. A reduction in breast cancer mortality through early diagnosis can only be achieved through the implementation of an organized, national screening program.

Keywords: breast cancer, mammography, screening, early detection, opportunistic screening

Introduction

Breast cancer is the most common malignancy among women and represents a leading cause of cancer-related mortality worldwide. Due to its insidious onset in early stages and marked biological heterogeneity, effective management of breast cancer relies on early detection in order to improve survival outcomes and to reduce morbidity (1,2).

Screening is a structured, systematic process based on the application of targeted investigations to individuals who appear clinically healthy and display no symptoms of disease. The main purpose is to discover a condition in its earliest, potentially curable

stage (3). There are two main approaches: organized (population-based) and opportunistic screening. An organized screening program is defined as a process that is implemented at the population level. It consists of the invitation of the eligible individuals at regular intervals, based on predefined criteria. On the other hand, opportunistic screening is defined as an individual process that typically takes place during routine medical encounters or at the patient's request. It is not supported either by centralized invitation systems or by standardized population coverage (4).

Mammography is the gold standard for population-based screening among the currently available imaging techniques for breast cancer diagnosis, and it is implemented in most developed nations. It is a suitable screening method given its widespread availability, consistent methodology, and relatively low costs in contrast to other advanced imaging modalities (3,5). Furthermore, mammography is considered to be a well-tolerated investigation with a favorable safety profile, as radiation exposure levels are minimal compared with the clinical benefits derived from early cancer detection (3).

A reduction of 32% in breast cancer mortality was observed in women who were invited to participate in screening programs. This represents a sustained effect with persistence of nearly two decades, and it was followed by several positive outcomes such as a clear stage shift and a notable downstaging effect, with tumors diagnosed at less advanced stages more frequently (6).

The advantages of mammographic screening are further substantiated by longitudinal survival data. Early-stage detection is known to be associated with a five-year overall survival rate exceeding 90%, whereas advanced-stage disease correlates with exponentially higher mortality and a profound deterioration in quality of life (7).

A functional breast cancer screening program is strongly associated with decreases in breast cancer mortality and more favorable mortality-to-incidence ratios. A global analysis that integrated data from 194 countries between 2015 and 2021 showed that countries with structured screening programs have significantly lower breast cancer mortality and mortality-to-incidence ratios than countries without such programs (8).

These observations highlight that the decreases in breast cancer mortality that were observed in many high-income settings may be linked due to the joint effect of mammographic screening and advances in systemic therapy, with screening contributing by shifting the stage distribution towards earlier, more curable disease (9).

Unfortunately, in Romania, a considerable proportion of breast cancer cases are still diagnosed at advanced stages, despite significant technological progress and growing public awareness. This persistent delay in the process of diagnosing this disease underscores the absence of a nationally organized and functional screening program and points the limited levels of health knowledge and also insufficient patient-initiated engagement in preventive care (10). In the absence of a structured invitation-based screening program, participation relies mainly on individual initiative, personal motivation, and awareness of the risk of developing this disease (11). As a consequence, routine mammographic examination is inconsistent. Proactive screening participation is discouraged by the inadequate public understanding of the benefits of early detection of this disease, coupled with the limited populational health education, contributing to delayed presentation and diagnosis (12,13).

National data regarding the utilization of this imaging technique as a medical check-up method for breast cancer are scarce, and the burden of screening non-participation remains largely unexplored. The aim of this study was to assess the use of mammography in detection of breast cancer in a large cohort of Romanian women and to analyze its connection with key sociodemographic characteristics such as age, educational level and area of residence within a non-organized, opportunistic screening context.

Material and Methods

This retrospective study analyzed, from June 2025 to December 2025, a cohort of 2500 consecutive female patients with confirmed breast cancer originated from across all geographical regions of Romania. Yet, they were diagnosed and treated in Bucharest, Romania, in 4 medical centers: Profesor Doctor Alexandru Trestioreanu Institute of Oncology, Bucharest, Medicover Pipera Hospital, ProfMedica Clinic, and CIB Medical Clinic.

Inclusion Criteria

Female patients aged between 40 and 90 years old, with confirmed breast cancer. Eligibility was independent of tumor histological and immunohistochemical subtype, the area of residence, educational level, hereditary cancer history, germline mutation status, or comorbidities.

Exclusion Criteria

Female patients under 40 years of age. Women

presented with a second primary breast cancer, or with recurrent disease, or those who did not consent to participate in the study.

