Evaluating and improving the implementation of a community-based hereditary cancer screening program

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Abstract

Healthcare disparities exist in the provision of cancer genetic services including genetic counseling and testing related to *BRCA1/2* mutations. To address this in a community health setting a screening tool was created to identify high-risk women. This study evaluates the implementation of the tool and identifies opportunities for improved cancer genetic screening, including regular clinician education. A mixed-method approach was used to evaluate clinician utilization of the screening tool at Planned Parenthood affiliates. Novel surveys that evaluated acceptance and implementation were administered to clinicians ($n = 14$) and semi-structured interviews ($n = 6$) were used to explore clinicians' perspectives and identify gaps in its utilization. Educational modules that addressed gaps were developed, implemented, and evaluated using a post-education survey ($n = 8$). Clinicians reported confidence in administering and interpreting the screening tool, but reported less confidence in their knowledge of cancer genetics and ability to connect clients with genetic counseling and testing ($p = .003$). Educational modules resulted in significant gains in clinician knowledge on genetic topics ($p < .05$) and increased self-reported confidence in connecting clients with genetic services. The modules reinforced the belief that genetic testing is beneficial for patients at increased risk ($p = .001$) and is important to inform subsequent medical management ($p = .027$). While building community clinicians' capacity to connect clients with genetic services is crucial, it is challenged by knowledge and confidence gaps in discussions of genetic services with clients. Consistent genetic-focused education with non-genetic clinicians can improve confidence and knowledge, enabling a more effective screening program in community health settings.

Keywords *BRCA1/2* mutations · Cancer genetic services · Cancer risk evaluation · Access to genetic services · Genetic education · Medically underserved populations

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Background

Health care disparities have been well documented in the delivery of health care services in the USA such that underserved populations fail to receive adequate access to cancer genetic services (Ward et al. 2010; Levy et al. 2011; Komenaka et al. 2015). Organizations ranging from community health centers to state organizations have attempted to increase access to cancer genetic services for underserved populations by utilizing non-genetics healthcare providers or questionnaires to screen for women that are at higher risk for breast and/or ovarian cancer (Cohen et al. 2009; Christianson et al. 2012; Brannon Traxler et al. 2014). These efforts are integral to assuring that the Healthy People 2020 objective to increase the proportion of women with a family history of breast and/or ovarian cancer who receive genetic counseling is realized by diverse socio-economic and racial

populations (2014). Each of these screening programs has provided compelling evidence that a hereditary cancer screening program can identify high-risk women who do not seek health care at typical hospital systems. In general, cancer genetic screening programs have contained four main components: administering a family history screening tool, interpreting the results, discussing personalized risk factors with the client, and connecting them to genetic services, such as genetic counseling and testing, when appropriate (Bellcross et al. 2009; Cohen et al. 2009; Brannon Traxler et al. 2014).

Planned Parenthood's affiliate clinics are in a unique position to reach minority populations who may not have access to hospital-based services and connect high-risk clients with cancer genetic services (Schranz et al. 2015). In January 2013, Planned Parenthood Federation of America (PPFA), which oversees the affiliate clinics, initiated such a program as part of their Breast Health Initiative (BHI). PPFA's BHI aimed to improve clinician comfort with clinical breast exams, breast cancer screening guidelines, and interpretation of screening mammography results. Additionally, PPFA incorporated a Breast Cancer Risk Screening Questionnaire (BRSQ) developed by one of the authors (MDP) to identify women at potentially higher risk for breast and/or ovarian cancer due to hereditary factors. The BRSQ was developed as a novel tool to help address constraints on Planned Parenthood clinician's time and their limited access to previously validated screening tools (Gilpin et al. 2000; Evans et al. 2004; Bellcross et al. 2009; Moyer 2014). The BRSQ asks two questions about personal and family history of breast and/or ovarian cancer, with more detailed follow up questions about the age, relation, and type of cancer in the client or their family member if the client does have a personal or family history. Consequently, the BRSQ can quickly and concisely identify women that may be at increased risk for breast and/or ovarian cancer in accordance with the 2012 National Comprehensive Cancer Network (NCCN) guidelines (National Comprehensive Cancer Network 2013). A positive screen prompts the clinician to discuss the client's potentially increased risk for cancer and recommend genetic counseling where the appropriate professional can provide a precise evaluation of a client's cancer risk and a detailed discussion of related management.

