Joanna R. Dullum, MPH
Elizabeth C. Lewis, MPH
Joni A. Mayer, PhD

Index terms:
Breast, 00.11
Breast radiography, 00.11
Cancer screening, 00.11

Radiology 2000; 214:547–552

[1] From the Graduate School of Public Health, Hardy Tower 119, San Diego State University, San Diego, CA 92182-4162. Received November 5, 1998; revision requested December 10; revision received April 6, 1999; accepted April 27. Supported in part by the U.S. Army Medical Research and Materiel Command under grant no. DAMD-17-94-J-4360. **Address reprint requests to** J.A.M. (e-mail: *jmayer@mail.sdsu.edu*).

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Army, Department of Defense, or the United States Government.

Author contributions:
Guarantor of integrity of entire study, J.A.M.; study concepts, J.A.M., J.R.D.; study design, J.A.M.; definition of intellectual content, J.A.M., J.R.D.; literature research, J.R.D., E.C.L.; clinical studies, J.A.M.; data acquisition, E.C.L.; data analysis, J.R.D., J.A.M.; statistical analysis, J.R.D., J.A.M.; manuscript preparation, J.A.M., J.R.D., E.C.L.; manuscript editing and review, J.A.M.

Rates and Correlates of Discomfort Associated with Mammography[1]

PURPOSE: To explore the rates and correlates of discomfort at mammography in asymptomatic women aged 50–74 years from six San Diego, Calif, mammography facilities.

MATERIALS AND METHODS: Subjects (N = 1,800) completed a 43-item telephone interview approximately 3 weeks after screening mammography. Bivariate associations between variables were analyzed with χ^2 analysis. Logistic regression was used to assess the independent predictors of discomfort at mammography while controlling for all other factors.

RESULTS: Nine hundred thirty-three (52%) women reported moderate to extreme discomfort at mammography. Discomfort was not related to the intention to undergo future mammography (P = .95). Factors that were significantly associated with discomfort in multivariate analyses were facility ($P < .001$), satisfaction with care ($P < .04$), and perception of the technologist's ''roughness'' ($P < .001$).

CONCLUSION: Discomfort, although not related to the intention to undergo future mammography, had a relatively high incidence.

Regular mammographic screening can decrease mortality by approximately 26% in women aged 50–74 years (1). In addition, results from a recent meta-analysis of findings of studies that included a mean of 12.7 years of follow-up data indicated that mammography significantly decreased mortality (by approximately 18%) in women aged 40–49 years (2). Therefore, major health organizations such as the American Cancer Society recommend that women 40 years of age or older undergo yearly mammography. Despite the potential benefits, the majority of women 40 years of age or older do not undergo mammography on a regular basis (3).

Mammography involves a fairly tight compression of the breast to obtain a good image. Several previous studies (4–17) have assessed subjects' perceptions of this compression. Findings of these studies have been variable with respect to the distributions of discomfort. The variability may be due in part to methodological differences across the studies. For example, the rating scales used have varied with respect to assessing discomfort, pain, or a combination of these two constructs. Nevertheless, taken as a whole, the results of previous research suggest that a substantial proportion of women experience at least some physical discomfort during mammography.

The purpose of this study was to examine the rates of physical discomfort associated with mammography among asymptomatic women at six San Diego County, Calif, mammography facilities. In addition, potential correlates of discomfort at mammography were examined. Although no formal hypotheses were tested, the choice of potential correlates was guided by data in previous literature.

MATERIALS AND METHODS

Setting and Subjects

Subjects in the present study (N = 1,800) were recruited to participate in a larger controlled trial, the Picture of Health Mammography Project. The goal of the intervention being evaluated in the trial was to increase adherence to mammographic screening

guidelines among women 50–74 years of age. The outcome was whether the subject underwent mammography within 12–14 months of the mammography performed at entry to the study.

The study was conducted at six San Diego County mammography facilities. At the time of the study, each participating facility was performing an estimated mean of 2,508 screening mammographic examinations per year for women of ages 50–74 years.