Structured patient interviews were used to gather all of the data, which were then cross-checked with available medical records. The interview included standardized questions regarding previous mammographic examinations, with a particular focus on the interval between the last mammogram and the date of diagnosis. Response options included 'never' or specification of an interval in years (e.g., 1, 2, 5, and so on). These data reflected individual, non-systematized utilization of mammographic imaging and permitted the stratification of patients into temporal categories reflecting opportunistic imaging uptake.

Variables

Sociodemographic variables

Sociodemographic characteristics of these 2,500 patients were recorded. They included: age at diagnosis, area of residence, and the educational level.

Age at diagnosis represents a continuous variable and was then divided into different age groups in order for a complete descriptive and comparative analyses to be conducted.

The area of residence was classified as either rural or urban according to the patient's permanent residence at the time of diagnosis.

Furthermore, level of education was categorized into three groups: Primary education, Secondary education (high school/vocational school), Higher level of education (university degree/postgraduate studies). It must be noted that this characteristic was self-reported by each patient.

Mammography utilization and timing variables

Patients were classified into two groups: never-screened (women who reported no prior mammographic examination until the diagnosis) and everscreened (women who reported at least one mammography before diagnosis).

Among individuals allocated to the second category, the time interval (in years) between the last mammographic examination and the date of cancer diagnosis was recorded as a variable. It was considered both a continuous numeric variable and a categorical one in order to enable a stratified descriptive profiling. This approach allowed the assessment of a longitudinal screening history rather than limiting the analysis to a "yes/no" indicator of prior mammography.

Outcomes of interest

The primary outcomes of the study were to assess the number of women who had never undergone a mammography before the diagnosis of breast cancer (never-screened), and the number of women who had not received a recent mammographic evaluation within the four years preceding breast cancer diagnosis, which might have enabled earlier detection of the disease. These variables served as the main indicator of the absence of engagement in the process of mammographic screening in Romania.

Secondary outcomes were selected in order to assess disparities and time-related patterns associated with previous mammographic examinations and were subsequently described according to the sociodemographic variables detailed above (age, residence, educational level).

The outcome structure was implemented in order to allow a multidimensional characterization of prior mammographic utilization. More precisely, the primary outcome highlighted the proportion of complete absence of previous mammographic examinations, while the secondary ones provided a framework for evaluation of when and under what circumstances opportunistic screening occurred before diagnosis.

Results

Baseline Characteristics of the Study Population

A total number of 2,500 consecutive female patients diagnosed with breast cancer were included in this analysis. The age distribution of the study population was evaluated first, and patients were stratified into predefined age categories.

This numbers highlighted that most of the cases are between 40 and 70 years of age. Overall, 69% of the subjects were diagnosed between 40 and 70 years of age. Precisely, 673 patients (26.9%) were aged 40-50 years, 542 (21.7%) were aged 50-60 years, and 505 (20.2%) were aged 60-70 years. It was observed that older age groups appeared underrepresented, with 449 patients (18%) with ages between 70-80 years, and 331 (13.2%) between 80-90 years.

The median age of the cohort was 60.7 years, while its mean age was 61.9 years (*Fig. 1*).

Regarding the place of residence, 1,575 patients (63%) belonged to urban areas, while 925 patients (37%) originated from rural areas (*Fig. 2*).

A clear urban predominance emerged across most age strata, particularly within the 40–50-year group (526 urban vs. 147 rural), the 50–60-year group (392 vs. 150), the 60–70-year group (312 vs. 193), and the

