OPINIONS, KNOWLEDGE AND ATTITUDES OF GENETIC COUNSELORS IN THE UNITED STATES ABOUT PREIMPLANTATION GENETIC DIAGNOSIS FOR \textit{BRCA1/2} MUTATION CARRIERS

Master’s Thesis

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ABSTRACT

Debates continue about which conditions are ‘serious enough’ to warrant the use of preimplantation genetic diagnosis (PGD). Most individuals find it acceptable to offer PGD for highly penetrant, early onset conditions that have few or no treatment options. (HFEA, 2006). The Practice Committee of the Society for Assisted Reproductive Technology and the Practice Committee of the American Society for Reproductive Medicine (2008) published a report stating PGD is also indicated for couples who carry \textit{BRCA} mutations where a significant increased risk for disease is present. Quinn \textit{et al.} (2008) found that \textit{BRCA} high risk individuals identified genetic counselors as the preferred professionals with who to discuss reproductive options, yet little data exist regarding the opinions of genetic counselors on this matter. The purpose of this project, therefore, was to assess genetic counselors’ knowledge of and attitudes toward offering PGD for \textit{BRCA} mutation carriers. We recruited genetic counselors for participation in an online, anonymous survey and received 147 completed surveys. The questions focused on knowledge of, and opinions about PGD, with a specific emphasis on the use of PGD for \textit{BRCA} mutation carriers. Whether or not an individual was morally comfortable offering PGD to \textit{BRCA} mutation carriers significantly influenced other responses. Most respondents felt that counselors have a duty to inform (62.6\%) \textit{BRCA} patients about this reproductive option and that PGD should be discussed with every \textit{BRCA} mutation carrier of reproductive age (60.4\%). Respondents were more in favor of professional regulation
of PGD (79.6%) than governmental regulation (25.9%). Regardless of a counselor’s personal beliefs or biases, most of the respondents seem to be practicing in line with the NSGC code of ethics.
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I. INTRODUCTION

In 1989, Coutelle et al. were able to demonstrate that, in principle, genotyping for single gene disorders is possible and can be done pre-implantation. Ever since that time, the ethical, political and health issues of preimplantation genetic diagnosis (PGD) have been widely debated by bioethicists, advisory groups, members of disability communities, lawmakers, social scientists, genetics experts, and lay citizens. However, attempts to reach a consensus about which conditions are appropriate for PGD or prenatal diagnosis (PND) have been unsuccessful (Clancy, 2009). Some believe that it is possible to delineate ‘serious’ and ‘not serious’ conditions by evaluating variables of a condition such as effectiveness of treatment, impact of the condition on the individual, age of onset, and penetrance (Wertz and Knoppers, 2009). Others argue that these criteria overlook important factors such as an individual’s experience and awareness of a condition and that it is not possible to objectively rank or list conditions for which PGD is appropriate (Clancy, 2010; Wertz and Knoppers, 2009).

In 1990, the UK regulatory agency, Human Fertilization and Embryology Authority (HFEA), was established under the Human Fertilization and Embryology Act (OPSI, 1990). One of the roles of HFEA is to licence centers undertaking PGD (OPSI, 1990). The majority of approved conditions are highly penetrant, with onset in childhood and limited treatment available (HFEA, 2009). In 2006, HFEA added later onset conditions with incomplete penetrance and potential treatment options, such as hereditary breast and
ovarian cancer (HBOC) syndrome, to the list of conditions licensed for PGD (Clancy, 2009; HFEA, 2006). The United States currently does not have standardized guidelines or an approved list of conditions for which PGD is acceptable. There are, however, several organizations that have developed committee opinion statements regarding the use of PGD, including the Society for Assisted Reproductive Technology and the American Society for Reproductive Medicine (Practice Committee of the Society for Assisted Reproductive Technology and the Practice Committee of the American Society for Reproductive Medicine, 2008).

In 2009 in the United States, an estimated 192,370 women were diagnosed with breast cancer and an estimated 21,550 women were diagnosed with ovarian cancer (Horner et al., 2009). Between 5%–10% of women diagnosed with breast or ovarian cancer carry a mutation in one of two major susceptibility genes, \textit{BRCA1} and \textit{BRCA2} (Schwartz et al., 2005). PGD for \textit{BRCA1} and \textit{BRCA2} mutations continues to elicit reactions from high-risk hereditary breast and ovarian cancer syndrome (HBOC) family members, the public, and healthcare professionals. Recently, several studies have been published presenting knowledge of and attitudes towards PGD for hereditary cancer syndromes from across a range of groups, giving insight into various perspectives. (Robertson, 2003; HFEA, 2006; Lancet Oncology, 2006; Niermeijer \textit{et al.}, 2006; Offit \textit{et al.}, 2006a; Offit \textit{et al.}, 2006b; Menon \textit{et al.}, 2007; Peshkin \textit{et al.}, 2007; Quinn \textit{et al.}, 2008; Fortuny \textit{et al.}, 2009; Julian-Reynier \textit{et al.}, 2009; Sagi \textit{et al.}, 2009).
Many arguments both for and against PGD for hereditary cancer syndromes have been presented by consumers, advocates, ethicists, healthcare professionals, mutation carriers, and other high-risk individuals. Major concerns regarding the extension of PGD to hereditary cancer syndromes included the relatively later age of onset, existence of prevention and treatment strategies, and reduced penetrance (Lancet Oncology, 2006; Niermeijer et al., 2006; Offit et al., 2006a; Offit et al., 2006b; Robertson, 2003; HFEA, 2006).

One of the main motivating factors for individuals to undergo genetic testing for BRCA1 and BRCA2 is because of reproductive concerns and to clarify risks to existing and future children (Fortuny et al., 2009, Smith et al., 2004). One study reported that the majority of individuals surveyed who carry a mutation report frequent or extreme worry about transmitting the mutation to their children (Staton et al., 2008). On the whole, several studies concluded that most individuals who carry BRCA1 or BRCA2 mutations are supportive of offering PGD technology as a reproductive option to others who carry these mutations (Fortuny et al., 2009; Quinn et al., 2008; Menon et al., 2007).

Most of the literature appears to be in agreement that an individual’s risk of developing disease later in life is not a significant determinant of the appropriateness of a condition for PGD (Robertson, 2003; HFEA, 2006; Practice Committee of the Society for Assisted Reproductive Technology and the Practice Committee of the American Society for Reproductive Medicine, 2008). It has become clear that parents suffer with the knowledge that their child is at risk for a cancer syndrome and that this has the potential
to affect their reproductive decisions (Robertson, 2003; Staton et al., 2008; Fortuny et al., 2009).

The debate surrounding the extension of PGD to cancer susceptibility syndromes sometimes invokes the ‘slippery slope’ argument (Offit et al., 2006a; HFEA, 2006; Robertson, 2003). That is, there is concern that PGD could subsequently be offered to select against progressively less medical and more trait-like conditions, such as hair or eye color, sexual orientation, or traits such as intelligence or athletic ability. When asked about what level of disease penetrance would make offering PGD acceptable, there was no consistent answer among respondents at a public forum mediated by HFEA (HFEA, 2006). Acceptable penetrance ranges were proposed from 0-100%. Some individuals felt that any risk greater than that for the general population was an acceptable threshold (HFEA, 2006). Others argued that a risk greater than 50% would be acceptable because the risk of developing cancer would be higher than not (HFEA, 2006). Still others felt that the appropriate risk should be dependant on the perception of the individual seeking PGD, which fits most closely with a current HFEA recommendation to assess each case individually (HFEA, 2006).

The Practice Committee of the Society for Assisted Reproductive Technology and the Practice Committee of the American Society for Reproductive Medicine (2008) published a report stating PGD is indicated for couples were there is a risk for transmitting a genetic disease. PGD would be appropriate if the risk for an affected embryo is 50% for an
autosomal dominant condition, including BRCA mutations, 25% for an autosomal recessive condition or a 25% risk of an affected male embryo for an X-linked disorder.

A sense of obligation toward patients to discuss PGD as a reproductive option has been reported in the literature. Fortuny et al., (2009) found that a large majority of healthcare professionals attending a hereditary cancer symposium thought that high-risk cancer clinics have a duty to inform patients about various reproductive options for avoiding the transmission of a cancer predisposition gene. It is noteworthy that only 61% were in favor of offering PGD and only 58% were in favor of offering PND.

Offit et al. (2006a) addressed the issue of a duty to warn family members. The authors weigh the duty to warn family members at risk of hereditary cancer syndromes with hypothetical wrongful birth liabilities. They concluded that there is a duty to inform mutation carriers about alternative reproductive options for non-transmittance. Contrarily Peshkin et al. (2007) encourage discussion and collaboration amongst health care providers, but advocate for discussion of reproductive options on a case-by-case basis in order to respect patient autonomy. They discourage the imposition of a mandatory discussion about reproductive choices involving selection against affected embryos. Rather support counseling that is tailored to each individual patient’s goals and values.

PGD will continue to be a contentious issue, particularly from the ethical perspective. Encouraging public discussion in the United States and other countries without regulatory bodies is important in developing a consistent standard of care. To date, studies have
been conducted assessing the attitudes and knowledge of \textit{BRCA} mutation carriers, select healthcare professionals, and some members of the public with regards to PGD for \textit{BRCA1} and \textit{BRCA2}. Because genetic counselors are the preferred professionals to discuss reproductive options with mutation carriers (Quinn \textit{et al.}, 2008), their thoughts and opinions are vitally important. To date, these opinions have not been systematically ascertained. This project aims to fill the gap in the current literature by assessing the knowledge and attitudes of genetic counselors in the United States with regards to PGD for \textit{BRCA1} and \textit{BRCA2}. 
II. METHODOLOGY

IIa. Sampling

We used an anonymous online survey to collect information from genetic counselors regarding their knowledge, attitudes and experience with preimplantation genetic diagnosis (PGD) for cancer susceptibility syndromes, most specifically with regards to BRCA1 and BRCA2 mutation carriers.