The BRSQ exemplifies a unique approach to cancer genetic screening programs in a community setting. However, the community clinician is a central figure in the success of implementing any screening program, as it is his/her acceptance, implementation, and consistent utilization that contribute to identification of potentially high-risk clients. Clinicians who perceive the utility of genetic services and display positive attitudes towards genetics are more likely to refer to and engage with genetic service providers (Trivers et al. 2011; Prochniak et al. 2012; Klitzman et al. 2013; Salm et al. 2014). Even with clinician buy-in, implementation of a genetic screening program also requires training to build the

confidence of non-genetics clinicians (Suther and Goodson 2003; Bellcross et al. 2014). Finally, in order to maintain consistent utilization of the screening program, clinicians must have access to on-going education on genetics topics so that they have a solid knowledge base with which to discuss genetic services with clients (Brandt et al. 2008; Christianson et al. 2010, 2012; Houwink et al. 2011; Salm et al. 2014). In PPFA's case, implementation of the BRSQ was preceded by a variety of efforts to educate the greater than 1600 clinicians that work for PPFA in the use and interpretation of the tool, including a 'Train the Trainer' approach, supplemented with online learning modules and instructional videos (Levine et al. 2007; Segre et al. 2011; Kint 2014; Pearlman 2014).

The BRSQ was designed to empower clinicians who are not genetic specialists to provide basic screening that can identify clients at potentially higher risk of breast and/or ovarian cancer, and subsequently recommend seeking genetic services (Cohen et al. 2012, 2013). While each clinician's training via "Train the Trainer" and multimedia education can shape their attitudes and knowledge about cancer genetics, their confidence in implementing all the BRSQ-associated tasks is also critical to successful implementation. In this study, we examined utilization of the BRSQ in Planned Parenthood of Mid and South Michigan (PPMSM). PPMSM serves over 52,000 unique clients each year, spanning a wide spectrum of demographic backgrounds. Fifty-eight percent of the client population identifies as White, and the remaining 42% as Black, Asian, and American Indian descent. Notably, over 50% of the PPMSM population is self-pay, and 70% of their population is under age 30 (Planned Parenthood Federation of America, 2014, PPMSM Medical Services Data 2014. Location: Planned Parenthood Federation of America, unpublished). Data collected by PPMSM indicated that in 2013, the BRSQ's inaugural year, more than 875 clients screened positive at 12 of the 16 PPMSM centers (personal communication with Mary Kint 2014). We sought to evaluate the effectiveness of the implementation of this community-based cancer risk screening program and identify opportunities for improving long-term utilization. This study also aimed to evaluate the impact of continued clinician education on the effectiveness of the BRSQ implementation and utilization.

Materials and methods

PPMSM's implementation of the BRSQ was analyzed using a mixed-methods analysis consisting of a baseline survey and semi-structured interviews of clinicians. The baseline survey conducted between August and October 2014 gathered information on clinician's knowledge and confidence surrounding the BRSQ and was followed up with optional semi-structured interviews from December 2014 to January 2015. After analyzing the initial baseline survey and semi-structured interview

transcripts, areas were identified in which the clinicians desired more knowledge (described in the results). Educational modules were developed and administered to the clinicians from September through December 2015, and a post-educational modules survey conducted from January to March 2016 measured changes in knowledge, confidence, and behaviors related to the BRSQ.

The study was approved for exemption through University of Michigan IRB HUM00090186.

Study participants

The study populations were recruited from healthcare providers, defined as clinicians in this article, who provided direct client care for preventive care visits within the Planned Parenthood of Mid and South Michigan (PPMSM) system. This system spans mid- and southeast Michigan and contains 16 health care centers. All eligible clinicians had previously received training regarding breast health and the BRSQ as part of their job responsibilities through a variety of mechanisms including online modules, videos and/or in-person training. In-person training was conducted by either one regional expert (who attended a national “Train the Trainer” session), or during new hire orientation training.

Baseline survey recruitment All 14 clinicians working at the 16 PPMSM centers in August of 2014 were invited to participate in the baseline survey via an email from the PPMSM leadership. Additional recruitment occurred through follow-up emails from PPMSM leadership and reminders on regularly scheduled monthly PPMSM team calls.

