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Comparison of Attitudes Regarding Preimplantation Genetic Diagnosis Among Patients with Hereditary Cancer Syndromes

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Abstract

Introduction—Preimplantation Genetic Diagnosis (PGD) allows couples to avoid having a child with an inherited condition, potentially reducing cancer burden in families with a hereditary cancer predisposition. This study investigated awareness and acceptance of PGD among patients with hereditary cancer syndromes.

Methods—Questionnaires were mailed to 984 adults with hereditary breast and ovarian cancer, Lynch syndrome, familial adenomatous polyposis, or multiple endocrine neoplasia type 1 or 2. Associations between clinical, demographic, and psychosocial factors and awareness and acceptance of PGD were examined.

Results—Of 370 respondents (38% return rate), 28% felt their syndrome impacted family planning, 24% were aware of PGD, 72% felt that PGD should be offered, 43% would consider using PGD, and 29% were uncertain. Family experience and syndrome-specific characteristics, such as disease severity, quality of life and availability of medical interventions as well as gender, family planning stage, and religiosity impact perceptions of the acceptability of PGD, though a high level of uncertainty exists.

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Conclusion—Hereditary cancer patients' opinions about the acceptability of PGD are similar to those of genetics and ethical experts. Patients should be told about PGD given that most had not heard of PGD, but feel that PGD should be offered.

Keywords

Preimplantation genetic diagnosis; hereditary cancer syndromes; hereditary breast and ovarian cancer; Lynch syndrome; familial adenomatous polyposis; multiple endocrine neoplasia

Introduction

Preimplantation genetic diagnosis (PGD) is an assisted reproductive technology that allows couples to avoid having a child with an inherited condition. PGD involves *in vitro* fertilization and genetic testing to select embryos for uterine implantation that do not have the genetic disorder. Embyos with the mutation are discarded or stored long-term. PGD is technically possible for any single gene disorder. It has been used for more than a dozen hereditary cancer syndromes including adult-onset disorders such as hereditary breast and ovarian cancer and Lynch syndrome[1]. Ethical questions have been raised about the usage of PGD. It has been suggested that PGD be used only for the more severe diseases, with high penetrance, early age at onset, and for which few medical interventions are able to reduce disease risks[2].

Approximately 5-10% of all cancers are caused by autosomal dominant hereditary cancer syndromes, characterized by a high lifetime risk for one or more cancer types, young ages of onset, high risk of second malignancies, and cancer occurring in successive generations of the family. Table 1 provides an overview of the age at onset, most commonly associated cancers, and management options for the five hereditary cancer syndromes most frequently encountered at our institution[3-10].

Hereditary breast and ovarian cancer (HBOC) and Lynch syndrome (LS) are adult-onset conditions with both surveillance and risk-reducing surgical options for the most commonly associated cancers, although other cancers occur at lower frequencies which do not have effective surveillance or risk-reduction options. Familial adenomatous polyposis (FAP) and multiple endocrine neoplasia types 1 and 2 (MEN1, MEN2) may have onset during childhood or adolescence. Prophylactic thyroidectomy is highly effective at addressing cancer risk in patients with MEN2; however thyroidectomized patients require lifelong thyroid hormone replacement and are also at risk for pheochromocytoma and primary hyperparathyroidism which require lifelong biochemical surveillance. Some patients may require bilateral adrenalectomy which results in adrenal insufficiency and life-long dependence on steroids. MEN1 is associated mainly with benign conditions (hyperparathyroidism and pituitary adenomas). However these may cause symptoms due to hormone overproduction and may require surgical or other treatment. There are no prophylactic surgical options that address the main cancer risks for patients with MEN1, though prospective monitoring and early surgical intervention for neuroendocrine tumors may positively impact survival, surgery is associated with high risk for pancreatic insufficiency and type 1 diabetes [11]. Most patients with FAP inevitably are recommended

to undergo some form of colectomy to reduce colon cancer risk. Surgery is typically performed after the polyp burden becomes too high to manage effectively with endoscopy. Thus, the surgery typically occurs after the onset of disease and is not truly prophylactic. While regular endoscopy and surgery significantly improve overall survival, excess death rates still occur due to other FAP-associated tumors, such as duodenal carcinoma and desmoid tumors[12].

