Family Medicine & Primary Care Review 2024; 26(1): 19–25, https://doi.org/10.5114/fmpcr.2024.134699

ORIGINAL PAPERS

ISSN 1734-3402, eISSN 2449-8580

Screening mammography beyond the limit recommended in a Portuguese Primary Care Centre: a cross-sectional study

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary **Background.** Despite the imminent change and controversy around screening mammography, many women are still screened beyond the recommended age.
Objectives. This study aims to characterise these women and to identify factors associated with this decision.
Material and methods. A cross-sectional study including women who attended a Portuguese primary health care centre and who performed at least one mammography after turning 70 from March 2007 until July 2019. Data was collected by accessing the electronic health records.
Results. Among all women who underwent mammography after the age of 50, 5.5% were 70 years of age and older. The main risk factor for breast cancer (BC) identified was the presence of other breast abnormalities (46.3%). Most requests in the screening group were for women under 75 years of age (79.2%) and were performed by the family physician (76.9%). Adherence to the BC national screening programme was lower in the screening group (73.3% vs 84.8%). After logistic regression, age at the time of request (OR = 0.815, 95% CI: 0.720–0.922, p = 0.001) and initiative of the request (OR = 0.176, 95% CI: 0.044–0.707, p = 0.014) of the last mammography added significantly to the model.
Conclusions. Only a small proportion of screening mammographs were performed on women beyond the recommended age limit, which complied with the National Cancer Plan currently implemented in Portugal. Patients' age, presence of arterial hypertension or osteoporosis or hip fracture, number of comorbidities and the initiative of the request may have contributed to the decision to continue screening. Our study provides important clues for understanding factors associated with prolonging BC screening. However, further research is still needed.
Key words: mass screening, mammography, breast neoplasms, women, aged, primary health care.

Barbosa J, Ferreira J, Santos P, Sá L. Screening mammography beyond the limit recommended in a Portuguese Primary Care Centre: a cross-sectional study. *Fam Med Prim Care Rev* 2024; 26(1): 19–25, doi: https://doi.org/10.5114/fmpcr.2024.134699.

Background

With 8,954 new cases and 2,211 deaths estimated in 2022, accounting for 28.2% of all cancers and 15.5% of all cancer-related deaths in women, breast cancer (BC) has become the most frequent cancer and the leading cause of cancer-related mortality among Portuguese women [1].

Despite the imminence of change and controversy concerning screening mammography, the European Council still recommends that women 50 to 69 years of age should undergo BC screening through mammography every two years. However, many women over 70 years of age continue to perform screening mammography [2, 3].

Some observational studies have shown reduced BC mortality associated with mammographic detection in women older than 75 years of age [4, 5]. Furthermore, some modelling studies have estimated a decrease in BC mortality by 6% to 10% if biennial screening was prolonged until age 79 [6].

It has also been acknowledged that screening mammography has a significantly higher sensitivity (80–89 years of age, 86% vs 50–59 years of age, 73%) and specificity (80–89 years of age, 94% vs 50–59 years of age, 92%) in older women. Consequently, false-positive mammographs and false-positive biopsies are less common [7].

However, with increasing age, there is a higher risk of death from other causes, such as cardiovascular or neurologic conditions, which may decrease the probability of dying from a screen-detected BC and reduce the benefit of mammography testing in older women [3, 7, 8]. In addition, older women may suffer the immediate downsides of screening (discomfort, anxiety, side effects of tests and treatment) and not live long enough to experience its benefits [8].

Another problem is overdiagnosis. Overdiagnosis estimates when screening older women range from 1% to 10%, with only a single modelling study stating that the risk of overdiagnosis significantly overtakes the benefits of screening at the age of 90 [7].

Several guidelines support screening mammography in older women unless each woman's comorbid conditions limit life expectancy. Nevertheless, it is possible that having more comorbid illnesses increases women's appointments with a family physician (FP), therefore increasing the opportunities to use preventive care [9].

