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ESHRE PGD Consortium data collection XI: cycles from January to December 2008 with pregnancy follow-up to October 2009†

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ABSTRACT: The 11th report of the European Society of Human Reproduction and Embryology Preimplantation Genetic Diagnosis Consortium is presented, documenting cycles collected for the calendar year 2008 and follow-up of the pregnancies and babies born until October 2009 which resulted from these cycles. Since the beginning of the data collections, there has been a steady increase in the number of cycles, pregnancies and babies reported annually. For data collection XI, 53 centres have participated, reporting on 5641 cycles to oocyte retrieval (OR), along with details of the follow-up on 1418 pregnancies and 1169 babies born. A total of 774 OR were reported for chromosomal abnormalities, 96 OR for sexing for X-linked diseases, 1363 OR for monogenic diseases, 3401 OR for preimplantation genetic screening and 5 OR for social sexing. Data XI is compared with the cumulative data for data collections I–X.

Key words: PGD / preimplantation genetic screening / fluorescence *in situ* hybridization / PCR / ESHRE PGD Consortium

Introduction

The European Society of Human Reproduction and Embryology (ESHRE) Preimplantation Genetic Diagnosis (PGD) Consortium was established in 1997. Since 1999, 10 data collections of PGD for autosomal and sex-linked monogenic diseases and chromosome abnormalities, preimplantation genetic screening (PGS) and social sex selection have been published (ESHRE PGD Consortium Steering Committee, 1999, 2000, 2002; Sermon *et al.*, 2005, 2007; Harper *et al.*, 2006, 2010b; Harper *et al.*, 2008b; Goossens *et al.*, 2008). This report summarizes data XI collected for the calendar year 2008 and the subsequent pregnancies. Data XI also includes the delivery rate for each indication.

Materials and Methods

Data were collected using a FileMaker Pro 5, 6 or 8 database, consisting of files for cycle, pregnancy and baby records. The submitted data were thoroughly analysed to identify omissions and any ambivalent data. Corrections were requested from the participating centres. Records with insufficient data, e.g. with no cycle, no patient identification, no clear indication or from an incorrect time period were excluded from the calculations. Detailed corrections and tables were made by expert co-authors. Clinical pregnancies were defined as the presence of one or more fetal hearts at ~6 weeks of gestation. Implantation rate was defined as the number of fetal hearts per 100 embryos transferred. Delivery rate was defined as the percentage of pregnancies with delivery per oocyte retrieval (OR) and per embryo transfer procedure.

†ESHRE pages documents are approved by the Executive Committee of ESHRE and have not been externally peer-reviewed.

Table Ia Overall cycle data collection I–X.

Indication	PGD	PGS	PGD-SS	Total
Cycles to OR	10 153[a]	16 806	671	27 630[a]
Number infertile	3766	14 030	104	17 900
Female age (years)	33	37	36	35
Cancelled before IVF/ICSI	52	2	0	20
ART method				
IVF	1079	1868	166	3113
ICSI	8847	14 502	481	23 830
IVF + ICSI	52	324	0	376
Frozen + ICSI + IVF + unknown	139[a]	60	24	223[a]
Unknown	20	50	0	70
Cancelled after IVF/ICSI	525	462	16	1003
Cycles to PGS/PGD	9612	16 342	655	26 609
FISH	5017	16 339	473	21 829
PCR	4578	3	182	4763
FISH + PCR	17	0	0	17
Zona breaching				
AT drilling	3910	4688	26	8624
Laser drilling	5182	10 083	202	15 467
Mechanical	506	1506	427	2439
Unknown	14	65	0	79
Biopsy method				
PB biopsy	162[b]	2708[b]	0	2870[b]
Cleavage aspiration	8875[b]	12 805[b]	156	21 836[b]
Cleavage extrusion	414	754	499	1667
Cleavage flow displacement	16	22	0	38
Blastocyst	91	2	0	93
PB and cleavage	49	0	0	49
Unknown	16	52	0	68
Embryology				
COC's	137 386	193 251	9329	339 966
Inseminated	116 040	159 527	7779	283 346
Fertilized	83 726	113 192	5439	202 357
Biopsied	62 365	90 404	4285	157 054
Successfully biopsied	61 526	89 373	4147	155 046
Diagnosed	55 560	82 596	3709	141 865
Transferable	20 517	29 278	1454	51 249
Transferred	13 408	21 543	993	35 944
Frozen	2923	3884	343	7150
Clinical outcome				
Cycles to ET	7338	12 071	492	19 901
hCG positive	2553	4085	197	6835
Positive FHB	2014	3210	143	5367
Clinical pregnancy rate				
(% per OR/% per ET)	20/27	19/26	21/29	19/27

OR, oocyte retrieval; AT, acid Tyrode's solution; COC, cumulus–oocyte complex; SS, social sexing; PGS, preimplantation genetic screening; FISH, fluorescence *in situ* hybridization; ET, embryo transfer; ART assisted reproduction technology; PB, polar body; FHB: fetal heart beat.

PGD column includes PGD for chromosome abnormalities, sexing for X linked disease and PGD for monogenic disorders.

[a]Includes two cycles with PGD on frozen embryos only. These cycles were not counted in the cycles with OR.

[b]Twelve cycles had PB biopsy and cleavage stage biopsy.

Table Ib Overall cycle data collection XI.

Indication	PGD	PGS	PGD-SS	Total
Cycles to OR	2235	3401	5	5641
Number infertile	752	2899	0	3651
Female age (years)	35	38	36	37
Cancelled after OR but before IVF/ICSI	0	0	0	0
ART method				
IVF	201	388	2	591
ICSI	2018	2993	3	5014
IVF + ICSI	10	20	0	30
Frozen + ICSI, IVF	6	0	0	6
Cancelled after IVF/ICSI	99	17	0	116
Cycles to PGS/PGD	2136	3384	5	5525
FISH	834	3384	5	4223
PCR	1291	0	0	1291
FISH + PCR	11	0	0	11
Zona breaching				
AT drilling	494	655	0	1149
Laser drilling	1520	2433	5	3958
Mechanical	122	296	0	418
Biopsy method				
PB biopsy	42	838	0	880
Cleavage aspiration	2010	2436	2	4448
Cleavage extrusion	56	108	3	167
Blastocyst	10	2	0	12
PB and cleavage	18	0	0	18
Embryology				
COCs	29 322	36 540	47	65 909
Inseminated	24 645	30 652	43	55 340
Fertilized	17 593	21 633	32	39 258
Biopsied	13 259	17 259	23	30 541
Successfully biopsied	13 098	17 147	19	30 264
Diagnosed	12 114	16 218	17	28 349
Transferable	4701	5191	8	9900
Transferred	2636	4024	5	6665
Frozen	921	643	0	1564
Clinical outcome				
Cycles to ET	1593	2411	2	4006
hCG positive	627	890	0	1517
Positive FHB	485	715	0	1200
Clinical pregnancy rate (% per OR/% per ET)	22/30	21/30	0	21/30
Number of FHBs	588	892	0	1480
Implantation rate (FHBs/100 embryos transferred)	22	22	0	22
Deliveries	413	556	0	969
Delivery rate (% per OR/% per ET)	18/26	16/23	0	17/24
Miscarriages	58	109	0	167
Miscarriage rate (% per clinical pregn—pregn lost to FU)[a]	13	16	0	29
Clinical pregnancies lost to FU	31	50	0	81

FU, follow-up; PGD column includes PGD for chromosome abnormalities, sexing for X linked disease and PGD for monogenic disorders.
[a]% per number of clinical pregnancies minus the number of pregnancies that were lost to FU.