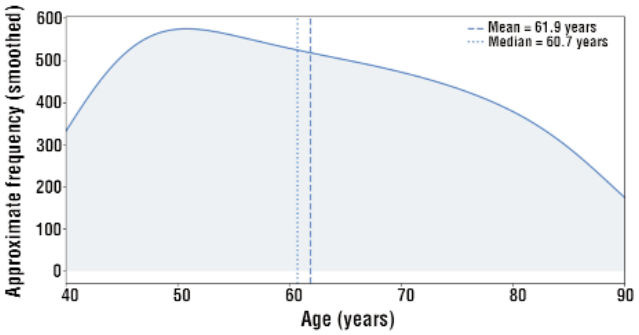

Figure 1. Age distribution

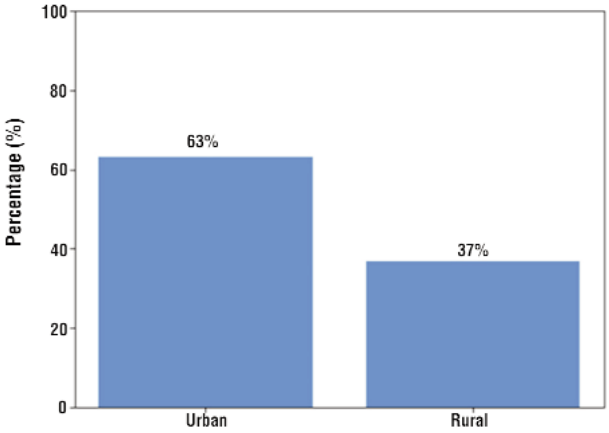

Figure 2. Urban vs rural distribution

70–80-year group (271 vs. 178). The 80–90-year group had a greater proportion of rural patients (257 rural vs. 74 urban) (*Fig. 3*).

Educational background was stratified as high, intermediate or low. Overall, 1,025 women (41%) belong to the first subgroup, 625 (25%) to the second one, and 850 (34%) had a low educational level (*Fig. 4*).

Use of Mammographic Examination Before Diagnosis

A total of 1,900 patients (76%) reported no previous mammographic examinations, while only 600 patients (24%) had a documented history of at least one mammographic examination before diagnosis (*Fig. 5*).

When stratified by age, 466 patients (69.2%) in the 40–50-year group, 401 patients (74.0%) in the 50–60-year group, and 390 patients (77.2%) in the 60–70-year group reported no prior mammo-graphy. In older age categories, 355 patients (79.1%) aged 70–80 years and 288 patients (87.0%) aged 80–90 years had never undergone mammographic examination.

A progressive increase in the proportion of patients without lifetime mammography was observed with advancing age (*Fig. 6*).

Among the 1,575 urban patients, 1,195 (75.9%) had never undergone a mammography examination prior to diagnosis, whereas 380 patients (24.1%) had undergone at least one. Across the 925 rural patients, 705 (76.2%) belong to the no mammography group, and 220 (23.8%) patients reported at least one mammographic examination (*Fig. 7*).

Analysis from the educational point of view showed that out of the 1,025 patients with a high level of education, 740 (72.2%) had never undergone mammography prior to diagnosis, while 285 (27.8%) had undergone at least one examination.

