Short Communication

Utilization of BRCA1/BRCA2 Mutation Testing in Newly Diagnosed Breast Cancer Patients

Marc D. Schwartz,[1] Caryn Lerman,[2] Barbara Brogan,[1] Beth N. Peshkin,[1] Claudine Isaacs,[1] Tiffani DeMarco,[1] Chanita Hughes Halbert,[2] Marie Pennanen,[1] and Clinton Finch[1]

[1]Department of Oncology, Lombardi Comprehensive Cancer Center, Georgetown University, Washington District of Columbia and [2]Department of Psychiatry, Abramson Cancer Center, University of Pennsylvania, Philadelphia, Pennsylvania

Abstract

Background: **Among newly diagnosed breast cancer patients who are at risk for carrying a BRCA1 or BRCA2 mutation, knowledge of mutation status can influence local breast cancer treatment decisions. Thus, genetic testing at the time of diagnosis is increasingly considered an option for such patients. In this study, we evaluated factors associated with the decision to undergo *BRCA1/BRCA2* gene testing at the time of initial breast cancer diagnosis.**
Methods: **Participants were newly diagnosed breast cancer patients who had not yet received definitive local breast cancer treatment and who had a family history consistent with hereditary breast cancer. Participants were offered genetic counseling and BRCA1/BRCA2 testing with results in 2 to 3 weeks.**
Results: **Of 231 patients who referred to the study, 20 (9%) declined the baseline interview, 34 (15%) completed a baseline interview but declined genetic testing, and 177 (76%) underwent BRCA1/BRCA2 testing. Physician recommendation for BRCA1/BRCA2 testing and indecision about definitive local treatment were both associated with undergoing testing. Among patients who were tested, 38 (21%) proceeded with definitive local treatment before receiving test results. Delay in the availability of test results and low levels of anxiety were associated with the decision to proceed with definitive local treatment before receiving test results.**
Conclusions: **These results suggest that if rapid testing is available and genetic referrals are made for appropriate patients, a high proportion are likely to opt for such testing. In particular, patients who have not yet reached a decision about definitive local treatment may benefit from a genetic referral.** (Cancer Epidemiol Biomarkers Prev 2005;14(4): 1003–7)

Introduction

Approximately 5% to 10% of all breast cancer is associated with hereditary predisposition (1), and the majority of hereditary breast cancer is attributable to mutations in either the *BRCA1* or *BRCA2* gene (2, 3). Unaffected women who carry a BRCA1/BRCA2 mutation have a 55% to 85% cumulative risk of developing breast cancer (4, 5). Moreover, breast cancer patients who carry a BRCA1/BRCA2 mutation have up to a 65% risk of developing a second breast cancer in the contralateral breast (6-8). Given the high rate of second cancers among BRCA1/BRCA2 carriers, bilateral mastectomy has emerged as a treatment option for newly diagnosed breast cancer patients who carry a BRCA1/BRCA2 mutation (9). Thus, high-risk patients may increasingly be asked to consider genetic testing at the time of their initial breast cancer diagnosis (10).

Among newly diagnosed breast cancer patients who receive a positive BRCA1/BRCA2 test result before their definitive local breast cancer treatment, over 50% opt for immediate bilateral mastectomy (9, 11). Advantages of immediate bilateral mastectomy for BRCA1/BRCA2 mutation carriers include the avoidance of radiation treatment and the possibility of enhanced reconstruction options (9, 11). Despite these advantages, there are several reasons that patients may decide against genetic testing at the time of diagnosis. First, breast-conserving treatment is an effective local treatment even for BRCA1/BRCA2 mutation carriers (12). Thus, decisions about genetic testing and bilateral mastectomy need not be made at the time of initial diagnosis (13). Second, the process of obtaining genetic counseling and testing immediately post-diagnosis could lead to treatment delay and may not be feasible in many settings (9, 13, 14). Finally, for some patients, BRCA1/BRCA2 testing may represent an added psychological burden during the already stressful period following a breast cancer diagnosis (9, 13, 15).

Given these benefits and risks, we sought to identify factors that are associated with the decision to undergo BRCA1/BRCA2 testing at diagnosis. In addition to basic demographic, disease- and treatment-related variables, we were interested in the roles of physician recommendation and psychological distress. These variables have been shown to be important predictors of medical decisions in general (16, 17) and genetic testing decisions in particular (18-20).