Table IIa PGD for chromosomal abnormalities, data collection I–X.

Indication	Robertsonian translocation, male carrier[a]	Robertsonian translocations, female carrier[b]	Reciprocal, male carrier[c]	Reciprocal, female carrier[d]	Sex chromosome aneuploidy[e]	Other	Total
Cycles to OR	742	471	1156	1257	337	290	4253
Number infertile	590	235	657	575	287	161	2505
Female age (years)	35	33	33	33	32	33	33
Cancelled before IVF/ICSI	0	0	3	0	7	2	12
ART method							
IVF	33	84	183	335	28	66	729
ICSI	692	371	929	881	298	215	3386
IVF + ICSI	4	7	8	12	3	3	37
Frozen + ICSI + IVF + unknown	12	9	32	29	1	4	87
Unknown	1	0	1	0	0	0	2
Cancelled after IVF/ICSI	42	25	79	84	22	17	269
Cycles to PGD	700	446	1074	1173	308	271	3972
Zona breaching							
AT drilling	305	230	568	646	116	126	1991
Laser drilling	374	202	465	480	154	114	1789
Mechanical	21	14	41	47	38	31	192
Biopsy method							
PB biopsy	2	10	1	18	1	1	33
Cleavage aspiration	656	409	1013	1074	299	255	3706
Cleavage extrusion	40	27	49	67	5	15	203
Cleavage flow displacement	2	0	2	4	3	0	11
Blastocyst	0	0	9	10	0	0	19
Embryology							
COC's	10 461	65 73	16 283	17 501	4225	3774	58 817
Inseminated	8710	5581	13 859	15 216	3481	3296	50 143
Fertilized	5910	4078	9863	11 208	2417	2383	35 859
Biopsied	4136	3101	7536	8719	1688	1888	27 068
Successfully biopsied	4081	3067	7428	8608	1670	1866	26 720
Diagnosed	3689	2831	6912	8062	1543	1736	24 773
Transferable	1402	828	1373	1558	681	543	6385
Transferred	949	606	1113	1266	466	375	4775
Frozen	178	78	77	87	69	63	552

Clinical outcome										
Cycles to ET	538	337	665	737	243	211	2731
hCG positive	204	117	207	235	83	56	902
Positive FHB	174	94	157	184	64	46	719
Clinical pregnancy rate (% per OR/% per ET)	23/32	20/28	14/24	15/25	19/26	16/22	17/26

[a]Five cycles included PGS.
[b]One cycle included PGS, two cycles included cystic fibrosis and one cycle sexing.
[c]One cycle included SS and three cycles included PGS.
[d]Five cycles included PGS, three cycles include the male partner with a reciprocal translocation and one cycle with the male partner with a supernumerary chromosome derived from chromosome 15.
[e]Seven cycles included PGS.

Results

The number of centres that become members of the PGD Consortium increases annually. Data from 53 centres were included in this report. The results are represented in tables according to an established lay out. Accompanying text is deliberately concise and seven tables are available in an electronic version only: Supplementary data, Table SIIc lists the abnormal karyotypes carried by the patients undergoing PGD, Supplementary data, Table SIIIc lists the X-linked diseases for which sexing was carried out, Supplementary data, Table SIVc lists the monogenic diseases for which PGD was carried out, Supplementary data, Tables SVIIIa (data I–X) and SVIIIb (data XI) list the complications of pregnancy and Supplementary data, Tables SXIIa (data I–X) and SXIIb (data XI) with the congenital malformations and the neonatal complications.

An overview of all cycles collected previously in data collections I–X can be found in Table Ia, while an overview of the current data collection can be found in Table Ib.

For all indications for PGD/PGS, ICSI was the most often used method of fertilization and cleavage-stage aspiration was the most commonly used method of biopsy. Overall zona pellucida drilling was more commonly performed using a laser (Table Ib).

PGD cycles for chromosomal abnormalities

Tables IIa and IIb summarize the 774 cycles to OR collected for data collection XI, a total number that is slightly higher than the previous year (729). In 17 cycles, PGD/PGS was simultaneously performed for an additional fluorescence *in situ* hybridization (FISH) indication and in 4 cycles PGD was simultaneously performed for an additional PCR indication. As for all years, data XI showed that PGD for reciprocal translocations was performed more often than for Robertsonian translocations or any other type of chromosome abnormality.

For reciprocal translocations, the number of cycles performed for female carriers equals that for male carriers, whereas for Robertsonian translocations, the majority (72%) is performed for male carriers.

Overall, half of the cycles are performed for infertile patients. The rate of infertility ranged from 20% in the group with chromosomal deletions up to 72% as observed in the groups with either sex chromosome aneuploidies and/or Robertsonian translocations carried by the male partner.

In 78% of all cycles, ICSI was used for fertilization, indicating its use for reasons other than male infertility.

The use of laser drilling for zona breaching is still increasing and covers two-thirds of all cycles in data XI.

Aspiration of blastomeres from cleavage stage embryos remains the preferred biopsy method (91%).

For data XI, 9807 oocytes were collected, a mean of 12.7 per cycle (range: 10.2 for sex chromosome aneuploidy to 14.6 for deletions). Of these, 59% (5802/9807) were fertilized (2 pronuclei) and 78% (4513/5802) of the resulting embryos were biopsied. Of the embryos successfully biopsied, 93% (4132/4452) gave a diagnostic result, of which only 27% (1123/4132) were transferable. As expected, the lowest percentage of transferable embryos was found in the reciprocal translocation group (19.8%), whereas generally 4 out of 10 embryos were transferable in the sex chromosome aneuploidy and inversion group. Of all transferable embryos, two-thirds were actually transferred and 15% were frozen.

Table IIb PGD for chromosomal abnormalities, data collection XI.

