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Title: Knowledge, attitude and ethical consideration of Chinese couples requesting pre-implantation genetic testing in Hong Kong

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Running title: Knowledge, attitude and ethical concerns of couples for PGT

ABSTRACT

Aim: Increasing pre-implantation genetic testing (PGT) cycles are being performed in Hong Kong. This study aims to evaluate the knowledge, attitude, ethical consideration of Chinese couples towards PGT.

Methods: Couples requesting PGT between June 2013 and March 2014 were invited to complete a questionnaire.

Results: Total 49 couples (49 women, 47 men) completed the questionnaires. 18 couples (37%) were waiting for PGT (Pre-PGT group), 15 couples (31%) were undergoing PGT (PGT group), and 16 couples (32%) had completed at least one PGT cycle (Post-PGT group). Only 53% of the couples could tell the recurrent risk, and 31 % (with monogenic disorders) could tell the mode of inheritance of their condition. The acceptability of PGT (>80%) and attitude towards the embryo fate (58% -78%) were good. The Post-PGT group had more concern than the PGT and pre-PGT groups on the prenatal diagnostic testing (p=0.007**). 12.5% of the couples worried about the transfer of healthy embryos with carrier state and they all had monogenic disorders. If the prenatal testing confirmed an affected fetus, a higher percentage (32%) in the Post-PGT group disagreed to terminate the pregnancy in contrast to a much lower 6% in the Pre-PGT group (p=0.02**). Three-quarter of the couples opted to tell their child about their conception through PGT.

Conclusions: Chinese couples in Hong Kong had an overall good acceptability and positive attitude towards PGT. We appreciate the difficulties the couples have to gone through PGT. A checklist on what to cover pre-during-post-PGT in the counseling process, is needed.

Key words

Pre-implantation genetic testing, attitude, concern, Chinese couples

TEXT

Introduction:

Pre-implantation genetic testing (PGT) is developed for couples whose offspring is at risk of inherited diseases from severe monogenic disorders, structural chromosome abnormalities or mitochondrial disorders [1]. It includes the testing of embryos for genetic defects and requires in vitro fertilization, embryo biopsy, and use of molecular methods at the single cell level. The first baby conceived by PGT was born in 1990 [2]. Since then the PGT technology has developed rapidly, and such service has been established in over 50 countries and gradually gained popularity among couples with high genetic risks. The 13th Preimplantation Genetic Diagnosis Consortium of the European Society of Human Reproduction and Embryology revealed that 7600 babies were born from PGT [3].

PGT is now an established alternative to prenatal diagnosis to select genetically disease-free embryos in vitro before transfer back to the mother. A number of studies have examined the acceptability of PGT among couples at high genetic risks. While early studies found that more couples favored prenatal diagnosis than PGT [4-8], more recent studies revealed a reverse trend with more showing preference of PGT over prenatal diagnosis [9-12]. All the studies showed that the overall acceptance of PGT was high with only a small percentage of the couples thinking that PGT was unacceptable [13]. Our previous study in women at risk of giving birth to a child with thalassemia major in Hong Kong also indicated that 82.3% of the women considered PGT either the same or better than conventional prenatal diagnosis [8].

Our group is the first one to provide PGT program in Hong Kong. In Hong Kong, PGT is allowed for detection of serious genetic conditions or abnormalities that significantly affect the health of an individual who might be born. The use of PGT is decided following discussion among those seeking PGT (i.e. the parents) and the clinical team consisting of two doctors with one having proper training in clinic genetics and /or genetic counselling on the seriousness of the genetic condition or

abnormality and their experience and perception of abnormality (http://www.chrt.org.hk/english/publications/publications_code.html). Since our report on two successful PGT performed in 2001 using fluorescent in-situ hybridization for chromosomal abnormalities [14] and our first live birth for α-thalassemia in 2005 [15], the number of couples requesting PGT continued to increase over the years. Therefore, there is a need to have a better understanding of the couples' knowledge of their genetic conditions, as well as their moral attitude, concern and ethical consideration towards PGT.

Methods:

This was a cross-sectional study carried out in the Centre of Assisted Reproduction & Embryology at the Department of Obstetrics and Gynecology, Queen Mary Hospital between June 2013 and March 2014. Approval by the Institutional Review Board of The University of Hong Kong and Hospital Authority Hong Kong West Cluster was obtained. We have recruited all the Chinese couples who had enrolled to the PGT program in our hospital in the past years and only those who declined PGT treatment after counselling or just underwent aneuploidy screening because of advanced maternal age or recurrent miscarriages were excluded from this study. Written consent was obtained from each partner of the couples. The couples were divided into 3 groups. In the Pre-PGT group, the couples were attending the counselling for PGT, which would be started within 2-3 months. In the PGT group, the couples were undergoing ovarian stimulation for PGT. In the post-PGT group, they had completed at least one PGT cycle.