After recruitment of the six facilities, each facility's staff identified up to 31 physicians who referred the most patients to that facility for screening mammography. A total of 160 physicians were asked to participate; 82 (51%) agreed.

Participating physicians gave permission for project and/or mammography facility staff to seek consent from physicians' patients who met study inclusion criteria. Inclusion criteria for the subjects were having an age of 50–74 years, negative results for the study-entry mammogram, the ability to speak Spanish or English, no personal history of breast cancer, no symptoms at the time of mammography, and a referral by a participating primary care physician.

Participation involved a telephone interview administered by a professional research firm. The interview was conducted prior to randomization in the trial. Written informed consent was obtained after the study was explained fully in an informational packet and, at times, in person. The study was approved by the Committee on the Protection of Human Subjects at San Diego State University.

Measures

Data were collected from 1995 to 1997 by means of a 43-item telephone interview, with 11 of the items explored in this study. The 11 items were (*a*) perceived discomfort from mammography, (*b*) satisfaction with the care received during study-entry mammography (three items), (*c*) intentions to undergo mammography the following year, (*d*) number of prior mammographic examinations, (*e*) fibrocystic breast status, (*f*) age, (*g*) educational level, (*h*) ethnicity, and (*i*) annual family income level.

The discomfort level scale was adapted from the work of Stomper et al (16). Although the original scale included levels of both physical discomfort and pain, our version included only levels of physical discomfort (none, slight, moderate, substantial, and extreme). Specifically, the subject was asked, ''I want you to think about the mammogram you had most recently. When the mammography equipment was pressing against your breasts during the x-ray, how did you feel?''

The three satisfaction-measurement items were adapted from the 26-item breast screening satisfaction scale of Cockburn and colleagues (18). The respondent was asked to rate her level of agreement on a five-point Likert scale (1 indicating strong disagreement; to 5, strong agreement) with the statements: ''I was very satisfied with the care I received,'' ''I feel confident that the mammogram was taken properly,'' and ''The person was too rough when taking the mammogram.''

For the intentions item, subjects rated the likelihood (on a five-point Likert scale) that they would ''have another routine screening mammogram next year, even if your doctor does not suggest one.'' This item was adapted from the work of Mayer et al (19).

The items for assessment of demographic characteristics were adapted from the National Cancer Institute Breast Cancer Screening Consortium survey (20), and the items for assessment of fibrocystic breast status and screening history were developed by our research team for this study. Two additional variables were included in the analysis: the facility at which mammography was performed and the time between mammography and the interview.

The interviewers attempted to contact the subjects as soon as possible after study-entry mammography and completion of informed consent procedures. Up to 20 attempts were made to contact subjects for the interview before they were considered ''unreachable'' (most respondents were contacted in one to three attempts). The interview was a mean of 14 minutes long and was conducted a median of 3 weeks after mammography (range, 3–145 days).

Analysis

The data were analyzed by using the Statistical Package for the Social Sciences, or SPSS (SPSS, Chicago, Ill). Frequencies for all variables were generated, and bivariate associations between variables were analyzed by using the χ^2 test. Logistic regression was used to assess the independent predictors of discomfort at mammography while controlling for all other factors.

RESULTS

Response Rate

Graduate assistants (including J.R.D.) used mammography facility schedules to identify all women who met study inclusion criteria during the recruitment phase of the study. A total of 3,701 women were identified as eligible and were asked to participate in the study. Of the 3,701 women approached, 1,863 (50%) enrolled in the study.

Of the 1,863 women, 63 did not complete the telephone interview for one of the following reasons: They could not be contacted within the 20 attempts (n = 33), they refused to participate in the interview when they were telephoned (n = 18), their telephone number was incorrect (n = 4), they had an incomplete telephone interview (n = 4), their telephone was disconnected (n = 3), or they had limited English-speaking skills and spoke no Spanish (n = 1). Thus, data for 1,800 subjects were available for this analysis.