Even though it is unlikely that women with a life expectancy of fewer than ten years experience a reduction in mortality from screening mammography, many women with a complex comorbidity burden still receive routine mammograms after the rec-

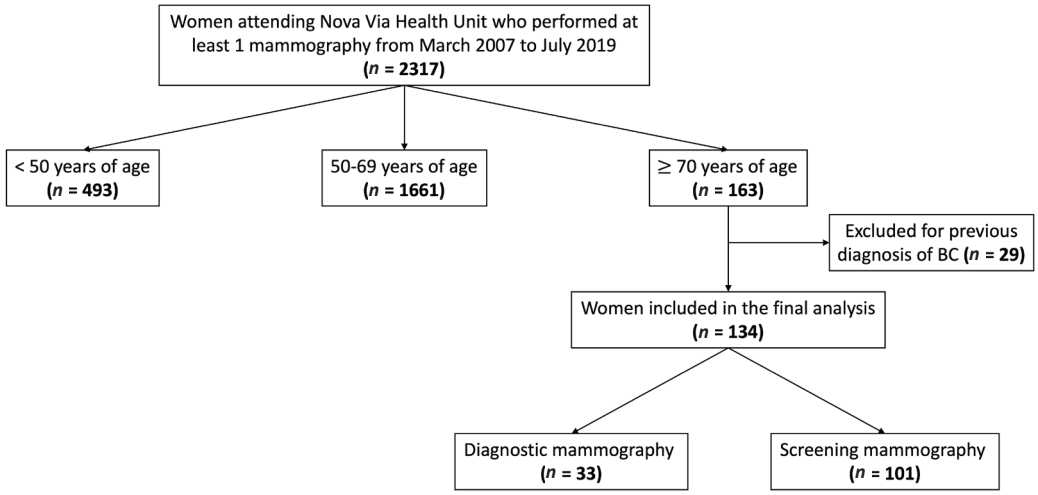

Figure 1. Flow diagram of the women included in the analysis

ommended limit [6]. Some studies noted a lack of time in the primary care setting to estimate each individual's indication for screening, particularly older patients with several complicated pathologies, leading physicians to screen more frequently to avoid not complying with panel recommendations or even suffering medicolegal consequences [9].

Given the fact that the existing randomised controlled trials excluded women older than 75 years of age or included few women 70 to 74 years of age, as well as the number of unanswered questions about reductions in advanced BC and treatment morbidity from mammography screening, at the time of this study, it is still recommended that BC screening is only performed until the age of 69 [3].

Objectives

We aim to characterise the women who continued BC screening beyond the recommended limit and to identify factors associated with this decision.

Material and methods

We conducted an observational cross-sectional study in a local primary care centre in Vila Nova de Gaia, Portugal, called Nova Via Health Centre. Using the MIM@UF platform**,** we identified women of at least 70 years of age who attended this primary care centre and had underwent at least one mammography after turning 70 from March 2007 until 31 July 2019. A database protected by a password was created and developed using Microsoft Excel®. According to their list of problems on the electronic health record (EHR) system SClínico®, women who had already been diagnosed with BC were excluded, as they were no longer part of the national BC screening programme. Afterwards, the women were divided into the groups "Screening Mammography" or "Diagnostic Mammography" according to the purpose of their last mammography. Mammography was categorised as diagnostic when it was requested following a symptom mentioned by the patient, worrisome findings on physical examination or abnormalities in a previous screening mammography. Screening mammography was considered whenever this intention was conveyed on the EHR of that consultation (SOAP) of that consultation or when a justification was missing.

The ethics committee of the Northern Regional Health Administration approved the study protocol. Data collection occurred from September 2022 to December 2022.