Indication	Robertsonian translocation, male carrier	Robertsonian translocation, female carrier	Reciprocal translocation, male carrier	Reciprocal translocation, female carrier	Sex chromosome aneuploidy	Deletion	Inversion	Other	Total
Cycles to OR	163[a]	64[b]	238[a]	220[c]	33	10	27	19	774
Number infertile (%)	118 (72.4)	25 (39.0)	131 (54.9)	83 (37.7)	24 (72.7)	2 (20)	20 (74.1)	11 (57.9)	414 (53.4)
Female age (years)	34.5	33.8	35.1	38.0	36.0	32.3	33.4	33.6	35.6
Cancelled after OR before IVF/ICSI			1	2					3
ART method									
IVF	7	14	53	75	3	2	4	1	159
ICSI	156	49	182	140	29	8	23	17	604
IVF + ICSI		1	2	3	1			1	8
Cancelled after IVF/ICSI	8		10	11	2	1	1		33
Cycles to PGD	155	64	227	207	31	9	26	19	738
Zona breaching									
AT drilling	40	21	84	74	3		4	5	231
Laser drilling	112	42	139	128	28	9	19	14	491
Mechanical	3	1	4	5			3		16
Biopsy method									
PB		1		3		2			6
Cleavage aspiration	143	58	209	191	24	6	26	16	673
Cleavage extrusion	10	4	16	13	7			3	53
Blastocyst	2	1	2			1			6
Embryology									
COCs (mean/OR)	2144 (13.2)	872 (13.6)	2987 (12.6)	2703 (12.3)	335 (10.2)	146 (14.6)	390 (14.4)	226 (11.9)	9807 (12.7)
Inseminated	1830	768	2530	2352	277	130	307	189	8386
Fertilized	1206	550	1780	1636	190	101	204	133	5802
Biopsied	925	416	1372	1319	152	59	159	111	4513
Successfully biopsied	919	413	1353	1292	150	59	155	111	4452
Diagnosed	859	382	1241	1220	138	50	146	96	4132
Transferable (%/diagnosed)	326 (38.0)	130 (34.0)	262 (21.0)	241 (19.8)	59 (42.8)	13 (26.0)	62 (42.5)	30 (31.3)	1123
Transferred	204	76	206	177	40	10	31	18	762
Frozen	68	29	26	25	8		13	3	172
Clinical outcome									
Cycles to ET (%/OR)	118 (72.4)	49 (77.0)	137 (57.4)	123 (55.9)	24 (72.7)	6 (60.0)	18 (66.7)	13 (68.4)	488 (63.0)
hCG positive	52	21	53	51	5	3	4	5	194
Positive FHB	44	14	39	40	4	3	3	4	151

Clinical pregnancy rate (% per OR/% per ET)	27.0/37.3	21.9/28.6	16.0/27.9	18.2/32.5	12.1/16.7	30.0/50.0	11.1/16.7	21.1/30.8	19.4/30.8
Number of FHB	52	22	46	41	4	4	6	5	180
Implantation rate (FHB 100 embryos transferred)	25.5	29.0	21.6	23.2	10.0	40.0	19.4	27.8	23.4
Deliveries	41	14	34	31	4	3	3	3	133
Delivery rate (% per OR/% per ET)	25.2/34.7	21.9/28.6	13.9/24.3	14.1/25.2	12.1/16.7	30.0/50.0	11.1/16.7	15.8/23.1	17.1/27.1
Miscarriages	3		3	7					13
(% per clinical pregn – pregn lost to FU)	7.7		8.3	18.4					9.0
Clinical pregnancies lost to FU			2	2				1	5

[a]Of which seven with an additional FISH indication (for details see list of indications).
[b]Of which four with an additional FISH indication (for details see list of indications).
[c]Of which six with an additional FISH indication and four with an additional PCR indication (for details see list of indications).

Table IIIa Sexing only for X-linked disease using PCR or FISH, data collection I–X.

	FISH	PCR	Total
Cycles to OR	1101	66	1167
Number infertile	260	0	260
Female age (years)	33	31	32
Cancelled before IVF/ICSI	2	0	2
ART method			
IVF	296	10	306
ICSI	788	56	844
IVF + ICSI	12	0	12
ICSI + frozen	2	0	2
IVF + frozen	1	0	1
Cancelled after IVF/ICSI	58[a]	1[b]	59[a,b]
Cycles to PGD	1041	65	1106
Zona breaching			
AT drilling	527	52	579
Laser drilling	463	3	466
Mechanical	51	10	61
Biopsy method			
PB	2	0	2
Cleavage aspiration	985	60	1045
Cleavage extrusion	47	5	52
Flow displacement	5	0	5
Blastocyst	2	0	2
Embryology			
COC's	14 532	912	15 444
Inseminated	12 770	701	13 471
Fertilized	9004	556	9560
Biopsied	6859	458	7317
Successfully biopsied	6719	422	7141
Diagnosed	6211	329	6540
Transferable	2154	178	2332
Transferred	1459	139	1598
Frozen	386[c]	58[d]	444[c,d]
Clinical outcome			
Cycles to ET	825	55	880
hCG positive	267	24	291
Positive FHB	211	17	228
Clinical pregnancy rate (% per OR/% per ET)	19/26[e]	26/31[e]	19/26[e]

[a]27 embryos from 2 cycles frozen before biopsy owing to hyperstimulation.
[b]20 embryos frozen before biopsy.
[c]11 cycles with embryos frozen without biopsy or after failed diagnosis included.
[d]13 cycles with embryos frozen without biopsy or failed diagnosis included.
[e]11 embryos transferred removed from calculations owing to lack of information regarding the number of FHB in pregnancies resulting from the transfer of those embryos.

From 774 cycles to OR, only 63% (488/774) resulted in an embryo transfer procedure (ranging from 55.9% for female reciprocal translocation carriers to 77.0% for female Robertsonian translocation

Table IIIb Sexing only for X-linked disease using FISH, data collection XI.

	FISH	Total
Cycles to OR	96	96
Number infertile	24	24
Female age (years)	34	34
ART method		
IVF	40	40
ICSI	53	53
IVF + ICSI	2	2
ICSI + frozen	1	1
Cancelled after IVF/ICSI	1	1
Cycles to PGD	95	95
Zona breaching		
AT drilling	29	29
Laser drilling	65	65
Mechanical	1	1
Biopsy method		
Cleavage aspiration	92	92
Cleavage extrusion	3	3
Embryology		
COCs	1189	1189
Inseminated	1042	1042
Fertilized	710	710
Biopsied	582	582
Successfully biopsied	575	575
Diagnosed	537	537
Transferable	160	160
Transferred	116	116
Frozen	12	12
Clinical outcome		
Cycles to ET	75	75
hCG positive	19	19
Positive FHB	13	13
Clinical pregnancy rate (% per OR/% per ET)	14/17	14/17
Number FHB	16	16
% Implantation rate (FHBs/100 embryos transferred)	14	14
Deliveries	11	11
Delivery rate (% per OR/% per ET)	11/15	11/15
Miscarriages	2	2
Miscariage rate (% per clinical pregn−pregn lost to FU)	15	15
Clinical pregnancies lost to FU	0	0

carriers). This is in agreement with previous data showing that a high level of chromosomally abnormal embryos is found in patients carrying chromosomal abnormalities.

A positive hCG was obtained in 194 cycles, with a positive heart beat in 151 cycles [19% per OR (151/774) and 31% per embryo transfer (151/488)]. Clinical pregnancy rates per OR and embryo transfer were higher for Robertsonian translocation carriers as compared with reciprocal translocation carriers. Overall, the implantation rate was 23% (180/760). Finally, the delivery rate was 17% per OR (133/774) and 27% per embryo transfer (133/488). There were 13 miscarriages (9% per clinical pregnancy), half of them occurring in the female reciprocal translocation group. Five clinical pregnancies were lost to follow-up.

PGD cycles for sexing for X-linked diseases

Tables IIIa and IIIb summarize the 1167 and 96 cycles to OR collected for data collections I–X and XI, respectively. This year, again, FISH was the only method used for sexing cycles. For data XI, 1189 oocytes were collected, 68% (710/1042) fertilized, 82% (582/710) of the resulting embryos were biopsied, with a successful biopsy in 99% (575/582) of the cases. Of the embryos successfully biopsied, 93% (537/575) gave a diagnostic result, of which only 30% (160/537) were transferable (male). From 96 OR procedures, only 78% (75/96) resulted in an embryo transfer procedure. A positive hCG was obtained in 19 cycles, with a positive heart beat in 13 cycles [14% per OR (13/96) and 17% per embryo transfer (13/75)]. This gave an implantation rate of 14% (16/116). Finally, the delivery rate was 11% per OR (11/96) and 15% per embryo transfer (11/75). There were 2/13 miscarriages (15% per clinical pregnancy) and no pregnancies were lost to follow-up.