Semi-structured interview recruitment Recruitment for the semi-structured interviews was accomplished through a final question on the confidential baseline survey inviting participation in this second phase of the study.

Educational module and post-educational modules survey recruitment All PPMSM clinicians (regardless of participation in the research study) who were required to attend regularly scheduled monthly telephone team meetings viewed the genetics educational modules as part of the monthly team meetings between September and December 2015. A post-educational modules survey was administered after the completion of the full series of educational modules with data collection from January through March of 2016.

Study design

Baseline survey The baseline survey was developed to evaluate utilization of and attitudes about the BRSQ. Three main areas were explored: (1) clinicians’ experiences administering the BRSQ to their clients, (2) clinicians’ knowledge and

confidence implementing the BRSQ, and (3) clinicians’ knowledge and confidence related to cancer genetics and its utility. In addition, frequency of BRSQ utilization and demographics of both the clinicians and their health centers were collected. The survey consisted of 40 questions, including multiple-choice, open-ended, and quantitative 5-point scale matrices. The majority of questions were novel, but three were adapted from confidence, knowledge, and attitude questionnaires (Salm et al. 2014). The survey was piloted with two PPFA clinicians prior to distribution. The baseline survey was administered on the Qualtrics survey platform and distributed via email to all actively employed PPMSM clinicians from August to October 2014. Clinicians received the book *Confronting Hereditary Breast and Ovarian Cancer: Identify Your Risk, Understand Your Options, Change Your Destiny* by Sue Friedman, Rebecca Sutphen, and Kathy Steligo as compensation for completing the survey.

Semi-structured interviews At the end of the baseline survey, participants were invited to participate in the semi-structured interviews. The semi-structured interview guide was informed by the results from the baseline survey and review of the literature. The interview guide focused on clinicians’ perceptions of motivators and barriers that impacted their ability to administer the BRSQ, as well as strengths and areas for improvement in regard to clinicians’ conversations with clients about their screening results and genetic resources. Interviews were conducted in-person by the primary investigator (SG). Interviews lasted approximately 30 min and were audio-recorded. Compensation was provided to participating clinicians in the form of a \$20 gift card. Semi-structured interviews took place from November 2014 to January 2015.

Audio recordings were transcribed verbatim and then reviewed by a second member of the research team to verify transcriptional accuracy. Transcribed interviews were de-identified to ensure confidentiality. Analysis was completed using Dedoose software to organize and code qualitative data. Three researchers (SG, MM, and BMY) independently read each transcript to identify individual themes related to the study objectives utilizing a structural coding approach (MacQueen et al. 2008; Namey et al. 2008; Guest et al. 2012). Codes were determined among the three researchers through an iterative and collaborative process to ensure inter-coding reliability. Final coding was completed by the principal investigator (SG) utilizing the developed codes in consultation with the investigational team. Code frequency and content from the interviews were discussed by the study team to identify overall themes related to the BRSQ tool’s effectiveness.

Genetics education modules and post-educational modules survey Analysis of the survey and semi-structured interviews identified opportunities for improving clinicians’ confidence and knowledge surrounding tasks associated with

implementation of the BRSQ tool. Educational modules were developed and executed as four 10-minute webinars. As requested by PPMSM leadership, these webinars took place during regularly scheduled monthly team calls during September–December 2015. Topics for the educational modules were derived from the most commonly cited issues identified during quantitative and qualitative analysis related to clinician attitudes, confidence, and knowledge. A variety of resources were used to build the educational webinars, including videos from previous organizations, society guidelines, and pedigrees used in former genetics education workshops. A post-educational modules survey was created including questions from the baseline survey related to attitude, confidence, and knowledge and 12 questions related to the participants' opinions about the educational modules' effectiveness.

Results from both surveys (baseline and post-educational modules) were transferred from the Qualtrics survey platform, and analyzed in SPSS Statistics 23. All questions that were asked on a five-point scale (e.g., from strongly disagree to strongly agree) were converted to a numerical discrete scale (1—strongly disagree, 5—strongly agree). Statistical analyses of quantitative data included inter- and intra-survey independent samples tests, means comparison analyses, and demographic descriptives.