A number of studies have recently been published about the attitudes of hereditary cancer patients toward PGD, but have mainly focused on HBOC and in many cases include only women[13-27]. In a recent meta-analysis of 13 studies published between 2005-2009 on attitudes toward PGD, awareness of PGD and acceptability of personal use of PGD was low (35% and 36% of pooled respondents, respectively) while acceptability of PGD being offered to others was relatively high (71%)[28]. PGD acceptability did not vary by study location (US vs. non-US) or syndrome in the metanalysis; however the authors were only able to assess HBOC vs. other with only two studies of FAP and one of Li Fraumeni syndrome and von Hippel Lindau disease included. Additionally, there are significant differences between study design, including the method of patient ascertainment, whether the participant was actually confirmed to be affected with a hereditary cancer syndrome, and the degree to which PGD was explained to the study participant. Patients may overestimate what PGD is able to accomplish, therefore, if PGD is not adequately explained in a study, it could bias overall acceptance rates[29].

The prevailing themes from these studies suggest that individuals with hereditary cancer syndromes who are in favor of PGD focus mainly on the health benefits and opportunity to have a biological child for those who might otherwise forego childbearing due to risk of disease transmission. Individuals with less favorable attitudes emphasize the moral, religious, and ethical considerations of this technology. Associations between attitude toward PGD and religion, age, gender, education level, personal and family history of cancer, desire for more children, and prior awareness of PGD have been found, however have been quite variable between studies with no consistently predictive factors.

To our knowledge, no studies have directly compared attitudes toward PGD between individuals with different hereditary cancer syndromes. Such a comparison will add to the body of knowledge regarding hereditary cancer patients' perceptions of the acceptability of PGD, and identify whether there are any syndrome-specific factors that influence attitudes toward PGD. In this study, the knowledge and acceptability of PGD across several different hereditary cancer syndromes, HBOC, LS, FAP, MEN1, and MEN2 is examined.

Patients and Methods

Eligible participants included adults (ages 18 or older) who could read and write in English; who had a known deleterious mutation in any of the genes associated with HBOC (*BRCA1* and *BRCA2* genes), LS (*MLH1*, *MSH2*, *MSH6*, *EPCAM*, and *PMS2* genes), FAP (*APC* gene), MEN1 (*MEN1* gene), or MEN2 (*RET* gene). These syndromes were selected as they are the most frequently encountered syndromes at our institution. Participants were identified from a database maintained by the Clinical Cancer Genetics Program at the

University of Texas M. D. Anderson Cancer Center and all had completed at least one visit with a genetic counselor at our institution between 1995 and 2011. This study was reviewed and approved by the MD Anderson Cancer Center Internal Review Board.

Eligible participants were mailed the study questionnaire. Non-responders received a second packet six weeks after the initial mailing. The questionnaire was modeled after questionnaires from two previous studies on this subject and was tailored to the patient's known syndrome [30, 31]. The survey was piloted on ten hereditary cancer patients. An informational paragraph about PGD was included (Box 1). Websites were provided if the participant wanted to learn more about PGD. Study questionnaires were deidentified. Unique tracking numbers were assigned so that questionnaire data could be linked with existing cancer and family cancer history data from the genetics database.

The main outcomes of interest included: 1) whether the patient had heard of PGD before receiving the study questionnaire (yes or no), 2) whether the patient thought PGD should be offered to people with their hereditary cancer syndrome (yes, no, or unsure) and 3) whether they would personally consider using PGD (yes, no, or unsure). If the participant had already completed childbearing, we asked whether they would have considered it at the time they were planning a pregnancy. Predictors included demographic variables, personal history of cancer, syndrome, religiosity, number of children, whether those children were born before or after the diagnosis of the hereditary cancer syndrome, desire for additional children, and whether having a hereditary cancer syndrome has affected family planning decisions. We also grouped patients according to whether they had an adult vs. childhood onset syndrome and based on the availability of a risk-reducing surgical management option.

Perceived severity of disease was rated using a five point Likert response scale from “no impact” to “great impact” on personal health and well-being. Agreement with 16 statements about ethical and practical aspects of PGD was measured using a five-point Likert response scale from “strongly disagree” to “strongly agree”. The survey also assessed preferences for learning about PGD.

Pearson's chi-square test was used to assess the association of categorical predictive variables with the three outcomes of interest. If a cell had an N of ≤ 5, Fisher's exact test was substituted. Mann-Whitney's U test was used to evaluate the difference in the responses of the Likert scale questions for the three outcomes of interest. All analyses were performed using Statistical Analysis System (SAS) software (version 9.2; SAS Institute Inc, Cary, NC). All statistical tests were two-sided with alpha of $P < 0.05$.