We sent an invitation (Appendix A) to members of the National Society of Genetic Counselors (NSGC) via the NSGC listserv, the NSGC Cancer Special Interest Group (SIG) listserv, and the NSGC Assisted Reproductive Technologies (ART)/ Infertility SIG listerv. Committee member, Michele Gabree, posted the recruitment notice twice over a three-week period in February 2010 to the NSGC and Cancer SIG listservs. ART SIG member, Suzanna Schott, posted the recruitment notice once on the ART SIG listserv in February 2010. We limited the inclusion criteria to genetic counselors working in the United States who were currently practicing or who had previously practiced in any specialty and were fluent in written English.

We provided the link to the online survey in the recruitment notice. We did not require informed consent, as study participation posed no more than minimal risk to participants.
The Brandeis University Institutional Review Board (Protocol #10084) approved the study proposal, all supporting documents, and the recruitment notice.

IIb. Data Collection Tool

We created the survey using the online collection tool, surveymonkey.com. The survey was anonymous. Respondents had the opportunity to participate in a raffle for an amazon.com gift card after completing the survey. The nineteen question survey contained three sections: demographic information; counselor’s opinions and experience with PGD in general and counselor’s opinions and experience with PGD for HBOC. The majority of the survey consisted of multiple-choice single answer, multiple-choice multiple answers (scaled), and the opportunity to expand upon selected choices (Appendix B).

IIc. Data Analysis

We used SPSS (Statistic Package for the Social Sciences) software version 15.0 for statistical analysis.

We used independent samples t-test to determine the relationship between variables. We used paired samples t-test to compare differences between the two answer sets of questions 9 and 14B (Appendix B). A p value of 0.05 or less indicated a statistically significant relationship while a p value of <0.10 indicated trending toward significance.
We created a measure of ethical acceptability by summing across answers selected in the scenario questions. Selecting ‘always’ ethically appropriate for a scenario would be scored 1, selecting ‘sometimes (case by case)’ would be scored 2, selecting ‘I don’t know’ would be scored 3 and selecting ‘never’ would be scored 4. Therefore, an individual’s score could range from 5 (selected ‘always’ ethically appropriate for every scenario) to 20 (selected ‘never’ ethically appropriate for every scenario). The lower the score, the higher on our measure of ethical acceptability meaning the respondent more often thought it was ethically appropriate to offer PGD. We also calculated a weighted sum, where answers were weighted based on the generally-acknowledged severity of the condition group. We found no differences between the summation and the weighted summation, so for simplicity, used only the summation.
III. RESULTS

We received a total of 159 responses were received. Eleven surveys were excluded because the majority of survey questions were unanswered. Therefore a total of 147 surveys were used.

IIIa. Demographics

Table 1 shows the distribution of respondents’ specialty, region of practice, age group, years of experience practicing in any specialty, and gender. The largest of respondents were currently practicing in the cancer genetic counseling setting, 37.5% (54/144). The most often represented regions were Region II and Region IV, each at 27.7% (39/141) (see Figure 1 for a map of the regional breakdown). Most of the respondents were between 26 and 30 years of age, 66.0% (95/144) and had 0-5 years of experience practicing in any specialty 52.1% (75/144). Reflecting the field of genetic counseling, the large majority of respondents were women 96.5% (139/144).
Table 1. Demographic information of respondents.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>% of respondents</th>
<th>number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>37.5</td>
<td>54</td>
</tr>
<tr>
<td>Prenatal</td>
<td>25.7</td>
<td>37</td>
</tr>
<tr>
<td>Pediatric</td>
<td>6.9</td>
<td>10</td>
</tr>
<tr>
<td>ART</td>
<td>4.9</td>
<td>7</td>
</tr>
<tr>
<td>Research</td>
<td>4.2</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>20.8</td>
<td>30</td>
</tr>
<tr>
<td>Currently Practicing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>90.3</td>
<td>130</td>
</tr>
<tr>
<td>No</td>
<td>9.7</td>
<td>14</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>13.5</td>
<td>19</td>
</tr>
<tr>
<td>II</td>
<td>27.7</td>
<td>39</td>
</tr>
<tr>
<td>III</td>
<td>9.2</td>
<td>13</td>
</tr>
<tr>
<td>IV</td>
<td>27.7</td>
<td>39</td>
</tr>
<tr>
<td>V</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>VI</td>
<td>9.9</td>
<td>14</td>
</tr>
<tr>
<td>Year Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5years</td>
<td>52.1</td>
<td>75</td>
</tr>
<tr>
<td>6-9years</td>
<td>22.9</td>
<td>33</td>
</tr>
<tr>
<td>10-15years</td>
<td>11.8</td>
<td>17</td>
</tr>
<tr>
<td>15 or more years</td>
<td>13.2</td>
<td>19</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25 years of age</td>
<td>9.0</td>
<td>13</td>
</tr>
<tr>
<td>26-30years of age</td>
<td>66.0</td>
<td>95</td>
</tr>
<tr>
<td>31-35years of age</td>
<td>13.9</td>
<td>20</td>
</tr>
<tr>
<td>36-40years of age</td>
<td>8.3</td>
<td>12</td>
</tr>
<tr>
<td>41-50 years of age</td>
<td>1.4</td>
<td>2</td>
</tr>
<tr>
<td>&gt;51 years of age</td>
<td>1.4</td>
<td>2</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>96.5</td>
<td>139</td>
</tr>
<tr>
<td>Male</td>
<td>3.5</td>
<td>5</td>
</tr>
</tbody>
</table>
IIIb. Factors genetic counselors consider important when offering PGD

All respondents were asked to rank a given list of factors they considered most important when offering PGD to patients for a genetic condition. Factors ranked as most important (assigned number 1) were: quality of life associated with condition, 43.15% (63/146); patient’s expressed desire to not transmit mutation, 32.88% (48/146); treatability of condition, 28.77% (42/146); age of onset, 14.38% (21/146); patient’s history of condition, 10.96% (16/146); patient’s family history of condition, 10.27% (15/146); patient’s reproductive history, 4.11% (6/146).

A subset of respondents who had discussed PGD with BRCA patients in 2009 were asked what factors were important when offering PGD to those patients, if the genetic counselor was the one who brought up the discussion. Factors ranked as most important (assigned
number 1) were: patient’s expressed desire to avoid transmitting mutation, 54.55% (24/44); and other, 31.82% (14/44), where most (9/14) specified they felt they had a ‘responsibility’ or were ‘ethically required’ to ‘present all the options available to their BRCA positive patients’. Other top-ranked factors included the reproductive stage of the patient and the availability of the technology in the respondent’s region or based on the financial means of a patient; patient’s reproductive history 20.45%, (9/44); quality of life for BRCA mutation carriers, 15.91% (7/44); treatability of BRCA associated cancers, 13.64% (6/44); patient’s history of cancer, 13.64% (6/44); patient’s family history of cancer, 11.36% (5/44); age of onset of BRCA associated cancers, 9.09% (4/44).

We used paired samples t-test to compare differences in rankings between the two answer sets. Counselors were significantly more likely to consider age of onset (t(17)=2.650, p<0.05), or treatability (t(19)=2.820, p<0.05) as the most important factor when offering PGD for a non-specified genetic condition than when offering PGD for BRCA. Quality of life also trended toward significance as being a more important consideration when offering PGD for an unspecified genetic condition than for BRCA (t(24)=2.031, p<0.1). Counselors were significantly more likely to rank a patient’s reproductive history as the most important factor when offering PGD for BRCA than for an unspecified condition (t(19)=2.498, p<0.05). A patient’s expressed desire to not transmit the familial mutation was a significantly more important factor for genetic counselors when offering PGD for BRCA than for a non-specified genetic condition (t(32)=2.861, p=0.007). “Other” factors were never considered most important when offering PGD for an unspecified condition, whereas for BRCA, it was the second most important consideration, and was often
specified as a duty of ‘disclosure’. Figure 2 compares the differences between the most important factors in offering PGD for an unspecified condition versus for BRCA.

Figure 2. Distribution of factors ranked as most important when offering PGD for an unspecified genetic condition and when offering PGD for BRCA.

IIIc. Ethics and PGD

Respondents were asked to indicate whether they felt the use of PGD is ‘always’ ‘sometimes (case by case)’, ‘didn’t know’, or ‘never’ ethically appropriate for five descriptive categories of conditions. Questions were asked in a random order, not in the order presented in Table 2. Table 2 shows the description of the categories of conditions, the example given for each category and the responses. As the generally acknowledged
severity of the condition decreases from Tay Sachs to non-syndromic deafness, so too does the selection of ‘always’ ethically appropriate (from 86.2% to 31.3% respectively). Selection of ‘sometimes (case by case)’ (11.6% to 47.4%), ‘I don’t know’ (0% to 8.8%), and ‘never’ (0% to 10.2%) increased with the decrease in the generally acknowledged severity of the condition.
Table 2. Categories and examples of conditions respondents were asked if they felt PGD is ethically appropriate.