PGD for monogenic diseases

Tables IVa and IVb summarize the 4733 and 1363 cycles to OR collected for data collections I–X and XI, respectively. All the monogenic diseases for which PGD was performed in the current data collection (XI) are listed in Supplementary data, Table SIVc. For data XI, the most common indications for PGD for autosomal recessive diseases were β-thalassemia and/or sickle cell syndromes (118 cycles plus 85 cycles for β-thalassemia and/or sickle cell syndromes with HLA compatibility, see below), cystic fibrosis (CF; 126 cycles and 2 cycles for CF and a second indication) and spinal muscular atrophy (SMA; 40 cycles and another 2 for SMA and a second indication). Amongst the autosomal dominant diseases, the most PGD cycles were performed for myotonic dystrophy type I (DM1) (126 cycles plus 2 cycles for DM1 and a second indication), Huntington disease (HD) (117 cycles plus 1 cycle for HD and a second indication), neurofibromatosis (42 cycles plus 2 cycles for neurofibromatosis I and a second indication) and familial adenomateous polyposis coli (30 cycles). For a specific diagnosis of X-linked diseases, the most common indications were for fragile X syndrome (110 cycles), Duchenne and Becker muscular dystrophy (30 cycles and 7 cycles, respectively) and haemophilia A and B (18 cycles and 2 cycles were for haemophilia A combined with a second indication). There were 32 cycles for HLA compatibility typing only and 106 cycles for HLA typing along with a specific disorder. The most common indication here was β-thalassemia/sickle cell anaemia (85 cycles). The total number of cycles with HLA typing has slightly decreased from 180 cycles in data X to 138 cycles in the current data collection.

For data XI, ICSI was used in the majority of cycles (99.5% of cycles to OR) and PCR was the most widely used method of DNA amplification (94.4% of cycles to OR). Whole genome amplification followed

Table IVa Cycles performed for single gene disorders using PCR, data collection I–X.

Indication	Autosomal recessive				Autosomal dominant		Specific X-linked			Other[a]	Total
	CF[b]	β-Thal/SC[c] and Thal/SC + HLA	SMA and SMA + retinitis pigmentosa[d]	HLA compatibility HLA + specific disease[e]	DM1[f]	HD and HD exclusion[g]	DMD and BMD[h]	FRAXA[i]	Haem[j]		
Cycles to OR	643	700	285	112	586	530	157	311	75	1334	4733
Number infertile	236	211	31	3	102	77	18	76	10	237	1001
Female age (years)	34	34	33	35	32	31	34	33	32	31	32
Cancelled before IVF/ICSI	0	0	0	0	3	0	0	0	0	1	4
Art method											
IVF	16	0	2	0	1	0	3	4	6	12	44
ICSI	618	686	276	109	576	523	148	305	67	1309	4617
IVF + ICSI	0	0	0	0	1	0	1	0	1	0	3
IVF + ICSI + frozen	4	14	7	3	2	4	5	0	1	9[k]	49[k]
Unknown	5	0	0	0	3	3	0	2	0	5	18
Cancelled after IVF/ICSI	25	28	12	6	31	14	10	15	2	54	197
Cycles to PGD	618	672	273	106	552	516	147	296	73	1281[a]	4534[a]
Zona breaching											
AT drilling	259	185	92	13	154	199	48	54	24	312	1340
Laser drilling	325	473	160	93	367	292	93	211	47	866	2927
Mechanical	30	14	21	0	29	22	6	29	2	100	253
Unknown	4	0	0	0	2	3	0	2	0	3	14
Biopsy method											
PB biopsy	19[l]	2	2	0	18[l]	5	4	12[l]	2[l]	63[l]	127[l]
Cleavage aspiration	563[l]	613	243	92	517[l]	477	137	264[l]	71[l]	1147[l]	4124[l]
Cleavage extrusion	31	14	28	6	11	30	1	4	1	33	159
Blastocyst	2	43	0	7	0	1	2	4	0	11	70
PB + embryo	1	0	0	0	5	0	3	10	0	25	44
Unknown	7	0	0	0	2	3	0	3	0	6	21
Embryology											
COCs	8419	9819	3972	1486	7182	7241	2054	3466	975	18 511	63 125
Inseminated	7143	8099	3118	1205	6096	6028	1692	2901	842	15 302	52 426
Fertilized	5019	6079	2243	933	4442	4283	1278	2137	628	11 265	38 307

Continued

Table IVa *Continued*

Indication	Autosomal recessive				Autosomal dominant		Specific X-linked			Other[a]	Total
	CF[b]	β-Thal/SC[c] and Thal/SC + HLA	SMA and SMA + retinitis pigmentosa[d]	HLA compatibility HLA + specific disease[e]	DM1[f]	HD and HD exclusion[g]	DMD and BMD[h]	FRAXA[i]	Haem[j]		
Biopsied	3814	4678	1656	684	3057	3103	934	1459	436	8159	27 980
Successfully biopsied	3780	4601	1648	681	3029	3073	908	1441	435	8069	27 665
Diagnosed	3288	3959	1420	608	2622	2699	835	1267	371	7178	24 247
Transferable	1990	1673	884	133	1137	1185	519	592	207	3480	11 800
Transferred	1068	1160	501	93	756	695	287	366	122	1987	7035
Frozen	348	287	113	47	131	192	100	65	36	608	1927
Clinical outcome											
Cycles to ET	541	554	248	62	445	421	123	212	64	1057	3727
hCG positive	193	234	83	26	141	143	39	77	23	401	1360
Postive FHB	149	183	72	18	106	111	33	60	17	318	1067
Clinical pregnancy rate (% per OR/% per ET)	23/28	26/33	25/29	16/29	18/24	21/26	21/27	19/28	23/26	24/30	22/29

CF, cystic fibrosis (various mutations); β-thal, β-thalassemia; SMA, spinal muscular atrophy; SC, sickle-cell anaemia; DM1; myotonic dystrophy type 1; HD, Huntington's disease; FRAXA, fragile-X syndrome; DMD, Duchenne muscular dystrophy (specific); BMD: Becker muscular dystroph; Haem, haemophilia.

[a]Includes one cycle for tuberous sclerosis and PGS + 3 cycles using FISH for a microdeletion.

[b]Nine cycles for two indications: CF and FRAXA; CF and SS, CF and PGS for diabetes insipidus; CF and diabetes insipidus (sexing); two cycles for CF and PGS; CF and HD; two cycles for CF and Haem (once via PCR and once via sexing).

[c]includes two cycles performed also with FISH for a Robertsonian translocation and one cycle for a reciprocal translocation.

[d]Includes three cycles for SMA and PGS, five cycles performed also for retinitis pigmentosa and one cycle for SMA and Marfan.

[e]In three cycles HLA typing was combined with PGS.

[f]Includes one cycle also for DMD.

[g]There were five cycles with a double indication: one cycle for PGS, two cycles for Marfan and two cycles for Antley-Bixler.

[h]Includes one cycle for BMD and PGS.

[i]Includes three cycles for FRAXA testing and PGS and one cycle for FRAXA and sexing for X-linked mental retardation.