Results

Participant Characteristics

Nine hundred eighty-four individuals met eligibility criteria and 370 completed the survey (38% response rate). Non-responders were slightly younger than responders (47 vs. 50 years, p=0.03), but otherwise had similar demographic and cancer histories and a similar response rate was observed between men and women. Table 2 provides an overview of the study population and awareness and attitudes toward PGD. The majority of respondents

were between the ages of 40 and 65, well-educated, married white women who considered themselves religious and had already completed childbearing. Median age at survey completion was 49 years (range 19-87). Respondents with a childhood-onset syndrome were younger than those with an adult-onset syndrome at the time of the survey (45 vs. 51y, p=0.04). Most of the respondents had borne children prior to finding out that they had a hereditary cancer syndrome, though 286 were diagnosed before completing childbearing. Of these, 28% reported that the diagnosis affected reproduction. Thirteen were unable to have children because of the syndrome or cancer treatment. Twenty-one decided to have fewer children and 10 had children either earlier or later in life than anticipated. Nine chose not to have any children and one participant chose to adopt. Some respondents fell into more than one of the above categories and 25 did not provide a response.

Most respondents (85%) felt that a good quality of life was possible despite having their hereditary cancer syndrome; though 47% reported feeling severely affected (reported a 4 or 5 on the disease severity scale) and 85% believed that it was important that their child not inherit the syndrome. Actual disease severity scores did not predict perceived quality of life scores, but ratings of disease severity were higher in those whose syndrome had no available surgical risk-reduction (median score of 4 vs. 3; p = .045). Perceived quality of life scores were lower for patients with a childhood onset syndrome (median score of 4 vs. 5; p = .02).

PGD Awareness

Twenty-four percent of respondents had heard of PGD before receiving the questionnaire. Higher levels of PGD awareness were associated with younger age, having a childhood-onset syndrome, income, and marital and childbearing status (Table 2). Respondents in the lowest income bracket were the least likely to know about PGD. Awareness was higher individuals who were never married, did not have children before diagnosis, have not completed childbearing, and if they felt their syndrome affected reproductive planning. When asked about the type of healthcare provider preferred for discussions of PGD, genetic counselors were most commonly selected. The next most preferred was the primary physician managing their syndrome.

PGD Acceptance

Overall, 72% of the respondents felt that PGD should be offered to individuals with their hereditary cancer syndrome. Respondents who had a surgical risk-reducing option, considered themself religious, and who had at least one child at the time of the survey were less likely to agree that PGD should be offered (Table 2).

Forty-three percent said they personally would consider using PGD, or would have if they had known about it at the time they were having children. MEN1 and FAP patients had the highest percent agreeing they would consider PGD. MEN2 patients were the mostly likely to respond that they would not consider PGD and HBOC patients had the highest level of uncertainty. Higher levels of personal acceptance were found in males and in individuals with a syndrome that was childhood-onset or without a risk-reducing surgical option (Table 2). Higher perceived disease burden, but not actual cancer history, predicted higher levels of personal PGD acceptance. Additional factors associated with positive PGD attitudes

included feeling strongly that their child should not inherit the syndrome, worry about blame, considering adoption, having spousal/family support, and feeling that PGD could lower the family's overall cost of healthcare (Table 3). Negative associations were seen in those who felt that PGD interferes with nature and that good quality of life is attainable (Table 3)

Discussion

To our knowledge, this is the first study to systematically compare the opinions of patients with different hereditary cancer syndromes about PGD and to investigate what aspects of the syndrome may be important factors in determining attitudes. Awareness of PGD was similar across all four syndromes in our study. Younger age, having childbearing potential, the never married, and having a childhood-onset syndrome predicted PGD awareness. Patients diagnosed at young ages have longer to find out about PGD before the completion of childbearing. It is also possible that healthcare providers preferentially inform patients about PGD if they are at risk to pass on a childhood-onset syndrome. In a French study from 2009 that surveyed cancer geneticists' and prenatal diagnosis healthcare providers' attitudes about the acceptability of PGD for hereditary cancer, providers had more positive attitudes for situations in which the disease is severe and the onset is in childhood [32]. Additionally, patients were more likely to be aware of PGD if reproduction was affected. Patients may be more likely to find out about PGD if they are seeking alternative family planning methods. Our study also suggests that there may also be differences in discussing PGD based on socioeconomic status, as patients with the lowest income were the least likely to be aware of PGD. It is possible that patients with lower incomes may have fewer resources in which to learn about PGD, however this may also reflect a disparity in healthcare providers discussing this option with patients who they think may not be able to afford it.