<table>
<thead>
<tr>
<th>Question Description</th>
<th>Always</th>
<th>Sometimes (case by case)</th>
<th>I don't know</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>Childhood onset, neurodegenerative disorder. Progressive. Treatment is mostly supportive. <strong>Example Tay Sachs disease</strong>: Autosomal recessive. Infantile onset. Phenotype includes progressive weakness, loss of motor skills, seizures, blindness and eventual total incapacitation. Death, usually before age four years</td>
<td>127</td>
<td>86.2</td>
<td>17</td>
<td>11.6</td>
</tr>
<tr>
<td>Childhood or young adulthood onset cancer syndrome, associated with multiple cancer types, is highly penetrant and little or no treatment or prevention available. <strong>Example Li-Fraumeni Syndrome (LFS)</strong>: Autosomal dominant. 85-100% lifetime cancer risk. Associated with osteosarcomas, soft tissue sarcoma, premenopausal breast cancer, brain tumors, adrenal cortical tumors and acute leukemias and others</td>
<td>102</td>
<td>69.2</td>
<td>40</td>
<td>27.2</td>
</tr>
<tr>
<td>Childhood or young adulthood onset cancer syndrome, cancer occurs in limited sites, highly penetrant, with effective treatment and screening, but quality of life is impaired. <strong>Example Familial adenomatous polyposis (FAP)</strong>: Autosomal dominant. Hundreds to thousands of precancerous colon polyps develop between age 7-36 years of age. Without prophylactic colectomy, approaching 100% risk of cancer</td>
<td>86</td>
<td>58.5</td>
<td>50</td>
<td>34.0</td>
</tr>
<tr>
<td>Cancer syndrome where onset is in adulthood but typically before 50 years of age. Cancer occurs in limited sites. Treatment and surveillance available but quality of life may be impaired. <strong>Example Hereditary Breast and Ovarian Cancer (HBOC)</strong>: Autosomal dominant. Cumulative lifetime breast cancer risks from 49-88% and ovarian cancer risks from 18% to 65%. Other associated cancers with lower lifetime risks. Surveillance, chemoprevention and prophylactic surgeries available</td>
<td>57</td>
<td>38.8</td>
<td>53</td>
<td>36.1</td>
</tr>
<tr>
<td>Congenitally onset condition. Non-progressive. One system affected. Treatments available. <strong>Example Non syndromic monogenic deafness</strong>: Autosomal recessive. Variable expression. Mild- to-profound sensorineural hearing impairment. No other associated medical findings. Early intervention, hearing aids and cochlear implants available.</td>
<td>46</td>
<td>31.3</td>
<td>70</td>
<td>47.6</td>
</tr>
</tbody>
</table>
Illd. PGD and BRCA

We used independent samples t-test to compare differences between respondents who answered that PGD was ‘always’ ethically acceptable (Group BRCAa) for BRCA and those that answered that it was ‘never’ ethically acceptable (Group BRCA n). Table 3a shows significant differences between the two groups.

Individuals in Group BRCAa were significantly more likely to be morally comfortable offering PGD with BRCA mutation carriers that Group BRCA n (100% vs. 38.9%, t(69)=8.997, p<0.01) and significantly less likely to feel that there should be professional regulation of PGD (71.9% vs. 94.4%, t(73)=24.425, p<0.01).

Group BRCAa and Group BRCA n were significantly different in their ‘ethical acceptance’ scores (t(72)=1.105, p<0.01). All of Group BRCAa scored higher on the ‘ethical acceptance’ scale (100% scored between 5 and 10). None of Group BRCA n scored in the same range of Group BRCAa (94.4% scored between 11 and 15, 5.6% scored between 16 and 20). Table 3b compares the ‘ethical acceptance’ scores of Group BRCAa and Group BRCA n and their responses for each scenario. Group BRCAa was more likely to find the use of PGD was ethically appropriate in all scenarios (73.7%) as compared to Group BRCA n. Of the 12% of respondents in Group BRCA n, one respondent found all scenarios except Tay Sachs to be unethical for the use of PGD; 7 individuals found all other scenarios to be ethically appropriate at least ‘sometimes (case by case)’; 3 were unsure about scenarios other than Tay Sachs and HBOC.
The apparent difference between GroupBRCAa and GroupBRCAn in their perception of genetic counselors’ duty to inform BRCA mutation carriers about PGD did not reach significance (73.6% vs. 38.9%, t(69)=2.767, p=0.10). The same is true for whether PGD should be discussed with every BRCA mutation carrier of reproductive age (81.1% vs. 27.8%, t(69)=4.645, p>0.10) and whether there should be governmental regulation of PGD (19.3% vs. 27.8% t(73)=0.758, p>0.10). There were no significant differences between groups in demographic information.

Table 3a. Significant differences between respondents who answered PGD was ‘always’ ethically acceptable (GroupBRCAa) for BRCA mutation carriers and those who answered it was ‘never’ ethically acceptable (GroupBRCAn).

<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupBRCAa</th>
<th>GroupBRCAn</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morally Comfortable Offering PGD for BRCA</td>
<td>100.0</td>
<td>38.9</td>
<td>8.997(69)*</td>
</tr>
<tr>
<td>Should there be professional regulation of PGD</td>
<td>71.9</td>
<td>94.4</td>
<td>24.425(73)*</td>
</tr>
<tr>
<td>Ethical Acceptibility</td>
<td></td>
<td></td>
<td>1.105(72)**</td>
</tr>
<tr>
<td>5 to 10</td>
<td>100</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11 to 15</td>
<td>0</td>
<td>94.4</td>
<td></td>
</tr>
<tr>
<td>16 to 20</td>
<td>0</td>
<td>5.6</td>
<td></td>
</tr>
</tbody>
</table>

p<0.01*; p<0.05**; p<0.1***

Table 3b. Ethical acceptability scores compared between GroupBRCAa and GroupBRCAn.
We asked respondents how many times in 2009 they discussed PGD with \textit{BRCA} mutation carriers. We then divided answers into two groups according to recent experience.

\textbf{GroupEXP1} discussed PGD with \textit{BRCA} mutation carriers six or more times in 2009, and \textbf{GroupEXP2} discussed PGD with \textit{BRCA} mutation carriers fewer than six times in 2009.

We used the independent samples t-test to compare these two groups. Table 4 shows the significant differences between these two groups.

Specialty was the only demographic variable that significantly varied between \textbf{GroupEXP1} and \textbf{GroupEXP2} (69.2\% in cancer vs. 34.1\% in cancer, \(t(140)=1.474, p<0.05\)). This result corresponds with responses of participants identifying cancer genetic counselors as the providers best-suited and most likely to discuss reproductive options with \textit{BRCA} mutation carriers. Almost half (47.5\%) of respondents chose cancer genetic
counselors as best-suited to discuss PGD with BRCA mutation carriers. The other most frequent responses were a prenatal counselor (37.1%) or a team approach, with a cancer genetic counselor and a prenatal counselor or a cancer genetic counselor and an ART counselor (9.6%). Respondents were also asked where discussion about PGD with BRCA mutation carriers was most likely to occur and 57.3% thought the cancer genetic counseling session.

Individuals in GroupEXP1 were significantly more morally comfortable with offering PGD for BRCA mutation carriers than individuals in GroupEXP2 (100% vs. 81.7%, t(137)=1.691, p<0.01). Individuals in GroupEXP1 were significantly more likely that individuals in GroupEXP2 to think that PGD should be discussed with every BRCA mutation carrier of reproductive age (100% vs. 56.3%, t(137)=3.150, p<0.01).

Individuals in GroupEXP1 were also significantly more likely than individuals in GroupEXP2 to believe that genetic counselors have a duty to inform BRCA mutation carriers about PGD (100% vs. 58.7%, t(137)=3.001, p<0.01). Individuals in GroupEXP2 were significantly more likely than individuals in GroupEXP1 to think that the best time to discuss PGD with a patient at risk for carrying a BRCA mutation was ‘only if the patient asked or expressed a desire to not transmit the mutation’ (31.5% vs. 0%, t(141)=2.430, p<0.01) (Survey question 13, Appendix B).

There was no significant difference between the groups with respect to who initiated the PGD discussion (t(62)=0.450, p>0.1). The counselor initiated the discussion most of the time (64.6%), the patient also initiated the discussion much of the time (29.2%). For the
rest of the responses respondents selected ‘other’ and specified that sometimes it was the patient who would initiate the discussion and sometimes it was the counselor (9.4%), or that the patient’s physician had referred the patient to discuss PGD (1.6%).

Table 4. Significant differences between respondents who discussed PGD with *BRCA* mutation carriers six or more times in 2009 (GroupEXP1) and those that discussed PGD with *BRCA* mutation carriers fewer than six times in 2009 (GroupEXP2).

<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupEXP1</th>
<th>GroupEXP2</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% that answered</td>
<td>% that answered</td>
<td></td>
</tr>
<tr>
<td><strong>SPECIALTY</strong></td>
<td></td>
<td></td>
<td>1.474(140)**</td>
</tr>
<tr>
<td>Cancer</td>
<td>69.2</td>
<td>34.1</td>
<td></td>
</tr>
<tr>
<td>Prenatal</td>
<td>0</td>
<td>28.7</td>
<td></td>
</tr>
<tr>
<td>Pediatric</td>
<td>0</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>ART</td>
<td>0</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>7.7</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>23.1</td>
<td>20.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% answered Yes</th>
<th>% answered Yes</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MORALLY COMFORTABLE OFFERING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGD FOR <em>BRCA</em></td>
<td>100</td>
<td>81.7</td>
</tr>
<tr>
<td>PGD SHOULD BE DISCUSSED WITH <em>EVERY</em> BRCA PATIENT OF REPRODUCTIVE AGE</td>
<td>100</td>
<td>56.3</td>
</tr>
<tr>
<td>GCs HAVE A DUTY TO INFORM BRCA PATIENTS ABOUT PGD</td>
<td>100</td>
<td>58.7</td>
</tr>
<tr>
<td>DISCUSS PGD ONLY IF THE PATIENT ASKS OR EXPRESS DESIRE TO NOT TRANSMIT</td>
<td>0</td>
<td>31.5</td>
</tr>
</tbody>
</table>

p<0.01*; p<0.05**; p<0.1***

Ille. Significant differences between groups

We used independent samples t-test to compare respondents’ answers to multiple questions. Tables 5- 8 show significant results. When we compared individuals who thought that genetic counselors have a duty to inform *BRCA* mutation carriers about PGD
(GroupDUTY1) and those that do not think genetic counselors have a duty (GroupDUTY2), we found that they significantly differed in three questions (Table 5).