Each partner of the recruited couple completed a separate questionnaire when attending the out-patient

clinics. The questionnaire (Appendix) was divided into four parts. The first part collected background information including the age, history of previous pregnancies and the indication for PGT. The second part assessed the individual's knowledge on the genetic condition for PGT, and their understanding of the mode of inheritance and the inherited recurrent risk of having an affected baby. The third part enquired about the individual's attitude towards PGT and its related procedures, and the fourth part asked about the individual's moral perspectives toward PGT.

Statistical analysis

Continuous variables were provided as mean ± standard deviation if normally distributed, and as median (interquartile range) if not normally distributed. Statistical comparison was carried out with Chi-square test among Pre-PGT, PGT and Post-PGT groups, and between monogenic disorder and chromosomal abnormalities groups, and with McNemar's test between man and woman within a couple. The two-tailed value of $P < 0.05$ was considered statistically significant.

Results:

All the Chinese couples that were joining the PGT program in our hospital which is a tertiary referral centre for such service, participated this study and there was zero dropout rate for those participating couples. Out of 49 couples recruited, 49 women and 47 men completed the questionnaires. The median age (interquartile range) for women was 34.7 (31.2-37.0) years and that of men were 37.0 (33.8-43.0) years. Around one-third (37%; 18 couples) were from the Pre-PGT group, another one-third (31%; 15 couples) were from the PGT group, and the remaining one-third (32%; 16 couples) were from the Post-PGT group. The indications for PGT were monogenic disorders that included lethal or severe autosomal dominant, recessive and X-linked diseases accounting for 67% (33 couples) while chromosomal abnormalities accounted for 33% (16 couples) (Table 1).

Knowledge on their genetic abnormality

Overall 90% of the couples could correctly tell whether oneself or the partner is carrying the genetic abnormality. Around one-third (31%) of the couples, mainly related to monogenic disorders, had correct knowledge about the mode of inheritance. Overall half (53%) of the couples can tell the risk of having an affected offspring correctly. For the couples with the chromosomal abnormalities, only one-third of them could give a correct answer of recurrent risk at 75% or higher. For the couples with monogenic disorders, two-third of them could tell the recurrent risk accurately. (Table 2)

Attitudes towards PGT

Most of the couples found the embryo biopsy (83%), the time required (86%) and the financial cost (82%) of the PGT procedures acceptable. 76% of couples would also like to tell their children about the PGT and conception via in vitro fertilization if they had given birth to a healthy baby through PGT. There was no significant difference in the couples' opinion among the Pre-PGT, the PGT and Post-PGT groups (Table 3).

Concerns about PGT treatment

Among all couples, 37% worried about the prenatal diagnostic confirmatory (PDC) testing need to confirm diagnosis, 42% worried of diagnostic accuracy and 58% worried about the limited success rate of IVF treatment. There was an observed trend with most worries from the couples in the post-PGT group and least worries in the pre-PGT group, with intermediate response from the PGT group. For the the use of invasive PDC including chorionic villi sampling and amniocentesis when a PGT pregnancy is established, both the PGT group (43%) and the post-PGT group (58%) had a significantly higher percentage of worries response in contrast to the pre-PGT group (14%) ($p=0.007^{**}$) (Table 4).

Ethical considerations about PGT treatment

Overall, 78 % of the couples agreed to discard the genetically abnormal embryo. A lower percentage of the couples agreed to discard (58%) or to donate (58%) the surplus embryo for future research purpose. For the difficult situation of having an affected fetus after PGT confirmed with prenatal diagnosis, a high percentage (32%) of the couples in the Post-PGT group disagreed with the termination of pregnancy in contrast to a much lower 6% in the Pre-PGT group (p=0.02**). Eighty-one percent of the couple regarded discarding an affected embryo prior to implantation is less " wrongful" or more acceptable than the termination of an affected pregnancy. (Table 5).

