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ORIGINAL ARTICLE – BREAST ONCOLOGY

Implementing a Screening Tool for Identifying Patients at Risk for Hereditary Breast and Ovarian Cancer: A Statewide Initiative

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ABSTRACT

Background. The Georgia Breast Cancer Genomic Health Consortium is a partnership created with funding from the Centers for Disease Control and Prevention (CDC) to the Georgia Department of Public Health to reduce cancer disparities among high-risk minority women. The project addresses young women at increased risk for hereditary breast and ovarian cancer (HBOC) syndrome through outreach efforts.

Methods. The consortium provides education and collects surveillance data using the breast cancer genetics referral screening tool (B-RST) available at www.BreastCancerGeneScreen.org. The HBOC educational protocol was presented to 73 staff in 6 public health centers. Staff used the tool during the collection of medical history. Further family history assessments and testing for mutations in the *BRCA1/2* genes were facilitated if appropriate.

Results. Data was collected from November 2012 through December 2013, including 2,159 screened women. The majority of patients identified as black/African American and were 18–49 years old. Also, 6.0 % ($n = 130$) had positive screens, and 60.9 % ($n = 67$) of the 110 patients who agreed to be contacted provided a detailed family history. A total of 47 patients (42.7 %) met National Comprehensive Cancer Network guidelines when family history was clarified. Fourteen (12.7 %) underwent genetic testing; 1 patient was positive for a *BRCA2* mutation, and 1 patient was found to carry a variant of uncertain significance.

Conclusions. The introduction of genomics practice within public health departments has provided access to comprehensive cancer care for uninsured individuals. The successful implementation of the B-RST into public health centers demonstrates the opportunity for integration of HBOC screening into primary care practices.

Since publication of the 2005 United States Preventive Services Task Force (USPSTF) guidelines regarding genetic risk assessment and testing for breast/ovarian cancer susceptibility, there has been a recognized need to develop screening tools to improve identification of individuals at increased risk for hereditary breast and ovarian cancer (HBOC) for referral to cancer genetic services. Specifically, the grade B recommendation stated "The USPSTF recommends that women whose family history is associated with an increased risk for deleterious mutations in *BRCA1* or *BRCA2* genes be referred for genetic counseling and evaluation for *BRCA* testing."[1] The task force commented on the shortage of tools that are available to guide physicians to make appropriate referrals for genetic counseling and/or testing in primary care practices. While several risk assessment models have been developed to calculate *BRCA1/2* mutation probabilities, such as BRCAPRO, the Tyrer–Cuzick model, and the BOADICEA model, the complexity of these models precludes their use in primary care settings as screening tools.[2–4]

Over the last several years, various screening tools have been developed and evaluated. The newest 2013 USPSTF guidelines recommend the use of such tools, specifically

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the Ontario Family History Assessment Tool, Manchester Scoring System, Referral Screening Tool, Pedigree Assessment Tool, and FHS-7.[5,6] The simplicity of a screening tool is known to be important in its use or sustainability in the medical setting. In 2009, Bellcross et al. reported results of the evaluation of simple paper-based tool, the Referral Screening Tool (RST).[7] The RST was administered to 2,464 unselected women undergoing screening mammography and validated against several complex models through collection of detailed 4-generation cancer pedigrees. Based on these findings, a web-based algorithm was developed and demonstrated to have increased accuracy, with overall sensitivity and specificity of 89.4 and 90.1 %, respectively, and an area under the curve receiver operator characteristic of 0.9.[8] In their 2013 updated guidelines, the USPSTF specifically noted the B-RST, along with the FHS-7, to be the quickest and easiest tools to administer.[6]

While significant advances have been made in screening, testing, and management of women with *BRCA1/2* mutations, inequities remain concerning access to and uptake of actual genetic counseling and testing among black/African American women.[9–11] Armstrong et al.[12] reported that among women with a family history of breast or ovarian cancer, African American women were 78 % less likely than white women to undergo genetic counseling and mutation testing, even when controlling for potential confounding factors. Suggested reasons for this difference included healthcare related distrust, which may be exacerbated with newer "technologies," and limitations in primary care providers' ability to appropriately explain mutation testing in detail. Given these disparities, a targeted approach is needed to increase identification and access to genetic services for minority women at risk for HBOC.

