Personal or first-degree family breast cancer history: which has higher impact on tumor detection and tumor size in breast cancer

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Abstract

Purpose A woman's risk of developing breast cancer (BC) is increased if she has a personal history (PH) or family history (FH) of the disease. We compared the impact of the two risk factors PH and FH on tumor detection and tumor size at diagnosis in a cohort of BC patients.

Methods The study cohort comprised 1,037 invasive BC patients (≤ 70 years at diagnosis). From these, 92 patients (8.5 %) had a positive PH and 151 patients (13.7 %) had a positive first-degree FH.

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Results Compared to the tumors of patients without PH or FH, the lesions of patients who had a positive PH or a positive FH were more often found by radiologic breast examinations (RBE) (PH: 49.4 %, FH: 43.4 %, no PH/FH: 26.2 %; both comparisons $p < 0.001$). In patients with a positive FH, the tumors were slightly less often found by RBE as in patients with a positive PH ($p = 0.468$). Patients with a positive PH or FH had smaller tumors compared with those without such a history (PH: 19.7 mm, FH: 19.6 mm, no PH/FH: 26.7 mm; $p = 0.015/p < 0.001$). The tumor sizes of patients with a positive PH were almost identical to those of patients with a positive FH ($p = 0.999$).

Conclusions In women with a positive FH or PH of BC, the increased awareness of BC risk led to the detection of smaller tumors compared to women who have not had this experience. However, comparison of the two risk factors showed that they had a similar impact on the RBE detection rate of BC lesions and that the tumor sizes were nearly identical.

Keywords Breast cancer · Family history · Personal history · Detection method · Mammography screening · Tumor size

Introduction

It is universally recognized that a woman's risk of developing breast cancer (BC) is increased if she has a:

- (a) Family history (FH) of the disease [1, 2].
In countries where BC is common, the cumulative incidence of BC up to the age of 80 is 13.3 % for women with one affected first-degree relative and 21.1 % for women with two [1]. For women without

a known genetic predisposition for BC (i.e., BRCA 1 or BRCA 2), but who have a history of BC in a first-degree relative, it has been suggested that screening mammography be initiated at an earlier age, particularly if the family member had BC at a younger age [3].

(b) Personal history (PH) of BC [4–9].

Approximately 10–15 % of patients undergoing breast-conserving therapy (BCT) for operable BC will develop a locoregional recurrence within 10 years [4, 5, 7–9]. In addition, BC survivors are also at a higher risk of developing a contralateral metachronous BC; a current review found an incidence of 4 % during an average follow-up of 7.5 years [6]. To account for these risks, annual surveillance mammography (i.e., mammography not indicated by clinical signs or symptoms) is a consensus-based recommendation for patients who were treated for primary BC [10, 11].

This study evaluates and compares to what extent established radiological screening methods for BC detection were utilized in:

- BC patients with a positive PH of BC.
- BC patients with a positive FH of BC (considered only women with first-degree BC affected relatives).
- In addition, we present data from a group of BC patients without a PH and first-degree FH of BC.

It has been widely demonstrated that personal and familial experiences with BC can influence individuals' behaviors to such an extent that the increased frequency of radiological examinations leads to earlier detection of the disease [2, 12–17].

To our knowledge, our study is the first comprehensive analysis comparing specifically the impact of both relevant risk factors FH and PH on tumor detection and tumor size. By doing so, we answer an up until now unanswered question: “Which personal factor has a higher impact on a more frequent tumor detection rate by radiologic examinations and leads more often to the diagnosis of smaller tumors: a positive family history or the woman's own history of breast cancer?”

Patients and methods

Data from the prospective relational Basel Breast Cancer Database (BBCD), which includes all newly diagnosed primary invasive BC cases treated at the University Women's Hospital Basel, Switzerland since 1990, provided the basis for this study. This institution comprises the largest BC center in the canton of Basel and is an adequate

representation of the regional population. Within this database, disease-specific clinical and histopathological data, treatment characteristics, personal and family history as well as outcome data were recorded. For this study, data from female patients up to and including 2009, who were ≤ 70 years at diagnosis, were analyzed. Since the goal of the study was to evaluate the impact of FH on tumor detection method and tumor size, 19 cases with inflammatory BC were excluded from further analysis. Due to the nature of inflammatory carcinomas, which arise rapidly, affect large parts of the breast, and often have no underlying definable mass, these cases are not suitable for evaluating tumor detection methods and tumor size. In total, our entire study cohort comprised 1,037 patients with 1,099 carcinomas (Table 1).