Individuals in GroupDUTY1 were significantly more likely than GroupDUTY2 to be currently seeing patients (94.2% vs. 84.6%, t(136)=1.875, p<0.01) and significantly less likely to feel PGD should have professional regulations (77.0% vs. 90.4%, t(137)=2.001, p<0.01). GroupDUTY1 felt significantly more morally comfortable offering PGD for BRCA (90.8% vs. 71.2%, t(137)=3.098, p<0.01).

Table 5. Significant differences between respondents who answered genetic counselors have a duty to inform BRCA mutation carriers about PGD (GroupDUTY1) and those who answered that genetic counsellors do not have a duty to inform (GroupDUTY2).

<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupDUTY1 % answered Yes</th>
<th>GroupDUTY2 % answered Yes</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENTLY PRACTICING</td>
<td>94.2</td>
<td>84.6</td>
<td>1.875(136)*</td>
</tr>
<tr>
<td>MORALLY COMFORTABLE OFFERING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGD FOR BRCA</td>
<td>90.8</td>
<td>71.2</td>
<td>3.098(137)*</td>
</tr>
<tr>
<td>SHOULD THERE BE PROFESSIONAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGULATION OF PGD</td>
<td>77.0</td>
<td>90.4</td>
<td>2.001(137)*</td>
</tr>
</tbody>
</table>

*p<0.01*; *p<0.05**; **p<0.1***

We compared the group of individuals who answered that PGD should be discussed with every BRCA mutation carrier of reproductive age (GroupEVRY1) with those that did not (GroupEVRY2) (Table 6). Individuals in GroupEVRY1 were significantly more likely that GroupEVRY2 to be currently seeing patients (92.9% vs. 85.5%, t(136)=1.683, p<0.01) and significantly less likely to feel that PGD should have professional regulations (75.0% vs. 92.7%, t(137)=2.712, p<0.01) or governmental regulations (23.8% vs. 32.7%, t(137)=1.151, p<0.05). GroupEVRY1 was significantly more morally comfortable
offering PGD for BRCA (94.0% vs. 67.3%, t(137)=4.407, p<0.01), and more likely to answer that genetic counselors have a duty to inform BRCA mutation carriers about PGD (90.5% vs. 20.0%, t(137)=11.875, p<0.01).

Table 6. Significant differences between respondents who answered that PGD should be discussed with every BRCA mutation carrier of reproductive age (GroupEVRY1) with those who did not (GroupEVRY2).

<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupEVRY1</th>
<th>GroupEVRY2</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENTLY PRACTICING</td>
<td>92.9</td>
<td>85.5</td>
<td>1.683(136)*</td>
</tr>
<tr>
<td>Morally comfortable offering PGD for BRCA</td>
<td>94.0</td>
<td>67.3</td>
<td>4.407(137)*</td>
</tr>
<tr>
<td>GCs HAVE A DUTY TO INFORM BRCA PATIENTS ABOUT PGD</td>
<td>90.5</td>
<td>20.0</td>
<td>11.875(137)*</td>
</tr>
<tr>
<td>SHOULD THERE BE PROFESSIONAL REGULATION OF PGD</td>
<td>75.0</td>
<td>92.7</td>
<td>2.712(137)*</td>
</tr>
<tr>
<td>SHOULD THERE BE GOVERNMENTAL REGULATION OF PGD</td>
<td>23.8</td>
<td>32.7</td>
<td>1.151(137)**</td>
</tr>
</tbody>
</table>

p<0.01*; p<0.05**; p<0.1***

We also compared individuals who answered that the best time to discuss PGD with an individual a risk for carrying a BRCA mutation was ‘only if the patient asked or expressed a desire to not transmit the mutation’ (GroupONLYP1) with those who selected other times, such as in a results session or in a follow-up session after mutation status is determined (GroupONLYP2) (Table 7). GroupONLYP1 was more concentrated in the cancer and prenatal specialties (40% and 35% vs. 35.9% and 22.3%, t(141)=1.492, p<0.01 respectively). GroupONLYP1 was significantly more likely to feel that PGD should have governmental regulations (36.6% vs. 22.3%, t(141)=1.533, p<0.01). GroupONLYP1 was significantly less likely to feel morally comfortable offering PGD for BRCA (70.7% vs. 84.5%, t(137)=1.810, p<0.01). GroupONLYP1 trended toward being
significantly less likely to believe that genetic counselors have a duty to inform BRCA mutation carriers about PGD (34.1% vs. 70.9%, t(137)=4.295, p<0.1).

Table 7. Significant differences between respondents who answered that the best time to discuss PGD with an individual at risk for carrying a BRCA mutation was ‘only if the patient asked or expressed a desire to not transmit the mutation’ (GroupONLYP1) and those who selected other times, such as in a results session or in a follow-up session after mutation status is determined (GroupONLYP2).

<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupONLYP1</th>
<th>GroupONLYP2</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIALTY</td>
<td></td>
<td></td>
<td>1.492(141)*</td>
</tr>
<tr>
<td>Cancer</td>
<td>40.0</td>
<td>35.9</td>
<td></td>
</tr>
<tr>
<td>Prenatal</td>
<td>35.0</td>
<td>22.3</td>
<td></td>
</tr>
<tr>
<td>Pediatric</td>
<td>6.0</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>ART</td>
<td>0.0</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>5.0</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>20.0</td>
<td>21.4</td>
<td></td>
</tr>
<tr>
<td>% that answered Yes</td>
<td>% that answered Yes</td>
<td>t(df)</td>
<td></td>
</tr>
<tr>
<td>MORALLY COMFORTABLE OFFERING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGD for BRCA</td>
<td>70.7</td>
<td>84.5</td>
<td>1.810(137)*</td>
</tr>
<tr>
<td>GCs HAVE A DUTY TO INFORM BRCA PATIENTS ABOUT PGD</td>
<td>34.1</td>
<td>70.9</td>
<td>4.295(137)***</td>
</tr>
<tr>
<td>SHOULD THERE BE GOVERNMENTAL REGULATION OF PGD</td>
<td>36.6</td>
<td>22.3</td>
<td>1.533(141)*</td>
</tr>
</tbody>
</table>

p<0.01*; p<0.05**; p<0.1***

Finally, we compared individuals who were morally comfortable offering PGD for BRCA (GroupMC1) with those who were not (GroupMC2) (Table 8). We found that GroupMC1 was significantly more likely to be currently practicing (92.2% vs. 82.6%, t(136)=1.434, p<0.01). GroupMC1 was significantly less likely to feel there should be professional (79.3% vs. 95.7%, t(137)=1.874, p<0.05) or governmental (25.0% vs. 39.1%, t(137)=1.389, p<0.01) regulation of PGD.

Table 8. Significant differences between those who were morally comfortable offering PGD for BRCA (GroupMC1) with those who were not (GroupMC2).
<table>
<thead>
<tr>
<th>Test Question</th>
<th>GroupMC1</th>
<th>GroupMC2</th>
<th>t(df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENTLY PRACTICING</td>
<td>92.2</td>
<td>82.6</td>
<td>1.434(136)*</td>
</tr>
<tr>
<td>SHOULD THERE BE PROFESSIONAL REGULATION</td>
<td>79.3</td>
<td>95.7</td>
<td>1.874(137)**</td>
</tr>
<tr>
<td>SHOULD THERE BE GOVERNMENTAL REGULATION</td>
<td>25.0</td>
<td>39.1</td>
<td>1.389(137)*</td>
</tr>
</tbody>
</table>

p<0.01*; p<0.05**; p<0.1***

**III.f. Qualitative data**

Respondents were provided with opportunities to elaborate upon select answers. We selected some quotations to illustrate themes and support data (*IV. Discussion*).
IV. DISCUSSION

IVA. Factors genetic counselors consider important when offering PGD

Genetic counselors did not rank age of onset as an important factor when considering offering PGD to BRCA mutation carriers. They ranked age of onset as a more significant factor when offering PGD for an unspecified genetic condition. The literature appears to offer some agreement as well that age of onset should not be a significant determinant of whether or not PGD should be offered (Robertson, 2003; Offit et al., 2006b). Some members of the public in the UK expressed that a later age of onset is almost more burdensome because by the age 30, 40, or 50, an individual could already have young dependants and discovery of a familial mutation could have a greater impact on family life (HFEA, 2006).

Quality of life tended to be more important for genetic counselors when offering PGD for an unspecified genetic condition than for BRCA mutation carriers. Genetic counselors were also less likely to consider treatment options to be an important factor when offering PGD for BRCA compared to for an unspecified condition. It has been argued that the impact and burden of intensified cancer screening and consideration of risk-reducing prophylactic surgeries are underestimated (Niermeijer et al., 2006).