In 2011, the CDC provided funding to 3 state health departments for a 3-year cooperative agreement "Enhancing Breast Cancer Genomic Practices through Education, Surveillance, and Policy (ESP)." The 3 state agencies that were funded were expected to "develop or enhance activities related to promotion of breast cancer genomics."[13] One state to apply for and receive a funding opportunity award was Georgia, who received it, in addition to Michigan and Oregon, for 2011–2014. The state created the Georgia Breast Cancer Genomic Health Consortium ESP as a public-private partnership aimed to reduce the disparities among high-risk minority women. This multidisciplinary consortium includes members from the Georgia Department of Public Health, Georgia Center for Oncology Research and Education (Georgia CORE), Emory University, Morehouse School of Medicine, and Georgia State University. The objectives of the consortium include components related to education, surveillance, and policy. The purpose of this demonstration project was to evaluate the application of B-RST as a screening tool in Georgia public health centers primarily serving minority and disadvantaged women; and to implement a unique system for genetic education and follow-up of screen positive individuals.

METHODS

Since this was a funding opportunity award from the CDC that addressed education, surveillance, and policy, no IRB approval was deemed necessary. However, all patients who completed a screening tool agreed to participate via an online waiver, and an informed consent form was completed for each patient who had genetic testing. The newly created consortium developed an implementation protocol for educational sessions utilizing existing public health cancer screening and family planning programs to offer risk assessment and instruction on genomics for underserved populations. Nursing personnel at selected health centers underwent a session that included basic information on HBOC and guided practice with the B-RST. The educational session was provided by consortium members to 73 staff members in 6 Georgia public health centers between November 2012 and December 2013 (Table 1). Health centers were selected based on the disproportionate cancer burden of minority women. The specific objectives were to increase the staff individuals' knowledge of HBOC and facilitate implementation of screening with B-RST to help identify women at risk for HBOC. Teaching strategies consisted of shared stories from *BRCA*-positive individuals, lectures by breast and gynecologic surgeons, and a demonstration of the B-RST screening tool by consortium members through interactive learning. A pretest and posttest and an evaluation were administered to each staff member who took part in the session. The tests were not graded, but responses were measured and evaluated.

Each center chose to proceed with screening slightly differently, but the overall goal was to screen all women of any ethnicity/race who were seen in the family planning

TABLE 1 Educational session's locations and education implementation dates

County	Clinic name	Session date
DeKalb	Clifton Springs Health Center	11/5/2012
Bibb	Bibb County Health Department	1/16/2013
Chatham	Chatham County Health Department	3/20/2013
Gwinnett	Lawrenceville Health Center	4/10/2013
Cobb/Douglas	Acworth Health Center	5/20/2013
Clayton	Clayton County Board of Health Comprehensive Health Facility	6/10/2013