- Personal history group ($n = 92$; 8.4 % of the entire cohort): In total, 92 patients analyzed in this group had a history of invasive BC. In these cases, there was no distant metastatic disease known up until the diagnosis of the second malignancy (in nine cases, however, distant metastases were found during the staging examinations for the second BC). In 61 patients, contralateral metachronous disease was diagnosed. In addition, we also considered 31 cases in which an ipsilateral non-inflammatory in-breast recurrence after previous breast-conserving surgery occurred.
- Family history group ($n = 151$; 13.7 % of the entire cohort): The criterion for a positive FH of BC was met when a patient reported one or more first-degree (mother, sister, daughter) affected relatives. Table 2 lists the number of relatives with a history of BC and the age group of the affected relative at the time that her BC was diagnosed.
In 17 cases, the patients had both a positive PH and a positive FH; we placed these patients in the “personal history”-category.
- Control group ($n = 856$; 77.9 % of the entire cohort): These patients had neither a PH of BC nor any first-degree BC affected relatives.

Clinicopathological data

The following data were available for all patients: age at initial diagnosis, histological subtype, grading, hormonal receptor (HR) status, tumor stage according to the American Joint Committee on Cancer (AJCC)/International Union Against Cancer (UICC) TNM Classification; because HER-2 status has been routinely assessed for all patients since 2002, we included data from 2002 to 2009 only in the analysis of this particular characteristic.

Table 1 Comparison between a cohort of 1,099 cases of breast cancer patients (≤ 70 years) with and without personal and family history of breast cancer

Variable	Personal history $n = 92$ (%)	Family history $n = 151$ (%)	No BC history $n = 856$ (%)
Age (years)			
Mean	58.7 ^a	54.9	54.3
Median	59 ^a	56	55
Tumor detection method			
Breast self-examination	39 (42.8)	73 (49.6)	517 (61.6)
Radiologic breast examination	38 (41.8)	56 (38.1)	184 (21.9)
Clinical breast examination	14 (15.4)	17 (11.6)	127 (15.1)
Other method	–	1 (0.7)	12 (1.4)
Unknown	1	4	16
Tumor size (mm)			
Mean	19.7	19.6	26.7
Median (range)	16.5 (≤ 1 –125)	16 (≤ 1 –115)	20 (0–220)
Tumor category			
T0	–	–	2 (0.2)
T1	62 (67.4)	102 (67.5)	439 (51.3)
T2	24 (26.1)	42 (27.8)	316 (36.9)
T3	5 (5.4)	3 (2.0)	68 (8.0)
Non-inflammatory T4	1 (1.1)	4 (2.7)	31 (3.6)
Bilateral synchronous carcinoma	–	3 (2.0)	17 (2.0)
AJCC/UICC TNM stage			
I	52 (56.5)	76 (50.3)	308 (36.0)
II	24 (26.1)	50 (33.1)	350 (40.9)
III	7 (7.6)	21 (13.9)	156 (18.2)
IV	9 (9.8)	4 (2.7)	42 (4.9)
Histologic subtype			
Ductal invasive	77 (83.7)	107 (71.8)	658 (77.3)
Lobular invasive	12 (13.0)	28 (18.8)	106 (12.5)
Rare types	3 (3.3)	14 (9.4)	87 (10.2)
Not available	–	2	5
Grading			
G1/2	40 (46.5)	100 (69.4)	438 (54.4)
G3	46 (53.5)	44 (30.6)	367 (45.6)
Not available	6	7	51
Hormonal receptor status			
Positive	67 (78.8)	129 (87.2)	669 (81.2)
Negative	18 (21.2)	19 (12.8)	155 (18.8)
Not available	7	3	32
HER2 status, 2002–2009	$n = 45$	$n = 79$	$n = 370$
Positive	12 (26.7)	8 (10.3)	66 (18.0)
Not available	–	1	3
Triple-negative subtype	7 (15.6)	4 (5.1)	50 (13.6)

AJCC American Joint Committee on Cancer; UICC International Union Against Cancer (LIT)

^a Analysis of patient's age: metachronous BC ($n = 61$) was included; local recurrence ($n = 31$) was excluded