Views of couples with single gene disorders or with underlying chromosomal abnormalities

The couples with underlying chromosomal abnormalities had more concern of the embryo biopsy (p=0.02*) and less ready to tell their children about IVF and PGT (p=0.02*) when compare with the couples with monogenic disorders. We also found the couples with monogenic disorder had more worries about the prenatal diagnostic testing for the established pregnancy with PGT than those with chromosomal abnormalities (p<0.01**). For the transfer of healthy embryos with carrier state, while overall 12.5 % of the couples expressed concern (Table 4), all of the concerned couples were from the monogenic disorder group. For the ethical consideration, there is no major difference in the couples' responses among the two groups (Table 6).

Views between men and women

There were no differences in knowledge of their genetic abnormality, attitudes, concerns and ethical consideration about PGT between men and women (data not shown).

Discussion:

The present study showed that couples with monogenic disorders could have difficulty in telling the correct mode of inheritance of their genetic condition and the recurrence risk of having an affected offspring related to their mode of inheritance. Couples with chromosomal abnormalities had more

difficulty in telling the possible recurrent risk of having an affected baby. Despite the fact that the recurrence risk for monogenic disorder is more straight forward, as it would be 25% for autosomal recessive disorder, 50% for autosomal dominant disorder, and 25% for the affected male in X-linked recessive disorder, the concepts, however, could be difficult for the lay persons to understand. For those with underlying chromosomal translocation problems, the counselling on the recurrent risk for the next pregnancy is more complex as the mechanism is more complicated and depends on the different specific condition, and lower percentage of couples could report the high recurrent risk correctly.

We found our Chinese couples have an overall good acceptability for PGT including the embryo biopsy, the treatment time required and the financial cost from the treatment. This could be related to the counseling which was provided before PGT was started and also during PGT treatment, aiming to ensure that the participating couples fully understand the risk of having an affected child related to the underlying genetic condition, and the benefits and limitations of all available options for PGT and prenatal diagnosis. Couples were also informed about the fact that while PGT can reduce the risk of conceiving a child with a genetic defect carried by one or both parents if the defect can be found with tests performed on a single cell or on embryo biopsy, invasive prenatal testing to confirm the results of PGT was still necessary, as the methods used for PGT have technical limitations that included the possibility of false negative result. The parents therefore have a realistic expectation of the PGT treatment process and its technical limitation.

Three quarter of the couples opted to tell their child later about the PGT conception if they had a healthy child from a successful PGT pregnancy. This finding is similar to a previous UK study with over 90% of the couples with a child/twin conceived from PGT expressing wish to tell their child later about how they were conceived [20]. In that study, the parents wished to have advice on the best time and the best way to tell their child, and the best person to do the explanation. Written information and supportive counseling to prepare the parents on how to explain to their children at a follow-up consultation session will be helpful.

A significantly higher percentage of those in the PGT and post-PGT groups have concerns on 'prenatal testing including the invasive chorionic villus sampling and amniocentesis are recommended as a secondary confirmatory test". This is understandable as these couples have experienced the actual invasive prenatal testing procedures so the more concern. For the couples with single gene disorders, they usually do not have infertility problem and can conceive through natural pregnancy. Having to go through repeated IVF cycles to achieve a successful pregnancy and to have further invasive prenatal diagnostic study could be stressful for them. For the "transfer of healthy embryos with carrier state", while it is generally acceptable to transfer healthy carrier embryos of an autosomal recessive disease or the healthy carrier female embryos of an X-linked disorder, our study found couples with monogenic disorder expressed worries on this arrangement. One possible explanation is that these couples, despite their understanding of the fact that their child being a carrier will be asymptomatic like themselves, they know that their child still carries the potential risk of passing on the genetic condition to the next generation. Therefore, they are reluctant to have a child after growing up has to go through the stress they have gone through from all the required investigations and interventions in order to avoid passing on the genetic risk to their next generation.

For the ethical consideration about the fate of the embryos, majority of the couples (78%) agreed to discard the genetically abnormal embryos. For discarding the remaining embryos irrespective of the genetic status if no further IVF/PGT pregnancy is planned, only half of the couples (58%) agreed to do so and a quarter of the couples (23%) disagreed to this arrangement. One suggested possible explanation was that couples who sought PGT treatment had actual concern of having an affected pregnancy with natural conception, so they would be more ready to go for another same treatment to fulfil further fertility wish. Another possibility is that they feel uncomfortable of discarding the unaffected embryo with ethical concern. Similarly, for the donation of the remaining embryos to research purpose if no further PGT pregnancy was planned, only half of the couples (58%) agreed to do so and 29% refused the suggestion. This finding highlights the complexity in counseling when the

clinicians are to discuss the possible arrangement of the remaining embryos after PGT. Multiple factors including individuals' moral value, religious belief, previous reproductive history, underlying genetic condition and the pregnancy rate per PGT cycle, could all affect the couple's decision on the embryo fate.

