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WHAT WOMEN WITH OVARIAN CANCER THINK AND KNOW ABOUT GENETIC TESTING

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Abstract

Objectives—Few women with ovarian cancer undergo genetic testing for the Breast and Ovarian Cancer susceptibility genes, BRCA1 and BRCA2. With the prospect of BRCA-directed therapeutics, we investigated ovarian cancer patients' knowledge and willingness to undergo genetic testing.

Methods—All ovarian cancer patients seen in the Gynecology Center of a Cancer Center and a private clinic were asked to complete an anonymous questionnaire regarding knowledge and willingness to undergo BRCA testing. Women who had prior genetic testing were asked not to participate. Data was analyzed using Fisher's exact test.

Results—Two-hundred and thirty seven ovarian cancer patients voluntarily completed the questionnaire. Fifty-five percent (131/237) of participants had not heard of BRCA testing. Of Caucasian respondents, 51% were unaware of BRCA testing, compared to 70% of Hispanic and 88% of African American respondents ($p=0.008$). Awareness was correlated with education ($p<0.001$). Eighty-nine percent of participants were willing to be tested if it would directly affect their therapy and 86.9% would be tested to benefit their family. Seventy-four percent of patients would pay 20% of the cost of testing, only 25.1% would pay in full.

Conclusions—A majority of women with ovarian cancer are not aware of the availability of BRCA testing. This lack of awareness is more profound in minorities. Despite lack of knowledge, most patients would undergo testing if it would impact their care. However, cost may be a barrier. Given the willingness of patients to undergo testing and the possibility of targeted therapy, clinicians who care for these patients should work to make appropriate genetic counseling referrals.

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Background

Epithelial ovarian cancer is the leading cause of death from gynecologic cancer in the United States [1]. It is estimated that there will be 21,650 new cases of ovarian cancer in the United States in 2008 with 15,520 deaths from ovarian cancer this year [2]. Prognosis for ovarian cancer patients is dismal, as disease is most often diagnosed at an advanced stage with a 53% median five-year survival [1].

The overall prevalence of BRCA mutations in patients with invasive ovarian cancer has been reported to be 11.7-15.3% [3,4]. Based on the frequency of BRCA mutations in ovarian cancer patients, Pal *et al.* state that genetic testing may be considered for all women with invasive, epithelial ovarian cancer [4]. Moreover, a committee statement has recently been released by the Society of Gynecologic Oncologists, providing guidelines for which at-risk ovarian cancer patients should be referred for genetic counseling [5].

The presence of a BRCA mutation may soon have treatment implications for women with ovarian cancer. Cells lacking BRCA have a defect in the mechanism to repair DNA damage that occurs during the cell cycle, leading to an accumulation of breaks in doubled-stranded DNA [6]. Poly (ADP-ribose) polymerase (PARP) is an enzyme involved in repair of DNA damage, specifically base-excision repair [7]. Loss of PARP leads to an increase in the number of errors in the DNA. In recent studies, BRCA-deficient cells have exhibited sensitivity to PARP inhibition [6,8]. This agent has the potential to be an effective chemopreventative and chemotherapeutic agent specific for patients with BRCA mutations, with a less toxic side effect profile than agents currently available.

With this new therapeutic option on the horizon for BRCA-associated ovarian cancer, and thus the possibility of a new indication for genetic testing, we wanted to evaluate the extent to which the general population of ovarian cancer patients is aware of BRCA testing and what the barriers to testing might exist. Given the possibility of a BRCA-targeted therapy, the objective of this study was to evaluate the knowledge and willingness of patients with ovarian cancer to undergo genetic testing, regardless of risk profile.

Materials and Methods

After obtaining approval for the protocol and questionnaire from the M.D. Anderson Cancer Center Institutional Review Board, an anonymous survey was provided to all ovarian cancer patients at the M.D. Anderson Gynecology Center and at a private clinic in Houston, in 2007. The self-administered survey included an information page which provided a simple explanation of the genetics of ovarian cancer, questions to obtain information regarding race, religion and education, as well as eleven yes or no questions about prior knowledge, willingness and possible barriers to BRCA testing (Table 1). Barriers of interest included cost and insurance discrimination.

All ovarian cancer patients, regardless of history or risk profile, were asked to acquire a survey from the registration desk upon arriving at the clinic. Those who took and completed the survey were instructed to return the survey to a drop-box in the waiting area, where a member of the study staff collected them daily. Patients who had previously undergone genetic testing were asked not to participate. In addition, patients who were under the age of 18 or did not read or write English were excluded from participation in the study.

This was a one-time only cross-sectional survey of patients. All statistics are descriptive, addressing participants' responses to survey questions, presented in a yes/ no format. Contingency tables were created to examine the distribution of responses in relation to the various races, ethnicities and levels of education, and these comparisons were evaluated

using a Fisher's exact test. Based on the distribution of races, four categories: Caucasian, African American, Hispanic and Other, were used for analysis. Based on the distribution of levels of education, four categories: high school or less and GED (HS), two-year community college and technical school (Comm Coll), four-year degree (4 yr Degree), and graduate or professional school (Graduate school), were used for analysis.

