Early adoption of *BRCA1/2* testing: Who and why

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Purpose: Relatively little is known about the characteristics of women who chose to undergo *BRCA1/2* testing soon after testing became available, including how they became aware of and chose to pursue testing. Diffusion of innovation theory states that acceptance of an innovation is a function of the potential adopter's value for innovation and perceptions of the compatibility, complexity, and relative advantage of the innovation. These factors may contribute to early uptake of *BRCA1/2* testing. The purpose of this study was to describe the characteristics of women who were "early adopters" of clinical *BRCA1/2* testing and to determine whether diffusion theory explains variation in uptake of testing after participation in genetic counseling for *BRCA1/2* testing. **Methods:** A retrospective cohort study of participants in genetic counseling for *BRCA1/2* testing was conducted at a clinical program in a large academic health system. Measures included components of diffusion of innovation theory (participant's value for innovation, i.e., "innovativeness," and perceptions of the compatibility, complexity, and relative advantage of *BRCA1/2* testing), characteristics of how the participant became aware of and sought *BRCA1/2* testing, and decisions about testing after counseling. **Results:** From the 229 respondents, 71 (31%) had undergone testing at the time of the survey. Fifty-seven women (25%) had sought *BRCA1/2* testing because a family member had breast or ovarian cancer and 37 (16%) because they had breast or ovarian cancer. Only 15 women (7%) reported seeking testing because of a physician's recommendation. After multivariate adjustment, higher innovativeness and higher ratings of the compatibility of *BRCA1/2* testing were associated with undergoing testing after counseling [relative risk (RR) 1.76, 95% confidence interval (CI) 1.2–2.6]. However, ratings of the complexity or relative advantage of testing were not associated with testing decisions. Higher innovativeness was associated with being the first in the family to undergo testing (RR 4.85, 95% CI 1.6–14.9), becoming aware of *BRCA1/2* testing through the media (RR 1.50, 95% CI 1.0–2.4), and being aware of *BRCA1/2* testing prior to counseling (RR 1.25, 95% CI 1.1–1.4). **Conclusions:** The uptake of *BRCA1/2* testing among women undergoing genetic counseling was associated with innovative characteristics of the participant and the perceived compatibility of the test with existing values and needs, but not with the complexity or relative advantage of the test. Most "early adopters" had heard of *BRCA1/2* testing from a source other than their physician and had sought testing because of a personal or family member's cancer diagnosis. These findings can inform predictions surrounding the introduction of future genetic susceptibility tests and strategies for guiding the further diffusion of *BRCA1/2* testing. ***Genet Med* 2003:5(2):92–98.**

Key Words: BRCA1/2 *genetic testing, utilization, diffusion*

The two major breast cancer susceptibility genes, *BRCA1* and *BRCA2,* were isolated in 1994 and 1995.[1,2] Their identification offered the first promise of genetic susceptibility testing for defining individual cancer risk. In 1996, *BRCA1/2* mutation screening became the first genetic test for cancer risk to become available as a clinical service.[3] Although many health professionals predicted a huge market for these tests, the uptake of *BRCA1/2* testing, even among women with a family history of cancer, has been substantially less than predicted.[4,5] This low rate of uptake is similar to experience with genetic tests for other conditions, such as Huntington disease and cystic fibrosis.[6,7] Although a few studies have identified some of the factors associated with actual or intended use of *BRCA1/2* testing, relatively little is known about the characteristics of women who chose to undergo *BRCA1/2* testing soon after testing became available, including how they became aware of and chose to pursue testing.[8–11]

Diffusion of innovation theory offers a potentially useful model for understanding the acceptance of *BRCA1/2* tests.[12]

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Diffusion is defined as the process by which an innovation is communicated through certain channels, over time, among the members of a social system.[12] This framework has been applied across fields to analyze and explain the process by which a new idea or technology spreads through a population. The theory posits that diffusion of innovations follows a predictable pattern, in which adoption grows slowly, has a period of rapid growth, and then tapers off. The rate of adoption, when plotted cumulatively over time, takes the form of an "S" curve. The slope of that curve (if the innovation diffuses throughout a population) differs for each innovation and can be understood along four dimensions: (1) how the innovation is perceived, (2) how information about the innovation is communicated, (3) how long it takes for an individual to learn about the innovation and decide to adopt or reject, and (4) the individual's social network and contacts. The following briefly describes these dimensions.