PGD acceptance was not associated with personal history of cancer, which has been found in several other studies [19, 21, 24, 26, 27, 30], but not all[22]. However, PGD acceptance was associated with syndrome, age of syndrome onset, and perceived disease burden and belief that a good quality of life is possible despite having the syndrome. Additionally, cancer history did not correlate with perceived severity of disease. This supports that there may be unique aspects about each syndrome, rather than simply the cancer risk, that impacts acceptability of PGD. The theme that individuals' perception of their disease, rather than actual disease history, may more important in shaping attitudes about the acceptability of having a child with the disease and therefore influence thoughts about PGD, has been supported by other studies [13, 16, 19, 22, 30]. Perceived severity of disease may be shaped not only by personal experience with cancer/disease, but also by the experience of family members, witnessing death and suffering in the family, perceived acceptability and confidence in current management options, hope in future advancements in medicine, perceived ability to cope, and the degree to which difficulties were encountered finding a partner or deciding whether or not to have children [13, 16].

We did observe that disease burden was rated as more severe by those whose syndrome lacked a surgical risk-reduction option and those with a childhood onset syndrome rated their syndrome as less compatible with a good quality of life. This theme might explain why

we observed differences in PGD acceptability between the different syndromes analyzed in our study. Patients with MEN2 had the lowest acceptance rate for PGD, even though it is associated with the highest cancer risk of all of the syndromes included and is a childhood onset disorder. However, the potential for prevention or cure of MTC is high in MEN2 with early thyroidectomy, a procedure that, relative to the surgeries required in the other syndromes (e.g. colectomy, mastectomy, or oophorectomy), may be associated with a lower risk for adverse side effects and psychological burden. MEN1 and FAP patients had the highest rates of acceptability of PGD and share in common childhood onset and management that requires technically more difficult procedures such as pancreatectomy or colectomy that have a high risk to impact quality of life. LS had the second lowest acceptance rate for PGD. The main cancer risks in LS also have a high potential for prevention with colonoscopy, hysterectomy and/or oophorectomy. Additionally, men with LS reduce most of their cancer risk through colonoscopy and do not require prophylactic surgery. HBOC had the highest level of uncertainty about PGD. While cancer risks are drastically reduced through surgical intervention, bilateral mastectomy may have a negative impact on body image and sexuality which might explain why the rates of uncertainty were higher than patients with LS[33].

Gender was the only demographic characteristic that predicted acceptance of PGD. The fact that men with hereditary cancer syndromes were more likely to be accepting of PGD warrants further investigation, as this trend has been previously reported [29, 30, 34]. There could be physical, and/or psychosocial variables that might explain this observation. Physically speaking, PGD is an easier process for males to go through than females. Males are required to donate a sperm sample whereas females are required to go through injectable stimulating hormone treatments to induce ovulation, as well as procedures for egg retrieval and embryo transfer, although it is unclear to what extent the differences in what is required of each gender for PGD was appreciated by our study participants. Other potential factors could include concern about exposure of cancer cells to high estrogen levels during IVF given that we had a large proportion of women with HBOC in our population. This was a deterrent to PGD in a study of women with HBOC [35]. It is also possible that males may be more accepting of PGD as a reproductive option in general. In a study of attitudes toward PGD in individuals with FAP, men were more likely to agree that it is important to have a genetically related child[30]. In a German study, men were more likely to approve of or undergo PGD for severe chronic disease or cancer predisposition than women[34].

The only reproductive factors that were associated with PGD acceptance in this study were whether the participant would consider adoption and whether they had at least one child. Individuals who would consider adoption may be more concerned about having a child affected by their cancer syndrome. Trends in our data suggest higher rates of agreeing that PGD should be offered in those who have no biological children, and a greater degree of uncertainty about PGD in those who already have a child. It would be interesting to study further whether and how the birth of a child might impact PGD attitudes. It is possible that those who have a child focus more on the value of that life and thus are less accepting of PGD. Alternatively, parents may worry about the possible psychological impact on an existing at-risk child if they choose to have another child who will not be at risk because of PGD.