The socio-demographic data included age at the request of the last mammography, civil status, parity and level of education. We also evaluated some risk factors for BC, such as family history of BC, obesity, other breast abnormalities (such as fibroadenoma, fibrocystic breast disease, history of breast surgery for benign findings, complex cysts, any mammography categorised as R3, R4 or R5 by the Marseille classification which turned out to be a false positive or reference to dense breast tissue in the last mammography), T-score ≥ -1 from the most recent bone density scan, alcohol consumption ≥ 7 units/week and past or current smoking habits [6, 10–20]. The comorbid illnesses assessed were cancer (except BC), coronary artery disease or previous acute myocardial infarction, stroke, diabetes mellitus, arterial hypertension, chronic obstructive pulmonary disease, osteoporosis or hip fracture and dementia [21–23]. We also included data about the number of mammographs performed after 70, justification on the SOAP record for requesting the last mammography performed, which type of mammography it was and whose initiative it was to request it. Information regarding which FP requested the last mammography was also obtained. The number of presential appointments with the FP in the previous year and the adherence to the BC and colorectal cancer (CRC) national screening programmes were estimated (mammography at 68/69 years of age for BC screening; faecal occult blood test at 73/74 years of age or in the last two years for women 70, 71 or 72 years of age or colonoscopy in the previous ten years for CRC screening) [9]. Cervical cancer screening could not be estimated since Nova Via Health Centre was built in 2007, and there were no reliable EHRs before this time.

Statistical analyses were performed using IBM SPSS® Statistics, version 27. Absolute and relative frequencies were used for categorical variables. Normally distributed quantitative variables were described using means and 95% confidence intervals (95% CI). For non-normally distributed quantitative variables, median and interquartile ranges were preferred. The chi-square and Fisher's exact tests were used to assess the association between the categorical variables. The Mann-Whitney test was used to analyse the data and compare the distributions of the two independent samples. We performed a binary logistic regression for the multivariate analysis. The significance level used was 0.05.

Results

Among the 2,317 women who underwent at least one mammography, 163 women were 70 years of age and older. We excluded 27 because they had a history of BC. A total of 134 women were included for analysis, 33 in the diagnostic mammography group and 101 in the screening group (Figure 1). Among all women who underwent a mammography after the

age of 50, 5.5% continued breast cancer screening. Out of the 1,543 women 70 years of age and older attending the Nova Via Health Centre, only 163 underwent at least one mammography since turning 70, i.e. 10.6%.

The median age at the request of the last mammography was 72 years of age (IQR: 5), with a vast majority of requests being for women under 75 years of age in the screening group (79.2%) (Table 1). The women who underwent a screening mammography were significantly younger than those who underwent a diagnostic check (p = 0.002). As the age at the request of the last mammography increased, there were fewer women who underwent a screening mammography (Table 1).

Most women for whom a mammography was requested were married and had children. The majority had a poor education level (54.5% completed four years of school or less) (Table 1).

The most common risk factors found for BC were the presence of other breast abnormalities (46.3%) and obesity (24.6%) in both groups (Table 2). Regarding comorbid illnesses, arterial hypertension (73.1%) was the most frequent, followed by osteoporosis or hip fractures (34.3%). Both were significantly less common in the women who underwent a screening mammography (68.3% vs 87.9%, p = 0.028 for arterial hypertension; 29.7%, 48.5%, p = 0.049 for osteoporosis/hip fractures).

Women predominantly had one (42.4%) or two (33.1%) of the comorbidities assessed (Table 2). The women who underwent screening mammography tended to have less comorbidity burden than those diagnostic (predominantly one illness vs two comorbid illnesses, p = 0.005) (Table 2).

Most women only underwent one screening mammography after turning 70 (p = 0.298), and the mean number of mammographs after 70 was 1.87 (95% CI: 1.67–2.06; Range: 1–6) (Figure 2).