Perceptions of the innovation

Diffusion research suggests that at least half of the variance in rates of adoption is explained by five perceived attributes of an innovation: relative advantage (is the innovation better than the idea it supersedes?), compatibility (is it consistent with the existing values and needs?), complexity (is it difficult to understand and use?), trialability (can it be tried on a limited basis?), and observability (are results visible to others?). Innovations that are perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations. One meta-analysis found that only three attributes—relative advantage, compatibility, and complexity—were consistently related to adoption behavior across technologies.[13]

Communication

Information about innovations is communicated through the mass media or through personal communication. Mass media reaches more people and can efficiently spread knowledge of an innovation. However, most people form attitudes and make decisions about innovations based on information from interpersonal channels. Diffusion theory notes that the majority of people decide to adopt or reject an innovation based on the subjective experience of peers who adopted before them.

Time

Time is a crucial element of the diffusion process in two ways: first, in whether an individual adopts an intervention relatively early or relatively late, and second, in the time it takes to move through different stages of the innovation-decision process. Diffusion studies have shown that the distribution of individuals, based on the time of adoption of an innovation, generally follows a normal bell curve and can be separated into five categories of "innovativeness": innovators (the first 2.5% of individuals to adopt an innovation), early adopters (the next 13.5%), early majority (the next 34%), late majority (the next 34%), and laggards (the last 16% to adopt, if the innovation successfully diffuses through the population). Generally, innovators are risk-taking information seekers with relatively high financial status; early adopters tend to become opinion leaders who then influence the remainder of the population. Mass media exposure alone may be enough to influence innovators and early adopters, while role modeling and change agents may be required to influence later adopters.

The innovation-decision process is likely to be shorter for innovators and the early majority than for later adopters. Diffusion theory describes five stages of this process: *Knowledge,* the individual learns about the innovation; *Persuasion,* the individual forms an attitude or image (positive or negative) about the innovation through discussion and interaction with others; *Decision,* the individual resolves to seek additional information, leading to a decision to accept or reject the innovation; *Implementation,* the individual gains additional information needed to put the innovation into regular use; and *Confirmation,* the individual looks for benefits of the innovation to justify its continued use.

Social networks and contacts

Diffusion is essentially a social process, involving social relationships among individuals in a system. These social networks and contacts are crucial in achieving critical mass, which occurs when enough individuals have adopted an innovation that the innovation's further rate of adoption becomes self-sustaining (a "social snowball"). Diffusion research suggests that critical mass occurs, and the "S" curve takes off, when 10% to 25% of the population has adopted the innovation.

Diffusion of innovation theory has been used to explain the rate of adoption of health innovations[14–19] and to design interventions to speed up the adoption of beneficial health strategies and technologies.[20–24] In general, interventions using diffusion theory emphasize changing the perceived attributes of the innovation, using appropriate communication channels for each stage of the innovation-decision process, and identifying and using opinion leaders and change agents.

To our knowledge, relatively few studies describe the characteristics of "early adopters" of clinical *BRCA1/2* testing and none investigates whether diffusion theory can explain some of the variance in the uptake of testing after participation in genetic counseling. Thus the aims of this study were to describe the early adoption of clinical *BRCA1/2* testing within a large academic health system and to determine whether decisions about *BRCA1/2* testing after participation in genetic counseling could be explained by the components of diffusion theory.

MATERIALS AND METHODS

Study setting

The University of Pennsylvania Breast and Ovarian Cancer Risk Evaluation Program (BCREP) was founded in 1994 and was one of the first programs in the country to provide genetic testing for *BRCA1/2* mutations to interested individuals. The program initially provided *BRCA1/2* testing to women through research protocols. In the fall of 1996, BCREP began

offering testing as a clinical service to individuals with and without a cancer diagnosis. Although clinical testing is provided to any individual who chooses to undergo testing after participating in genetic counseling, women with an estimated probability of a *BRCA1/2* mutation less than 5% are counseled that they are unlikely to gain useful information from testing. Risk of *BRCA1/2* mutation is estimated based on available prediction models.[25,26] During the period of this study, women calling for appointments at BCREP were not screened for appropriateness for *BRCA1/2* testing.