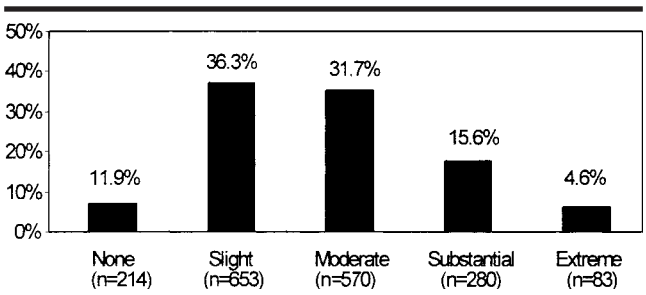
Sample Characteristics and Descriptive Data

Demographic and selected health-related information for the study sample is provided in Table 1. The mean age was 60.0 years ± 7.4 (SD). The majority of the sample was non-Latina white and had relatively high educational and income levels. Approximately 32% of the sample had been told by a physician that they had fibrocystic breast disease. The number of subjects who reported multiple previous mammographic examinations was high.

As shown in the Figure, 933 (51.8%) of the women in the sample reported moderate or greater physical discomfort when the mammographic equipment was pressing against the breasts. As shown in Table 2, the reported likelihood that a subject would return the next year for a mammographic examination even if her physician did not recommend one was high. When questioned regarding their overall satisfaction with the care they received, the majority of the subjects reported being very satisfied. Most were very confident that mammography was performed properly and did not think that the technologist was too rough when performing mammography.

Associations between Discomfort and Selected Variables

Table 3 presents the percentages of subjects who reported moderate or higher levels of discomfort, by categories of various factors, with the results of χ^2 analyses. Moderate to higher levels of discomfort



Graph demonstrates that approximately one-half the sample reported at least a moderate level of discomfort associated with recent mammography.

TABLE 1
Characteristics of the Sample (*N* = 1,800)

Characteristic	No. of Subjects
Age (y) (mean age, 60.0 ± 7.4)	
50–64	1,205 (66.9)
65–74	595 (33.1)
Ethnicity	
White, non-Latina	1,513 (84.3)
Latina	141 (7.9)
African American	62 (3.5)
Asian	27 (1.5)
American Indian	7 (0.4)
Pacific Islander	7 (0.4)
Other	37 (2.1)
Annual family income level	
$0–$25,000	431 (27.5)
$25,001–$40,000	448 (28.6)
Over $40,000	686 (43.8)
Educational level	
High school graduate or below	513 (28.6)
Some college	657 (36.6)
College graduate	626 (34.9)
Has fibrocystic breast disease	575 (32.4)
No. of previous mammographic examinations	
0	35 (1.9)
1–4	444 (24.7)
5–7	468 (26.0)
8–10	453 (25.2)
11+	400 (22.2)

Note.—Numbers in parentheses are percentages.

* Figures in the columns for ethnicity, income level, educational level, and fibrocystic breast disease do not add to 1,800 because of missing data.

TABLE 2
Intention to Undergo Mammography the Next Year (*N* = 1,800)

	No. of Subjects
Intention to undergo mammography the next year	
Very unlikely	82 (4.6)
Somewhat unlikely	56 (3.1)
50% chance	108 (6.0)
Somewhat likely	133 (7.4)
Very likely	1,421 (78.9)
Satisfied with care	
Strongly disagree	11 (0.6)
Disagree	17 (0.9)
Neutral	25 (1.4)
Agree	416 (23.1)
Strongly agree	1,331 (73.9)
Confident that mammography was performed properly	
Strongly disagree	11 (0.6)
Disagree	6 (0.3)
Neutral	34 (1.9)
Agree	443 (24.6)
Strongly agree	1,306 (72.6)
Thought person performing mammography was too rough	
Strongly disagree	1,181 (65.6)
Disagree	497 (27.6)
Neutral	44 (2.4)
Agree	43 (2.4)
Strongly agree	35 (1.9)

Note.—Numbers in parentheses are percentages.

(vs no discomfort or slight discomfort levels) were present significantly more often in subjects with higher (vs lower) income levels, with higher educational levels, with fibrocystic breast disease, with less than strong satisfaction with the care received during mammography, with less than a strong level of confidence that mammography was performed properly, and with stronger (vs weaker) agreement that the technologist was ''too rough.''