Among the 625 women with intermediate educa-

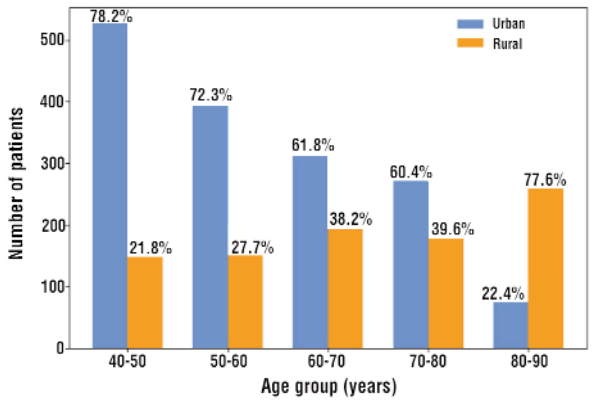

Figure 3. Urban vs rural distribution across age groups

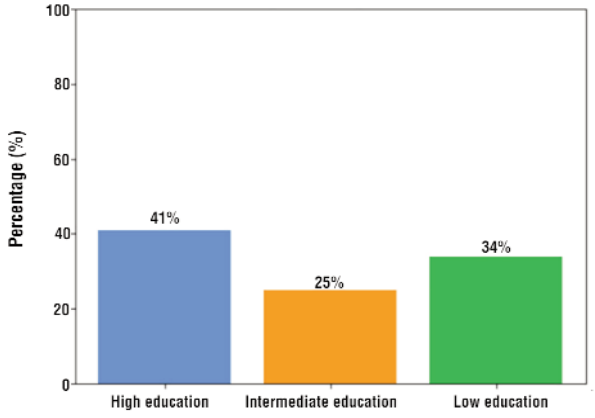

Figure 4. Educational level

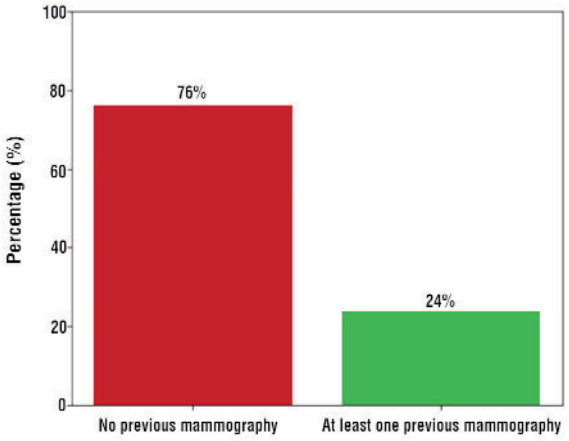

Figure 5. Mammographic examination prior to diagnosis

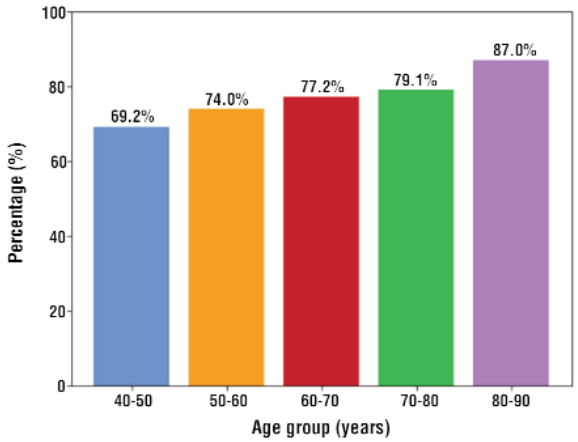

Figure 6. Patients without prior mammography by age group

tional attainment, 400 (64.0%) had no prior mammography, and 225 (36.0%) reported at least one mammographic examination.

In contrast, of the 850 patients with a low educational level, 760 (89.4%) had never undergone mammography prior to diagnosis, whereas 90 (10.6%) had undergone at least one examination (*Fig. 8*).

Of the 600 patients who had undergone at least one mammographic examination prior to diagnosis, 224 (37.3%) had their last mammography more than four years before confirmed disease. When combining these 224 patients with the 1,900 patients who had never undergone mammography, a total of 2,124 patients (85%) had either no prior mammography or had undergone mammography at an interval exceeding four years before diagnosis.

In practical terms, 85% (2125) of the patients included in this study discovered the disease without any recent mammographic examination (*Fig. 9*).