For the hypothetical difficult situation of termination of the pregnancy if the IVF/PGT fetus was confirmed to be genetically affected, one -third of the couples (32%) in the Post-PGT group, and 13% in the PGT group disagreed, in contrast to only 6% of the couples in the Pre-PGT group disagreed to do so. This result highlights the difficult dilemma a clinician and the parents could face if such scenario occurs. The observed differences in the responses among the three groups suggested that difficult decision by the parents could be affected by their emotional attachment to the current pregnancy, on top of their moral value towards the affected fetus. Genetic counselling by a certified geneticist or genetic counsellor in this situation to ensure that the recruited couples can fully understand the risk of having an affected child related to the underlying genetic condition could be helpful to the couples when making their final decision. For the moral judgment on whether 'discarding the affected embryos prior to implantation is less wrongful or more acceptable to the termination of pregnancy of an affected fetus', majority of the couples (81%) agreed on this. This moral perspective of the couples supports PGT as an acceptable option to many of the couples.

The limitation of the present study includes a smaller sample size. However, we have recruited all the Chinese couples that were participating the PGT program in our hospital which is a tertiary referral centre for such service, and there was zero dropped out rate for those participating couples, so the recruited couples are a good representation of our study population. PGT is a relatively new technology with rapid improvement in platforms of the genetic testing. However, the questionnaire focuses on the knowledge on the genetic problems, attitude, ethical consideration of the couples towards PGT. These may not be changed very much despite improvement of technology itself.

In conclusion, the Chinese couples selected PGT over the alternative prenatal diagnosis and had an overall good acceptability of PGT irrespective of the treatment stages they were experiencing. Most couples do not have major ethical concern of discarding a genetically abnormal embryo and regarded it as less wrongful than termination of pregnancy. We appreciate the difficult decisions the couples are going through, whether to go for further prenatal diagnosis, to continue an affected pregnancy after PGT, or to replace the carrier embryos and even to tell their children when they grow up. The difficulty for the couples to understand the genetic basis of their own genetic condition is also well acknowledged. A checklist with user suggestion on what to cover in the counseling process, pre-and-during-post PGT, will be useful to the team when supporting the recruited families. The design of counseling aids to help the couples to understand the mode of inheritance and recurrence risk better, but not of too much detail, will also assist them when deciding for PGT.

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TABLE TITLE AND LEGEND

Table 1. Indication for PGT and partners carrier status

Table 2. Knowledge on their genetic problems

P-value was calculated using Chi-square test. There is no significant difference in the knowledge on their genetic problems among the three groups, but significant difference between the single gene disorder and chromosomal abnormalities groups (* $p<0.05$; ** $p<0.01$).

Table 3. Attitudes towards PGT

IVF: in vitro fertilization.
P-value was calculated using Chi-square test (among-the three-groups). There is no significant difference in the different attitude toward PGT among the three groups.

Table 4. Concerns of the couples about PGT treatment

IVF: in vitro fertilization; PDC: prenatal diagnostic confirmatory testing including ultrasound follow-up study, chorionic villus sampling or amniocentesis.
P-value was calculated using Chi-square test (among the -three-groups). There is significant difference (** $p<0.01$) in the responses to the question on the 'need of PDC to confirm diagnosis' among the three groups.

Table 5. Ethical considerations about embryo fate and affected fetus in PGT

PDC: prenatal confirmatory diagnostic testing including ultrasound follow-up study, chorionic villus sampling or amniocentesis.

P-value was calculated using Chi-square test (among the -three-groups). There is significant difference (*p<0.05) in the response to the question on ‘terminating pregnancy if fetal abnormality detected at PDC’ among the three groups.

Table 6. Views from couples with monogenic disorders and chromosomal abnormalities

IVF: in vitro fertilization; PDC: prenatal confirmatory diagnostic testing.
P-value was calculated using Chi-square test (between-two-groups). There are significant differences in the acceptability to embryo biopsy (*p<0.05), willingness to tell their child (*p<0.05), PDC use to confirm the diagnosis (**p<0.01) and replacement of carrier embryos (*p<0.05) between the two groups.