Table 2 Family history ($n = 151$): number of affected relatives, and age of the affected relative at the time that her BC was diagnosed

Characteristic	n (%)
FH	
Relative diagnosed before age 50	65 (43.3)
Relative diagnosed ≥ 50 years	85 (56.7)
Relative's age unknown	1
One first-degree relative affected with BC	134 (88.7)
Two first-degree relatives affected with BC	16 (10.6)
Three first-degree relatives affected with BC	1 (0.7)
Mean number	1.1
PH	
Tumor size of the first tumor: ≤ 20 mm	51 (55.4)
Tumor size of the first tumor: > 20 mm	41 (44.6)
Period between 1st and 2nd lesion: < 72 months	46 (50.0)
Period between 1st and 2nd lesion: ≥ 72 months	46 (50.0)

Personal history ($n = 91$): tumor size of the first tumor, and period between the primary and the second lesion

FH family history, PH personal history, BC breast cancer

Tumor size

For most of the cases analyzed ($n = 943$, 93.6 %), the size of the primary tumor was measured during pathological examination of the surgically resected lesion. In 40 patients (4.0 %; positive FH: $n = 4$, negative PH/FH: $n = 36$), who received neoadjuvant therapy, the pre-therapeutic clinically assessed tumor sizes were used. This was also the case for 24 patients (2.4 %; positive PH: $n = 2$; positive FH: $n = 1$; negative PH/FH: $n = 21$) in whom no surgery was performed.

Of the entire study cohort, 20 patients presented with synchronous bilateral BC (2.0 %); of these cases, the tumor with the more advanced tumor size ("reference lesion") was considered for analysis.

Tumor detection method

The following two methods were analyzed:

1. Breast self-examination (BSE), $n = 629$ (57.2 %).
2. Radiological breast examination (RBE), $n = 278$ (25.3 %).

Cases in which the tumor was found by a physician during a clinical breast examination [CBE, $n = 158$ (14.4 %)] were not considered in the diagnostic method analysis because, contrary to BSE and the utilization of RBE, CBE does not necessarily reflect the patient's awareness of early BC detection. The following patients were also excluded from this part of analysis: 13 patients (1.2 %) with BC detected by other methods

than the three mentioned above, and 21 patients (1.9 %) who lacked documentation of the tumor detection method.

Data collection methods and study design were approved by the Ethics Committee of the University of Basel.

Statistical methods

Comparisons between nominal parameters were made using the Fisher's exact test. In the case of metric variables, *t* test or paired *t* test was performed as appropriate. To predict age and tumor size, univariate linear regression analysis was performed. Results are presented as differences of means (MD) with corresponding 95 % confidence intervals (95 % CI) and *p* values. In the case of the binary dependent variable (detection method), logistic regressions were performed. Results are presented as odds ratios (OR) with the corresponding 95 % CI and *p* values. In all statistical tests, the level of significance was $p < 0.05$. All evaluations were performed with R Development Core Team software, version 13.1. The study is exploratory; therefore, no adjustments for multiple comparisons were done.

Results

Personal history

For patients who had metachronous BC or ipsilateral intramammary recurrence, the median interval between primary diagnosis and the second event was 71.5 months (range 3–324 months). The median tumor size at first diagnosis was 20 mm (mean 21.9 mm, range 1–68 mm) and the median tumor size of the second BC event was 16.5 mm (mean 19.7 mm, range <1–125 mm); the paired *t* test showed no significant difference (MD 2.16, 95 % CI 2.05–6.38, $p = 0.311$). A comparison between tumor sizes of the primary and the second lesion showed the following results:

- In 38 cases (41.3 %), the second lesion was at least 5 mm smaller than the primary tumor,
- In 35 cases (38.0 %), the tumors were of similar size (± 5 mm),
- In 19 cases (20.7 %), the second lesion was at least 5 mm larger than the primary tumor.

Patients with a positive PH were with 58.7 years significantly older when compared both with the patients who had a FH and the group without a BC history ($p = 0.004$ for both variables; Tables 1, 3).