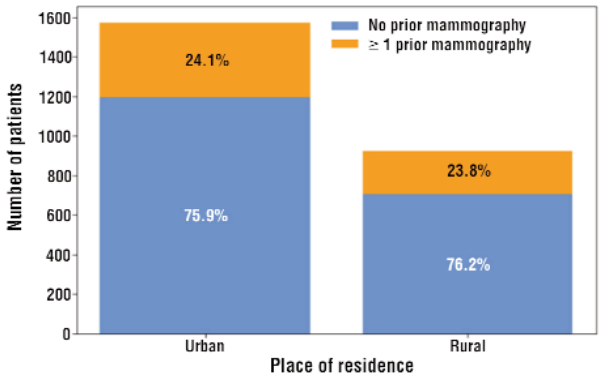

Figure 7. Distribution of prior mammography utilization by residence

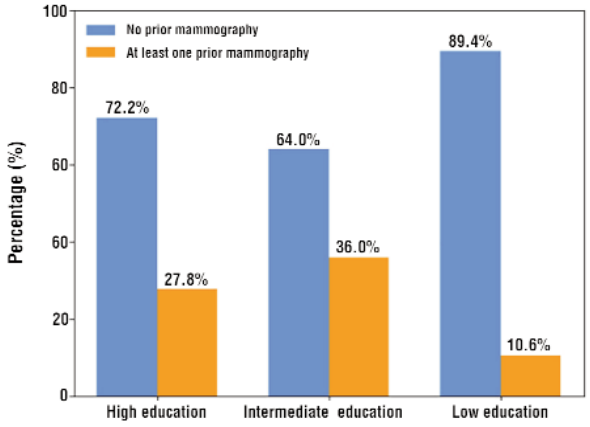

Figure 8. Prior mammography status according to educational attainment

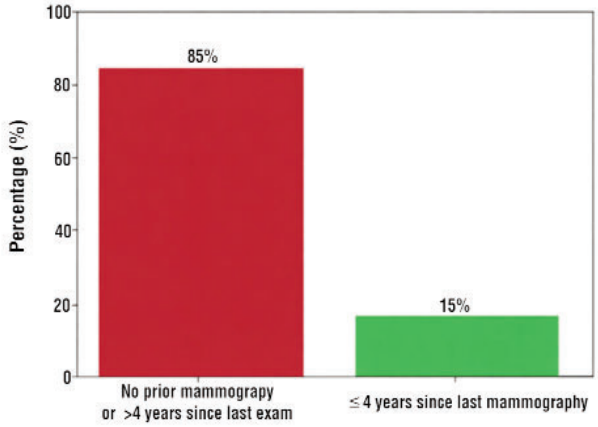

Figure 9. Interval between latest mammography before diagnosis

Discussion

According to the latest global estimates, breast cancer remains the most commonly diagnosed malignancy worldwide. It accounts for approximately 12% of all cancer cases across both sexes and nearly one-quarter (24.5%) of all neoplastic diseases among women (1,14). There were almost 2.3 million new cases of breast cancer diagnosed in women worldwide in 2022, and the disease was responsible for about 670,000 deaths (15).

Romania shows a similar national pattern, with breast cancer being the leading cause of cancer morbidity and also the primary contributor to cancer-related mortality among women patients (16,17). In 2022, almost 13,000 new cases were reported and 4,000 deaths attributable to this neoplasm. The age-standardized incidence rate stated was 69.2 per 100,000 and the age-standardized mortality rate was 16.5 per 100,000. These figures seem lower than those found in Western Europe, but despite this fact, they should be interpreted cautiously because underdiagnosis and the lack of a formal national screening program probably led to a significant underestimating of the actual illness burden (16).

The results of our study point to a critical deficiency in the utilization of mammography in the process of detecting breast cancer. More than three-quarters of women with breast cancer (76%) stated no previous mammographic examination. When analyzing patients whose last imaging investigation was performed more than four years before diagnosis, the proportion increased to nearly 85% of the overall cohort.

The age distribution of our cohort is broadly consistent with international and national breast cancer epidemiology. In our cohort of 2,500 women aged 40–90 years, most of the cases belonged between 40 and 70 years of age (approximately 69%), with an estimated mean age at diagnosis of around 62 years based on grouped data. Despite the fact that our study is not population-based and in consequence it cannot provide official population-based incidence rates per 100,000 individuals, the age structure of our cohort fits remarkably well with both global and Romanian profiles, with the main numbers of cases in the fifth to seventh decades of life.

We analyzed the number of patients who had no mammographic examination in the last four years before diagnosis. During this interval, undergoing this examination might have allowed earlier detection of the disease. When taking these results into account, nearly 85% of the individuals in our cohort reached the time of diagnosis without presenting any recent mammographic imaging. This highlights an important mismatch between the epidemiologic risk of breast cancer onset and the actual implementation of preventing imaging. The age-specific distribution of women with no prior mammography in our series of patients is highly concerning.

Educational level of the individuals is a strong determinant of the participation in cancer screening programs. It was stated that persons presenting higher levels of education attainment were more likely to participate in a screening program rather than those belonging to a lower educational background. On the other hand, the educational gap in participation rates is markedly attenuated in nations with a well-established, organized screening system (18).

In Romania, breast cancer screening participation remains critically low, being strongly shaped by educational and socioeconomic factors. National estimates indicate that only about 9% of women aged 50–69 years reported a bilateral mammographic examination within the last two years in 2019–2020, the lowest level in the EU, compared with a European average of approximately 60 percent (16).

Socio-economic and residential differences are present, but moderate. In high-income women, the screening uptake was reported about 17%, versus 4% in lower-income women subgroup, and 9% in urban compared with 4% in rural residents (19).

Unexpectedly, in this study, the absence of mammographic examinations before confirmed breast cancer was not confined to populations with limited access to preventive services.

Data regarding Romania states that only about 25 to 30 percent of adult women belong to the tertiary education subgroup, with most belonging to the medium one and a substantial minority staying in the low educated group (20,21). In contrast, 41% of individuals in our cohort had higher education.

Despite this favorable educational profile, 72.2% of highly educated women in our study had never undergone mammography prior to diagnosis, and only 27.8% reported at least one mammographic examination. These findings suggest both that the real population-level situation may be even more concerning than reflected by our results, and that our data may define a modest estimate of mammography underutilization in general female population.

Three out of four patients reach the time of diagnosis without ever having undergone a mammographic evaluation, despite having reached the risk age of developing breast cancer.

Romania continues to operate predominantly through opportunistic screening, characterized by limited or inconsistent follow-up for positive cases,

insufficient human resources, and an unequal territorial distribution of specialized services (22).