[j]Includes one cycle for Haem A and PGS.

[k]Two cycles were on frozen-thawed embryos only so they were not counted as cycles with an OR, but were counted as cycles going to PGD.

[l]Eleven cycles had both PB biopsy and cleavage stage biopsy.

Table IVb Cycles performed for single gene disorders using PCR, data collection XI.

Indication	X-linked		Autosomal recessive		Autosomal dominant		HLA				Total	
		%		%		%	Only		+ monogenic disease			%
Cycles to OR	235		415		575		32		106		1363	
Number infertile	51	21.7	140	33.7	115	20.0	1	3.1	7	6.6	314	23.0
Female age (years)	33		34		34		37		33		34	
Cancelled before IVF/ICSI												
ART method												
IVF	2	0.9	1	0.2	0	0.0	0	0.0	0	0.0	3	0.2
ICSI	233	99.1	413	99.5	572	99.5	32	100.0	106	100.0	1356	99.5
IVF + ICSI	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
IVF + frozen	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	1	0.2
ICSI + frozen	0	0.0	1	0.2	2	0.3	0	0.0	0	0.0	3	0.2
IVF + ICSI + frozen	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Cancelled after IVF/ICSI	12	5.1	14	3.4	32	5.6	0	0.0	4	3.8	62	4.5
Cycles to PGD	223	94.9	401	96.6	543	94.4	32	100.0	102	96.2	1301	95.5
Zona breaching												
AT drilling	34	15.2	87	21.7	105	19.3	3	9.4	8	7.8	237	18.2
Laser drilling	162	72.6	273	68.1	404	74.4	29	90.6	91	89.2	959	73.7
Mechanical	27	12.1	41	10.2	34	6.4	0	0.0	3	2.9	105	8.1
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Biopsy method												
PB	15	6.7	7	1.7	14	2.6	0	0.0	0	0.0	36	2.8
Cleavage aspiration	195	87.4	386	96.3	528	97.2	32	100.0	102	100.0	1243	95.5
Cleavage extrusion	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Blastocyst	0	0.0	5	1.2	0	0.0	0	0.0	0	0.0	5	0.4
PB + embryo	13	0.0	3	0.7	2	0.4	0	0.0	0	0.0	18	1.3
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Biopsy policy												
1 cell biopsy	66	29.6	224	55.9	167	30.8	25	78.1	60	58.8	542	41.7
2 cell biopsy	119	53.4	124	30.9	279	51.4	5	15.6	42	41.2	569	43.7
1 or 2 cell biopsy	38	17.0	48	12.0	90	16.6	2	6.3	0	0.0	178	13.7
>2 cells (including TE)	0	0.0	5	1.2	8	1.5	0	0.0	0	0.0	13	1.0

Continued

Table IVb *Continued*

Indication	X-linked		Autosomal recessive		Autosomal dominant		HLA				Total	
		%		%		%	Only		+ monogenic disease			%
Amplification method												
FISH	3	1.3	1	0.2	1	0.2	0	0.0	0	0.0	5	0.4
FISH + PCR	1	0.4	3	0.7	1	0.2	1	3.1	3	2.8	9	0.7
PCR	221	94.0	374	90.1	551	95.8	31	96.9	103	97.2	1280	94.4
WGA-PCR	10	4.3	37	8.9	22	3.8	0	0.0	0	0.0	69	5.1
Embryology												
COCs (mean/OR)	2873 (11.1)		5626 (13.6)		7784 (13.5)		481 (15.0)		1560 (14.7)		18 324 (13.5)	
Inseminated	2393		4709		6420		408		1289		15 129	
Fertilized	1691		3445		4627		333		985		11 081	
Biopsied	1240		2605		3286		242		790		8163	
Successfully biopsied	1219		2574		3248		241		788		8070	
Diagnosed (mean/OR)	1118 (4.0)		2380 (5.7)		2981 (5.2)		226 (7.1)		739 (7.0)		7444 (5.5)	
Transferable (mean/OR)	552 (1.8)		1459 (3.5)		1253 (2.2)		50 (1.6)		108 (1.0)		3422 (2.5)	
Transferred	282		705		652		39		80		1758	
Frozen	92		246		204		39		158		739	
Clinical outcome												
Cycles to ET	171	76.7	361	90.0	423	77.9	24	75.0	52	51.0	1031	79.2
hCG positive	62		161		150		8		33		414	
Positive FHB	52		119		113		7		30		321	
Clinical pregnancy rate (% per OR)		22.1		28.7		19.7		21.9		28.3		23.6
Clinical pregnancy rate (% per ET)		30.4		33.0		26.7		29.2		57.7		31.1
Number FHBs	61		147		140		9		33		390	
Implantation rate (FHB/embryos transferred)		21.6		20.9		21.5		23.1		41.3		22.2
Deliveries	42		98		98		6		25		269	
Delivery rate (% per OR)		17.9		23.6		17.0		18.8		23.6		19.7
Delivery rate (% per ET)		24.6		27.1		23.2		25.0		48.1		26.1
Miscarriages	9		3		9		0		5		26	
Miscarriage rate (% per clinical pregn−pregn lost to FU)		17.6		3.0		8.4		0.0		17.9		8.9
Clinical pregnancies lost to FU	1		18		6		1		2		28	

TE, trophectoderm; WGA, whole genome amplification.

Table Va **Cycles performed for PGS, data collection I–X.**

Indication	AMA	AMA + miscarriage[a]	AMA + RIF1	Recurrent miscarriage	Recurrent IVF failure	Severe male factor[b]	Oocyte donation[c]	Prev abn preg[c]	No indication	Other[d]	Total
Cycles to OR	5400	546	1473	2100	4093	1498	155	48	462	1031	16 806
Number infertile	4248	358	1377	1319	3933	1339	103	22	442	889	14 030
Female age (years)	41	41	41	34	34	35	41	35	35	36	37
Cancelled before IVF/ICSI	0	0	0	0	1	0	0	0	0	1	2
ART method											
IVF	755	87	212	225	341	4	2	2	130	110	1868
ICSI	4534	437	1244	1813	3661	1454	152	46	281	880	14 502
IVF + ICSI	90	16	9	49	52	32	1	0	50	25	324
IVF + frozen	0	2	1	1	1	0	0	0	0	0	5
ICSI + frozen	15	4	2	11	13	8	0	0	1	1	55
Unknown	6	0	5	1	24	0	0	0	0	14	50[e]
Cancelled after IVF/ICSI	183	26	9	44	121	30	0	0	26	23	462
Cycles to PGS	5217	520	1464	2056	3971	1468	155	48	436	1007	16342
Zona breaching											
AT drilling	1350	146	347	782	1071	506	5	11	157	313	4688
Laser drilling	3648	291	777	1189	2350	800	102	37	244	645	10 083
Mechanical	206	83	340	84	513	162	48	0	35	35	1506
Unknown	13	0	0	1	37	0	0	0	0	14	65[e]
Biopsy method											
PB biopsy	572[f]	138	876	85	663	29	0	0	97	248	2708[f]
Cleavage aspiration	4370[f]	351	531	1883	3067	1382	107	47	336	731	12805[f]
Cleavage extrusion	256	31	57	83	196	56	48	1	3	23	754
Cleavage flow displacement	7	0	0	3	7	1	0	0	0	4	22
Blastocyst	0	0	0	1	0	0	0	0	0	1	2
Unknown	13	0	0	1	38	0	0	0	0	0	52[e]
Embryology											
COC's	52414	5253	13 351	26 451	53 339	21 829	2055	567	5278	12 714	193 251
Inseminated	44216	4227	10 327	21 830	43 841	17 651	1740	454	4523	10 718	159 527
Fertilized	30 917	2971	7200	16012	31 643	12 173	1297	338	3097	7544	113 192
Biopsied	23 982	2729	7774	12 107	25 063	9064	972	246	2506	5961	90 404
Successfully biopsied	23 676	2719	7700	11966	24 725	9016	967	241	2460	5903	89 373
Diagnosed	21 784	2556	7105	11 008[g]	23 091[g]	8444	952	230	2145[g]	5281[g]	82 596[g]
Transferable	6317	742	2525	3960[g]	8660[g]	3348	435	86	1012[g]	2193[g]	29278[g]
Transferred[h]	5462	570	1991	2847[g]	5920[g]	2285	244	54	630[g]	1540[g]	21543[g]