Current breast cancer screening recommendations for BRCA carriers include annual mammogram and annual breast MRI, in addition to monthly self breast exam and clinical
exam (NCCN, 2009). Although data is limited in BRCA carriers, the American Cancer Society supports these guidelines for early detection of breast cancer in high risk populations (ACS, 2010). The option of prophylactic mastectomy should also be discussed as an option to reduce the risk for breast cancer. With respect to ovarian cancer, currently screening is not proven to be effective; therefore, in women who carry a BRCA1 or BRCA2 gene mutation, oophorectomy is recommended by age 35-40 or upon completion of childbearing (NCCN, 2009). Although a residual risk for cancer remains, surgery is the most effective form of cancer risk reduction (Schwartz et al., 2005). Other options for risk reduction include chemopreventive drugs. Data is limited regarding their effectiveness in mutation carriers, however some studies have shown that chemoprevention may reduce the risk of breast cancer by as much as 50% (Jatoi and Anderson, 2008). These establish guidelines for BRCA carriers and offer the opportunity for early-detection and/or risk-reduction; however, they are not without limitations. For example, breast surveillance involves multiple appointments which may require these women to travel, be absent from work, arrange for childcare or other activities.

Prophylactic oophorectomy and mastectomy are accepted as cancer preventative measures, yet only a minority of women will opt for either of these options. Although surgical prophylaxis is beneficial with respect to cancer risk-reduction, women may feel there is insufficient information to make a decision, that the surgery may impact psychosocial functioning such as body image and sexuality in some women, and there may be obstacles in access to care (Metcalfe et al., 2008; Schwartz et al., 2005). In
addition, the surgery itself involves risk to the patient. Oophorectomy, more specifically, affects childbearing decisions and timing of menopause (Schwartz et al., 2005).

A recent study looking at the international variation on uptake of preventative options found that about half of women drawn from an international database of *BRCA1* or *BRCA2* mutation carriers relied on screening alone. Interestingly, 72.2% of American women in this study did choose at least one preventative option (71.1% chose oophorectomy, they may or may not have had cancer; 36.3% of women without cancer chose prophylactic mastectomy; 97.5% chose mammography; 24.4% chose MRI; 12.4% chose chemoprevention). The authors speculate that the higher uptake of prevention measures in American women may be due to the type of women who present for *BRCA* testing many of which had health insurance and/or the financial means for testing and surgery. (Metcalfe et al., 2008).

Genetic counselors most often ranked a patient’s desire to avoid transmitting the *BRCA* mutation to their children as the most important factor when offering PGD to *BRCA* mutation carriers. They were also significantly more likely to consider this to be the most important factor when offering PGD to *BRCA* mutation carriers than for an unspecified genetic condition. A major source of suffering for a parent with a *BRCA* mutation is knowing that their child is at risk for a cancer susceptibility syndrome and this has the potential to affect reproductive decisions (Robertson, 2003; Staton et al., 2008; Fortuny et al., 2009). Staton et al. (2008) found that 88% of respondents surveyed from the FORCE
(Facing Our Risk of Cancer Empowered) website reported frequent or extreme worry about transmitting the mutation to their children.

A patient’s reproductive history was ranked significantly more important to counselors when offering PGD to BRCA mutation carriers than when offering for an unspecified genetic condition. This is likely because many high-risk individuals who seek or are referred for genetic counseling for HBOC syndrome tend to be older and to have completed their families. It is more likely that individuals who are known carriers or have a family history of a condition like Tay Sachs, would be referred for preconception counseling. Offit et al., (2006) argue that presenting the option of PGD may motivate individuals to seek counseling at a younger age, before they begin having children. Knowledge of this reproductive option may be a relief to young couples and discussion of this option can empower cancer-prone relatives (Offit et al., 2006).

The factor ranked as second most important for counselors when offering PGD to BRCA mutation carriers was ‘Other’. Some elaborations that counselors gave were:

“need to avoid censuring information, full disclosure”

“ethically required to provide this information to the patient”

“need to present all feasible options”

“want to provide patient with all possible options”

“I feel that it is my responsibility to make patients aware of all the options related to their mutation status...”

“professional obligation to inform pt about available option”
Clearly there is a common theme of professional or ethical obligation to the patient to present all available reproductive options. The National Comprehensive Cancer Network (NCCN) published clinical practice guidelines in oncology in 2009 for HBOC. According to these guidelines, clinicians should advise patients about options for assisted reproduction which should include PGD to couples that express the desire to not transmit the familial BRCA mutation. Because a patient’s desire to not transmit and a sense of obligation for full disclosure rank highest for genetic counselors when offering PGD to BRCA mutation carriers, this suggests that many counselors are practicing in lines with the guidelines.

IVb. Ethics and PGD

The words ‘serious enough’ are often attached to the word ‘genetic’ in many state laws and policies and are an important determinant for establishing the availability, support and access to genetics services such as prenatal diagnosis, termination, or PGD (Wertz and Knoppers 2009). Some ethicists believe it is possible to list and delineate between serious and less serious conditions, and several criteria have been proposed: efficacy of treatment; quality of life of the affected individual and their family; age of onset; and penetrance (Wertz and Knoppers, 2009). The American Medical Association (AMA) has made similar statements suggesting a framework for ART discussions (Offit et al., 2006). We used these criteria to design our scenarios where we asked counselors if they thought it was ethically appropriate to offer PGD for the described conditions. Table 2 shows deceased acceptance of PGD as the conditions become ‘less serious’ by these criteria. Across each scenario, most surveyed counselors voiced their sense of obligation toward
their patient for full disclosure and that it was the patient’s decision whether or not PGD was an ethical option and not the opinions of the counselor.

“PGD can be offered to parents in this situation, but it is not up to the GC [genetic counselor] to decide whether it is ethically appropriate for the parents. It would be unethical to withhold information about PGD from an interested family”- non-syndromic deafness

“Always ethically appropriate for any medical condition, although perhaps not always recommended”- in each scenario

“If the patient desires it, it is acceptable, but of course not every family will want PGD for these conditions.” – Tay Sachs

“Patients have a right to know the options available to them in any case. If asked about the options to prevent transmission of a syndrome, I present PGD as an option” - FAP

“determined solely on the patient’s perception of ‘impaired quality of life’”- FAP

“For all the above cases, I think that [if] the patient chooses PGD and they find it ethical, then I am not going to tell them that they should not have done it. Who and [am] I to choose what they can live with or not? I think that PGD is actually a responsible approach since it allows parent to be proactive. Isn’t it saving parents from potentially terminating a 15+ week fetus?” -LFS

The scenario that described a cancer syndrome like HBOC elicited the most responses.

Most genetic counselors place great value on being non-directive, particularly with respect to reproductive options (Clancy, 2009). This was evident by some responses:

“I’ve never actually offered this to a patient, but I’ve had patients that pursued it on their own or expressed interest so wished to discuss it in session. I personally do not feel it is ethical, given the late onset and that it is a susceptibility syndrome rather than an absolute diagnosis, but I have come across enough patients who feel strongly about this that I would never absolutely refuse it.”

“Many individuals live in fear of their cancer risk. It is understandable that a potential parent should want to shield their child from that risk. Again, this is a very personal decision for each family. It is our job as genetic counselors to always give a patient all of their options.”
“If questioned, yes PGD as an option is discussed. I do not feel it is ethical to withhold any of the options from a family, even if I feel that the condition is not limiting to quality of life, I can not account for the experiences and beliefs of the patient, these are their choices based on their own backgrounds”

“While I personally don't feel that PGD is necessarily appropriate in this instance, I am not sure that I would say it is unethical. There are some people that based on their personal experiences, do not want to pass on one of these mutations to their children, and it is not my job to tell them that is not appropriate. So I would support a patient who wanted to use PGD in this instance, but I personally wouldn't choose it. That doesn't mean it isn't ethical.”

Another theme across scenarios was counselors making determinations on whether or not the condition was ‘serious enough’:

“...While I personally don't feel that PGD is necessarily appropriate in this instance, I am not sure that I would say it is unethical. There are some people that based on their personal experiences, do not want to pass on one of these mutations to their children, and it is not my job to tell them that is not appropriate. So I would support a patient who wanted to use PGD in this instance, but I personally wouldn't choose it. That doesn't mean it isn't ethical.”