TABLES

Table 1. Indication for PGT and partners carrier status

Partners carrying the genetic abnormality	**Number of couples**
1. Both men and women	20
2. Women only	18
3. Men only	11
Indication for PGT	**Number of couples**
1. Single gene disorders	33
a. Autosomal dominant	*10*
b. Autosomal recessive	*20*
c. X-linked recessive	*3*
2. Chromosomal abnormalities	16
a. Balanced translocation	*10*
b. Robertsonian translocation	*6*

Table 2. Knowledge on their genetic problems

	Pre-PGT group (n=35)	PGT group (n=30)	Post-PGT group (n=31)	**P-value#**
Correct knowledge about the partner carrying the genetic abnormality	34/35 (97%)	27/30 (90%)	30/31 (97%)	0.362
Correct knowledge about mode of inheritance (for monogenic disorder only)	9/23 (39%)	6/20 (30%)	5/21 (24%)	0.543
Correct knowledge about risk of each offspring being affected	14/35 (40%)	16/30 (53%)	21/31 (68%)	0.079

P-value was calculated using Chi-square test (between-group comparison).
There is no statistically significant difference in the knowledge on their genetic problems among the three groups.

Table 3. Attitudes towards PGT

	Total (n=96)	Pre-PGT group (n=35)	PGT group (n=30)	Post-PGT group (n=31)	**P-value#**
Acceptability of embryo biopsy - Yes - No comment - No		28/35 (80%) 7/35 (20%) 0/35 (0%)	26/30 (87%) 4/30 (13%) 0/30 (0%)	26/31 (84%) 4/31 (13%) 1/31 (3 %)	0.702
Acceptability of duration of treatment process - Yes - No comment - No		34/35 (97%) 0/35 (0%) 1/35 (3%)	23/30 (76%) 3/30 (10%) 4/30 (13%)	26/31 (84%) 1/31 (3%) 4/31 (13%)	0.212
Acceptability of cost - Yes - No comment - No		30/35 (86%) 4/35 (11%) 1/35 (3%)	25/30 (83%) 4/30 (13%) 1/30 (3%)	24/31 (77%) 3/31 (10%) 4/31 (13%)	0.467
Willingness to disclose to child about IVF and PGT - Yes - No comment - No		28/35 (80%) 6/35 (17%) 1/35 (3%)	22/30 (73%) 6/30 (20%) 2/30 (7%)	23/31 (74%) 4/31 (13%) 4/31 (13%)	0.578

P-value was calculated using Chi-square test (between-group comparison); IVF: in vitro fertilization.
There is no statistically significant difference in the attitude toward PGT among the three groups.

Table 4. Concerns of the couples about PGT treatment

	Total (n=96)	Pre-PGT group (n=35)	PGT group (n=30)	Post-PGT group (n=31)	**P-value#**
Diagnostic inaccuracy - Absolutely not worried/Not worried - Neutral - Worried/ Very worried		17/35 (49%) 6/35 (17%) 12/35 (34%)	15/30 (50%) 4/30 (13%) 11/30 (37%)	13/31 (42%) 1/31 (3%) 17/31 (55%)	0.279
Limited success rate of IVF treatment - Absolutely not worried/Not worried - Neutral - Worried/Very worried		11/35 (31%) 6/35 (17%) 18/35 (52%)	7/30 (23%) 5/30 (17%) 18/30 (60%)	6/31 (19%) 5/31 (16%) 20/31 (65%)	0.823
Need PDC to confirm diagnosis - Absolutely not worried/Not worried - Neutral - Worried/Very worried		21/35 (60%) 9/35 (26%) 5/35 (14%)	12/30 (40%) 5/30 (17%) 13/30 (43%)	10/31 (32%) 3/31 (10%) 18/31 (58%)	0.007**
Replacement of carrier embryos - Absolutely not worried/Not worried - Neutral - Worried/Very worried		26/35 (74%) 7/35 (20%) 2/35 (6%)	17/30 (57%) 8/30 (27%) 5/30 (16%)	21/31 (68%) 5/31 (16%) 5/31 (16%)	0.459

P-value was calculated using Chi-square test (between-group comparison); IVF: in vitro fertilization; PDC: prenatal diagnostic confirmatory testing including ultrasound follow-up study, chorionic villus sampling or amniocentesis.
There is statistically significant difference in the responses to the question on the 'need of PDC to confirm diagnosis' among the 3 groups.