Continued

Table Va *Continued*

Indication	AMA	AMA + miscarriage[a]	AMA + RIFI	Recurrent miscarriage	Recurrent IVF failure	Severe male factor[b]	Oocyte donation[c]	Prev abn preg[c]	No indication	Other[d]	Total
Frozen	675	80	239	576	1196	411	139	20	135	413	3884
Clinical outcome											
Cycles to ET	3260	339	1131	1579	3186	1224	137	33	361	821	12071
HCG positive	948	76	243	627	1111	511	83	11	142	333	4085
Positive FHB	717	53	205	494	860	426	66	11	120	262	3214
Clinical pregnancy rate (% per OR/% per ET)	13/22	10/16	14/18	23/31	21/27	28/35	42/48	23/33	26/33	25/32	19/27

AMA, advanced maternal age; RIF, repeated implantation failure; SMF, severe male factor.
[a]These data were not extracted from I to IV.
[b]These data were not extracted from I to III.
[c]These data were not extracted form data I to VIII.
[d]'Others' contains also cycles with multiple indications and previous abnormal pregnancies (prev abn preg, data I–VIII).
[e]Several cycles had incomplete results.
[f]One cycle had cleavage stage biopsy and PB biopsy.
[g]Several cycles from one centre had no information on the number of embryos diagnosed as transferable, but patients did have embryos transferred. In these cases, undiagnosed/failed or abnormal embryos were transferred.
[h]Failed embryos were also transferred.

by specific PCR reactions was carried out in 5.1% of cycles to OR. The use of a non-contact diode infrared laser is the preferred method for biopsy (73.7% of cycles to PGD); acidic tyrode or mechanical action is applied in 18.2 and 8.1% of cycles to PGD, respectively. Day 3 cleavage-stage embryo biopsy is most frequently used (95.5% of cycles to PGD). Genetic testing is carried out on either one cell (41.7% of cycles to PGD) or two cells per embryo (43.7% of cycles to PGD). In the remaining cycles, a mixture of one and two cells, three cells or trophectoderm biopsy is applied.

A total number of 18 324 cumulus–oocyte complexes (COCs) were collected and 73.2% (11081/15129) of the mature oocytes inseminated were fertilized. A total of 73.6% (8163/11081) of the embryos were biopsied and 98.9% (8070/8163) were successfully biopsied. Of the embryos successfully biopsied, 92.2% (7444/8070) gave a diagnostic result, of which 46.0% (3422/7444) were genetically transferable. From 1301 PGD procedures, 79.2% (1031/1301) resulted in an embryo transfer. Per cycle, on average 13.5 COC were collected with 11.2 mature oocytes for insemination. This yielded, on average, 8.2 fertilized embryos of which 6 were suitable for biopsy. Diagnosis was achieved for 5.5 embryos, of which 2.5 embryos were shown to be genetically transferable. On average, 1.3 embryos could be transferred, while 0.6 embryos were used for cryopreservation.

A positive hCG was obtained in 414 cycles, with a positive heart beat in 321 cycles [24.6% per OR (321/1301), 31.1% per embryo transfer (321/1031), with 390 fetal hearts, giving an overall implantation rate of 22.2% (390/1758)]. These pregnancy rates were very similar to the previous data collection (data X). Finally, the delivery rate was 20.7% per OR (269/1301) and 26.1% per embryo transfer (269/1031). There were 26/293 miscarriages (8.9% per clinical pregnancy) and 8.7% (28/321) clinical pregnancies were lost to follow-up.

Overall, the number of PGD cycles performed for monogenic disorders between January and December 2008 further increased by 13% compared with data collection X. There were no marked changes with respect to the progress and outcome of cycles, including the embryology, rates of diagnosis and clinical outcome, such as clinical pregnancy and embryo implantation rates (Harper *et al.*, 2010b). Finally there were two cycles for mitochondrial disorders. One indication was Leigh syndrome, and the cycle ended in a pregnancy and birth of one healthy baby. The second cycle was carried out for mitochondrial myopathy, encephalopathy, lactic acidosis and stroke and did not result in a pregnancy.

Preimplantation genetic screening

Tables Va and Vb summarize the 16806 and 3401 cycles to OR reported for data collections I–X and XI, respectively. For data XI, 36 540 oocytes were collected, 70.6% (21633/30652) fertilized, 79.8% (17259/21633) embryos were biopsied and 99.4% (17147/17259) were successfully biopsied. Of the embryos successfully biopsied, 94.6% (16218/17147) gave a diagnostic result, of which only 32% (5191/16218) were transferable. From 3401 OR procedures, only 70.9% (2411/3401) resulted in an embryo transfer procedure. A positive hCG was obtained in 890 cycles, with a positive heart beat in 721 cycles [21.2% per OR (721/3401) and 29.9% per embryo transfer (721/2411)]. This gave an implantation rate of 22.3% (897/4024). These pregnancy rates were similar to the previous data collections.