There are several limitations to this study, the first being that we had a low (38%) response rate despite two separate mailings, and there were low numbers for LS, FAP, MEN1, and MEN2 relative to HBOC. Therefore, we may not have had enough power to detect differences between these populations, though we do feel the respondents were representative of the overall MDACC hereditary cancer population given that respondents and non-respondents demographic and cancer histories were similar. The low response rate may be due to the fact that we were contacting former patients who were seen over a fairly broad time period (1995-2011). The majority of the respondents were Caucasian (66%), well-educated (60% college graduates), and female (78%) and all patients had received genetic counseling at MD Anderson Cancer Center. The high female percentage likely reflects our high number of patients with HBOC since response rates were not different for males and females. There is not a uniform practice at our institution for discussion of PGD with hereditary cancer patients, therefore, there may also be bias introduced due to different genetic counseling practices in clinics that treat inherited syndromes in our institution, as well as differing practice patterns over the time period that the participants were seen by a genetic counselor. We also had a large proportion of respondents who had already completed childbearing (83%) at the time of the survey, which may add bias given that they were asked to retrospectively consider what they would have done; though their attitudes toward PGD were similar to respondents who had not completed childbearing. Additionally, it is well established that rates of intention to undergo genetic testing are higher than actual uptake; therefore, this study may overestimate the percentage of patients who would realistically pursue PGD. Additionally, in this exploratory analysis we may have found spurious associations due to the number of multiple comparisons.

Our data suggest that most, but not all, hereditary cancer patients are interested in hearing about PGD. We found that hereditary cancer patients identified several factors associated with acceptance or rejection of PGD that parallel opinions of genetics and ethics experts in the literature such as the importance to consider disease severity, age of onset, and availability of medical interventions. However, gender, religiosity, previous childbearing experience, and family support may also play a role in shaping opinions.

Because most respondents want to hear about PGD, healthcare providers should discuss the availability of reproductive technology with all hereditary cancer patients in a sensitive manner, acknowledging that some do not condone the procedure. In fact, consideration of PGD for hereditary cancer patients has been included in recent fertility preservation guidelines issued by the American Society for Reproductive Medicine and the American Society of Clinical Oncology [36, 37]. The question of which healthcare provider(s) should be approaching patients with information about PGD is important to consider. It is notable that patients most often preferred to have these discussions with a genetic counselor or with the physician in charge of syndrome management, however not all patients may have access to a genetic counselor and previous data have suggested that physician knowledge of PGD for hereditary cancer is limited[38]. Given the high degree of ambivalence about PGD that we observed in this population, continuing education may be indicated to ensure that providers have sufficient knowledge about PGD so that patients can make informed decisions about whether to seek more specialized reproductive counseling. Our institution recently recruited a physician to provide oncofertility services and fertility preservation

options to patients with cancer to protect their reproductive health and preserve current or future fertility. Specialty services such as these may be ideal settings in which to have more detailed discussions about PGD with patients with hereditary cancer syndromes. However, we also feel that PGD should be discussed even with patients who are beyond childbearing age, as they may have children or other younger relatives who might want to know about PGD who may not have access to such counseling services.

While our respondents' overall awareness and attitudes toward PGD were similar to findings from other studies in that few hereditary cancer patients (24%) are aware of PGD as an option and that there is a discrepancy between the percentage of patients who think PGD should be offered (71%) and those who would consider using it themselves (43%), the observed similarities and differences between syndromes provide additional insight into why some hereditary cancer patients may find PGD more acceptable than others. Data such as these may aid in understanding factors that influence individuals' attitudes toward PGD and may improve health care providers' ability to identify patients who may be interested in PGD and anticipate potential concerns regarding this technology.

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Table 1

Clinical Features of Hereditary Cancer Syndromes Evaluated

Syndrome	Most Common Lifetime Cancer Risks	Onset	Management Options	
			Risk-reducing Surgery*	Early Detection
HBOC	Breast 40-87%	Adult	✓	✓
	Ovarian 10-44%		✓	
LS	Colorectal 20-80%	Adult		✓
	Endometrial 15-60%		✓	
FAP	Colorectal 95+%	Child		✓
MEN1	Islet cell 40-75%	Child		✓
MEN2	Thyroid 95+%	Child	✓	✓

HBOC= hereditary breast and ovarian cancer syndrome; LS = Lynch syndrome; FAP = familial adenomatous polyposis; MEN = multiple endocrine neoplasia

*For the purpose of this study, FAP is classified a syndrome without a risk-reducing surgical option since the surgery is typically performed when the polyp burden becomes too high to manage endoscopically, thus it is performed at a time when the patient is already affected with disease.