Results

Study population

Fourteen clinicians completed the initial baseline survey (100% response rate), representing all 16 centers in PPMSM network. Among the 13 participants who shared demographic information, all were female, 85% of whom identified as Caucasian, ranging in age from 30 to 65, with a wide range of years of experience (1–20 years) working at Planned Parenthood (Table 1). Nine (69%) of the clinicians were nurse practitioners, and the remaining were physician assistants ($n = 1$; 9%) and certified nurse-midwives ($n = 3$; 23%). Given the rapid evolution of genetics, the amount of time since participant's last formal genetics training was surveyed as a demographic and did not account for continuing education the participant may have engaged in. We found that participants had last completed their highest-level graduate training across a 23-year window, with the most recent in 2013. Participants received training related to the BRSQ through multiple modalities, most commonly including online modules, breast health videos, and regional training prior to the genetics educational module training. The participants' self-reported demographics of their clientele were highly variable due to clinicians working at multiple centers with unique client populations (data not shown).

Of the 14 clinicians who completed the initial baseline survey, six clinicians (43%) elected to participate in the semi-structured interviews. The demographics of the six

interviewed clinicians were representative of the larger clinician population who participated in the survey (Table 1). After completion of the full series of educational modules, eight clinicians participated in the post-educational modules survey (57%). Six of the eight clinicians had taken the initial baseline survey, and of those six, four participated in the semi-structured interviews. There were two participants who completed the post-educational modules survey but were not part of the baseline survey due to the timing of their hiring. The demographics of all eight clinicians who participated in the post-educational modules survey were similar to those who participated in the initial clinician survey (Table 1).

General themes

Results from the baseline survey informed the content of the semi-structured interviews and several themes emerged when data from the baseline survey, semi-structured interviews, and post-educational modules were considered together.

1. Participants report BRSQ utilization with intended frequency

On the baseline survey, all participants reported administering the BRSQ at least once per week. Although the survey queried how many clients they administered the tool to each week, this data was difficult to compare between participants given differences in the number of hours per week each participant spends at a PPMSM clinic. During the semi-structured interviews, 100% of participants ($n = 6$) self-reported administering the BRSQ to all preventive care clients, as it was intended. Ease of use of the tool was also noted.

004: The questionnaire is very quick and easy to use and I'm not sure you could improve upon it that much.

Participants also described utilizing the BRSQ and providing related materials to patients, even when there were time constraints or doubts about a client's intent seek genetic services.

003: When we're in a time crunch of trying to get through patients...sometimes I'm just like "ok I just need to get through this and get you out of here." ... the form itself isn't difficult at all.

2. Clinicians are more confident in administering and discussing BRSQ results, and less confident discussing genetic services

In order to determine if there were individual elements of employing the BRSQ that were challenging to clinicians,

Table 1 Demographic distribution of the study population (PPMSM clinicians)

	Baseline survey	Semi-structured interviews	Post-educational modules survey
Total participants	14*	6	8*
Gender			
Female	13 (100%)	6 (100%)	7 (100%)
Race/ethnicity			
White	11 (85.6%)	6 (100%)	5 (71.4%)
African American/Black	1 (7.7%)	0	0
Asian	1 (7.7%)	0	0
Multiracial	0	0	1 (14.3%)
Other	0	0	1 (14.3%)
BRSQ training mechanism ^{&}			
PPFA online modules (n)	13 (100%)	6 (100%)	6 (85.7%)
PPFA breast health videos	10 (76.9%)	6 (100%)	6 (85.7%)
PPFA regional training	10 (76.9%)	6 (100%)	4 (57.1%)
New hire training	3 (23.1%)	0	1 (14.3%)
Mean age	44.9 (range 30–65)	43.8 (range 35–56)	45.7 (range 29–58)
Mean year of highest degree earned	2004 (range 1988–2011)	2006 (range 1994–2010)	2002 (range 1987–2013)
Mean years of planned parenthood experience	7.5 years (range 1–20)	7.2 years (range 2–17)	10.7 years (1–23)

*One of the participants preferred not to answer demographic or training questions. All percentages are out of 13 for the “Baseline Survey” population, and out of 7 for the Post-Educational Modules Survey