Table Vb **Cycles performed for PGS, data collection XI.**

Indication	AMA	AMA + misc	AMA + RIF	Rec.misc	RIF	SMF	Prev abn preg	RIF + SMF	AMA + RIF	Num abno	Genetic male	No indication	DET + ANECOVA	Ovum donation	Total
Cycles to OR	1340	190	329	391	563	268	27	26	18	10	58	67	13	101	3401
Number infertile	1248	159	324	139	506	235	7	26	16	9	58	63	13	96	2899
Female age (years)	40.82	40.29	39.36	35.85	35.08	38.32	30.04	34.62	41.18	37.95	36.66	38.10	34.83	41.60	38.78
ART method															
IVF	167	54	62	46	45	6	4	0	0	0	0	2	1	1	388
ICSI	1169	136	265	344	509	261	23	26	18	10	58	65	12	98	2994
IVF + ICSI	4	0	2	1	9	1	0	0	0	0	0	0	0	2	19
Cancelled post OR	3	0	1	0	6	4	0	0	0	1	0	1	0	0	16
Cycles to PGD	1337	190	328	391	557	264	27	26	18	9	58	66	13	101	3385
Zona breaching															
AT drilling	142	36	73	68	90	87	10	6	7	3	58	50	0	25	655
Laser drilling	1146	140	207	305	393	121	17	20	11	5	0	14	13	42	2434
Mechanical	49	14	48	18	74	56	0	0	0	1	0	2	0	34	296
Biopsy method															
PB	385	69	192	42	127	0	0	16	0	1	0	6	0	0	838
Cleavage aspiration	919	119	122	336	413	259	25	10	18	8	58	60	13	77	2437
Cleavage extrusion	33	2	14	13	17	5	0	0	0	0	0	0	0	24	108
Blastocyst	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Embryology															
COCs	12 908	1751	2981	4634	7018	3605	268	374	189	86	692	708	167	1159	36 540
Inseminated	11 041	1495	2444	3941	5699	2913	235	315	156	68	598	612	123	1012	30 652
Fertilized	7649	1071	1664	2933	3968	2110	159	197	95	50	431	434	90	782	21 633
Biopsied	5897	896	1579	2168	3278	1663	121	196	70	40	330	345	67	609	17259
Successfully biopsied	5841	891	1577	2155	3225	1656	120	193	70	40	330	344	67	608	17 147
Diagnosed	5521	845	1432	2065	3086	1590	114	161	69	39	315	325	58	598	16 218
Transferable	1392	233	428	717	1129	600	43	47	19	17	122	152	27	265	5191
Transferred	1228	201	418	512	806	381	28	45	16	16	89	99	13	169	4024
Frozen	129	24	54	112	165	80	12	0	0	2	0	15	2	48	643
Clinical outcome															

Continued

Table Vb *Continued*

Indication	AMA	AMA + misc	AMA + RIF	Rec.misc	RIF	SMF	Prev abn preg	RIF + SMF	AMA + RIF	Num abno	Genetic male	No indication	DET + ANECOVA	Ovum donation	Total
Cycles to ET	790	133	244	304	455	221	20	23	8	8	50	57	10	88	2411
hCG positive	246	41	57	142	172	114	6	9	2	1	24	24	5	47	890
Positive FHB	193	31	46	112	137	102	6	5	2	1	19	19	3	45	721
Clinical pregnancy rate (% per OR/ % per ET)	14.4/ 24.4	16.3/23.3	14.0/18.9	28.6/36.8	24.3/ 30.1	38.2/ 46.1	22.2/ 30.0	19.2/ 21.7	11.1/25.0	10.0/ 12.5	32.8/38.0	28.4/33.3	23.1/30.0	44.6/51.1	21.2/29.9
Number of FHB	226	33	52	149	175	134	7	6	3	1	26	24	3	58	897
Implantation rate (fetal hearts/100 embryos transferred)	18.4	16.4	12.4	29.1	21.7	35.2	25.0	13.3	18.75	6.25	29.2	24.2	23.1	34.3	22.3
Deliveries	145	24	22	96	107	85	6	3	2	1	15	16	3	31	556
Delivery rate (% per OR/ % per ET)	10.8/ 18.4	12.6/18.0	6.7/9.0	24.6/31.6	19.0/ 23.5	31.8/ 38.5	22.2/ 30.0	11.5/ 13.0	11.1/25.0	10.0/ 12.5	25.9/30.0	23.9/28.1	23.1/30.0	30.7/35.2	16.4/23.1
Miscarriages	39	6	14	7	19	4	0	1	0	0	2	2	0	12	106
Miscarriage rate (% per clinical pregn−pregn lost to FU)	21.2	20.0	38.9	6.8	15.1	4.5	0	25	0	0	11.8	11.1	0	27.9	16.0
Clinical pregnancies lost to FU	9	1	10	9	11	13	0	1	0	0	2	1	0	2	59

AMA, advanced maternal age; RIF, repeated implantation failure; Rec.misc, recurrent miscarriage; SMF, severe male factor; DET, double embryo transfer; ANECOVA, study.

Table VIa PGD for social sexing, data collection I–X.

Method for sexing	FISH (SS only)	FISH (SS + AS)[a]	PCR	Unknown	Total
Cycles to OR	355	122	189	5[b]	671[b]
Number infertile	60	27	16	1	104
Female age (years)	34	39	37	35	36
ART method					
IVF	134	19	10	3	166
ICSI	209	102	168	2	481
Frozen	3	0	2	0	5
Frozen + IVF + ICSI + unknown	9	1	9	0	19
Cancelled after IVF/ICSI	4	0	7	5	16
Cycles to PGD	351	122	182	0	655
Zona breaching					
AT drilling	16	0	10	0	26
Laser drilling	168	33	1	0	202
Mechanical	167	89	171	0	427
Biopsy method					
Cleavage aspiration	145	0	11	0	156
Cleavage extrusion	206	122	171	0	499
Embryology					
COC's	4741	1687	2878	23	9329
Inseminated	4102	1470	2188	19	7779
Fertilized	2950	1026	1452	11	5439
Biopsied	2366	776	1143	0	4285
Successfully biopsied	2256	775	1116	0	4147
Diagnosed	2002	658	1049	0	3709
Transferable	769	212	473	0	1454
Transferred	485	147	361	0	993
Frozen[c]	214	43	86	0[d]	343
Clinical outcome					
Cycles to ET	271	83	138	0	492
hCG positive	110	29	58	0	197
Positive FHB	84	20	39	0	143
Clinical pregnancy rate					
(% per OR/% per ET)	24/31	16/24	21/28	0	21/29

AS, aneuploidy screening.
[a]These data were not extracted from I to VII.
[b]One natural cycle included.
[c]Eleven cycles with embryos frozen without biopsy or failed diagnosis included.
[d]Three embryos frozen without biopsy were not included.

Finally, the delivery rate was 16.4% per OR (556/3401) and 23.1% per embryo transfer (556/2411). There were 106/662 miscarriages (16% per clinical pregnancy) and 8.2% (59/721) clinical pregnancies lost to follow-up.

The main indications were advanced maternal age (AMA; 1340 OR) and repeated implantation failure (563 OR). There were still a number of cycles reported where no indication was given (67 OR). The indications showing lower clinical pregnancy rates compared with the other indications were all indications involving AMA (between 11.1 and 16.3% per OR), although the pregnancy rates were slightly higher than in data collections I–IX, and patients with karyotypes with numerical chromosomal abnormalities (10% per OR). Patients with severe male factor showed a relatively high pregnancy rate [38.2% per OR (102/267)] as did patients where oocyte donation was performed [44.6% per OR (45/101)]. Patients with no indication had a pregnancy rate of 28.4% per OR (19/67). From 3401 cycles, 291 involved the biopsy of only one embryo and 441 involved the biopsy of two embryos. As stated in data VII (Harper et al., 2008a,b), in the majority of cases these embryos should be replaced without

biopsy. In all 3401 cycles to OR, FISH was the method used for analysis in the laboratory. The PGD Consortium recently published a position statement on the use of PGS (Harper et al., 2010a). All randomized controlled trials (RCTs) to date for PGS using FISH and mainly cleavage-stage biopsy show no improvements in assisted reproduction technology success rates towards achieving healthy pregnancies. The Consortium recommendation was that the use of arrays on either polar bodies or trophectoderm biopsies should be validated and appropriate RCTs performed. The ESHRE PGS Task Force has conducted a pilot into the feasibility of using arrays for polar body biopsy (Geraedts et al., 2010) and is in the process of setting up a multi-centre RCT.