Table 1. Study sample description according to the type of mammography last undergone by eligible women

Characteristics	Total women (n = 134)	Women who underwent diagnostic mammography (n = 33)	Women who underwent screening mammography (n = 101)	p*
Age at the request of the last mammography				
70	27 (20.1%)	2 (6.1%)	25 (24.8%)	0.002
71	26 (19.4%)	5 (15.2%)	21 (20.8%)	
72	17 (12.7%)	4 (12.1%)	13 (12.9%)	
73	17 (12.7%)	4 (12.1%)	13 (12.9%)	
74	9 (6.7%)	1 (3.0%)	8 (7.8%)	
≥ 75	38 (28.4%)	17 (51.5%)	21 (20.8%)	
Marital status				
Single	9 (6.7%)	1 (3.0%)	8 (7.9%)	0.734
Married	70 (52.2%)	17 (51.5%)	53 (52.5%)	
Widowed	53 (39.6%)	15 (45.5%)	38 (37.6%)	
Divorced	2 (1.5%)	–	2 (2.0%)	
Parity				
Nulliparous	20 (14.9%)	4 (12.1%)	16 (15.8%)	0.781
Multiparous	113 (84.3%)	29 (87.9%)	84 (83.2%)	
Data missing	1 (0.7%)	–	1 (1.0%)	
Highest level of education completed				
≤ 4 years of education	73 (54.5%)	20 (60.6%)	53 (52.5%)	0.141
5–12 years of education	20 (14.9%)	5 (15.2%)	15 (14.9%)	
Graduate	18 (13.4%)	1 (3.0%)	17 (16.8%)	
Data missing	23 (17.2%)	7 (21.2%)	16 (15.8%)	

*Chi-square test; Fisher's exact test and Mann-Whitney test for the age variable.

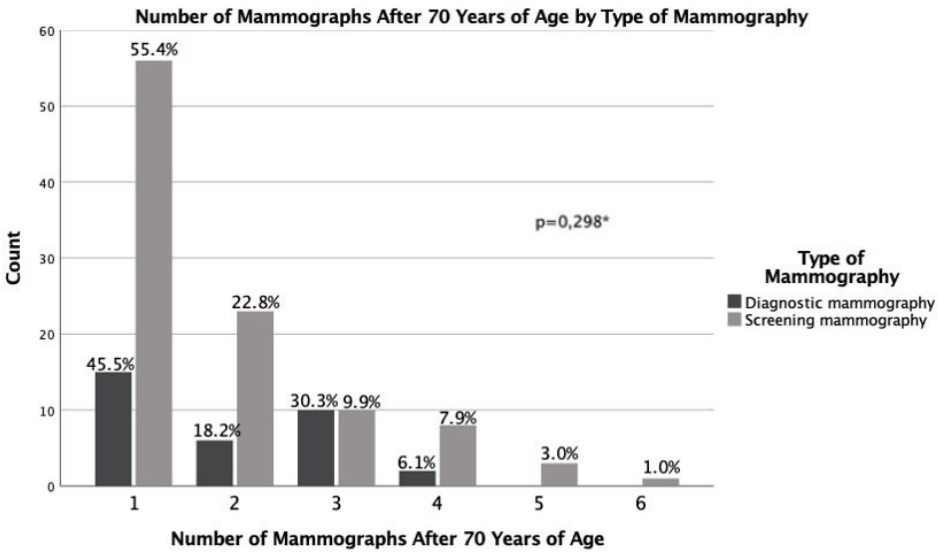

Figure 2. Bar chart representing the number of mammographs performed by type of mammography

*Mann-Whitney test.

For most women (47.8%), there was no justification for requesting the last mammography. Both groups' requests were more often from the doctors than their patients (p = 0.523). The initiative to request mammographs was mainly from the FP than from another doctor (p = 0.028). Nevertheless, the proportion of mammographs requested by another doctor, either in the public or private medical care setting, was much higher in the screening group (27.7%) than in the diagnostic group (9.1%) (Table 2).

Despite not having statistical significance, differences were encountered when analysing the number of patients who underwent at least one mammography after 70 by the FP, ranging from 5.9% to 16.4% (Table 2).

More women who underwent diagnostic mammography had more than two appointments with their FP in the past year compared to those who underwent screening mammography (84.8% vs 65.3%, p = 0.323) (Table 2).