Materials and Methods

This study was approved by the Institutional Review Board at Georgetown University. Newly diagnosed breast cancer patients referred to the study by contacting the program directly or by indicating their interest on a family history screening form that was completed in the waiting room of participating physicians at Lombardi Comprehensive Cancer Center or collaborating community practices. Eligible participants were women who were newly diagnosed with ductal

Received 12/29/03; revised 11/23/04; accepted 12/21/04.
Grant support: RO1 CA/HG74861 (M.D. Schwartz) and KO7 CA65597 (M.D. Schwartz).
The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked advertisement in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.
Requests for reprints: Marc D. Schwartz, Lombardi Comprehensive Cancer Center, Cancer Control Program, Georgetown University School of Medicine, Suite 317, 2233 Wisconsin Avenue, Northwest, Washington, DC 20007. Phone: 202-687-0185; Fax: 202-687-8444. E-mail: schwartm@georgetown.edu

carcinoma *in situ* to stage IIIa breast cancer, had ~10% or higher prior probability of carrying a BRCA1/BRCA2 mutation (21-23) and had not received definitive local breast cancer treatment. As in previous reports (9), we defined definitive local treatment as either mastectomy (unilateral or bilateral) or lumpectomy plus the initiation of radiation treatment. Thus, patients who had received a lumpectomy were not deemed to have received definitive local treatment until they initiated radiation or obtained a completion mastectomy.

Overall, 231 eligible patients referred to the study. Of these, 20 (8.7%) declined the baseline interview. Thus, our final sample consisted of 211 patients.

Procedures. Interested patients were contacted by study staff to assess eligibility. After completing a structured telephone interview that assessed sociodemographics, family history of cancer, disease characteristics, psychological distress, quality of life, and physician genetic testing and surgical recommendations, eligible participants were invited to a pretest genetic counseling session with a trained oncology nurse educator or genetic counselor. The content of this session has been described previously (24). Briefly, this session was comparable with traditional genetic counseling for hereditary breast cancer but with an added focus on risks for second breast cancers, risks and benefits of genetic testing at the time of initial diagnosis, and efficacy of breast conservation and bilateral mastectomy for BRCA1/BRCA2 mutation carriers. Following counseling, participants were given the option of providing a blood sample for BRCA1/BRCA2 testing. When test results were available (usually within 2-3 weeks) a disclosure session was scheduled. Genetic counseling and testing were provided free of charge.

Measures

Sociodemographics. We assessed sociodemographics at the baseline interview. We dichotomized these variables as follows: age (≤40 versus >40), race (Caucasian versus other), marital status (married/living with partner versus other), education (college graduate versus <college graduate), employment (employed full time versus other), and religion (Jewish versus other).

Family History. We assessed the number of first- and second-degree relatives affected with breast or ovarian cancer. For analysis, we dichotomized this variable to compare patients with ≤2 affected relatives versus those with >2 affected relatives.

Cancer Stage. Tumor-node-metastasis stage was abstracted from medical records and dichotomized to compare patients with ductal carcinoma *in situ*/stage I versus stage II/IIIa. Staging data was missing for 38 (18%) participants.

Psychological Distress. We measured baseline cancer-specific distress with the total score on the 15-item Impact of Events Scale (Cronbach's Alpha, this study = 0.82; refs. 25, 26). We measured baseline anxiety with the 20-item State Anxiety Scale of the State Trait Anxiety Inventory (Cronbach's Alpha, this study = 0.92; refs. 27, 28).

Quality of Life. We measured baseline quality of life with the total score on the 27-item Functional Assessment of Cancer Therapy-General (Cronbach's Alpha this study = 0.87; refs. 29, 30).

Genetic Testing Recommendation. We categorized patients into those who reported (on the baseline interview) receiving a genetic testing recommendation from their surgeon, medical or radiation oncologist (n = 117) versus those who did not (n = 94).

Surgical Recommendation. We categorized patients into those who reported receiving a surgical recommendation to consider bilateral mastectomy (n = 43) versus those who received no recommendation (n = 168).

Rapid versus Delayed Local Treatment Decision. We categorized patients into those who could delay their definitive local treatment decision until completing adjuvant chemotherapy (i.e., had received a lumpectomy, were eligible for breast conservation and required adjuvant chemotherapy; n = 74) versus those who could not (i.e., ineligible for lumpectomy or did not require adjuvant chemotherapy; n = 128). Ten (5%) patients were missing data on this variable.

Definitive Local Treatment Intentions. We classified patients as to whether they reported having made a definite local treatment decision (n = 167) or not (n = 44) at baseline.