The sample sizes for ethnic groups, with the exception of non-Latina white women, were relatively small. Nevertheless, the rates of discomfort were compared between white women, Latina women, and the combination of all other groups, and the association was significant, with Latina women reporting the lowest rates of at least moderate discomfort.

Finally, the association between facility and discomfort was significant, with the percentage of women with at least moderate discomfort ranging from 37.7% to 65.9%. Factors that were not significantly associated with discomfort in bivariate analysis included the subject's age, the number of previous mammographic examinations she had undergone, the interval between mammography and the interview, and the intention to undergo future mammography.

In an exploratory manner, χ^2 tests of the association between discomfort level and intentions were conducted by using two other dichotomous coding schemes for the discomfort variable: (*a*) no discomfort to moderate discomfort versus substantial or extreme discomfort and (*b*) no discomfort to substantial discomfort versus extreme discomfort. The distributions resulting from these tests were comparable with each other and with the primary test results presented in Table 3. The associations resulting from the new test results were not statistically significant.

Each of the variables that was included in the bivariate tests was entered simultaneously in a logistic regression analysis, with discomfort as the dependent variable. A total of 1,515 subjects were included in this analysis; the remaining 285 subjects were excluded because of missing data. A zero indicated no discomfort or slight discomfort; 1, moderate, substantial, or extreme discomfort. There were approximately 47% (705 of 1,515 women) and 53% (810 of 1,515 women) of the logistic regression sample in these respective categories. The only variables that were significantly predictive of discomfort in the logistic regression model were facility ($P < .001$), satisfaction with care ($P < .04$), and belief that the technologist was too rough ($P < .001$).

DISCUSSION

This article addresses the level and correlates of discomfort at mammography in a sample of older women with a history of high mammographic compliance. The distribution of reported discomfort was none (12%), slight (36%), moderate (32%), substantial (16%), and extreme (5%).

Stomper et al (16), in a large (N = 1,847) multicenter survey on mammographic discomfort, found that only 1% of their sample reported pain and that the levels of discomfort were none (49%), mild (39%), moderate (9%), and severe (1%). Thus, the reported levels in that

study were substantially lower than those found in the present study.

As discussed in a review (21), a multitude of methodological differences may explain the discrepant results between these two studies and across the other studies published to date of which we are aware. For example, compared with that in the Stomper et al study (16), our sample was older (mean age, 60 vs 50 years), had higher rates of previous mammography (98% vs 63%), was assessed with a phone interview days to weeks after mammography (vs with a self-administered questionnaire immediately after), and was presented with a scale used to assess only discomfort (vs a scale used to assess both discomfort and pain).

Eight of the 12 possible correlates of discomfort that were tested by using bivariate analysis showed significant associations. However, when these same 12 variables were simultaneously included in a logistic regression analysis, only three remained statistically significant. These variables were the facility (at which higher discomfort levels ranged from 38% to 66%), overall satisfaction with the care received, and perception that the technologist was too rough.

Stomper et al (16) also found that the facility was independently predictive of reported discomfort. By using a similar dichotomization of discomfort level, their seven facilities ranged from 5% to 22% on moderate or higher discomfort. The researchers hypothesized that the variation in technologists was one of the reasons that the facilities differed on discomfort ratings.

The facility-based differences found in our results may be due to technologist characteristics and differences in facility ambience. For example, the facility at which the lowest discomfort level was reported provided each subject with a fresh rose after her mammographic examination. However, from existing data, we are unable to determine the actual contributions of this and other amenities to subjects' perceptions.

The significant relationships between discomfort and both satisfaction with care and rating of the technologist's roughness were not surprising. However, given the study design, no causality should be inferred. In contrast, Cockburn and colleagues (8) found no relationship between discomfort and the roughness variable.

An initially surprising finding was the lack of a significant association between discomfort and intention to undergo mammography in the future. However, it may be explained by the lack of variability in our intentions variable; approximately 79% of our sample reported that they were very likely to undergo future mammography. The mammographic history of our sample also suggests that they were highly motivated to undergo mammography regularly, even if the examination was perceived to be uncomfortable. Cockburn and colleagues (8) also found no relationship between discomfort level and intentions, but, similar to us, had few subjects with lack of intention.