Table 2. Potential contributors to continue screening and their frequencies among women who performed diagnostic or screening mammographs

Contributors	Total mammographs (n = 134)	Women who underwent diagnostic mammography (n = 33)	Women who underwent screening mammography (n = 101)	p*
Risk factors of BC				
Family history of BC	4 (3.0%)	1 (3.0%)	3 (3.0%)	0.682
BMI ≥ 30 kg/m^2	33 (24.6%)	9 (27.3%)	24 (23.8%)	0.684
Other breast abnormalities	62 (46.3%)	17 (51.5%)	45 (44.6%)	0.486
T-score ≥ -1	16 (11.9%)	4 (12.1%)	12 (11.9%)	0.554
Alcohol consumption ≥ 7 units/week	18 (13.4%)	3 (9.1%)	15 (14.9%)	0.560
Past or present smoking habits	1 (0.7%)	1 (3.0%)	–	0.246
Comorbid illnesses				
Cancer (except BC)	5 (3.7%)	2 (6.1%)	3 (3.0%)	0.596
Coronary artery disease/acute myocardial infarction	5 (3.7%)	1 (3.0%)	4 (4.0%)	0.641
Stroke	15 (11.2%)	6 (18.2%)	9 (8.9%)	0.200
Diabetes mellitus	23 (17.2%)	7 (21.2%)	16 (15.8%)	0.477
Arterial hypertension	98 (73.1%)	29 (87.9%)	69 (68.3%)	**0.028**
COPD	2 (1.5%)	–	2 (2.0%)	0.567
Osteoporosis/hip fracture	46 (34.3%)	16 (48.5%)	30 (29.7%)	**0.049**
Dementia	5 (3.7%)	1 (3.0%)	4 (4.0%)	0.641
Number of comorbid illnesses				
1 comorbid illness	59 (42.4%)	11 (33.3%)	48 (47.5%)	**0.005**
2 comorbid illnesses	46 (33.1%)	14 (42.4%)	32 (31.7%)	
3 and 4 comorbid illnesses	15 (11.2%)	7 (21.2%)	8 (7.9%)	
Justification on SOAP for the last mammography				
Yes – requested by the patient	23 (17.2%)	3 (9.1%)	20 (19.8%)	0.523
Yes – requested by the FP or another doctor	47 (35.1%)	10 (30.3%)	37 (36.6%)	
No justification	64 (47.8%)	20 (60.6%)	44 (43.6%)	
Initiative of the request of last mammography				
Another doctor	31 (23.1%)	3 (9.1%)	28 (27.7%)	**0.028**
FP	103 (76.9%)	30 (90.9%)	73 (72.3%)	
FP who requested the mammography				
A	15 (11.2%)	2 (6.1%)	13 (12.9%)	0.782
B	8 (5.9%)	2 (6.1%)	6 (5.9%)	
C	15 (11.2%)	2 (6.1%)	13 (12.9%)	
D	10 (7.5%)	3 (9.1%)	7 (6.9%)	
E	22 (16.4%)	6 (18.2%)	16 (15.8%)	
F	10 (7.5%)	2 (6.1%)	8 (7.9%)	
G	20 (14.9%)	4 (12.1%)	16 (15.8%)	
H	21 (15.7%)	8 (24.2%)	13 (12.9%)	
I	13 (9.7%)	4 (12.1%)	9 (8.9%)	
Number of presential contacts with the FP in the past year				
≤ 2 appointments	40 (29.9%)	5 (15.2%)	35 (34.7%)	0.323
> 2 appointments	94 (70.1%)	28 (84.8%)	66 (65.3%)	
Compliance to BC screening				
Yes	102 (76.1%)	28 (84.8%)	74 (73.3%)	0.068
No/Unknown	32 (23.9%)	5 (15.2%)	27 (26.7%)	
Compliance to CRC screening				
Yes	117 (84.3%)	29 (87.9%)	88 (87.1%)	0.450
No/Unknown	17 (12.7%)	4 (12.1%)	13 (12.9%)	

*Chi-square test; Fisher's exact test and Mann-Whitney test for the number of comorbid illnesses and the number of presential contacts with the FP in the past year.