Time Until Availability of Test Results. Patients who were tested (n = 177), were further classified into those whose test result was available for disclosure within 14 days (n = 95) versus those whose test result was not available within 14 days (n = 82).

Genetic Testing Decision. Participants were classified into those who received test results (n = 177) versus declined testing (n = 34). Participants who received test results were further classified into those who received their results before their definitive local treatment (n = 139) versus those who received their results after proceeding with definitive local treatment (n = 38).

Data Analysis. After generating descriptive statistics to characterize the sample, we conducted bivariate analyses (χ^2, t tests) to determine the association between genetic testing decision and baseline predictors. Next, we entered significant ($P \leq 0.05$) bivariate predictors of testing decision into a backward logistic regression to identify independent predictors of testing decision. In analyses limited to patients who underwent BRCA1/BRCA2 testing, we conducted bivariate analyses (χ^2, t tests) to identify predictors of the decision to proceed with definitive local treatment before the receipt of test results. Next, we employed logistic regression to identify independent predictors of this decision.

Results

Sample Characteristics. The mean age of participants was 43 years (SD = 9), 85% were Caucasian, 67% were married, 60% were employed full time, 81% were college educated, 31% were of Ashkenazi Jewish descent, 25% had at least two first-degree relatives with breast or ovarian cancer, and 61% were diagnosed with ductal carcinoma *in situ* or stage I breast cancer.

Bivariate Predictors of Genetic Testing Decisions. Of 231 eligible patients, 20 (9%) declined study participation, 34 (15%) agreed to participate in the study but declined BRCA1/BRCA2 testing, and 177 (76%) chose to undergo BRCA1/BRCA2 testing. Among study participants, three variables distinguished those who received test results from those who declined testing (Table 1). Those who received test results had poorer baseline quality of life, were less likely to have reached a definitive local treatment decision, and were more likely to have received a physician recommendation for BRCA1/BRCA2 testing.

Multivariate Model of Genetic Testing Decisions. To identify independent predictors of BRCA1/BRCA2 testing decisions, we entered baseline quality of life, physician recommendation for genetic testing, and indecision regarding definitive local treatment into a logistic regression model

Table 1. Bivariate associations between baseline variables and genetic testing decision

Variable	Level	% Receiving test results	χ^2 (1 *df*)
Age	<40	89	
	>40	82	1.64
Race	Caucasian	85	
	Other	78	0.90
Education	<College	75	
	>College	86	2.88
Marital status	Unmarried	83	
	Married	84	0.08
Employment status	<Full time	87	
	Full time	82	0.87
Religion	Jewish	85	
	Non-Jewish	83	0.08
First-degree relatives with breast cancer	<2	82	
	>2	88	1.14
Required to make a rapid treatment decision	No	92	
	Yes	83	3.24
TNM stage	0/I	91	
	II/IIIa	93	0.08
Physician recommendation for BRCA1/BRCA2 testing	No	76	
	Yes	91	8.75*
Surgical recommendation	UM/BCT/ No record	82	
	BLM	93	3.33
Patient definitive surgery decision	Undecided	97	
	Decided	81	6.23*

Continuous variables

Variable	Received results, mean (SD)	Declined testing, mean (SD)	*t* (209 *df*)
Quality of life (FACT-G)	79.7 (13.9)	84.7 (8.5)†	2.0†
Cancer distress (IES)	25.7 (14.0)	23.9 (13.8)	0.7
State anxiety (STAI-S)	47.8 (12.5)	44.7 (12.3)	1.4

Abbreviations: *df*, degrees of freedom; TNM, tumor-node-metastasis stage; IES, Impact of Events Scale; STAI-S, State Anxiety Scale of the State Trait Anxiety Inventory; FACT-G, Functional Assessment of Cancer Therapy-General.
*$P = 0.01$.
†$P < 0.05$.

with backward elimination of nonsignificant variables. After eliminating nonsignificant variables [Functional Assessment of Cancer Therapy-General: χ^2 (1) = 2.5, $P = 0.11$], the final model included physician recommendation for genetic testing and indecision about definitive local treatment. Compared with patients who did not receive a physician recommendation, those who reported receiving such a recommendation were three times more likely to undergo genetic testing (odds ratio, 3.2; 95% confidence interval, 1.5-7.1). Furthermore, compared with patients who had reached a definitive local treatment decision at baseline, those who were undecided about their definitive local treatment were five times more likely to undergo genetic testing (odds ratio, 5.3; 95% confidence interval, 1.2-23.3). The wide confidence interval for the effect of indecision about definitive local treatment reflects the fact that only 2 of 38 undecided participants declined testing.