Study design and subject selection

We conducted a cross-sectional survey of the 412 women who had participated in the BCREP between May 1998 and June 2000. Six participants were excluded from the survey because they had previously requested not to participate in further research. In September 2000, the 406 remaining subjects were mailed a questionnaire, letter, and stamped, addressed envelope. Subjects who did not respond were mailed two reminder letters including questionnaires.

Measurements

The survey instrument included three sections: (1) how the participant became aware of and chose to pursue *BRCA1/2* testing; (2) components of diffusion theory, including attitudes about the relative advantage, complexity, and compatibility of *BRCA1/2* testing and assessment of the level of participant's innovativeness within the medical domain; and (3) decisions about undergoing *BRCA1/2* testing after counseling. Sociodemographic characteristics including age, race, and education were obtained from clinical records.

Awareness and pursuit of testing

Items assessing how the participant became aware of and chose to pursue *BRCA1/2* testing were developed after four focus group discussions with women who had participated in the BCREP prior to the beginning of the study ($N = 16$). Based on these discussions and the principles of diffusion theory, items were included that assessed whether the participant had been aware of *BRCA1/2* testing prior to BCREP. If they had been aware of testing, additional items asked how they had first heard of *BRCA1/2* testing and how long after hearing of testing they had waited to make an appointment at BCREP. In addition, participants were asked about any specific events that had led them to make an appointment at BCREP, who had been first in their family to undergo testing, and if any of their friends or family sought *BRCA1/2* testing after hearing of their experience at BCREP.

Components of diffusion theory

Items to assess perceived attributes of *BRCA1/2* testing as an innovation were adapted from scales developed by Moore and Benbasat[27] originally designed to measure user perceptions of information technologies. These multi-item scales were shortened and made relevant to *BRCA* testing. Two items were used to measure compatibility ("*BRCA* testing is consistent with my approach to my health" and "*BRCA* testing fits well with my values and goals"); two items measured complexity ("*BRCA* testing is hard to understand" and "*BRCA* testing has many different parts"); and a single item measured relative advantage ("*BRCA* testing can tell more about cancer risk than other methods of risk assessment").

Although classical diffusion theory uses time-to-adoption to assign individuals to adopter categories, this approach cannot be used to explain or predict adoption behavior. Instead, researchers have developed self-reported scales to measure innovativeness.[28,29] Personal innovativeness is most useful when it is measured in specific domains, rather than as a global or innate quality. Domain-specific innovativeness was measured by adapting a six-item scale that assesses the tendency to learn about and adopt innovations.[28] Three items were adapted and made relevant to the medical domain: (1) "If I heard of a new medical test or treatment, I would try to find out more about it"; (2) "Among my friends, I am usually one of the first to find out about a new medical test or treatment"; and (3) "In general, I am hesitant to undergo a new medical test or treatment," which was reverse-scored. For all of these items, participants were asked to endorse how strongly they agreed or disagreed with the statement on a 5-point scale from "strongly agree" to "strongly disagree."

Decisions about BRCA1/2 *testing after counseling*

Many women choose not to undergo testing after participating in genetic counseling. Thus participants were asked whether they had either undergone *BRCA1/2* testing, had decided to undergo testing but had not yet completed the testing process, had decided to undergo testing at a later date in the future, had not decided about testing, had decided not to undergo testing, or did not think testing was available to them. To assess the role of diffusion theory in explaining the uptake of testing among women who underwent counseling, participants were categorized into two groups: those who had undergone testing at the time of the survey and those who had not yet undergone testing.

Statistical analysis

Most responses were analyzed with simple descriptive statistics. Because established scales had been shortened for the survey instrument, simple psychometric tests were conducted to determine the performance of the abbreviated scales. For the three-item innovativeness scale, principal components analysis determined that the items loaded on a single factor that explained 58% of the variance. Based on these results and the a priori analytic plan, a summary score of personal innovativeness was created by adding the responses for each item. The three-item innovativeness scale had a Cronbach α of 0.60. For two of the three characteristics of *BRCA* testing related to diffusion theory (complexity and compatibility), mean scores were created by averaging the responses from two items.