[&] All participants engaged in multiple training methods

participants were surveyed on the specifics of how they implemented the BRSQ. Implementation was divided into discrete tasks focused on (1) administering the BRSQ, (2) interpreting the BRSQ results, (3) discussing BRSQ results with clients, and (4) referring clients that screen positive onto genetics clinics. Participants’ confidence in each task was measured on a scale of 1 to 5, with 1 being not at all confident and 5 being extremely confident. In general, clinicians felt confident administering ($\bar{x}=4.5$; $s=.52$) and interpreting the BRSQ ($\bar{x}=4.4$; $s=.51$) and discussing BRSQ results with clients ($\bar{x}=4.43$, $s=.67$). However, they felt less confident providing additional genetics support or referrals ($\bar{x}=3.68$; $s=0.87$; $p=.003$). Mean comparison analysis showed a statistically significant difference in clinicians confidence talking with patients about additional genetics support or referrals ($p=.003$) as compared to their overall, combined confidence related to administering, interpreting, and talking with patients about their results.

Furthermore, clinicians thought that “none” ($n=3$) or “a few” ($n=11$) of their BRSQ-positive clients received follow up genetic services. This finding was affirmed during the semi-structured interviews in which 88% of clinicians stated that very few of their clients were seeking genetic services. A representative sentiment follows:

003: Now that we’ve been doing it for more than a year, we definitely are seeing patients back where we’re

saying “... last year it was recommended that you see a genetic counselor, was that something that you followed up on?” And I have yet to have a patient say yes...

- Clinicians believe that genetic services are valuable but are uncertain about financial accessibility to clients

In order to explore clinicians’ attitudes about genetic services, participants were surveyed about their opinions on statements regarding the utility, impact, and accessibility of genetic services for their clients. Clinicians selected their opinion on each statement (1—strongly disagree, 5—strongly agree), and in aggregate the responses indicated that clinicians perceive that genetic services are of value to their clients (Fig. 1). At the baseline survey, participants agreed most strongly with the statements “genetic testing can help determine medical management” ($\bar{x}=4.21$, $s=.43$), and “genetic testing is useful for those at increased risk” ($\bar{x}=4$, $s=.56$). There was wide variability with regard to whether clinicians felt that insurance coverage impacted how they discussed genetic testing with clients. In general, clinicians did not report concerns regarding genetic discrimination or psychological harms related to genetic testing.

Some participants also described the services received by their clients who did seek genetic services as comprehensive, as described here:

Fig. 1 Clinician responses to statements regarding genetic services. Clinicians were asked to rate their opinion for each statement on a five-point scale, with 1 being strongly disagree and 5 being strongly agree. Grey bars indicate averages at the baseline survey, and black bars indicate averages obtained from the post-educational modules survey with standard deviation. GT = genetic testing; E-B = evidence-based

002: When they get it [genetic counseling] done, the information they get is very thorough...the ones that I've had go ...have a full on, like, packet, practically, of an assessment of what happened and they know what their options are and what their follow up should be and whatnot.

All clinicians ($n = 6$) indicated uncertainty surrounding the financial aspects of a client accessing genetic services, resulting in obstacles to their conversations with clients:

001: A lot of them, unfortunately there are still quite a few that don't have insurance, so that's sort of where it {the conversation} stops. That's the hard part... we don't know where to direct them...[if] us as clinicians had more information about resources and costs to share, [because] I don't know...what the cost is...if insurance doesn't cover it [genetic counseling and testing].

4. Clinicians' reported knowledge gaps regarding cancer genetics and genetic counseling

Clinicians completed a quantitative self-assessment of their knowledge on six topics related to hereditary cancer, genetic counseling and testing, and medical management of BRCA mutation carriers. Each topic was rated on a 5-point scale, with 1 being very poor and 5 being very good, as indicated in Fig. 2. At the baseline survey, clinicians had less comfort with their knowledge of hereditary breast and ovarian cancer (HBOC) and genetic services in general, self-assessing all topics below

a "moderate level of knowledge." There was wide variation in their self-assessed knowledge, ranging from very poor knowledge to a good level of knowledge, particularly on topics related to hereditary cancer and genetic counseling. The topic that clinicians felt most knowledgeable about was breast cancer inheritance ($\bar{x} = 2.86$, range 2–4), while they felt least knowledgeable about BRCA1/2 genetic testing and results ($\bar{x} = 2.36$, range 1–3). Of note, none of the respondents in the baseline survey self-assessed their knowledge of breast cancer inheritance, the BRCA1/2 genes, or screening recommendations for mutation carriers as very poor or very good.