Bivariate Predictors of Receiving Test Results before Definitive Treatment. Of the 177 patients who were tested, 38 (21%) chose to proceed with definitive local treatment before receiving the results of their BRCA1/BRCA2 test. In bivariate analyses (Table 2), patients who were less anxious and those for whom test results were not available within 14 days were more likely to proceed with definitive local treatment before receiving test results.

Multivariate Model of the Receipt of Test Results before Definitive Local Treatment. In multivariate modeling, both time until the availability of test result and baseline anxiety independently predicted the decision to proceed with definitive local treatment before the receipt of test results. Compared with patients for whom test results were available within 14 days, patients whose test results took longer to become available were over three times more likely to proceed with testing before receiving test results (odds ratio, 3.4; 95% confidence interval, 1.5-7.6). In contrast, compared with less anxious patients, those patients who reported higher levels of baseline anxiety, were 23% less likely to proceed with definitive local treatment before receiving test results (odds ratio, 0.77; 95% confidence interval, 0.59-0.91).

Table 2. Bivariate associations between baseline variables and decision to proceed with definitive local treatment before the receipt of test results

Variable	Level	% Received results before definitive local treatment	χ^2 (1 *df*)
Age	<40	89	
	>40	82	1.64
Race	Caucasian	85	
	Other	78	0.90
Education	<College	75	
	>College	86	2.88
Marital status	Unmarried	83	
	Married	84	0.08
Employment status	<Full time	87	
	Full time	82	0.87
Religion	Jewish	85	
	Non-Jewish	83	0.08
First-degree relatives with breast cancer	<2	82	
	>2	88	1.14
Required to make a rapid treatment decision	No	92	
	Yes	83	3.24
TNM stage	0/I	91	
	II/IIIa	93	0.08
Physician recommendation for BRCA1/BRCA2 testing	No	76	
	Yes	91	
Surgical recommendation	UM/BCT/ no record	82	8.75*
	BLM	93	3.33
Patient definitive surgery decision	Undecided	97	
	Decided	81	6.23*
Time until BRCA1/2 test results were available for disclosure (d)	<14	88	
	>14	67	11.9*

Continuous variables

Variable	Results before treatment, mean (SD)	Results after treatment, mean (SD)	*t* (175 *df*)
Quality of life (FACT-G)	78.8 (14.3)	82.9 (12.2)	1.6
Cancer distress (IES)	26.3 (14.1)	23.5 (13.4)	1.1
State anxiety (STAI-S)	49.2 (12.6)	42.5 (10.8)	3.0†

Abbreviations: *df*, degrees of freedom; TNM, tumor-node-metastasis stage; IES, Impact of Events Scale; STAI-S, State Anxiety Scale of the State Trait Anxiety Inventory; FACT-G, Functional Assessment of Cancer Therapy-General.
*$P = 0.01$.
†$P < 0.05$.

Discussion

This is the first report to examine factors associated with BRCA1/BRCA2 testing among newly diagnosed breast cancer patients. Within this sample of self-referred patients, 77% chose to receive BRCA1/BRCA2 test results. Consistent with research on a variety of medical decisions (16, 17, 31), physician recommendation was a strong predictor of patients' testing decisions. This underscores the need for physicians to accurately identify patients who are candidates for genetic testing and discuss options and implications of genetic referral. We also found that patients who were undecided about their definitive local treatment were more likely to choose testing. This reflects a key benefit of offering genetic testing at the time of diagnosis. Such testing can provide undecided patients with the opportunity to incorporate genetic information into their local treatment decision making to reach a more fully informed decision. In contrast, patients who have already reached a definitive local treatment decision would benefit little from immediate genetic testing.

Among patients who chose to be tested, 21% proceeded with definitive local treatment before receiving test results. It is possible that these patients chose to be tested for reasons other than treatment decision making. The fact that testing was provided free of charge might have been a motivator to pursue testing at this time even for patients who had already made a definitive local treatment decision. However, our data also indicate that delay in the availability of test results may have led some patients to proceed with definitive local treatment rather than wait further for their test results to become available. This highlights the need to provide test results as quickly as possible in this setting. However, it is also important to consider the possibility that this finding may be partially artifactual. It is logistically difficult to proceed with definitive local treatment within 2 to 3 weeks of diagnosis. Thus, regardless of whether a patient intended to wait for test results or not, the more quickly those test results became available, the more likely it is that that patient would have received the results before having an opportunity to proceed with definitive local treatment. This situation was likely the case for some participants. However, the strong effect of genetic test result on definitive local treatment decisions (11) suggests that many participants did indeed wait for their test results to guide their final local treatment choice.