Tumor detection method: radiological breast examination vs. breast self-examination (Tables 1, 4)

Compared to the tumors of patients without PH or FH, the lesions of patients who had a positive PH were more often found by RBE (49.4 vs. 26.2 %; OR 2.63, 95 % CI 1.64–4.35, $p < 0.001$; Table 4); a similar result was found in the comparison between patients without PH/FH and those with a positive FH, which also reached statistical significance (43.4 vs. 26.2 %; OR 2.12, 95 % CI 1.45–3.13, $p < 0.001$). In patients with a positive FH, the tumors were less often found by RBE as in patients with a PH; this, however, failed to reach statistical significance (43.4 vs. 49.4 %, OR 1.24, 95 % CI 0.70–2.19, $p = 0.468$).

Within the group of patients with a positive FH, the number of affected relatives had impact on the detection rate of tumors by RBE: having more than one affected relative was associated with more frequent detection by RBE (1 affected relative: 40.2 % vs. ≥ 1 affected relative: 75.0 %, $p = 0.030$; Table 4). The age of the affected relative at the time that her BC was diagnosed was not relevant ($p = 0.285$). Within the group of patients with a positive PH, the length of time between the primary and the second lesion ($p = 0.651$) and the size of the first tumor ($p = 1.00$) were no significant factors which led that the second BC was more often found by RBE.

Tumor size (Tables 1, 5)

Patients with a positive PH or a FH had smaller tumors at diagnosis compared with those without such a history (PH: 19.7 vs. 26.7 mm; MD 7.0, 95 % CI 4.5–9.5, $p = 0.015$. FH: 19.6 vs. 26.7 mm; MD 7.1, 95 % CI 5.1–9.1, $p < 0.001$; Table 5). The tumor sizes of patients with a positive PH were almost identical to those of patients with a positive FH (19.7 vs. 19.6 mm, $p = 0.999$).

Within the group of patients with a positive FH, neither the number of affected relatives ($p = 0.235$; Table 5) nor the

Table 3 Patient's age according to family and personal history of BC

	MD (95 % CI)	<i>p</i> value
(0) no FH/PH: 54.3 years		
(1) FH: 54.9 years		
(2) PH: 58.7 years		
Overall		0.006
0 vs. 1	−0.6 (−1.5, 0.3)	0.794
0 vs. 2	−4.3 (−5.7, −2.9)	0.004
1 vs. 2	−3.7 (−5.3, −2.19)	0.004

Bold values are statistically significant at $p < 0.05$

MD mean difference, CI confidence interval, FH family history, PH personal history, BC breast cancer

Table 4 Tumor detection method (radiological examination vs. self-examination) according to family and personal history of breast cancer

	OR (95 % CI)	<i>p</i> value
(0) no FH/PH (<i>n</i> = 856)		
RBE: <i>n</i> = 184 (26.2 %); SE: <i>n</i> = 517 (73.8 %)		
(1) FH (<i>n</i> = 151)		
RBE: <i>n</i> = 56 (43.4 %); SE: <i>n</i> = 73 (56.6 %)		
(2) PH (<i>n</i> = 92)		
RBE: <i>n</i> = 38 (49.4 %); SE: <i>n</i> = 39 (50.6 %)		
Overall		<0.001
0 vs. 1	2.12 (1.45, 3.13)	<0.001
0 vs. 2	2.63 (1.64, 4.35)	>0.001
1 vs. 2	1.24 (0.70–2.19)	0.468
(1) FH (<i>n</i> = 151)		
Number of affected relatives		
1 affected relative, <i>n</i> = 134 vs. ≥ 1 affected relative, <i>n</i> = 17		
RBE: <i>n</i> = 47 (40.2 %) vs. <i>n</i> = 9 (75.0 %)		0.030
Age of the affected relative at the time that her BC was diagnosed		
<50 years, <i>n</i> = 65 vs. ≥ 50 years, <i>n</i> = 85		
RBE: <i>n</i> = 28 (49.1 %) vs. <i>n</i> = 28 (38.9 %)		0.285
(2) PH (<i>n</i> = 92)		
Period between the primary and the second lesion		
<72 months, <i>n</i> = 46 vs. ≥ 72 months, <i>n</i> = 46		
RBE: <i>n</i> = 19 (46.3 %) vs. <i>n</i> = 19 (52.8 %)		0.651
Size of the first tumor		
≤ 20 mm, <i>n</i> = 51 vs. > 20 mm, <i>n</i> = 41		
RBE: <i>n</i> = 22 (50.0 %) vs. RBE: <i>n</i> = 16 (48.5 %)		1.00

Bold values are statistically significant at $p < 0.05$

OR odds ratio, CI confidence interval, FH family history, PH personal history, BC breast cancer, RBE radiological breast examination, SE self-examination

age at which the affected relative was diagnosed with BC ($p = 0.622$) correlated with tumor size. For the patients with a positive PH, no significant correlations were found with the length of time between the primary and the second lesion ($p = 0.224$) and the size of the first tumor ($p = 0.848$).