The proportion of responses to each question was tabulated, and a 95% confidence interval was calculated for each response using the Wald Method. Statistical differences in responses between groups were determined based on the proportion of "yes" responses and the 95% confidence interval for each response. Data was coded, stored, and analyzed using SPSS 12.0 software (SPSS Inc., Chicago, IL).

Results

Patients

Of the 552 eligible patients with ovarian cancer seen during the study period, 237 of these women completed the survey (Table 2). The majority of participants (64.6%) were Caucasian. Eight percent were African American and 11.8% were Hispanic. Another eight percent of the participants considered themselves to be Asian or American Indian, and are included in the "other" category for statistical purposes. A majority of participants considered themselves to be Protestant (51%) and thirty percent considered themselves to be Catholic. Few (3) participants considered themselves to be Jewish. There was a fairly equal distribution of education levels among participants.

Knowledge of BRCA testing

When asked if they had heard of BRCA genetic testing prior to reading the information provided in the survey, overall, only 43.5% of ovarian cancer patients participating in the survey were aware. Race was significantly associated with knowledge of testing ($p=0.008$), with only 11.8% of African American ovarian cancer patients and 29.6% of Hispanic patients having prior knowledge of BRCA testing (Figure 1). A similar pattern of knowledge was demonstrated with increasing level of education ($p<0.001$) (Figure 1). Stratification by level of education resulted in very small numbers of participants in African American and Hispanic cohorts, which were not acceptable for statistical comparison.

Willingness

Overall, 89% of ovarian cancer patients participating in the survey would be willing to have genetic testing if it would directly benefit their personal cancer therapy and 87% would be willing to have genetic testing solely for the purpose of helping their family. More highly educated participants stated that they would be more willing to have genetic testing if it would directly benefit their personal cancer therapy (Figure 2.). Race did not significantly impact willingness to have genetic testing if it would directly benefit personal cancer therapy. There was no significant difference in education or race of participants who would or would not be willing to have genetic testing solely for the purpose of helping their family.

Cost

Overall, 73.6% of ovarian cancer patients participating in the survey would be willing to pay 20% of the cost of genetic testing (approximately \$600) and only 25.1% would be willing to pay the full cost. Level of education was significantly associated with willingness to pay 20% of the cost of genetic testing ($p=0.03$) (Figure 3A). However, level of education was not associated with willingness to pay full cost of genetic testing (Figure 3B). Race was not correlated with willingness to pay 20% or full cost of genetic testing.

Insurance discrimination

Information provided in the survey made patients aware that there have been no documented cases of insurance discrimination. Nevertheless, among the ovarian cancer patients who completed the survey, 44.5% stated that the possibility of insurance discrimination would deter them from having genetic testing. This result did not differ by race nor level of education.

Discussion

From this study, we conclude that a majority of women with ovarian cancer are not aware of the availability of testing for BRCA and this lack of awareness is more profound in minorities. Level of education impacted both knowledge of the availability of genetic testing and willingness to pay for genetic testing. Despite this lack of knowledge, most patients would be willing to undergo testing if it would impact their care. That being said, our results suggest that cost may be a barrier to obtaining testing.

Previous studies regarding the acceptance of genetic testing that included patients with ovarian cancer have focused on patients meeting certain risk criteria for genetic counseling [9,10], while most studies in this field have concentrated on women with breast cancer. In women with ovarian cancer, the risk of carrying a BRCA mutation is estimated to be 11-15% [3,4], which is higher than in women with breast cancer. The prevalence of BRCA mutations in women with breast cancer has been estimated to range from 2.9%, in women diagnosed at greater than 50 years of age, to 6.8% in women diagnosed under the age of 50 [11].

The current study is unique, in that, we surveyed ovarian cancer patients of all backgrounds and histories regarding their acceptance, understanding, and willingness to undergo genetic testing in anticipation of the availability of a BRCA-directed therapy. Little has been published regarding patients' knowledge of genetic testing. Our study suggests that knowledge of genetic testing is associated with race and level of education. Stratification by level of education could not be performed because the sample of African-American and Hispanic ovarian cancer patients in this study was too small.

Although concerning, the lack of awareness of BRCA testing and Hereditary Breast and Ovarian Cancer Syndrome in our ovarian cancer patients is not surprising. BRCA awareness has not been addressed in the general ovarian or breast cancer population, but has been evaluated in specific high-risk populations. A study of African American women at risk for breast cancer found that the average knowledge score regarding the genetics of breast cancer was 45.4% [12].