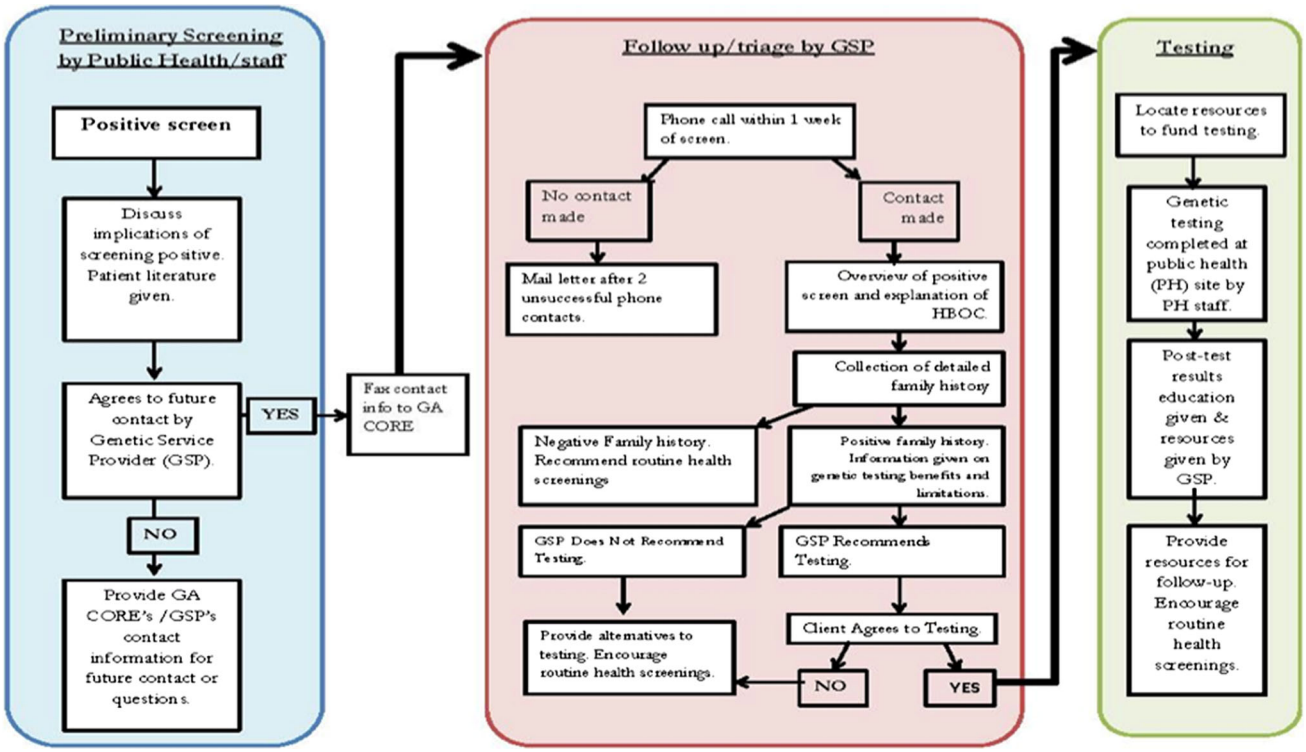

FIG. 1 Patient flow through the process of screening, follow-up, and testing

clinic, for routine exams, or were presenting with a breast complaint. The age range targeted was 18–49 years, but some older patients already enrolled in the Breast and Cervical Cancer Prevention program through the state of Georgia were included. The 6-question screening using B-RST took less than 5 min to administer. A client counted as being screened if they were administered the tool. The B-RST provided instant results (positive, negative-moderate risk, negative-low risk), which the staff shared with the clients along with an information sheet explaining the results and the follow-up process. Screen positive on B-RST indicates a 5–10 % or greater probability for the individual to carry a *BRCA1/2* mutation. Negative-moderate indicates *BRCA* mutation probability is likely less than 5 %; however, some family history of breast or ovarian cancer was reported. Negative-low indicates no family history of breast or ovarian cancer was reported. Summary screening results were recorded monthly by each center. Each center had its own log-in for data collection, which was stored in a HIPPA-compliant, secured database. Data on clients' ages, zip codes, and races/ethnicities were also collected. Clients who screened positive and agreed to follow-up were contacted by phone by the genetics professional (Fig. 1). Initially, the genetics professional was a Certified Genetics Counselor, but since May 2013, all clients have been contacted by an advanced practice nurse in genetics (APNG credential), who is also a board-certified adult health clinical nurse specialist and an advanced oncology certified nurse. A positive screen was a client at potentially high risk for breast and ovarian cancer, who had a specific need for counseling based on family history, as determined by the B-RST tool that was validated previously and is consistent with the National Comprehensive Cancer Network guidelines. The phone interview with each positive screen included review of personal health and family history and development of a 3- to 4-generation cancer pedigree. This information was evaluated by the genetics professional to determine what, if any, genetic testing was appropriate based on NCCN, USPSTF, and ASCO guidelines. The conversation included discussion of HBOC, the testing process, possible test results, and the impact on the client and/or her family related to future screening or treatment.