We also found that participants who were most anxious were also most likely to wait for genetic test results before proceeding with definitive local treatment. This is consistent with previous research suggesting that anxiety may motivate participation in genetic testing (18-20). However, it is also plausible that anxiety may be a consequence of genetic testing rather than a cause. For example, patients who chose to await test results before proceeding with their treatment may have experienced anxiety in anticipation of their test result and the uncertainty associated with their treatment status (32). This is consistent with conceptual models that emphasize the role of uncertainty in the adjustment to genetic testing (33). Regardless of whether anxiety is a cause or consequence of genetic testing decisions, anxiety can serve as barrier to informed medical decision making (34) and risk comprehension (35). Thus, future research must further evaluate the role of anxiety in this context.

Generalizability of this study is limited by participant self-selection, the provision of genetic counseling/testing free of charge, and the lack of diversity of our sample. The most important limitation is that we do not know how many eligible patients chose not to refer to the study. Without this true denominator, any conclusions regarding level of interest or characteristics of patients who seek pretreatment BRCA1/BRCA2 counseling and testing must be considered preliminary. Clinically, it would be premature to recommend genetic testing at the time of initial diagnosis before there are data evaluating the effect of testing on subsequent patient quality of life. Although evidence suggests few adverse effects of BRCA1/BRCA2 testing among breast cancer survivors (36, 37), the unique concerns and stresses of newly diagnosed breast cancer patients make it difficult to extrapolate from previous studies. Future research can address these limitations by replicating these results in a clinical setting in which a true denominator of eligible patients can be characterized.

References

1. Claus EB, Schildkraut JM, Thompson WD, et al. The genetic attributable risk of breast and ovarian cancer. Cancer 1996;77:2318–24.
2. Miki Y, Swensen J, Shattuck-Eidens D, et al. A strong candidate for the breast and ovarian cancer susceptibility gene BRCA1. Science 1994;226:66–71.
3. Wooster R, Bignell G, Lancaster J, et al. Identification of the breast cancer susceptibility gene BRCA2. Nature 1995;378:789–92.
4. Struewing JP, Hartge P, Wacholder S, et al. The risk of cancer associated with specific mutations of BRCA1 and BRCA2 among Ashkenazi Jews. N Engl J Med 1997;336:1401–8.
5. Ford D, Easton DF, Stratton M, et al. Genetic heterogeneity and penetrance analysis of the BRCA1 and BRCA2 genes in breast cancer families. Am J Hum Genet 1998;62:676–89.
6. Haffty BG, Harrold E, Khan AJ, et al. Outcome of conservatively managed early-onset breast cancer by *BRCA1*/2 status. Lancet 2002;359:1471–7.
7. Easton DF, Ford D, Bishop DT, et al. Breast and ovarian cancer incidence in BRCA1-mutation carriers. Am J Hum Genet 1995;56:265–71.
8. Ford D, Easton DF, Bishop DT, et al. Risks of cancer in BRCA1-mutation carriers. Lancet 1994;343:692–5.
9. Weitzel JN, McCaffrey SM, Nedelcu R, MacDonald DJ, Blazer KR, Cillinane CA. Effect of genetic cancer risk assessment on surgical decisions at breast cancer diagnosis. Arch Surg 2003;138:1323–8.
10. Ryan PD, Haber DA, Shannon KM, Smith BS, Fan MJ. Case 28-2003: a 51 year old pre-menopausal woman with newly diagnosed breast cancer and a strong family history of breast cancer. N Engl J Med 2003;349:1076–82.
11. Schwartz MD, Lerman C, Brogan B, et al. The impact of BRCA1/2 counseling and testing in newly diagnosed breast cancer patients. J Clin Oncol 2004;22:1823–9.
12. Pierce LJ, Strawderman M, Narod SA, et al. Effect of radiotherapy after breast-conserving treatment in women with breast cancer and germline BRCA1/2 mutations. J Clin Oncol 2000;18:3360–9.
13. Robson ME, Boyd J, Borgen PI, Cody HS. Hereditary breast cancer. Curr Probl Surg 2001;38:380–480.
14. Daly MB. Tailoring breast cancer treatment to genetic status: the challenges ahead. J Clin Oncol 2004;22:1776–7.
15. Glanz K, Lerman C. Psychosocial impact of breast cancer: a critical review. Ann Behav Med 1992;14:204–12.
16. Cyran EM, Crane LA, Palmer L. Physician sex and other factors associated with type of breast cancer surgery in older women. Arch Surg 2001;136:185–91.
17. Katz SJ, Lantz PM, Zemencuk JK. Correlates of surgical treatment type for women with noninvasive and invasive breast cancer. J Womens Health Gend Based Med 2001;10:659–70.
18. Lerman C, Schwartz MD, Lin TH, Narod S, Lynch HT. The influence of psychological distress on use of genetic testing for cancer risk. J Consult Clin Psychol 1997;65:414–20.
19. Codori AM, Petersen GM, Miglioretti DS, et al. Attitudes toward colon cancer gene testing: factors predicting test uptake. Cancer Epidemiol Biomarkers Prev 1999;8:342–51.
20. Lerman C, Hughes C, Trock BJ, et al. Genetic testing in families with hereditary nonpolyposis colon cancer. JAMA 1999;281:1618–22.
21. Frank TS, Manley SA, Olopade OI, et al. Sequence analysis of BRCA1 and BRCA2: correlation of mutations with family history and ovarian cancer risk. J Clin Oncol 1998;16:2417–25.
22. Couch FJ, DeShano ML, Blackwood A, et al. BRCA1 mutations in women attending clinics that evaluate the risk of breast cancer. N Engl J Med 1997;336:1409–15.
23. Parmigiani G, Berry DA, Aquilar O, et al. Determining carrier probabilities for breast cancer susceptibility genes. Am J Hum Genet 1998;62:145–58.
24. DeMarco TA, Peshkin BN, Brogan BM. Across the spectrum: case studies in genetic counseling for breast and ovarian cancer. J Genet Counsel 2001;10:379–95.
25. Horowitz M, Wilner A, Alvarez W. Impact of Event Scale: a measure of subjective stress. Psychosom Med 1979;41:209–18.
26. Croyle RT, Smith KR, Botkin JR, et al. Psychological responses to BRCA1 mutation testing: preliminary findings. Health Psychol 1997;16:63–72.
27. Spielberger CD, Gorsuch RL, Lushene RE. Manual for the State-Trait Anxiety Inventory (self-evaluation questionnaire). Palo Alto (CA): Consulting Psychologists Press; 1970.
28. Spielberger CD, Gorsuch RL, Lushene R, et al. Manual for the State-Trait Anxiety Inventory STAI (Form Y) (''self-evaluation questionnaire''). Palo Alto (CA): Consulting Psychologists Press; 1983.