“I don't like to say never, however in a situation such as deafness there are no major health consequences as in the scenarios mentioned above. While being deaf may place an individual at a few disadvantages in life, individuals who are deaf can live long fulfilling lives with no increased risk for adverse health.” – non-syndromic deafness

“I do not think we can necessarily pick and choose which conditions should be allowed to be tested for. It’s a slippery slope. But I would, in this case, talk about cons of testing similar to why we do not test children for HBOC.” - HBOC

“Given the lack of treatment and high penetrance, I would be comfortable discussing this with patients as a possibility, though I would still discuss the ethical implications in detail.” - LFS

“Tay-Sachs disease is a traumatic diagnosis that is only guaranteed to bring sadness and suffering to a family and the affected child. Childhood death is inevitable and the child's condition deteriorates rapidly as the disease progresses.” – Tay Sachs

“While quality of life CAN be poor in some cases, if PGD is an option then early screening and prophylactic surgeries can be initiated. This is an adult onset condition so I feel that these individuals can have a very fulfilled and meaningful life, EVEN IF this disease is fatal in adulthood. I disagree with PGD in these cases.” - HBOC
“I believe this comes down to a lethality issue for me. Will a child with SNHL potentially die from their condition? No. Therefore, preventing this condition prior to conception does not feel appropriate to me.” – non-syndromic deafness

“I would offer PGD for any condition. I don't think the decision to offer should be restricted by age of onset or treatability of the condition. It is an available service that may not be for everyone (most due to cost issues and need for IVF), however, I don’t feel it is my place to decide whether a couple try to attempt a pregnancy lacking the chromosome abnormality or gene mutation they are at risk for just like it is not my place to decide about prenatal testing and termination. Most of the couples that proceed with this type of testing are at a high risk (25% or higher) and have personal experience with the condition meaning they know what it is like to be affected themselves, an affected child or another affected relative and it seems to make sense why they would want to try to spare their child from having to experience the emotional and physical symptoms that are caused by a genetic condition.” – HBOC

Despite some strong feelings against the use of PGD in certain cases, overall genetic counselors seem to support their patients’ decisions to pursue this reproductive option. Ultimately, counselors ‘don’t have a crystal ball’ (respondent HBOC) and cannot predict the impact of a condition on an individual or a family, particularly in the context of a family’s experience. Counselors should be able to discuss reproductive options aptly (or to refer to a colleague if this is against their personal values) (Clancy, 2009). These practices are in line with the NSGCs code of ethics with respect to counselors and their patients:

1. “Serve those who seek services regardless of personal or external interests or biases.
2. Enable their clients to make informed decisions, free of coercion, by providing or illuminating the necessary facts, and clarifying the alternatives and anticipated consequences.
3. Refer clients to other qualified professionals when they are unable to support the clients.” (NSGC, 2006).
When we compared respondents who thought that PGD for HBOC was ‘always’ ethically appropriate and those who thought it was ‘never’ ethically appropriate we found that they differed significantly on three questions (Table 3a). One finding was that individuals who selected ‘always’ or ‘never’ differed significantly in their ethical acceptability scores. It is not surprising that respondents who selected PGD to ‘always’ be ethically appropriate for HBOC were more likely to find PGD ethically appropriate for all scenarios because this group tended to be more morally comfortable with the topic of PGD and separated their personal beliefs from their practice (See discussion below*). What is interesting are the individuals who felt PGD was ‘never’ ethically appropriate for HBOC, but felt less strongly against the use of PGD in other conditions (Table 3b). These individuals did not comment on their selections so we can only speculate. It is possible that a lack of experience with PGD for HBOC or the other conditions could be a factor. We did not find any significant differences between respondents who selected PGD is ‘always’ or ‘never’ ethically appropriate with respect to specialty, years of experience, age group, or region. Perhaps because participants knew this survey was specifically to ascertain attitudes of genetic counselors about PGD for BRCA mutation carriers, they had already formed opinions about the ethical acceptance of PGD for HBOC but had not yet thought about the appropriateness of the technology for the other conditions.

All respondents who answered that PGD is ‘always’ ethically appropriate for HBOC were morally comfortable with offering PGD for BRCA whereas only a small number of those who selected ‘never’ were. It is interesting to note the contradiction between the two
answers. Although offering PGD for *BRCA* did not conflict with these counselors’ beliefs, they felt it was unethical to offer PGD to a *BRCA* mutation carrier. Some thoughts from these counselors were*:

“I am not morally comfortable but if a patient asks for the information I will discuss it with them as it is our jobs to give all the information necessary to have a patient make an informed decision.”

“While I personally do not feel PGD is necessary for conditions that have later onset and have treatment and prevention options, I am very comfortable discussing it with patients who would like to be able to have the option of PGD. My morals should not play into the patient’s decision or what is offered to them; it is up to them to decide if they feel PGD is morally acceptable for *BRCA* mutations.”

These sentiments reflect counselors who are practicing in accordance with the NSGC’s code of ethics, to support a patient’s reproductive options and choices, regardless of the counselor’s personal beliefs. Counselors often distinguished between their beliefs and those of their patients.

Respondents who answered that PGD is ‘always’ ethically appropriate for HBOC were significantly less likely to think that PGD should have professional regulations than those than those who answered ‘never’. There was apparently variability in how respondents interpreted the question. Some counselors who answered ‘yes’ and some counselors who answered ‘no’ had similarly themed comments:

“I think that there should be ACOG guidelines that help GC’s to guide the process but not to implement rules or laws” – Yes to professional regulation

“I don’t know that regulation is the correct description, but I do think that there should be some sort of guidelines about uses of PGD.” – Yes to professional regulation
“I am not sure what you mean by regulation. I don't think there should be rules, but I do think there should be guidelines or professional position statements.” – No to professional regulation

“Not regulation but there should be professional recommendations by NSGC, ACMG, etc.” - No to professional regulation

The remainder of the comments reflected respondents’ support for, or opposition to professional regulation for PGD.

“I do think there should be some limits on PGD for cosmetic, frivolous reasons as more genes are discovered in the future that could contribute to the possibility of this type of PGD.” – Yes to professional regulation

“Patients certainly have the right to choose PGD for SOME genetic disease-related reasons, but there should be regulation in terms of PGD not being available for couples that simply want to chose for sex or other harmless traits (eye color, etc). We need to make sure that we are all consistently offering PGD for appropriate reasons.” – Yes to professional regulation

“Again, I think professional regulation would only result in limiting what conditions PGD can be used for, and I don't think this is necessary.” – No to professional regulation

“These are patient's decisions, not ours. I feel we should offer PGD to anyone who would consider it. I don't feel it is our duty to determine whether PGD is appropriate for a given condition.” – No to professional regulation

Some of these comments (and others not shown) bring to light the ‘slippery slope’ argument. That is, fears that the direction of genetic screening and selection could lead to a world of designer children where they are valued for their genotype rather than their inherent qualities (Robertson, 2003). With regards to PGD for BRCA1/2 gene mutations and other susceptibility syndromes, one important ethical question that should be considered: “is the burden of carrying the gene so great that the burden of IVF and PGD are justified to avoid transmitting the familial mutation?” (Robertson, 2003). Again, when Staton et al., (2008) surveyed FORCE members, 88% of respondents reported
frequent or extreme worry about transmitting their mutation. Fortuny et al., (2009) surveyed *BRCA* high-risk individuals undergoing genetic testing in Spain, about their reproductive intentions should they receive a positive result. Respondents could choose more than one option. Only about one third of respondents (36%) thought that they would have children regardless of the result. The remainder would have children but would consider PND (55%) or PGD (45%), or would consider adoption (30%) or remain childless (12%). *BRCA* testing has been found to affect reproductive decisions. A study surveying adults after undergoing testing showed that women who were *BRCA*-positive were less likely to want additional (or any) children than women found not to be carriers (Smith et al., 2004). These studies clearly indicate that for some patients, the burden of transmitting a familial *BRCA* mutation is great, perhaps greater than that of undergoing IVF and PGD.

We also compared individuals who had discussed PGD for *BRCA* six or more times in 2009, and those that had discussed PGD for *BRCA* fewer than six times. Individuals with more recent experience were significantly more likely to be morally comfortable with discussion PGD with *BRCA* mutation carriers than individuals with less recent experience. These results may suggest that counselors who are morally comfortable discussing PGD with *BRCA* mutation carrier, are more likely to have this discussion than counselors who are less morally comfortable. Alternatively, it could be that a counselor who ‘sits with’ many *BRCA* families may become increasingly comfortable with PGD for this condition.
Individuals who had more recent experience were also significantly more likely to think that counselors have duty to inform patients about PGD and that PGD should be discussed with every BRCA patient of reproductive age. As with moral comfort, these results are not surprising. Genetic counselors who feel they have a duty to inform all eligible patients of this reproductive option would be expected to discuss PGD more often than an individual who did not share these beliefs.

We asked participants when they thought was the best time at which to discuss PGD with a BRCA mutation carrier, or high-risk patient. We gave several options. One option was ‘only if the patient expressed a desire to not transmit the familial mutation’. The group with less recent experience discussing PGD with BRCA mutation was significantly more likely to choose this option than the group with more recent experience discussing PGD with BRCA mutation carriers, where no one chose this option (Table 4). For respondents with more recent experience, this result is consistent with a sense of duty and belief that PGD should be discussed with every patient of reproductive age. Quinn et al., (2008) surveyed high-risk American women who had been personally affected by a familial BRCA mutation about their knowledge of PGD, in addition to their level of acceptance of the technology. They found that over 1/3 of respondents had not heard of PGD. The respondents in this study represented a well educated, health seeking population. This study represents the constant struggle genetic counselors face between their roles as information providers and patient care-takers. Perhaps some counselors do not discuss PGD until patients request the information because they do not want to overwhelm them or increase the sense of burden. However, in their efforts to minimize patient stress,
could some counselors be missing the opportunity to discuss this option that could benefit and influence family planning for some patients? For counselors who are morally uncomfortable with PGD for BRCA and do not perceive a duty to inform patients of this option, one wonders about the level of care they are able to provide to their BRCA positive patients and families.

IVd. Significant differences between groups

When we compared individuals who responded ‘yes’ or ‘no’ to several questions, we found interesting relationships. In each comparison, whether or not an individual was morally comfortable offering PGD for BRCA differed significantly (Tables 5-7). If an individual was morally comfortable offering PGD for BRCA that individual was more likely to respond that s/he has a duty to inform patients about the option of PGD, that PGD should be discussed with every BRCA patient of reproductive age, and that PGD should be not only be discussed when the patient expresses a desire to not transmit the familial mutation. An interesting apparent contradiction was that the 20% of counselors who responded that they did not think PGD should be discussed with all patients of reproductive age did believe that genetic counselors had a duty to inform patients about PGD. The following responses illustrate some of the apparent internal conflict:

“I would like to say "yes" and "no." PERSONALLY...I don't want to tell them about it b/c I disagree with it. However, since it IS an option for them at this time, I feel like I owe them the information to make their own decisions. I'm not currently a cancer counselor, but if I were, I think that I would discuss this information on a case by case basis - if I thought that the patient needed to hear the information.”