Inferential statistics were used to test the a priori study hypotheses, including the primary hypothesis that women with higher levels of personal innovativeness would be more likely

to undergo testing after counseling. In addition, we examined several other hypotheses predicted by diffusion theory, including that women with higher levels of personal innovativeness would be more likely to have heard of testing through the media, to be the first in their family to get tested, and to have other friends and family members pursue testing after hearing about their experience. Because innovativeness did not appear normally distributed, innovativeness was analyzed both as an ordered categorical variable using the Wilcoxon-Mann-Whitney test and as a dichotomous variable (upper third or "high innovativeness" versus middle and lower third or "low innovativeness"). Because the results of both analyses were similar, we present the results for the dichotomous variable. Multiple logistic regression was used to adjust the association between personal innovativeness, attitudes about the innovative characteristics of *BRCA1/2* testing, and the decision to undergo testing after counseling for the participants' clinical and demographic characteristics, including cancer status, age, and religion. Race was not included in multivariate models because it was completely confounded with religion (all Jewish participants were Caucasian) and our sample was almost uniformly Caucasian (97%). Variables were retained if they were significantly associated with outcome or altered the coefficient for another variable by >15%.[30]

The free text responses about the specific event that had led a woman to make her appointment at BCREP were coded by two research assistants. The sample of all responses was randomly divided into a code development set and an evaluation set. Working together, the two research assistants developed a series of codes for the items in the code development set, including "personal cancer diagnosis," "family cancer diagnosis," "concern for children," and others. The responses in the evaluation set were then coded independently by the two research assistants and the κ statistic was used to measure interrater reliability. Differences were adjudicated between the two reviewers.

RESULTS

From the 412 eligible subjects, 37 questionnaires were returned because of an incorrect address and 12 because the intended recipient had died. Two hundred twenty-nine women responded to the survey for a response rate of 63%. The sociodemographic characteristics of respondents are reported in Table 1. The mean score on the innovativeness scale was 12.0 with a range from 6 to 15. Ninety-six women (40%) had scores greater than 13. These women were significantly more likely to have a college education or higher [relative risk (RR) 1.81, 95% confidence interval (CI) 1.12–2.91, $P = 0.008$] but did not differ from low innovators in age, ethnicity, religion, or marital status ($P > 0.5$). Of the 229 participants, 71 (31%) had undergone *BRCA1/2* testing at the time of the survey.

Table 1
Sociodemographic characteristics

	Overall ($n = 229$)	High innovators ($n = 96$)	Low innovators ($n = 133$)	*P* Value
Mean age, yr (range)	45.5 (18–78)	45.9 (29–67)	45.0 (18–78)	0.50
Ethnicity (%)				0.82
Caucasian	97.2	96.4	97.7	
African American	0.5	0	0.8	
Asian American	0.5	0	0.8	
Hispanic	0.9	2.4	0	
Religious heritage (%)				0.66
Jewish	33.0	31.9	34.1	
Christian	58.6	63.7	54.8	
Islamic	1.3	1.1	1.5	
Hindu	0.9	0	1.5	
None	3.1	2.2	3.7	
Marital status (%)				0.72
Married	79.3	80.2	78.5	
Separated/divorced	7.1	8.8	5.9	
Widowed	4.0	5.5	2.9	
Never married	7.9	5.4	9.6	
Education (%)				0.0007
Less than college	23.4	14.3	29.8	
College degree or higher	76.6	85.7	70.2	

Awareness and pursuit of testing

Of the 229 women who participated in genetic counseling for *BRCA1/2* testing at BCREP, 181 women (79%) said they were aware of *BRCA1/2* testing prior to their participation at BCREP. Among these women, 60 (33%) had first heard of *BRCA1/2* testing from their health care provider, 57 (31%) from the lay media (television, radio, newspaper, magazine, or Internet), 32 (18%) from a family member, 11 (6%) from a friend or colleague, 10 (5%) because they worked in the health care field, 7 (4%) from a conference or seminar, and 4 (2%) from a medical journal. Among the 138 women (60%) who could remember how long they had waited after becoming aware of *BRCA1/2* testing to make an appointment for genetic counseling, 52 (38%) had waited up to 3 months, 32 (23%) had waited between 4 months and a year, and 54 (39%) had waited more than a year.

One hundred eighty-four women (80%) said there was a specific event that had led them to make an appointment at BCREP. These events are listed in Table 2. The most common events were a cancer diagnosis in a family member, a personal cancer diagnosis, and a personal breast abnormality. Only 15 women (7%) said the recommendation of a physician had led them to make an appointment at BCREP.