Between 2019 and 2023, pilot projects that targeted women aged 50-68 years were implemented. Moreover, a framework for regional expansion is thought to have been established, consisting in the transition towards an organized, functional, population-based screening program (23,24). In the absence of a robust infrastructure (call–recall systems, predictable financing, QA mechanisms, and a functional registry), education and urban residence do not automatically translate into service utilization (25).

Taken together, all of the criteria required for a disease to justify population-based screening are fulfilled in the case of breast cancer. It is highly prevalent, and it is associated with significant rates of mortality and morbidity. It is defined by a well-documented preclinical phase that may be detected through specific imaging modalities, and that may be amenable to interventions that yield substantial improvements in survival when initiated at early stages. Moreover, well-defined high-risk age groups exist. The disease has an accepted pathological and biological definition, and screening technology is safe, reproducible, and cost-effective at the population level (26–28). For these reasons, mammographic screening programs are considered the international standard of care, and are currently implemented as organized public health interventions across most high-income countries (29,30). Despite this, Romania has not yet achieved the infrastructural and organizational conditions that are necessary to support a functional, population-based screening program. Consequently, the vast majority of breast cancers are diagnosed outside screening pathways, typically following symptom onset (16,31). The findings of our cohort underscore the magnitude of this situation. Although the age distribution of our 2,500 patients closely mirrored official epidemiologic data and, therefore, did not deviate from what would normally be considered the target screening population, more than three quarters of women had never undergone a mammographic examination prior to diagnosis.

It must be acknowledged that recent evidence highlights that the idea of breast cancer screening may be transitioning to a new paradigm: from the strategies based on the age of the patients towards a personalized risk-based approach. Large randomized studies have been shown that risk-tailored screening is non-inferior to annual mammography, and that it may actually be preventing more deaths and also be reducing false-positive results. Precision screening may become part of the future in standard of care (32).

Conclusions

Breast cancer is a suitable and well-validated target for population-based screening, with early mammographic detection consistently associated with substantial gains in survival and quality of life. In Romania, most of the breast cancer cases are diagnosed when signs and symptoms of the disease appear. This represents the consequence of the absence of an effective, invitation-based national screening program, and also the limited use of opportunistic mammographic screening.

Our study highlights the concerning lack of mammographic examination for early detection of breast cancer.

In a cohort reflecting the age profile of the screening-eligible population with breast cancer, 76% of women had never undergone a mammographic examination prior to diagnosis. Moreover, 85% of the study population had no mammographic examination within the previous four years. This reflects the low adherence of the population for periodic medical controls. Surprisingly, the rate of individuals with no lifetime mammography was even higher among urban and educated women.

Therefore, improving population-level awareness of the role of routine medical check-ups in detecting breast cancer at clinically silent and potentially curable stages is essential. Diagnosis of this disease at early stages provides the following benefits: improved survival, the possibility of avoiding more extensive surgical interventions, and reduced treatment-related morbidity.

At present, Romania relies almost exclusively on opportunistic screening. By design, this model is unable to sustain meaningful reductions in breast cancer mortality. When considering the scenario in which a formal, invitation-based program would be implemented, it would not be expected to yield mortality benefits unless accompanied by sufficiently high participation rates. Furthermore, any measurable effects would become notable only over a period of time following this structured program.

It is indicated by multiple international experiences that a significant reduction in breast cancer mortality becomes measurable only when a minimum of ~70% of the eligible women attend the screening program at the recommended intervals. Therefore, both structural health system reforms and sustained public education efforts are required to ensure that screening implementation will translate into effective cancer control. Medical education and health awareness regarding routine mammographic examinations

represent an important first step that shall be taken before large-scale screening uptake may be achieved.

Authors' Contributions

Conceptualization: Alexandru Blidaru, Maria Teodora Popa; Methodology: Alexandru Blidaru, Maria Teodora Popa, Bogdan Severus Gaşpar; Data collection: Alexandru Blidaru, Cristian Bordea, Andreea Preda; Formal analysis: Alexandru Blidaru, Teodora Mihaela Peleaşă, Mihaela Năstase, Andreea Preda; Writing-original draft: Alexandru Blidaru, Maria Teodora Popa, Teodora Mihaela Peleaşă; Writing - review and editing: Alexandru Blidaru, Maria Teodora Popa, Teodora Mihaela Peleaşă; Supervision: Alexandru Blidaru, Cristian Bordea, Octav Ginghină, Bogdan Severus Gaşpar.

Conflicts of Interest

The authors declare that they have no competing interests.

Ethical Statement

Informed consent was obtained from all participants prior to inclusion in the study. All data were anonymized, and patient confidentiality was strictly maintained.

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