Several methodological issues should be considered when interpreting the findings. First, to be eligible for the study, a

TABLE 3
Bivariate Relationships between Discomfort and Selected Variables ($N = 1,800$)

Factor	No. of Patients with Moderate or Greater Discomfort (%)	χ^2 Statistic	*P* Value
Age (y) (mean age, 60.0 ± 7.4)		3.41	.065
50–64	53.4 (643/1,205)		
65–74	48.7 (290/595)		
Ethnicity		12.17	.002
White non-Latina	52.5 (794/1,513)		
Latina	38.3 (54/141)		
Other	57.1 (80/140)		
Annual family income level		10.58	.005
$0–$25,000	50.1 (216/431)		
$25,001–$40,000	48.4 (217/448)		
Over $40,000	57.4 (394/686)		
Educational level		10.95	.004
High school graduate or below	46.0 (236/513)		
Some college	53.1 (349/657)		
College graduate	55.6 (348/626)		
Has fibrocystic breast disease		6.70	.010
Yes	56.3 (324/575)		
No	49.8 (598/1,201)		
No. of previous mammographic examinations*		3.42	.331
1–4	48.6 (216/444)		
5–7	53.6 (251/468)		
8–10	54.1 (245/453)		
11+	53.3 (213/400)		
Facility visited		84.09	.001
1	37.7 (154/408)		
2	42.9 (3/7)		
3	44.4 (99/223)		
4	49.2 (229/465)		
5	59.8 (110/184)		
6	65.9 (338/513)		
Intention to undergo mammography the next year†		0.004	.949
Very likely	51.8 (736/1,421)		
Other responses	52.0 (197/379)		
Satisfied with care†		5.05	.025
Strongly agree	50.3 (669/1,331)		
Other responses	56.3 (264/469)		
Confident that mammography was performed properly†		7.52	.006
Strongly agree	49.8 (651/1,306)		
Other responses	57.1 (282/494)		
Thought person performing mammography was too rough†		60.24	< .001
Strongly disagree	45.2 (534/1,181)		
Other responses	64.5 (399/619)		
Interval between mammography and interview (d)‡		1.33	.248
3–21	50.5 (461/913)		
≥22	53.2 (472/887)		

Note.—Numbers in parentheses are number of patients with moderate or greater discomfort divided by the total number of patients.

* Numbers are based on number of patients who underwent at least one previous mammographic examination, which was 98% of the sample ($n = 1,765$).

† Responses to these five-point Likert scales were dichotomized on the basis of the skewness of the distributions (see Table 2).

‡ Median interval = 21 days.

subject had to have been referred for her study-entry mammographic examination by a participating physician. Because only 51% of the physicians recruited consented to participate, and subsequently only 50% of their patients (who underwent screening mammography at one of the six facilities) consented to participate, limitations to the generalizability of the results must be considered.

For example, as noted earlier, our sample was relatively adherent to undergoing regular mammographic examination, which may have been a function of self-selection bias. Thus, the number of barriers to mammography they had (including discomfort) may have differed from the barriers of samples with lower adherence.

Researchers in future studies of discomfort at mammography should select both women who are undergoing mammography for the first time and those who have a more sporadic, less adherent history. In the current study, refusers were, on average, approximately 1 year older than consenters ($P < .001$, data not presented). Unfortunately, no additional data on refusers were available for a comprehensive comparison.

Second, our interviews were delayed by a median of 3 weeks from when mammography was performed. A more accurate measure of the subject's perceived discomfort level may have been obtained during or immediately after the procedure, with additional (eg, 3- and 6-month) follow-up assessments. Although we found no relationship between time since mammography and discomfort level, we were unable to assess whether discomfort perception 1 day or more after the procedure changed from the initial (at-mammography) perception. Cockburn and colleagues (8) found that subjects changed their discomfort ratings from 1–2 days to 3 months after mammography, with a tendency to report greater discomfort at the 3-month follow-up.