“This survey has actually got me thinking that I should start talking about this during sessions but I am not sure even how to bring it up”
“not sure about this-- I have not discussed this with anyone but this survey makes me think more about it-- I would not counsel at length but would mention just to open all future options”

Some counselors acknowledged that patients may experience ‘information overload’ in their initial meetings with a counselor. Because “our job is to present all options to [the] patient”, PGD can at least be mentioned so patients know their options and not necessarily discussed in great detail during this initial encounter. Some counselors include it in their patient letters, as “it is part of NCCN guidelines”. One counselor responded:

“I think discussing PGD with every patient could imply to some patients that having a mutation is a "bad" thing. I could even see some patients feeling like passing on a mutation is something they should feel guilty about, which is definitely not something a patient should take out of a GC session!”

Perhaps there are parallels to be drawn between this situation with PGD and a counselor who is uncomfortable with discussing the option of termination because a patient might feel guilt. Likewise, in general counselors are expected to discuss prenatal testing options whether or not a patient expresses a specific desire for that knowledge. It is certainly possible that there would be greater opportunity for interested patients to utilize PGD if it were more regularly discussed during counseling sessions.

Similarly to the results of comparing counselors who reported more recent experience with discussing PGD with BRCA patients with those that reported less recent experience, whether or not an individual felt they had a duty to inform patients about PGD was significantly different between respondents who thought that PGD should be discussed
with every *BRCA* mutation carrier of reproductive age and those that did not, as well as between those that thought PGD should only be discussed with a patient at risk for carrying a *BRCA* mutation if they asked or expressed a desire to not transmit the mutation and those that did not (Tables 6 and 7). Obligation toward patients to discuss PGD as a reproductive option was voiced more than once in the literature. Fortuny *et al.*, (2009) found that the majority of healthcare professionals (89%) attending a hereditary cancer symposium thought that high-risk cancer clinics have a duty to inform patients about different reproductive options for not transmitting a genetic predisposition of cancer. Offit *et al.*, (2006a) compared the duty to warn family members at risk of hereditary cancer syndromes, with hypothetical wrongful birth liabilities because of the duty to inform mutation carriers about alternative reproductive options to avoid passing on a familial mutation. One counselor commented:

“If a patient is not told about PGD by their GC and discovers it is an option only after having children, he/she has a right to be angry, as harm has been done (whether or not they have a child with a BRCA mutation, the harm done is that they are angry/anxious at not having known about the option for PGD). This would constitute negligence on the part of the GC.”

Peshkin *et al.*, (2007) counter this reasoning arguing that standard of care should not be driven by fear of litigation. The authors feel that it is not appropriate to compel on each individual a discussion about reproductive choices geared toward the non-selection of affected embryos. The authors feel that discussion should be tailored to each individual patient, over a period visits pre- and post-testing were the patient’s goals and values can be explored and patient autonomy can be respected. Overall, most counselors expressed that they had a duty to inform (62.6%) and that PGD should be discussed with every *BRCA* patient of reproductive age (60.4%). One counselor commented:
“You cannot discuss with some and not others as that is introducing your own bias”

Some counselors expressed concern for one of the main limiting factors of PGD in the United States, namely cost:

“...The other major issue is that I anticipate that PGD is out of the price range of many patients we see.”

“I think it probably should be a discussion with everyone, although I currently don’t do so. One issue with this is that not everyone can afford this procedure and therefore by discussing this option there are automatically some people who are excluded due to financial restraints. This can make them feel bad and excluded from current technology.”

In reality there are many factors limiting the uptake of PGD for BRCA mutation carriers in addition to cost. In the United States PGD is not covered universally for high-risk couples and is therefore not equally accessible by all. Some argue that this inevitably leads to PGD only for the wealthy and a world with gene selection according to economic means (Offit et al., 2006a; Robertson 2003; Peshkin et al., 2007; Menon et al., 2007). A study surveying BRCA mutation carriers found that of 17 individuals who would consider using PGD, only 4 would be willing to pay for the service (Menon et al., 2007).

Another concern is the process of PGD itself. The process is cumbersome and only 25% of couples can expect to have healthy children (Julian-Reynier et al., 2009). Offit et al., (2006b) raised the issue of cycles of hope and disappointment with failed IVF cycles. This could result in high anxiety and depression (Offit et al., 2006b). There is also high incidence of unplanned and untested pregnancies as well as a small risk (3-5%) of error of
embryo analysis (Julian-Reynier et al., 2009, Sagi et al., 2009). Lodder et al., (2000) found that no confirmed mutation carrier felt that termination of pregnancy (TOP) was acceptable for an affected pregnancy. The investigators speculated that mutation carriers saw termination of an affected pregnancy to be incompatible with their own existence (Lodder et al., 2000). This sentiment was echoed among mutation carriers in other studies (HFEA, 2006; Menon et al., 2007). Another concern is that PGD is not a guarantee of a healthy future and may give false reassurance to some people (Lancet Oncology, 2006).

Many studies have shown that while there is high acceptance of PGD for BRCA mutations by BRCA mutation carriers; however actual uptake is predicted to be low (Fortuny et al., 2009; Menon et al., 2007; Sagi et al., 2009; Neirmeijer, 2006). This pattern was previously observed with Huntington’s disease with regard to prenatal testing. Adam et al, (1993) found that 43% of adult predictive testing candidates said they would use prenatal testing. The actual demand for prenatal testing was much lower (18%) (Adam et al, 1993). The most frequent reason for declining prenatal testing was the hope that a cure would be found for their children (Adam et al., 1993).

Tables 5-8 show each response that significantly differed according to whether or not individuals believe there should be governmental and/ or professional regulation of PGD. While no group feels that there should be absolutely no regulation, individuals who responded that counselors have a duty to inform BRCA mutation carriers about PGD, that PGD should be discussed with every BRCA mutation carrier of reproductive age, that
PGD should be discussed with patients at risk for carrying a BRCA mutation regardless of whether or not the patient asks to explicitly expresses a desire to not transmit, and that they are morally comfortable offering PGD for BRCA were significantly less likely to feel there should be regulation. As mentioned above with regards to professional regulation perhaps individuals who favor regulation fear the ‘slippery slope’. They may wish for regulation to monitor appropriate use of the technology so that it is not abused for development of so-called ‘designer babies’. On the other side, one counselor commented:

“In fact, I am morally uncomfortable at setting a list of conditions that we as professionals decide are "serious" enough or for which the onset is "early" enough to warrant PGD. Parents are often thinking about the best life for their child. . . and that may include not going through a similar burden of cancer risk.” – No to professional regulation (response from moral comfort question)

Wertz and Knoppler (2002) surveyed certified genetics providers from the United States, Canada, and Europe about their definition of ‘serious enough’. They found that most professionals did not want national committees, laws, or professional societies to determine what conditions were serious enough to warrant approval for particular services. Discussion and agreement between the patient and the genetics provider was the preferable route to decision making. Wertz and Knoppler (2002) felt that listing conditions and limited services based on a definition of ‘serious’ would be highly discriminatory. Such a definition may also be unhelpful because it cannot take into account an individual’s experience with a condition (Clancy, 2009).

In general, counselors were more in favor of professional regulation than governmental regulation. The main reasons were that medical procedures and decisions should be
monitored and regulated by those who understand the medical field and grasp the implications associated with policies or decisions. Many respondents felt that the government has too much involvement in healthcare already and that PGD is a personal decision and should be dealt with on a case-by-case basis. Counselors who were in favor of governmental regulation thought that it should be used to ensure quality and clinical standards. There were also counselors who, as with professional regulation, voiced their concerns about the ‘slippery slope’ of trait or sex selection.

**IVe. Implications for future research**

While most respondents answered that genetic counselors do have a duty to inform *BRCA* mutation carriers about PGD and that PGD should be discussed with every *BRCA* mutation carrier of reproductive age, the numbers do not reflect that discussion of PGD is occurring in the majority of counseling sessions. Additional studies could be done to ascertain how best to educate patients and counselors about discussing PGD with *BRCA* mutation carriers. Several surveyed counselors commented on how the survey for this study advanced their thinking about this topic. A follow-up study could be done to see if more counselors are discussing PGD with their *BRCA* patients or if counselors have changed their opinions on the topic. Another theme that emerged was the distinction counselors make between their personal ethics and those of their patient’s. Studies could be done to investigate how counselors remedy their apparent internal conflict of ethics with respect to PGD.
V. CONCLUSION

We surveyed genetic counselors in the United States about their opinions, attitudes and knowledge about PGD for BRCA mutation carriers. We found that genetic counselors express a diversity of opinions about PGD for BRCA mutation carriers and that there are extremes at both ends about the ethical use of PGD in general. Counselors consider different factors important when offering PGD for BRCA and when offering PGD for an unspecified condition. A patient’s expressed desire to not transmit a familial mutation was an important consideration for offering PGD in either circumstance. A duty to inform one’s patient was only reported as an important factor for respondents when offering PGD for BRCA. Whether or not a counselor was morally comfortable offering PGD for BRCA mutations was a significant predictor for other issues, such as whether a duty exists to inform patients about PGD. Most counselors expressed that they had a duty to inform their BRCA patients about PGD and that PGD should be discussed with every BRCA patient of reproductive age. Cancer genetic counselors were identified as best suited to discuss reproductive options, including PGD, with BRCA patients. Not all counselors were morally comfortable discussing PGD with BRCA mutation carriers nor did they feel that it was ethically appropriate to offer PGD for BRCA. However, most counselors seem to be practicing in line with the NSGC code of ethics which supports a patient’s reproductive choices regardless of the personal beliefs or biases of the counselor.
VI. REFERENCES


(NSGC) National Society of Genetic Counselors. 2006. Code of ethics. [http://www.nsgc.org/about/codeEthics.cfm](http://www.nsgc.org/about/codeEthics.cfm)


VII. APPENDICES

APPENDIX A: RECRUITMENT NOTICE – NSGC, CANCER SIG, ART SIG
SUBJECT HEADING: BRANDEIS STUDENT MASTER’S PROJECT

ARE YOU A GENETIC COUNSELOR IN ANY SPECIALTY, IN THE UNITED STATES?