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Table 2

Study Population Characteristics and Awareness and Acceptance of PGD

	Overall n	Aware of PGD Yes/No	p	Think PGD Should be Offered Yes/No/Unsure	p	Would Consider PGD[1] Yes/No/ Unsure	p
Medical Characteristics							
Syndrome							
HBOC	171	33/135		122/19/28		65/37/56	
LS	43	8/34		29/8/5		16/13/10	
FAP	65	16/48	.085	50/3/11	.087	31/12/13	**.028**
MEN1	33	10/23		27/0/6		19/4/8	
MEN2	58	21/36		34/8/14		23/21/10	
Age of Onset							
Childhood	155	47/107	**.015**	113/11/31	.153	73/37/31	**.041**
Adulthood	215	41/169		151/27/33		81/50/66	
Available risk-reducing surgery							
Yes	274	62/105	.480	185/35/47	**.020**	104/71/76	**.033**
No	96	26/71		77/3/17		50/16/21	
History of cancer							
Yes	157	41/113	.351	105/21/28	.202	59/38/56	.321
No	213	47/163		157/17/36		65/27/47	
Demographic Characteristics							
Age							
≤40	89	37/51		66/7/15		40/24/19	
41-64	226	42/182	**<.001**	161/26/37	.600	89/56/59	.097
65+	46	9/35		29/4/11		22/4/16	
Gender							
Male	80	16/63	.357	61/4/15	.197	46/17/13	**.008**
Female	290	72/213		201/34/49		108/70/84	
Race/Ethnicity							
White	244	55/185		176/26/38		103/57/61	
Other	12	1/11	.220	9/0/3	.577	6/1/4	.721
Unknown	114	32/80		77/12/23		45/29/32	

	Overall n	Aware of PGD Yes/No	p	Think PGD Should be Offered Yes/No/Unsure	p	Would Consider PGD[1] Yes/No/ Unsure	p
Education							
College graduate	217	52/163		158/23/34		89/55/54	
Some college	101	25/75	.950	70/10/21	.795	48/19/29	.583
High school graduate	38	8/29		25/5/6		11/11/11	
Some high school	6	1/5		6/0/2		2/2/2	
Income							
<$20K	25	3/22		19/1/5		13/1/5	
$20-50K	61	23/37	**.030**	42/4/14	.347	25/14/14	.089
$50-100K	113	25/86		79/17/16		39/36/30	
>$100K	148	33/115		108/13/26		65/31/43	
Considers self religious							
Yes	295	67/223	.433	201/36/54	**.003**	123/76/73	.071
No	65	18/47		58/1/6		30/8/20	
Family Characteristics							
Marital status							
Married/partner	271	66/201		190/32/45		112/72/75	
Divorced/separated/widowed	59	8/51	**.032**	43/3/13	.538	17/10/15	.566
Never married	36	13/22		26/3/6		16/5/7	
Have biological children							
Yes	284	62/218	.066	194/31/55	**.029**	121/74/86	.092
No	82	26/55		68/6/7		32/11/11	
Childbearing initiated before syndrome diagnosed							
Yes	233	43/186	**.001**	157/29/45	.073	98/59/74	.231
No	122	42/80		95/8/17		51/25/23	
Have completed childbearing							
Yes	298	61/235		210/32/55		115/71/82	
No	49	17/32	**.002**	38/4/7	.902	26/12/11	.298
Unsure	12	7/5		9/1/2		8/3/1	
Reproduction affected[2]							
Yes	80	32/47	**.001**	63/3/11	.057	40/15/14	.156

	Overall n	Aware of PGD Yes/No	p	Think PGD Should be Offered Yes/No/Unsure	p	Would Consider PGD[1] Yes/No/ Unsure	p
No	191	36/156		125/28/37		71/56/48	
Unsure	15	6/9		12/1/2		8/3/3	
Overall	**370**	**88/276**		**262/38/64**		**154/87/97**	

Abbreviations: PGD, preimplantation genetic diagnosis; HBOC, hereditary breast and ovarian cancer syndrome; LS, Lynch syndrome; FAP, familial adenomatous polyposis; MEN, multiple endocrine neoplasia

[1] excludes 24 individuals who indicated they did not want children, or could not have them

[2] excludes 72 individuals who had completed childbearing before syndrome was diagnosed

Table 3

Other Factors Associated with Consideration of PGD

More Likely to Consider PGD	p	Less Likely to Consider PGD	P
Higher perceived severity of disease	.008	Feel PGD interferes with nature	<.001
Feel strongly that child not inherit syndrome	<.001	Feel good quality of life is attainable with syndrome	<.001
Would consider adoption	<.001		
Higher concern about blame	<.001		
Feel PGD could lower overall cost of family's healthcare	<.001		
Would have support of spouse and family	<.001		

Abbreviations: PGD, preimplantation genetic diagnosis