Third, characteristics of the discomfort scale may have influenced our discomfort ratings. For example, in an attempt to ensure that respondents rated the physical discomfort they experienced from the compression, we worded the item very specifically (ie, ''When the mammography equipment was pressing against your breast. . .''). This may have biased the responses in the direction of reporting greater discomfort.

In addition, our scale was used to measure only discomfort, and we had no items that asked about pain. For the discomfort scale, subjects were not given analogies or examples to define what was meant by the various discomfort response options. Therefore, any conclusions about pain perceptions per se were limited, and it was not possible to ascertain whether use of response options about only discomfort influenced the scale's sensitivity.

However, researchers in a recent study (4) who separately measured pain and discomfort at mammography in the same cohort found that the distributions for these two constructs were nearly identical and that the scales were highly correlated ($r = 0.67$, $P < .001$). These data suggest that the constructs are strongly related.

Finally, similar to researchers in most of the previous studies on this topic, we do not have data on the degree of compression force of each mammographic examination. Force may have an important relationship with perceived discomfort. For example, Sullivan and colleagues (17) found that the amount of force used was significantly associated with the reported level of discomfort or pain. Although adequate compression is essential for high-quality mammography, there is likely a level of force above which the added quality is negligible and the discomfort level is unnecessarily high. Sullivan and colleagues (17) found that high-quality mammograms could be obtained with forces of less than the maximum available level.

Our study also had several strengths. First, to our knowledge, it was the second largest of all eight U.S. studies on this topic and, along with the largest study (16) we know of, had a sample exceeding 1,000 women.

Second, it was one of only three studies that to our knowledge included multiple mammography facilities, which enhances the generalizability of the findings.

Third, given our geographic location, we used a variety of strategies to ensure inclusion of Latina women in our sample. To our knowledge, researchers in only three previous studies (6,12,15) of discomfort at mammography had reported including any Latina subjects in their samples.

Fourth, in general, the women in our study were older (mean age, 60 years ± 7.4; age range, 50–74 years) than the women in previous studies with detailed age data (composite mean, 53 years of age, with some studies including women in their 30s and 40s) (4,6,9,12,15,16) reported. Thus, our sample was at high risk for developing breast cancer and was more likely to benefit from annual screening. Focusing on the potential barriers to screening in this age group (relative to younger age groups) is therefore important.

Finally, we used a rating scale with which we attempted to measure only one construct—discomfort. The validity of the scales used in some of the previous studies was compromised by inclusion of two constructs, perceived discomfort and perceived pain, whose relationship is unclear from both measurement and perceptual perspectives (21).

In summary, although researchers in this study found a relatively large proportion of women who reported physical discomfort during mammography, discomfort did not appear to have an effect on the intention to undergo future mammography. Nevertheless, discomfort may be important to mammography facilities with respect to consumer satisfaction. For example, had we assessed intention to return to the same facility for mammography, those women with higher discomfort levels may have been more likely to respond negatively.

Future researchers should investigate samples with greater heterogeneity with respect to mammographic history and motivation; assess discomfort level in proximity to mammography; assess objective characteristics of the pain stimulus, such as compression force; and investigate the effect of discomfort on facility loyalty.

At three of our six facilities, approximately one-half or more of the respondents reported at least moderate mammography-related discomfort; at one facility, this figure approached two-thirds. Managers of individual mammography facilities should systematically assess patient discomfort level and monitor examination characteristics (eg, level of compression) and other variables (eg, treatment by technologist and receptionist, advance notification that examination may be uncomfortable). Until additional research-based data become available, the results of facility-specific clinical observations may help equip facility managers with the information needed to reduce patient discomfort.

Acknowledgments: We thank Heather Kurata, MPH, for her excellent subject recruitment and library skills and Donald Slymen, PhD, for providing consultation on the statistical analysis. We are grateful to the staff at the following mammography facilities for their contributions to this study: the Scripps Lybrand Mammography and Education Center, Scripps Memorial Hospital; the Center for Women's Health, University of California at San Diego; the Alvarado Breast Center; the Mercy Women's Imaging Center, Scripps Mercy Hospital;

Scripps South Bay Imaging; and the Tri-City Outpatient Imaging Center, Tri-City Medical Center. Lester Greenberg and his staff at Luth Research provided outstanding expertise in conducting the interviews and in managing the interview data.