Responses from the interviews supported these survey findings. All clinicians ($n = 6$) noted that they desired more in-depth training and information about genetics and genetic counseling that they could utilize to speak with clients, as shown below:

003: I think it would be nice if we had more information about what happens when a patient goes to see a genetic counselor...I have no idea what I would tell a patient... because I don't know.

006: We had a brief training, I think when we first pulled this [BRSQ] out. And [they] gave us... a couple pages that just gives a quick synopsis of it and the BRCA genes and I've read a little bit on my own too. But I mean I'm not at all, I don't feel qualified...

5. Execution of educational modules resulted in increased knowledge

Fig. 2 Clinicians' perceptions of their genetic knowledge. Participants self rated their knowledge of 6 genetics topic corresponding to content provided in the educational intervention. Average knowledge was measured on a five-point scale, with 1 being no knowledge and 5 indicating they had very good knowledge. Grey bars indicate averages at the baseline survey, and black bars indicate averages obtained from the post-educational modules survey with standard deviation. *P* values are representative of means comparison analysis between the baseline survey and post-educational modules survey for the genetics topic

Topics for the educational modules were derived from the most commonly cited issues from the baseline survey and semi-structured interviews and included (1) HBOC, (2) the genetic counseling process, (3) insurance coverage and affordability of genetic counseling and/or testing, and (4) high-risk medical management. These four topics informed the development and implementation of educational modules for PPMSM, tailored to address clinician perceived knowledge gaps and client barriers. The post-educational modules survey identified changes in attitudes, knowledge, and confidence compared to the initial baseline survey utilizing means comparison analyses. Clinicians had significant increases in positive attitudes towards genetic testing as useful for those at increased risk ($p = .001$) and as a mechanism for determining medical management ($p = .027$) (Fig. 1). Additionally, clinicians felt more prepared to explain the genetic counseling process to clients after they screen positive ($p = .009$). Furthermore, clinicians reported increased genetic knowledge after the modules, particularly regarding BRCA1/2 genetic testing and results ($p = .015$), as well as screening recommendations for BRCA1/2 carriers ($p = .007$) (Fig. 2).

Clinicians were also asked to provide their opinions about the educational modules on a scale of 1 (strongly disagree) to 5 (strongly agree). In aggregate, clinicians agreed that each session taught them something new ($\bar{x}$ range 4–4.25) and had more confidence in talking with clients about genetic counseling due to the modules ($\bar{x} = 4.00$; $s = .76$). They reported that the training not only highlighted the importance of a

client seeking genetic services ($\bar{x} = 4.38$; $s = .94$), but was also a productive use of time ($\bar{x} = 4.13$; $s = .64$).

Discussion

The BRSQ represents an innovative tool that was designed to efficiently identify women at potentially increased risk for breast and/or ovarian cancer who receive their health care within a community health setting. PPMSM's positive screen records in 2013 are a strong indication that Planned Parenthood clients are being screened for cancer risk due to hereditary factors. Our results confirm that Planned Parenthood providers recognize the value of cancer genetic services and are able to consistently incorporate the BRSQ tool into their daily practice, as evidenced by our quantitative and qualitative data. The tool was well accepted and clinicians felt confident in administering the tool and interpreting its results. We also identified areas where additional education could be useful in optimizing implementation, particularly by increasing clinician confidence in discussions with clients that screen positive. Additional education may help improve uptake of client referrals to genetic services. Bridging the gap from a positive BRSQ result to a client seeking genetic services is imperative given the young age of PPMSM's population, where over 70% of the client population is under age 30, an ideal age for identification and cancer prevention (2014).

At baseline, clinicians indicated that they had low levels of genetic knowledge, indicating a need for educational intervention to address this concern: addressing this deficit is particularly important given previous research suggesting that clinicians providing healthcare to underserved populations have reduced utilization of genetic referrals (Shields et al. 2008). While these low levels of genetic knowledge may not be substantially different from clinicians in other non-genetics settings, they highlight the on-going, general need in multiple healthcare settings for clinician education. Our educational modules were useful in addressing the baseline inadequacies in clinician knowledge which may be contributing to their reported concerns about underutilization of genetic services among their clients (Carroll et al. 2009; Bellcross et al. 2011; Klitzman et al. 2013; Salm et al. 2014). The acceptance and impact of the educational modules on clinicians' perceptions of genetic knowledge reinforce the idea that working directly with clinicians who see underserved populations can provide added benefit (Small and Patel 2012). Our educational modules clarified many misconceptions, including those related to the affordability and accessibility of genetic services. This is important because healthcare providers must have an accurate understanding of not only genetic testing and counseling, but the financial and legal implications of genetics (Guttmacher et al. 2007).