Our study indicates that the cost of genetic testing would prevent many ovarian cancer patients from undergoing BRCA testing. Level of education, which can be considered a surrogate for income, was associated with willingness to pay the partial cost of BRCA testing. Kieran *et al.* reported in 2007 that women who had been seen for BRCA-directed genetic counseling were 5.5 times less likely to undergo testing if they could not afford full or partial payment of the testing, compared to those who could afford testing [10]. Interestingly, in the Susswein study, African American race was associated with decreased uptake in breast cancer patients, even when the testing was offered free of charge [13]. It has been reported that African-American women with a family history of breast cancer who refused genetic testing did so due to the anticipated feeling of guilt regarding the mutation status of their relatives [12]. The same study suggested that feelings of guilt may be associated with lack of knowledge [12].

There is scarce information available regarding level of education and awareness of the availability of genetic testing. In terms of acceptance of BRCA testing, a study of breast cancer patients approached for genetic counseling did not demonstrate a difference in level of education between women who decided to pursue testing and those who refused [14]. In our study, level of education was associated with a patient's willingness to undergo testing if it would direct their personal cancer care, but not with willingness to undergo testing if it would solely help their family members. Our questionnaire was presented in a hypothetical format, as patients answering the questionnaire were not currently being offered genetic counseling, but were invited to pursue genetic counseling if the questionnaire brought up a concern or interest.

The possibility of selection bias is a limitation of this study. In order to create anonymity in this study, patients were simply asked to complete a survey as they waited for their appointment. There is an inherent difference in those who are willing to participate and those who are not. This, in turn, means that the results of this study may not be applicable to the entire population of women with ovarian cancer, but only those who volunteered to complete the anonymous survey. The anonymity of this project also limited the information available about the patients who completed the survey. It would have been possible to attain more information about age and family history for the analysis had participation not been anonymous. Thus, it may have been feasible to determine if genetic testing awareness and willingness were correlated with risk profile.

Given the hypothetical nature of the current study, it is not known what the true actions of patients faced with these scenarios would be. To our knowledge, no formal research has been performed to provide a correlation between hypothetical questions and actual patient behavior, specific to cancer patients' willingness to undergo genetic testing based on a proposed clinical implication. However, "willingness-to-pay" is an accepted and validated form of measuring patient preferences across medical specialties, including oncology [15,16].

This study casts a much broader net than previous studies on this topic, in anticipation of the introduction a drug specific for those ovarian cancer patients with BRCA mutations. Given the willingness of patients to undergo testing and the possibility of targeted therapy, clinicians who care for these patients should work to make appropriate referrals for genetic counseling. Knowing that cost is a factor, this may become a more significant barrier to patients if targeted therapies are approved and a greater number of patients may have a more personal reason and direct implication for pursuing BRCA testing.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Article Précis

In anticipation of BRCA-targeted ovarian cancer therapy, ovarian cancer patients completed an anonymous questionnaire regarding their knowledge and willingness to undergo BRCA testing.

Figure 1.

Knowledge of BRCA Testing by Race and Level of Education A. Knowledge of BRCA Testing by Race. Race was significantly associated with knowledge ($p=0.008$). B. Knowledge of BRCA Testing by Level of Education. Increasing level of education was associated with knowledge of testing ($p<0.001$).

Figure 2. Willingness to Undergo Genetic Testing to Direct Personal Cancer Therapy by Level of Education. More highly educated participants would be willing to undergo BRCA testing if it would directly benefit their personal therapy.

Figure 3.

Willingness to Pay for Genetic Testing by Level of Education A. Willingness to Pay 20% of the Cost of Genetic Testing (approx. \$600) was associated with level of education ($p=0.003$).

B. Willingness to Pay Full Cost of Genetic Testing (approx. \$3000) did not differ among different levels of education.

Table 1

Survey Questions

Would you be willing to have genetic testing if it would help direct cancer therapy?
Would you be willing to have genetic testing solely for the purpose of helping family?
Have you heard of BRCA1/BRCA2 genetic testing before today?
Have you thought about looking into BRCA1/BRCA2 genetic testing?
Would you like an educational pamphlet about BRCA1/BRCA2 genetic testing?
Do you think that might have a BRCA1 or BRCA2 mutation?
Do you think would personally benefit from BRCA1/BRCA2 genetic testing?
Do you think results would affect family?
Would you be willing to have genetic testing if asked to pay 20% of the cost (approximately \$600)?
Would you be willing to have genetic testing if asked to pay the full cost (approximately \$3000)?
Would the possibility of insurance discrimination keep you from having genetic testing?

Table 2

Demographics of Survey Participants

Characteristic	N= 237 (%)
Race	
Caucasian	153 (64.6)
African Am	19 (8.0)
Hispanic	28 (11.8)
Other	37 (15.6)
Religion	
Catholic	71 (30.0)
Protestant	121 (51.1)
Jewish	3 (1.3)
Other	42 (17.7)
Education	
HS/ GED	64 (27.0)
2 yr CC/ Tech School	45 (19.0)
4 yr college	72 (30.4)
Graduate/ Prof School	48 (20.3)
Other	8 (3.4)