References

1. Kerlikowske K, Grady D, Rubin SM, Sandrock C, Ernster VL. Efficacy of screening mamography: a meta-analysis. JAMA 1995; 273:149–154.
2. Hendrick RE, Smith RA, Rutledge JH, Smart CR. Benefit of screening mammography in women aged 40–49: a new meta-analysis of randomized controlled trials. J Natl Cancer Inst Monogr 1997; 22:87–92.
3. Breen N, Kessler L. Changes in the use of screening mammography: evidence from the 1987 and 1990 National Health Interview surveys. Am J Public Health 1994; 84:62–67.
4. Aro AR, Absetz-Ylöstalo P, Eerola T, Pamilo M, Lönnqvist J. Pain and discomfort during mammography. Eur J Cancer 1996; 32A:1674–1679.
5. Baines CJ, To T, Wall C. Women's attitudes to screening after participation in the National Breast Screening Study: a questionnaire survey. Cancer 1990; 65:1663–1669.
6. Baskin-Smith J, Miakowski C, Dibble SL, Weekes D, Nielsen BB. Perceptions of the mammography experience. Cancer Nurs 1995; 18:47–52.
7. Brew MD, Billings JD, Chisholm RJ. Mammography and breast pain. Australas Radiol 1989; 33:335–336.
8. Cockburn J, Cawson J, Hill D, De Luise T. An analysis of reported discomfort caused by mammographic x-ray attenders at an Australian pilot breast screening program. Australas Radiol 1992; 36:115–119.
9. Fine MK, Rimer BK, Watts P. Women's response to the mammography experience. J Am Board Fam Pract 1993; 6:546–555.
10. Jackson VP, Lex AM, Smith DJ. Patient discomfort during screen-film mammography. Radiology 1988; 168:421–423.
11. Leaney BJ, Martin M. Breast pain associated with mammographic compression. Australas Radiol 1992; 36:120–123.
12. Nielsen BB, Miakowski C, Dibble SL, Beber B, Altman N, McCoy CB. Pain and discomfort associated with film-screen mammography. J Natl Cancer Inst 1991; 83:1754–1756.
13. Roworth MA, McIlwaine GM, Wallace AM. Women's views of the Scottish breast screening programme: a national consumer opinion survey. Public Health 1993; 107:185–192.
14. Rutter DR, Calnan M, Vaile MSB, Field S, Wade KA. Discomfort and pain during mammography: description, prediction, and prevention. BMJ 1992; 305:443–445.
15. Stein JA, Fox SA, Murata P. The influence of ethnicity, socioeconomic status, and psychological barriers on use of mammography. J Health Soc Behav 1991; 32:101–113.
16. Stomper PC, Kopans DB, Sadowsky NL, et al. Is mammography painful? a multicenter patient survey. Arch Intern Med 1988; 148:521–524.
17. Sullivan DC, Beam CA, Goodman SM, Watt DL. Measurement of force applied during mammography. Radiology 1991; 181:355–357.
18. Cockburn J, Hill D, Irwig L, DeLuise T, Turnbull D, Schofield P. Development and validation of an instrument to measure satisfaction of participants at breast screening programmes. Eur J Cancer 1991; 27:827–831.
19. Mayer JA, Slymen DJ, Jones JA, et al. Mammography knowledge and intentions among insured women. Prev Med 1992; 21:8–17.
20. National Cancer Institute. Screening mammography: a missed clinical opportunity? results of the NCI Breast Cancer Screening Consortium and National Health Interview survey studies. JAMA 1990; 264: 54–58.
21. Keefe FJ, Hauck ER, Egert J, Rimer B, Kornguth P. Mammography pain and discomfort: a cognitive-behavioral perspective. Pain 1994; 56:247–260.