A critical factor in utilization of a screening tool is the clinician's belief that there is high medical utility in the potential referral, in this case genetic services. We found that clinicians in our study population agreed with the concept that genetic counseling and testing are valuable services that can help determine medical management. These opinions have been shown in many clinical settings but our data represent important evidence of similar attitudes by clinicians who work in a freestanding reproductive health care organization like Planned Parenthood (Bellcross et al. 2011, 2014; Prochniak et al. 2012; Klitzman et al. 2013). PPMSM's clinicians not only believe there is utility in genetic services for high-risk clients, but these attitudes were reinforced through the educational modules. These results suggest that this type of clinical setting and screening program are a viable mechanism for identifying at-risk women who often have limited access to hereditary cancer screening programs at hospitals and academic centers.

Building clinicians' capacity to connect clients with genetic services is crucial, as the clinician-client conversation has a significant impact on whether the client will seek genetic services (Armstrong et al. 2005). During our interviews, clinicians indicated that financial factors (insurance, cost, etc.) played a large role in their conversations with clients and they often felt ill-equipped to address such concerns. Given that almost 50% of PPMSM services are self-pay, it is not surprising that this was a common topic of discussion and it is clearly an issue that freestanding reproductive health care centers like Planned Parenthood must address (Planned Parenthood Federation of

America, 2014, PPMSM Medical Services Data 2014. Location: Planned Parenthood Federation of America, unpublished). In response to these issues, our educational modules included specific information on the financial side of genetic services, in addition to content on basic cancer genetics and genetic counseling. Ultimately, the increased knowledge resulting from our educational modules are likely to have a positive impact on conversations with clients regarding genetic services (Metcalf et al. 2002; Carroll et al. 2009). However, reported mean knowledge and confidence was still below a 4 on a 5-point scale and short-term outcome gains can be lost in long-term follow-up (Niedermann et al. 2004). In order to continue to empower clinicians to have in-depth conversations and sustain our initial efforts to increase the number of BRSQ-positive clients that seek genetic services, it will be important to provide recurrent education to clinicians about all aspects of genetic services. Furthermore, frequent education would likely increase both clinicians' knowledge and confidence in their ability to have a meaningful conversation with their clients. Clients and clinicians interact in a feedback loop, however, and time constraints are a looming factor when clinicians determine what information to cover during an appointment. If clinicians continue to experience low rates of genetic service uptake, a client's failure to seek genetic services has the potential to eventually result in fewer clinician conversations on this topic. In response, educational interventions should occur periodically to emphasize the importance of consistent utilization of the BRSQ tool, as well as incorporate educational strategies geared at the adult learner in order to maximize clinician uptake of information and utilization (Merriam 2001; Brown et al. 2004; Guttmacher et al. 2007; Carroll et al. 2009).

The strengths of this study are derived from the fact that we were able to evaluate a unique cancer genetics screening program that relies on non-genetics clinicians in a freestanding reproductive health care clinics which provide care to a historically underserved population. While our results are limited to a snapshot of the BRSQ program within one region that experienced a fair amount of clinician turnover (at least three new hires in the first 18 months of implementation), in aggregate our assessment of this screening program can be used to improve clinician implementation of both the BRSQ and similar programs. An important next step is to evaluate the program from the clients' perspectives, as the success of the BRSQ is ultimately measured by how many clients actually follow through on referrals from their clinicians. Our group is currently evaluating client perspectives on the motivators and barriers in utilizing genetic services post BRSQ screening in order to identify client-directed interventions. While the results of our current study provide crucial information on ways to improve cancer genetic screening and lay the groundwork for future work in this important area, overcoming the barriers that exist in the community health setting will require integrating clinician and client perspectives.

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Compliance with ethical standards

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study, per exempt approval of University of Michigan IRB HUM00090186.

Conflict of interest The authors declare that they have no conflict of interest.

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