In the subgroup of patients who found their tumors by self-examination (BSE), patients with either a positive FH or PH found smaller lesions than patients with no history (no PH/FH: 30.8 mm; FH: 23.1 mm; PH: 26.1 mm); a statistically significant difference, however, was only found in the comparison between the “no PH/FH” group and patients with a positive FH (MD -7.4 , 95 % CI 7.8 – 11.3 , $p = 0.038$; Table 5). There was no significant difference in

Table 5 Tumor size according to family and personal history of breast cancer

	MD (95 % CI)	<i>p</i> value
I. All patients		
(0) no FH/PH (<i>n</i> = 856): 26.7 mm		
(1) FH (<i>n</i> = 151): 19.6 mm		
(2) PH (<i>n</i> = 92): 19.7 mm		
Overall		0.001
0 vs. 1	7.1 (5.1, 9.1)	<0.001
0 vs. 2	7.0 (4.5, 9.5)	0.015
1 vs. 2	−0.1 (−3.1, 2.9)	0.999
(1) FH		
Number of affected relatives		
1 affected relative, <i>n</i> = 134 vs. ≥ 1 affected relative, <i>n</i> = 17		
Median tumor size: 19.9 vs. 16.9 mm		0.235
Age of the affected relative at the time that her BC was diagnosed		
<50 years, <i>n</i> = 65 vs. ≥ 50 years, <i>n</i> = 85		
Median tumor size: 18.6 vs. 20.3 mm		0.622
(2) PH		
Period between the primary and the second lesion		
<72 months, <i>n</i> = 46 vs. ≥ 72 months, <i>n</i> = 46		
Median tumor size: 21.9 vs. 17.6 mm		0.224
Size of the first tumor		
≤ 20 mm, <i>n</i> = 51 vs. > 20 mm, <i>n</i> = 41		
Median tumor size: 19.4 vs. 20.1 mm		0.848
II. Tumors found by self-examination		
(0) no FH/PH (<i>n</i> = 517): 30.8 mm		
(1) FH (<i>n</i> = 73): 23.1 mm		
(2) PH (<i>n</i> = 39): 26.1 mm		
Overall		0.034
0 vs. 1	8.0 (4.8, 11.3)	0.038
0 vs. 2	4.7 (0.4, 9.0)	0.524
1 vs. 2	−3.2 (−8.5, 1.9)	0.797

Bold values are statistically significant at $p < 0.05$

I. All patients, II. Tumors found by self-examination

MD mean difference, CI confidence interval, FH family history, PH personal history

the size of self-detected tumors in patients with a positive PH compared to those with a positive FH ($p = 0.797$).

Discussion

Not surprisingly, our data demonstrate that BC patients who had a positive PH or FH show distinct differences with regard to tumor detection and tumor size at diagnosis when compared to a group of patients without such a history: in patients with a positive PH or FH, the tumors were more often found by RBE and were significantly smaller.

However, returning to our main question, “Which personal factor has a higher impact on tumor detection rate by radiologic examinations and leads more often to the diagnosis of smaller tumors: a positive family history or the woman’s own history of breast cancer?”, our data show that both situations have a similar effect. The tumors of BC patients with a positive PH were more often diagnosed by radiological examinations; patients with a positive FH obviously developed a slightly higher body awareness and tended to detect their tumors (self-examination) at a smaller size. Both factors seemed to be of approximately equal weight, such that the tumor sizes found in both groups were nearly identical (PH: 19.7 mm; FH: 19.6 mm).

There are particular factors which must be considered in the interpretation of our findings:

Family history

As inclusion criterion for a positive FH, we only included patients who had a first-degree relative with BC. We did not include patients with more distantly related BC affected relatives in the FH group because we showed in a previously published study [15] that, in BC patients who had only second-degree relatives, the tumors were diagnosed similarly often by RBE and were of a similar size compared to BC patients without a positive FH. These results were in line with data from other studies [18, 19].