Fifty-two women (23%) said that someone else in their family had undergone *BRCA1/2* testing. Among these women, 17 (33%) had been the first to undergo testing in their family. Eleven women (21%) reported their sister had been the first to

Table 2
Events that led to seeking counseling for *BRCA1/2* testing

	Respondents *n* (%)
A family member was diagnosed with BC/OC.	57 (25)
I was diagnosed with BC/OC.	37 (16)
I had breast biopsy/breast lump/breast pain/abnormal mammogram.	21 (9)
A family member died or I reached the age at which a family member died from BC/OC.	19 (8)
A physician recommended *BRCA* testing.	15 (7)
I was diagnosed with a noninvasive breast cancer.	5 (2)
A family member/friend recommended *BRCA* testing.	4 (2)
I was concerned for my children.	4 (2)
I tested positive for *BRCA* mutation.	3 (1)
A family member tested positive for a *BRCA* mutation.	3 (1)
I was concerned about using HRT after menopause.	2 (1)
I heard media coverage of genetic testing or a new study.	2 (1)

BC, breast cancer; OC, ovarian cancer; HRT, hormone replacement therapy.

undergo testing, 11 (21%) their mother, 6 (12%) their cousin, 4 (8%) their aunt, and 3 (6%) their father. Forty-eight women (22%) said a family member or friend had sought counseling for *BRCA1/2* testing after hearing of their experience.

Association between components of diffusion theory and uptake of *BRCA1/2* testing after counseling

High innovativeness was associated with undergoing testing after genetic counseling (RR 1.76, 95% CI 1.2–2.6, $P = 0.003$). This association remained after adjustment for age, education, religion, and breast cancer diagnosis (Table 3). In addition, women who underwent testing after counseling had significantly higher ratings of the compatibility of *BRCA1/2* testing ($P < 0.00005$) in bivariate analysis or after adjustment for age, education, religion, and breast cancer diagnosis (odds ratio 6.42, 95% CI 2.11–13.34, $P < 0.001$). However, undergoing testing was not associated with ratings of the complexity of testing ($P = 0.87$) or the relative advantage of *BRCA1/2* testing over other forms of risk assessment ($P = 0.16$). Attitudes about the complexity, compatibility, and relative advantage of testing were not associated with level of innovativeness. Furthermore, the association between compatibility and testing did not vary by the woman's level of innovativeness ($P > 0.4$ for likelihood ratio test of interaction).

Table 3
Multivariate analysis of association with use of *BRCA1/2* testing

	OR	95% CI	*P* Value
High innovativeness	2.03	1.02–4.05	0.04
Jewish religion	4.70	2.37–9.32	<0.0005
Breast cancer	3.77	1.85–7.68	<0.0005
Married	1.46	0.58–3.65	0.42
Education beyond college	1.41	0.72–2.76	0.31
Age	1.03	0.99–1.07	0.13

OR, odds ratio; CI, confidence interval.

Association between innovativeness and awareness and pursuit of testing among women undergoing counseling

High innovativeness was associated with being aware of *BRCA1/2* testing prior to being seen at BCREP (RR 1.25, 95% CI 1.1–1.4, $P = 0.0008$), becoming aware of *BRCA1/2* testing through the media (RR 1.50, 95% CI 1.0–2.4, $P = 0.04$), and being the first in the family to undergo testing (RR 4.85, 95% CI 1.6–14.9, $P = 0.0008$). These associations also remained after adjustment for age, ethnicity, breast cancer diagnosis, and ovarian cancer diagnosis. Innovativeness was not significantly associated with the time between becoming aware of *BRCA1/2* testing and making an appointment at BCREP ($P > 0.4$).