Regarding the high compliance with BC screening (76.1%), women who underwent a screening mammography beyond the defined age limit were less compliant, which could explain why women tend to undergo this mammography at 70–71 years of age. These women tend to have high compliance rates with CRC screening (84.3%) (Table 2).

Our data met the assumptions required to perform a binomial logistics regression. The logistic regression model was statistically significant when compared to the null model: ($X^2(5) = 29{,}850$, $p < 0.001$), which explained 29.7% (Nagelkerke R^2) of the variance in the type of mammography performed and correctly predicted 80.6% of cases. Of all the potential contributors included, only age at the request ($p = 0.001$) and initiative of the request ($p = 0.014$) of the last mammography added significantly to the model. As a woman gets older, there is a reduction in the likelihood of requesting screening mammography (OR = 0.815, 95% CI: 0.720–0.922). Being the FP requesting the mammography also decreases the odds of it being for screening purposes (OR = 0.176, 95% CI: 0.044–0.707).

Table 3. Logistic regression analysis

Variables	OR	95% CI	*p*
Age at the request of the last mammography	0.815	0.720–0.922	**0.001**
Arterial hypertension			
no	Ref		
yes	0.299	0.065–1.388	0.123
Osteoporosis/hip fracture			
no	Ref		
yes	0.388	0.122–1.237	0.109
Number of comorbidities	0.682	0.312–1.488	0.336
Initiative of the request of the last mammography			
another doctor	Ref		
FP	0.176	0.044–0.707	**0.014**

*Chi-square test; Fisher's exact test and Mann-Whitney test for the number of comorbid illnesses and the number of presential contacts with the FP in the past year.

Discussion

Our study shows that a small proportion (5.5%) of the women who underwent screening mammography at Nova Via Health Centre were above the age limit currently recommended for BC screening. In fact, only 10.6% of the women 70 years of age and older kept undergoing screening mammographs. FPs at this Portuguese primary care centre appear to comply with the national cancer care plan.

We found that most women only underwent one screening mammography after turning 70. Women in the screening group were mainly under 75 years of age (mostly 70 and 71) at the request of the last mammography. This might mean that physicians still feel uncertain about the right time to stop screening and, to avoid confusion with the different recommendations or medicolegal consequences, tend to prolong screening for a few more years [9]. Another explanation is that there is a lack of time in the primary care setting to assess each patient's indication for screening, especially older patients with multiple medical problems [9]. From a patient's perspective, an unwillingness to stop screening can not be ruled out, because the information in the medical records was very limited. Previous studies have reported that undergoing screening mammography frequently becomes a habit for women, and a negative BC finding brings them a feeling of reassurance [24]. Torke et al. suggest that for certain older women, ceasing BC screening might be viewed as a significant decision, while the act of maintaining screening does not pose such a dilemma. Also, women may find suspicious any advice advocating screening cessation [25].

More than half of the participants only completed four years of school or less, showing a very simple set of women who may require extra help to understand the right time to stop screening. Previous research has found that women with lower education levels had more difficulty understanding screening risks, the idea that older women may be more likely to die from competing risks and that mammography may find a BC that otherwise would not have caused any trouble [26].

About 76.1% of women in the screening group participated in the national BC screening programme at 68 or 69 years of age. In 2021, the estimated adherence of eligible Portuguese women to the national BC screening programme was 65.9%, suggesting a reasonable inference that these women exhibited a strong commitment to the BC screening program in recent years [27]. However, we found that those who underwent screening mammography showed worse compliance than those who underwent diagnostic mammography, which may be one of the reasons to continue screening at older ages (mainly at 70–71 years of age in order to complete the screening).

Women undergoing mammography screening were generally healthier than those in the diagnostic group, since most only had one illness, and fewer had more than two appointments with the FP in the last year. This aligns with the current knowledge that women with complex multimorbidity are less likely to undergo a screening mammogram after the recommended age limit [3, 4, 7, 9, 28].