WILL YOU LIKE TO CONTRIBUTE TO THE BODY OF KNOWLEDGE ABOUT THE IMPORTANT TOPIC OF PREIMPLANTATION GENETIC DIAGNOSIS (PGD) FOR BRCA MUTATION CARRIERS?

If you’ve answered YES to these questions, please follow the link below to an anonymous online survey.

This survey will take approximately 30 minutes.

The data will be used for a Master’s thesis project examining the knowledge and attitudes of genetic counselors with regards to PGD for BRCA mutation carriers. All responses are anonymous. Once you have completed the survey, if you would like to enter for a chance to win an Amazon.com gift card, please follow the instructions at the end of the survey.

HTTPS://WWW.SURVEYMONKEY.COM/S/QP7YBH

If you have any questions about the project or your participation, please contact the principle investigator, Shawna Morrison at smorriso@brandeis.edu. Thank you for your interest and participation

Shawna Morrison, BSc
Genetic counseling MS candidate
Brandeis University, Waltham, MA

APPENDIX B: SURVEY DOCUMENT

Please answer the following questions, skipping any you would prefer not to answer.
Demographic Information

1. Please indicate your current area of practice:
   a. Cancer
   b. Prenatal
   c. Pediatric
   d. Assisted reproductive technology (ART)
   e. Research
   f. Other:_________________________________________

2. Are you currently counseling patients:
   a. Yes
   b. No

3. Please indicate in which NSGC region you practice:
   a. Region I
   b. Region II
   c. Region III
   d. Region IV
   e. Region V
   f. Region VI

4. Please indicate how long you have been practicing:
   a. 0-5 years
   b. 6-9 years
   c. 10-15 years
   d. 15 or more years

5. Please indicate your age group:
   a. <25 years of age
   b. 26-30 years of age
   c. 31-35 years of age
   d. 36-40 years of age
   e. 41-50 years of age
   f. >51 years of age

6. Please indicate your gender:
   a. Female
   b. Male

Preimplantation genetic diagnosis (PGD)

Please answer the following questions about PGD.
7. Do you think there should be governmental regulation of PGD?
   a. Yes
   b. No
   c. Comment:______________________________

8. Do you think there should be professional regulation of PGD?
   a. Yes
   b. No
   c. Comment:______________________________

9. Which factors do you consider most important in offering PGD to patients for a genetic condition: (Please rank five options from the most important (1) down to the least important (5). If you feel some selections are equally important, please feel free to assign the same number)
   a. ___ Age of onset of condition
   b. ___ Treatability of condition
   c. ___ Quality of life associated with condition
   d. ___ Patient’s history of condition
   e. ___ Patient’s family history of condition
   f. ___ Patient’s reproductive history
   g. ___ Patient’s expressed desire to not transmit mutation
   h. ___ Other:_____________________
   i. ___ Other:_____________________

10. Please indicate whether or not you feel the use of PGD is ethically appropriate for the following conditions:

    a. Childhood or young adulthood onset cancer syndrome, cancer occurs in limited sites, highly penetrant, with effective treatment and screening, but quality of life is impaired. **Example Familial adenomatous polyposis (FAP):** Autosomal dominant. Hundreds to thousands of precancerous colon polyps develop between age 7-36 years of age. Without prophylactic colectomy, approaching 100% risk of cancer:
        i. Always
        ii. Sometimes (case by case)
        iii. I don’t know
        iv. Never
        v. Please comment:________________________________________

    b. Childhood onset, neurodegenerative disorder. Progressive. Treatment is mostly supportive. **Example Tay Sachs disease:** Autosomal recessive. Infantile onset. Phenotype includes progressive weakness, loss of motor skills, seizures, blindness and eventual total incapacitation. Death, usually before age four years.
c. Cancer syndrome where onset is in adulthood but typically before 50 years of age. Cancer occurs in limited sites. Treatment and surveillance available but quality of life may be impaired. *Example Hereditary Breast and Ovarian Cancer (HBOC)*: Autosomal dominant. Cumulative lifetime breast cancer risks from 49-88% and ovarian cancer risks from 18% to 65%. Other associated cancers with lower lifetime risks. Surveillance, chemoprevention and prophylactic surgeries available.

i. Always
ii. Sometimes (case by case)
iii. I don’t know
iv. Never
v. Please comment:__________________________


i. Always
ii. Sometimes (case by case)
iii. I don’t know
iv. Never
v. Please comment:__________________________

e. Childhood or young adulthood onset cancer syndrome, associated with multiple cancer types, is highly penetrant and little or no treatment or prevention available. *Example Li-Fraumeni Syndrome (LFS)*: Autosomal dominant. 85-100% lifetime cancer risk. Associated with
osteosarcomas, soft tissue sarcoma, premenopausal breast cancer, brain tumors, adrenal cortical tumors and acute leukemias and others.

i. Always
ii. Sometimes (case by case)
iii. I don’t know
iv. Never
v. Please comment:_____________________________________

Preimplantation genetic diagnosis (PGD) and BRCA mutation carriers

Please answer the following questions with regard to PGD for BRCA mutation carriers.

11. Which healthcare provider do you feel is best suited to discuss the option of PGD with BRCA mutation carriers?
   a. Cancer GC
   b. Prenatal GC
   c. Gynecologist/Obstetrician
   d. PCP
   e. Oncologist
   f. Other:_________________________________________

12. Where do you think discussion about the option of PGD is most likely to occur with BRCA mutation carriers?
   a. Cancer GC session
   b. Prenatal GC session
   c. Gynecologist/Obstetrician appointment
   d. PCP appointment
   e. Oncology appointment
   f. Other:_________________________________________

13. In the cancer genetic setting, when do you think is the best time to discuss PGD with individuals at risk for carrying a BRCA mutation? (Select all that apply.)
   a. Only if the patient asks or expresses desire to not transmit mutation
   b. Before mutation status is determined
   c. In results session
d. In follow-up session after mutation status is determined
e. During high risk follow-up, unrelated to genetic testing (ie. Screening)
f. Refer to outside provider for discussion
g. Other_____________________________________________
h. Please comment:____________________________________

14. In 2009, with how many BRCA positive or BRCA high risk patients did you discuss the option of PGD? *If you selected a. 0 times, please skip to question 15.*
   a. 0 times
   b. 1-3 times
   c. 4-5 times
   d. 6-10 times
   e. > 10 times

14A. Who initiated the PGD discussion?
   a. The patient
   b. I did (the genetic counselor)
   c. The physician
   d. Other:________________________________________________

14B. If you are the one who brought up PGD, what factors were important for you in doing so? (Please rank five options from the most important (1) down to the least important (5). If you feel some selections are equally important, please feel free to assign the same number)
   a. ___ Age of onset of BRCA associated cancers
   b. ___ Treatability of BRCA associated cancers
   c. ___ Quality of life for BRCA mutation carriers
   d. ___ Patient’s history of cancer
   e. ___ Patient’s family history of cancer
   f. ___ Patient’s reproductive history
   g. ___ Patient’s expressed desire to avoid transmitting mutation
   h. ___ Other:_____________________
   i. ___ Other:_____________________

14C. Did you discuss the PGD procedure, limitations, risks, advantages and alternatives?
   a. All of the above
   b. Some of the above
   c. None of the above
   d. Please Elaborate: ________________________________________
14D. Did you refer patients elsewhere to discuss reproductive options, including PGD?
   a. Yes
   b. No
   c. Please elaborate: ____________________________________________________________

15. Do you think the option of PGD should be discussed with every BRCA mutation carrier of reproductive age?
   a. Yes
   b. No
   c. Please elaborate: ____________________________________________________________

16. Are you morally comfortable offering PGD to patients with a BRCA mutation?
   a. Yes
   b. No
   c. Please elaborate: ____________________________________________________________

17. Are you comfortable discussing the technological issues of PGD with BRCA mutation carriers?
   a. Yes
   b. No
   c. Please elaborate: ____________________________________________________________

18. Are you concerned about the possibility of negative effects of fertility treatments/PGD (eg. possible increased breast cancer risk) on BRCA mutation carriers?
   a. Yes
   b. No
   c. Not sure

19. Do you feel genetic counselors have a duty to inform BRCA patients about PGD?
   a. Yes
   b. No
   c. Please elaborate: ____________________________________________________________

Thank you for your interest and participation.

If you would like to be entered in the draw for a gift card (one 50$ and five 20$ cards available) to amazon.com please email Shawna Morrison at smorriso@brandeis.edu with the subject PGD RAFFLE.
Your survey responses and your email will not be linked.