DISCUSSION

As predicted by diffusion of innovation theory, this study suggests that the uptake of *BRCA1/2* testing among women undergoing genetic counseling is associated with innovative characteristics of the participant, as well as the perceived compatibility of the test with personal values and needs. Furthermore, women with higher innovativeness scores were more likely to have heard of *BRCA1/2* testing through the media and to be the first one to undergo testing in their family. However, uptake of testing was not associated with two other components of diffusion theory, the perceived complexity and relative advantage of the test. This is not inconsistent with the observation that individuals have difficulty perceiving the relative advantage of many preventive innovations, because the rewards are often delayed in time, they are relatively intangible, and the unwanted consequence may not happen anyway.[31]

Most prior studies of *BRCA1/2* testing have used more traditional health behavior theories to show that decisions about testing are associated with beliefs about the risks and benefits of testing, risk of carrying a *BRCA1/2* mutation, and presence of a cancer diagnosis.[8–10,32] These findings add an additional perspective to this body of literature, demonstrating that variation in the use of *BRCA1/2* testing may be explained, in part, by an innate characteristic of the high-risk women—innovativeness—that is rarely considered in medical arenas. Because information needs and information-seeking behavior may differ among women of varying degrees of innovativeness, these findings can inform communication strategies to reach women further along the bell curve of adopter categories (for example, part of the early majority). One theory-driven intervention might include forming or activating near-peer networks of earlier adopters who can relay their experiences to women seeking genetic counseling for *BRCA1/2* testing.

Our study also provides insight into the process by which "early adopters" of genetic counseling for clinical *BRCA1/2* testing became aware of and sought testing. Most women who

pursued genetic counseling for *BRCA1/2* testing at the University of Pennsylvania clinical program had heard of *BRCA1/2* testing from a source other than their physician. Furthermore, more than three-quarters of participants reported that a specific event led to their seeking *BRCA1/2* testing, most often a personal or family member's cancer diagnosis. Very few women reported that their physician's recommendation led them to seek testing. These findings emphasize that the initial use of novel genetic tests may occur outside of the traditional framework of health care delivery where both information about and referral for specialty services is accessed through a patient's relationship with his or her primary physician.

In addition to innovativeness, use of *BRCA1/2* testing after counseling was associated with a personal diagnosis of breast cancer and Jewish religion in this sample. These results are supported by a previous survey we conducted in an earlier cohort of women attending the same clinical program.[8] Because the great majority of participants do not belong to families with known *BRCA1/2* mutations, the association with breast cancer diagnosis is likely to reflect the greater clinical utility of testing an affected individual than an unaffected individual in the absence of a known familial mutation. We believe higher rates of testing among Jewish women are attributable to the association between Ashkenazi heritage and mutation risk in most studies and prediction models.[25,26,33]

This study has several limitations. We were unable to include exact measures of risk of carrying a *BRCA1/2* mutation in our multivariate analysis, thereby limiting our ability to adjust for a factor that has been shown to affect decisions about genetic testing. However, we included factors that are associated with mutation risk (Jewish religion and breast cancer diagnosis). Furthermore, because it is unlikely that innovativeness is associated with mutation risk outside of these factors, the absence of specific data on mutation should not bias our results. Study participants were drawn from a single, clinical program and may not be representative of the overall experience with early adoption of *BRCA1/2* testing. However, because the BCREP was one of the first centers to offer clinical *BRCA1/2* testing in the United States and draws from a wide geographic area in the Delaware Valley, it offers an important perspective on the utilization of *BRCA1/2* testing. We did not collect data on women who had not undergone genetic counseling; thus we are unable to determine whether diffusion of innovation theory explains uptake of genetic counseling, in addition to use of genetic testing. It is possible that perceived complexity and relative advantage of *BRCA1/2* testing exerts its primary influence on an earlier stage of the innovation-decision process, the decision to seek genetic counseling. This might explain the lack of an association between these characteristics and uptake of *BRCA1/2* tests in our study sample, all of whom decided to undergo counseling. Concern about respondent burden limited our ability to include extensive measures of personal innovativeness and innovation characteristics. It is possible that other characteristics of the intervention, such as relative advantage, would have been associated with testing if more items had been included.

With recent developments in breast and ovarian cancer prevention, *BRCA1/2* testing has moved from a technology that provides information of only hypothetical benefit to one that has an important role in the management of high-risk women. In light of this progress, understanding the factors affecting utilization of *BRCA1/2* testing has taken on a new importance. By demonstrating the role of diffusion of innovation theory in describing the early decisions about *BRCA1/2* testing, these results suggest that the diffusion of *BRCA1/2* testing is following previously described patterns for new technology and is likely to increase substantially as early adopters begin to seek testing. These findings can inform strategies for guiding the further diffusion of *BRCA1/2* testing and predictions surrounding the introduction of future genetic susceptibility tests.

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