Table 5. Ethical considerations about embryo fate and affected fetus in PGT

	Total (n=96)	Pre-PGT group (n=35)	PGT group (n=30)	Post-PGT group (n=31)	**P-value#**
Discarding of genetically abnormal embryo - Absolutely disagree/disagree - Neutral - Agree/absolutely agree		2/35 (6%) 7/35 (20%) 26/35 (74%)	2/30 (7%) 7/30 (23%) 21/30 (70%)	1/31 (3%) 2/31 (6%) 28/31 (91%)	0.372
Discarding of surplus embryos - Absolutely disagree/disagree - Neutral - Agree/absolutely agree		8/35 (23%) 6/35 (17%) 21/35 (60%)	10/30 (33%) 6/30 (20%) 14/30 (47%)	4/31 (13%) 6/31(19%) 21/31 (68%)	0.400
Donating surplus embryos for research - Absolutely disagree/disagree - Neutral - Agree/absolutely agree		10/35 (29%) 5/35 (14%) 20/35 (57%)	9/30 (30%) 6/30 (20%) 15/30 (50%)	9/31(29%) 1/31 (3%) 21/31(68%)	0.352
Terminating pregnancy if fetal abnormality detected at PDC - Absolutely disagree/disagree - Neutral - Agree/absolutely agree		2/35 (6%) 7/35 (20%) 26/35 (74%)	4/30 (13%) 6/30 (20%) 20/30 (67%)	10/31 (32%) 9/31 (29%) 12/31 (39%)	0.020*
Discarding affected embryos is more acceptable than terminating an abnormal fetus - Absolutely disagree/disagree - Neutral - Agree/absolutely agree		3/35 (9%) 3/35 (9%) 29/35 (83%)	2/30 (7%) 4/30 (13%) 24/30 (80%)	3/31 (10%) 3/31 (10%) 25/31 (80%)	0.967

P-value was calculated using Chi-square test (between-group comparison); PDC: prenatal confirmatory diagnostic testing including ultrasound follow-up study, chorionic villus sampling or amniocentesis.
There is statistically significant difference in the response to the question on 'terminating pregnancy if fetal abnormality detected at PDC' among the 3 groups.

Table 6. Views from couples with monogenic disorders and chromososmal abnormalities

	Single gene disorders		Chromosomal abnormalities		P - value
	Pat. No	%	Pat. No.	%	
Acceptability of embryo biopsy					0.02
- Yes	57	89	22	69	
- No comment	1	2	0	0	
- No	6	9	10	31	
Acceptability of duration of treatment process					0.07
- Yes	53	83	30	94	
- No comment	9	14	0	0	
- No	2	3	2	6	
Acceptability of cost					0.17
- Yes	50	78	29	91	
- No comment	6	9	0	0	
- No	8	13	3	9	
Willingness to disclose to child about IVF and PGT					0.02
- Yes	48	75	25	78	
- No comment	2	3	5	16	
- No	14	22	2	6	
Diagnostic inaccuracy					0.63
– Absolutely not worried/Not worried	30	47	15	47	
– Neutral	6	9	5	16	
– Worried/ Very worried	28	44	12	37	
Limited success rate of IVF treatment					0.11
– Absolutely not worried/Not worried	14	22	10	31	
– Neutral	8	12	8	25	
– Worried/Very worried	42	66	14	44	
Need PDC to confirm diagnosis					<0.01
- Absolutely not worried/Not worried	27	42	16	50	
- Neutral	7	11	10	31	
- Worried/Very worried	30	47	6	19	
Replacement of carrier embryos					0.02
- Absolutely not worried/Not worried	41	64	23	72	
- Neutral	11	17	9	28	
- Worried/Very worried	12	19	0	0	
Discarding of genetically abnormal embryo					0.06
- Absolutely disagree/disagree	53	83	22	69	
- Neutral	10	16	6	19	
- Agree/absolutely agree	1	1	4	12	
Discarding of surplus embryos					0.06
- Absolutely disagree/disagree	41	64	15	47	
- Neutral	13	20	5	16	
- Agree/absolutely agree	10	16	12	37	
Donating surplus embryos for research					0.81
- Absolutely disagree/disagree	38	59	18	56	
- Neutral	7	11	5	16	
- Agree/absolutely agree	19	30	9	28	
Terminating the pregnancy if fetal abnormality detected at PDC					0.81
- Absolutely disagree/disagree	44	69	20	63	
- Neutral	11	17	7	22	
- Agree/absolutely agree	9	14	5	15	
Discarding affected embryos is more acceptable than terminating an abnormal fetus					0.22
- Absolutely disagree/disagree	55	86	23	72	
- Neutral	6	9	5	16	
- Agree/absolutely agree	3	5	4	12	