Insurance and income were also discussed to determine coverage for testing. Centers were informed of the phone counseling results and collaborated in scheduling in-person appointments for those proceeding with testing. At the testing appointment, the genetics professional met with the client (and family member if present) and nurse (if available) to review the pedigree, the testing process, and to verify understanding of potential results. If all criteria were met and the client agreed, a consent form was signed. Also, 12 clients who met criteria deferred testing to a later date because of conflicts with scheduling. Written information

was sent to every client who declined testing. Per protocol, if they return to health centers, they will be rescreened with the B-RST and may present back into the process at that time. For those who elected to proceed with testing, blood was drawn and sent to Myriad Laboratories, Inc., and a 1-month follow-up appointment was scheduled to discuss results (Fig. 1). The results were sent to the genetics professional at Georgia CORE. At the 1-month follow-up appointment, the results were provided to the client and explained verbally as well as in writing. Referrals for enhanced screening with mammography, ultrasounds, and magnetic resonance imaging and potential risk reduction surgery were made through the public health center.

RESULTS

Data were collected from November 2012 through December 2013, for a total of 13 months. As of December 31, 2013, 2159 individuals have been screened through this program. A positive B-RST screening result was obtained in 130 women (6.0 %), of which 110 (84.6 %) agreed to a follow-up call. The mean age of the women screened was 30 years old, with a range of 14–85 years. Most women were within the targeted 18–49 year old age group (88.3 %) and identified as Black/African American (73.2 %) or Hispanic/Latino (8.0 %). Client demographics overall and by public health center are described Table 2. Successful contact occurred in 60.9 % ($n = 67$) of positive screens who agreed to a follow-up call, and these identified clients then provided a detailed family history and received specific information about genetic testing. Family history collection revealed discrepancies between what had been recorded on B-RST and the client's actual history. These corrections resulted in 47 clients who met National Comprehensive Cancer Network (NCCN) high-risk guidelines for genetic testing. Of these clients, 14 were tested for *BRCA* mutations by full sequencing and deletion/duplication analysis, with 2 abnormal results. One client was positive for a deleterious *BRCA2* mutation, and the other was found to carry a variant of uncertain significance Table 3). The patient who tested positive at this point has had a mammogram, ultrasound, and biopsy, all of which were not definitive. She has been seen by a surgeon and was presented at a multidisciplinary conference, who recommended risk reduction surgery. The patient has not made a decision yet about surgery, and is in the process of scheduling enhanced screening that includes a breast MRI.

Regarding the education component provided to the healthcare staff members, there was an increase in knowledge about HBOC following the educational session, as measured by pre-session and post-session surveys. Prior to the session, the majority of the members (57.7 %) rated their knowledge of HBOC as "low"

TABLE 3 Client follow-up and test results

Action	*N* (%)
Screened	2,159 (100)
Positive screens	130 (6.0)
Agreed to follow-up	110 (84.6)
Successfully contacted for follow-up	67 (60.9)
Met NCCN guidelines for testing	47 (65.7)
Underwent genetic testing	14 (29.8)
Genetic variants	2 (14.3)
BRCA2 mutation	1 (7.1)
Variant of uncertain significance	1 (7.1)