An association was found between the type of mammography performed, diagnostic or screening, and the presence of arterial hypertension. We could not find any studies describing how suffering from arterial hypertension could influence the decision to screen for BC through mammography. Even though no association was found between the type of mammography performed and the number of consultations with the FP, it is possible that, as primary care services very closely follow hypertensive patients, contact with their healthcare provider increases the probability of using preventive care.

Some authors consider the long-term lack of exposure to endogenous and exogenous oestrogen a protective factor against the development of BC [13, 29, 30]. In our analysis, 34.3% of eligible women had a diagnosis of osteoporosis or suffered hip fracture, which may reflect this state of oestrogen deficit, reducing the risk of BC for these women. On the other hand, 11.9% had a higher bone density (T-score ≥ -1) and, consequently, a higher BC risk. However, we find that future research on this matter is still needed.

Our study also revealed that the most common risk factor for BC was the presence of other breast abnormalities, which indicates that many mammographs are being requested based on benign findings, positive results on previous mammographs or the presence of dense breast tissue. Obesity was the second most frequent risk factor, which is already well-known [12, 31].

By analysing the absolute and relative frequencies found, it seems that FPs are the ones who decided to prolong mammography testing in older women; however, an important amount of screening mammographs were requested by another doctor, either in the public or private medical care setting, revealing how approaches vary between physicians on when to discontinue BC screening.

Many associations with the type of mammography a woman undergoes were found. Age at the request of the last mammography, arterial hypertension, osteoporosis/hip fracture, the number of comorbid illnesses and initiative of the request are related to the decision to undergo a diagnostic or screening mammography. However, only age at the request and initiative of the last mammography could significantly predict which mammography a woman undergoes. Increasing age is accompanied by a reduced likelihood of undergoing screening mammography. Even though age alone should not be considered in the decision to perpetuate BC screening, this finding aligns with the

fact that older women have competing mortality risks, which decreases the need for mammography screening [7]. Consulting with an FP also decreases the chance of undergoing a screening mammography, which might suggest that a significant part of mammography requests are coming from doctors from other medical specialties and that FPs are less involved in the prolongation of screening until higher ages than what the absolute and relative frequencies seem to indicate.

There are several limitations to this study. First, we only focused on one primary care centre; therefore, a sampling bias may exist. This means that our sample may not represent the target population fairly, limiting the results' potential generalisability and our study's external validity. We used EHRs as the source of patient health information, which was not initially designed for research; therefore, some concerns about the data quality arose. Issues such as poorly measured variables and missing data leave the analysis prone to information bias. As this is a cross-sectional study, the exposure and outcome variables were also assessed simultaneously; thus, the associations identified are difficult to interpret, and we cannot draw a causal inference. Nonetheless, some of our conclusions, such as the tendency to reduce screening mammographs with increasing age, have been consistently observed in several studies, partly supporting our research's evidence [3, 4, 8, 28].

Limitations of the study

Despite its limitations, we strongly believe that this paper is highly relevant, since it provides a detailed description of women who typically prolong BC screening beyond the current age limit, as well as a comprehensive investigation of the factors that may be associated with that decision. This study paves the way for further research on the identified associations, which can have a significant impact on clinical practice. To the best of our knowledge, this is the first study to meticulously describe potential reasons for continuing breast screening beyond the recommended age limit, from both a medical professional and patient perspective.

Conclusions

In conclusion, this study has provided a better understanding of the characteristics of the women who keep undergoing mammographs despite being above the upper age limit recommended by public health authorities. We found that patients' age, presence of specific comorbidities, such as arterial hypertension and osteoporosis or hip fracture, number of comorbidities and the initiative of the request are probable factors contributing to the decision to continue screening. Further research is still needed to discover how these aspects influence FPs and patients' choices to stop or continue BC screening, but we think that our article provides important clues for understanding the factors associated with continuing BC screening beyond the recommended age.

Source of funding: This work was funded from the authors' own resources.
Conflicts of interest: The authors declare no conflicts of interest.

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Received: 23.06.2023
Reviewed: 29.06.2023
Accepted: 18.07.2023

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