29. Cella D, Tulsky D, Gray G. The functional assessment of cancer therapy (FACT) scale: development and validation of the general measure. J Clin Oncol 1993;11:570–9.
30. Brady M, Cella D, Mo F. Reliability and validity of the functional assessment of cancer therapy: breast quality of life instrument. J Clin Oncol 1997;15: 974–86.
31. Schwartz MD, Kaufman E, Peshkin BN, et al. Bilateral prophylactic oophorectomy and ovarian cancer screening following BRCA1/BRCA2 mutation testing. J Clin Oncol 2003;21:4034–41.
32. Tercyak KP, Lerman C, Peshkin BN, et al. Effect of coping style and test result on anxiety among women participating in genetic counseling and testing for breast/ovarian cancer risk. Health Psychol 2001;20:217–22.
33. Baum A, Friedman AL, Zakowski SG. Stress and genetic testing for disease risk. Health Psychol 1997;16:8–19.
34. Janis IL, Mann L. Decision making: a psychological analysis of conflict, choice, and commitment. New York (NY): The Free Press; 1977.
35. Lerman C, Lustbader E, Rimer B, et al. Effects of individualized breast cancer risk counseling: a randomized trial. J Natl Cancer Inst 1995;87:286–92.
36. Schwartz MD, Peshkin BN, Hughes C, et al. Impact of BRCA1/BRCA2 mutation testing on psychologic distress in a clinic-based sample. J Clin Oncol 2002;20:514–20.
37. Kaufman E, DeMarco T, Francini K, Schwartz MD. Psychological and behavioral outcomes of BRCA1 and BRCA2 genetic testing. Research Advances in Cancer 2003;3:95–111.

Utilization of BRCA1/BRCA2 Mutation Testing in Newly Diagnosed Breast Cancer Patients

Marc D. Schwartz, Caryn Lerman, Barbara Brogan, et al.

Cancer Epidemiol Biomarkers Prev 2005;14:1003-1007.