TABLE 2 Client demographics of educational session locations

	DeKalb	Bibb	Chatham	Gwinnett	Cobb/Douglas	Clayton	Total *N* (%)
Age, N (%)							
Less than 18 years	63 (5.5)	18 (6.4)	0 (0)	4 (1.0)	2 (1.7)	1 (7.4)	88 (4.1)
18–49 years	1073 (92.9)	224 (85.2)	221 (97.4)	272 (71.2)	108 (93.9)	8 (57.4)	1,906 (88.3)
50 years and over	0 (0)	7 (2.7)	5 (2.2)	96 (25.1)	1 (0.9)	0 (0)	109 (5.0)
Not specified	19 (1.6)	14 (5.3)	4 (1.4)	10 (2.65)	4 (3.5)	5 (35.7)	56 (2.6)
Race/ethnicity, N (%)							
American Indian/ Alaska Native	3 (0.3)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	4 (0.2)
Asian	7 (0.6)	3 (1.1)	2 (0.9)	11 (2.9)	3 (2.6)	0 (0)	26 (1.2)
Black/African American	1066 (92.3)	185 (70.3)	164 (71.3)	121 (31.7)	36 (31.3)	9 (64.3)	1,581 (73.2)
Native Hawaiian/ Other Pacific Islander	0 (0)	0 (0)	0 (0)	1 (0.3)	2 (1.7)	0 (0)	3 (0.1)
Not specified	18 (1.6)	16 (6.1)	3 (1.3)	13 (3.4)	8 (7.0)	1 (7.4)	59 (2.7)
Other	30 (2.6)	1 (0.4)	0 (0)	4 (1.0)	1 (0.9)	0 (0)	36 (1.7)
White/Caucasian	14 (1.2)	39 (14.8)	44 (19.1)	143 (37.4)	38 (33.0)	0 (0)	278 (12.9)
Hispanic/Latino	17 (1.5)	19 (7.2)	17 (7.4)	88 (23.0)	27 (23.5)	4 (28.6)	172 (8.0)

or "very low," while the percentage of members rating it this way on the postsession survey was only 1.22 %. Correspondingly, the members who rated their knowledge as "high" or "very high" rose from 7.7 to 26.8 %. Their knowledge of what percentages of breast and ovarian cancer are attributable to HBOC syndrome, from whom a woman can inherit a *BRCA1/2* mutation, and which patients should be referred for genetic counseling/testing also substantially increased.

DISCUSSION

The primary goal of this demonstration project was to identify underserved and minority women at high risk for HBOC who would not otherwise have access to systematic screening and appropriate testing. During the 13 months of the project, 2,159 women were screened. A significant percentage of the women reached were minority (73.2 % black/African American and 8.0 % Hispanic/Latino), and 88.3 % were between the ages of 18 and 49 years. Both race and age of the participants was consistent with the goals of the Consortium and the original grant. The percentage of women who screened positive, 6.0 %, is consistent with the findings of Bellcross et al.[7] who reported 6.2 % of subjects screened B-RST positive in a mammography setting.

We identified some limitations of our demonstration project. There were 20 women who screened positive by the B-RST and declined to be contacted by a genetics professional for more family information. The centers did not collect specific data concerning client rationale for declining additional contact. These clients were provided with written materials as well as the contact information for the genetic professional. They remain in the Department of Public Health system and will have the opportunity to re-enter the program at their annual visits. There were 53 clients who agreed to participate but could not be contacted. After 2 attempts, those who were not successfully contacted were sent a letter at their address. For those that then contacted the genetic professional, they were then included in the rest of the statistics. Also, 13 clients who screened positive on the B-RST and were successfully contacted did not meet NCCN guidelines for testing once a more complete family history was completed. One possible issue leading to these "false positives" was that the screenings were all done without any family history preparation by the client. In addition, verification of the family history by the genetics professional sometimes revealed different information from what was initially presented at the time of screening. This also occurred at testing appointments when the pedigree was reviewed in more depth.

There were 19 clients who did not proceed with testing but identified a more appropriate (and local) affected family member to test. Follow-up is in process for these cases. Individuals seeking services with public health centers are often characterized as underserved, low-income, and possibly more transient than the general population. This creates a potential barrier to contacting family members. The process used in this demonstration project focused on assisting unaffected women of Georgia at increased risk for HBOC based on family history. Future directions should explore new ways to improve outreach to family members most appropriate for testing, in order to ensure the most informative result for the client and their family. Efforts to discover barriers to testing acceptance through a needs assessment could uncover reasons why follow-up calls or testing was not accepted and guide targeted outreach strategies. Anecdotal reports suggests privacy issues, lack of trust, not understanding the process, and lack of interest as impacting client decision making.