In this study, 15.3 % of the entire cohort of BC patients diagnosed in a 20-year period had first-degree relatives with a history of BC (however, we included 17 patients who had both a positive FH and PH in the “PH group”). Our data are approximately comparable with that from the Collaborative Group on Hormonal Factors in Breast Cancer (this project analyzed 52 epidemiological studies with a total of 58,209 BC patients) in which 12.9 % of women with BC had first-degree relatives with a history of BC [1]. We deliberately did not consider BRCA1/BRCA2 mutation carriers separately. First, our study covers a 20-year period and during the first decade of this period hereditary BRCA1/2-related BC was not yet a focus of interest. Second, due to the infrequent nature of BRCA1/BRCA2 mutations, even in women with a first-degree history, these mutations do not play an important role in the general behavior of women regarding mammography screening [19].

Radiological breast examination

In patients who had local recurrence, the rate of detection by mammography varied in the literature and ranged from 32 to 66 %, whereas the clinical detection rate ranged from 33 to 41 % [13, 19]. In our cohort, the rate of recurrent

ipsilateral and contralateral metachronous tumors found by RBE was approximately 42 %; the rate of tumors found by the patients themselves was almost identically high. On the one hand, this is a disappointing finding regarding the usefulness of breast imaging in women with a high risk of developing subsequent BC lesions. On the other hand, it shows that both radiologic and clinical examination are important factors for the detection of tumors in patients with a personal BC history [20] and thus patients should be encouraged to feel and look for changes in their breasts and should not only rely on radiologic examinations during their BC follow-up. Since some studies showed that survival was improved when recurrence was found by mammography instead of physical examination [13, 21, 22], the detection rate of BC recurrence through better reading and technique of mammograms will hopefully also increase.

Several studies reported an underuse of surveillance mammography for follow-up among women diagnosed with BC. Typically, the percentage of women having mammograms decreases over time. Doubeni et al. [23] reported that during the fifth year after BC treatment only 63 % of the patients had mammograms; Keating et al. [24] reported that approximately 57 % had mammography yearly over 3 years. We do not have exact information regarding the use of mammography surveillance during BC follow-up in our cohort. However, we estimate that approximately 70 % of the patients analyzed in this study adhered to the guidelines and underwent annual surveillance mammography.

Our study confirms previously published data [19], which demonstrated that in a cohort of BC patients, the tumors of women who had a positive FH for BC were more often found by RBE compared to women who had no BC affected relatives. This might result from the fact that women with a family BC history, obviously influenced by personal and familial experiences with BC, generally use BC screening more often than women without such history [2, 12–15]. It is not possible to determine precisely to what extent the higher motivation for mammography can be attributed to the women’s own initiative, the direct influence of family members (e.g., mother–daughter communication) or the motivating influence of their doctors who are aware of the positive FH and incorporate this information into their mammography referral practices.

Mammography screening in the study cohort

In the canton of Basel and the adjoining region of Northwestern Switzerland, there was no publicly funded organized mammography screening program during the study period. All interested and motivated women, however, had free access to mammography. In such an environment, the utilization of RBE for early BC detection is strongly

dependent on the women's motivation and own initiative (opportunistic screening) as well as the recommendation by her physician. For the purpose of our study, i.e., to test whether the knowledge and experience of BC in the family increases BC awareness, a patient-driven screening setting was better suited than a general screening setting.

Breast self-examination

Our results confirm the findings of recent studies, which showed that women with affected first-degree relatives were more likely to have smaller carcinomas and more often early disease stage [18, 19, 25]. The phenomenon that patients with positive FH and PH had smaller tumors at diagnosis might be explained by more diligent use of BC screening amongst women who considered themselves to be at increased risk of developing the disease. However, we also observed this phenomenon in patients who detected their tumors by self-examination. In these cases, the personal experience of having a close family member with BC was so influential that they became more aware of the necessity of self-examination and perceived changes earlier, thus leading to the identification of smaller tumors.

Conclusions

Obviously, many women with a first-degree relative affected by BC and women with a positive PH of BC have been sufficiently touched by that experience. In cases when these patients developed a BC, this increased awareness of BC risk led to the detection of smaller tumors compared to women who have not had this experience. However, comparison of the two risk factors showed that they had a similar impact on the RBE detection rate of BC lesions and that the tumor sizes were nearly identical.

Conflict of interest The authors declare that there are no financial or personal relationships with other people or organizations that could inappropriately influence the work reported or the conclusions, implications, or opinions stated.

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