By the end of the 3-year grant period, 9 public health centers will have completed educational sessions and implemented screening with B-RST, and the target is to have screened 6,500 women. Future efforts will focus on expansion to health centers outside metro Atlanta and into rural parts of Georgia. Further, implementing the process within diverse settings, including federally qualified health centers, mammography centers, and cancer centers, will allow for greater reliability to extrapolate the model throughout the country.

In conclusion, our demonstration project was successful in identifying underserved and minority women at increased risk for HBOC who would not otherwise have access to systematic screening and appropriate testing. Expansion of this protocol may contribute to a long-term reduction in health inequity related to cancer incidence and mortality, among high-risk and minority populations. Further implementation of our protocol will add to the current data on this topic and may be used for future best practices in cancer care.

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REFERENCES

1. U.S. Preventive Services Task Force. Genetic risk assessment and BRCA mutation testing for breast and ovarian cancer susceptibility: recommendation statement. *Ann Intern Med*. 2005;143:355–61.
2. Berry DA, Iversen ES Jr, Gudbjartsson DR, Hiller EH, Garber JE, Peshkin BN, et al. BRACPRO validation, sensitivity of genetic testing of BRCA1/BRCA2, and prevalence of other breast cancer susceptibility genes. *J Clin Oncol*. 2002;20:2701–12.
3. Tyrer J, Duffy SW, Cuzick J. A breast cancer prediction model incorporating familial and personal risk factors. *Stat Med*. 2004;23:1111–30.
4. Antoniou AC, Pharoah PP, Smith P, Easton DF. The BOADICEA model of genetic susceptibility to breast and ovarian cancer. *Br J Cancer*. 2004;91:1580–90.
5. Teller P, Hoskins KF, Zwaagstra A, Stanislaw C, Iyengar R, Green VL, et al. Validation of the Pedigree Assessment Tool (PAT) in families with BRCA1 and BRCA2 mutations. *Ann Surg Oncol*. 2010;17:240–6.
6. Moyer VA on behalf of the U.S. Preventive Services Task Force. Risk assessment, genetic counseling, and genetic testing for BRCA-related cancer in women: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2014;160:271–81.
7. Bellcross CA, Lemke AA, Pape LS, Tess AL, Meisner LT. Evaluation of a breast/ovarian cancer genetics referral screening tool in a mammography population. *Genet Med*. 2009;11:783–9.
8. Bellcross CA. Further development and evaluation of a breast/ovarian cancer genetics referral screening tool. *Genet Med*. 2010;12:240.
9. Thompson HS, Sussner K, Schwartz MD, Edwards T, Forman A, Jandorf L, et al. Receipt of genetic counseling recommendations among black women at high risk for BRCA mutations. *Genet Test Mol Biomarkers*. 2012;16:1257–62.
10. Sheppard VB, Mays D, LaVeist T, Tercyak KP. Medical mistrust influences black women's level of engagement in BRCA1/2 genetic counseling and testing. *J Natl Med Assoc*. 2013;105:17–22.
11. Thompson HS, Valdimarsdottir HB, Duteau-Buck C, Guevarra J, Bovbjerg DH, Richmond-Avellaneda C, et al. Psychosocial predictors of BRCA counseling and testing decisions among urban African-American women. *Cancer Epidem Biomarkers*. 2002;11:1579–85.
12. Armstrong K, Micco E, Carney A, Stopfer J, Putt M. Racial differences in the use of BRCA1/2 testing among women with a family history of breast or ovarian cancer. *JAMA*. 2005;293:1729–36.
13. Centers for Disease Control and Prevention. CDC awards programmatic funding to support breast cancer genomics. http://www.cdc.gov/cancer/breast/what_cdc_is_doing/genomics_foa.htm (2013). Accessed 17 March 2014.