PGD cycles for social sexing

Tables VIa and VIb summarize the 671 and 5 cycles to OR collected for data collection I–X and XI, respectively. For data XI, 47 oocytes were collected, 74% (32/43) fertilized, 72% (23/32) embryos were biopsied and 83% (19/23) were successfully biopsied. Of the embryos successfully biopsied 89% (17/19) gave a diagnostic result, of which only 47% (8/17) were transferable (of the desired sex). From 5 OR procedures only 40% (2/5) resulted in an embryo transfer procedure. No cycles with a positive hCG were obtained. We have to take into consideration that these are only very small numbers which may of course be a biased to the results.

Table VIb PGD for social sexing, data collection XI.

	FISH (SS only)
Cycles to OR	5
Number infertile	0
Female age (years)	36
ART method	
IVF	2
ICSI	3
Cancelled after IVF/ICSI	0
Cycles to PGD	5
Zona breaching	
Laser drilling	5
Mechanical	0
Biopsy method	
Cleavage aspiration	2
Cleavage extrusion	3
Embryology	
COCs	47
Inseminated	43
Fertilized	32
Biopsied	23
Successfully biopsied	19
Diagnosed	17
Transferable	8
Transferred	5
Frozen	0
Clinical outcome	
Cycles to ET	2
hCG positive	0
Positive FHB	0
Clinical pregnancy rate (% per OR/% per ET)	0
Implantation rate (FHB/embryos transferred)	0
Deliveries	0
Delivery rate (% per OR/% per ET)	0
Miscarriages	0
Miscarriage rate (% per clinical pregn−pregn lost to FU)	0
Clinical pregnancies lost to FU	0

Table VIIa Evolution of pregnancy, data I–X.

	n pregnancies	*n* fetal sacs
Pregnancies	**6111**	**6458**
FISH cycles	4839	
PCR cycles	1264	
FISH + PCR	8	
Subclinical pregnancies[a]	**924**	
Clinical pregnancies	**5187**	**6458**
Singletons	3795	3795
Twins	1147	2294
Triplets	112	336
Quadruplet	8	32
Unknown	125	1[b]
Lost to FU during first trimester	62	68
First trimester loss	739	911
Miscarriage	615[c]	667
TOP	13[d]	14
Extra-uterine pregnancy	53[e]	43
Vanishing twins/triplets or miscarriage multiplet		149
Reduction of multiple pregnancies		47
Quadruplet to twin		10
Triplet to twin		15
Triplet to singleton		12
Twin to singleton		10[f]
Unknown	58	3
Ongoing pregnancies >12 weeks	**4386**	**5492**
Second trimester loss	115	188
Miscarriage	86[g]	120
Miscarriage twin to singleton		4
TOP	28[h]	29
Twin-to-twin transfusion	1	2
Reduction of multiple pregnancies		33
Quadruplet to twin		4
Triplet to twin		11
Triplet to singleton		14
Twin to singleton		4

Continued

Table VIIa *Continued*

	n pregnancies	*n* fetal sacs
Lost to FU during second trimester	131[i]	169
Deliveries	**4140**	**5135**
Singletons	3182	3182
Twins	921	1842
Triplets	37	111

[a]Subclinical pregnancy defined as pregnancy without any other clinical signs but positive serum hCG.
[b]Number of FHBs not known for data I–VIII. Counted further as one fetal heart.
[c]One miscarriage after amniocentesis.
[d]TOP, termination of pregnancy. Two TOPs for ancephalocoele, one TOP for social reasons, one TOP of twin with misdiagnosis for Charcot-Marie-Tooth (CMT) disease 1a, one TOP for 47,XY + 13, one TOP for encephelocele and one TOP for 47,XY + 21, two TOPs after ultrasound abnormalities, two TOPs for unknown reason and one because of divorce.
[e]One heterotrophic gestation continued as singleton after reduction of extrauterine gestation at 6 weeks.
[f]One misdiagnosis for sexing, PCR, indication Duchenne, twin pregnancy, selective termination of male fetus. Cycle performed in 1996, Y-specific amplification only.
[g]One triplet: fetal reduction, followed by amniocentesis and loss of remaining twin at 16 weeks (1 fetal sac counted in reduction, 2 in miscarriage, 1 second trimester pregnancy loss after miscarriage counted).
[h]TOP after misdiagnosis: one misdiagnosis for sexing, FISH, female fetus, indication SS; one misdiagnosis for β-Thal, PCR; one misdiagnosis for MD, PCR, one misdiagnosis after PGS, karyotype 45,X; one misdiagnosis for a reciprocal translocation 46,XY,der(15)t(13;15)(q25.1;q26.3). TOP after ultrasound (four): enlarged lateral ventricle, two singletons with cardiopathy, one singleton with tetralogy of Fallot. TOP after amniocentesis, not related to the PGD: trisomy 18, indication for PGD parent carrier of reciprocal translocation not involving chromosome 18; one polymalformation; one cystic hygroma, failed karyotype; one Turner mosaic, one spina bifida, five trisomy 21 pregnancies, one mosaic 46,XY/47,XY + 18 (misdiagnosis), one hemivertebrae, hypoplastic cerebellum, hydrocephaly (46,XX), one abnormal chromosome 15, one polycystic kidney, one Finnish nefrosis twin (both affected), one confirmed cytomegalovirus infection, one elective termination (unknown cause) and one hydrocephaly termination of a 8-month pregnancy (started as quadruplet: two selective reductions, one miscarriage after chorionic villus sampling (CVS) and the last fetus TOP).
[i]One misdiagnosis (47,XXX after PGS for RIF) lost to FU.

Pregnancies and babies

Tables VIIa, IXa, IXb, Xa, Xb, XIa and b and Supplementary data, Table SXIIa summarize the pregnancy and baby data. Data XI is comparable to previous data collections. Data XI included 1418 clinical pregnancies (Table VIIb). There were 950 deliveries of 1169 babies. Of the 1117 cycles ending in a pregnancy with a positive heartbeat, follow-up data on 1109 pregnancies were reported. Of the 950 pregnancies reported to have ended with a delivery (with a total number of 1169 babies), neonatal data on 1016 babies were submitted. The delivery rates per indication are reported in Tables IIb, IIIb, IVb, Vb and VIb. Caesarean section was performed for 48% of the deliveries (429/891) (Table IXb). In 12 cases, the method of delivery was not known.

Confirmation of the diagnosis was performed prenatally (386/732) and/or post-natally (346/732) (Table Xb). Table Xb and Supplementary data, Table SXIIb show the abnormalities found during pregnancy or post-natally. Several abnormalities were found that were not related to the PGD.

This report again confirms that pregnancies and babies born after PGD are very similar to the pregnancies obtained and babies born after ICSI treatment (Bonduelle *et al.*, 2002). In our series, the number of multiple pregnancies remains high (255/1117, 23%), which indicates that 37% (432/1169) of all babies born are part of a multiplet at birth (Table VIIb).

Table VIIb Evolution of pregnancy, data XI.

	N pregnancies	*N* fetus
Pregnancies	**1418**	
FISH only cycles	1028	
PCR only cycles	366	
WGA only cycles	22	
FISH + PCR	1	
WGA + PCR	1	
Subclinical pregnancies[a]	235	
Clinical pregnancies, without FHB	66	
Clinical pregnancies, with FHB	**1117**	**1395**
Singletons	862	862
Twins	235	470
Triplets	17	51
Quadruplet	3	12
Unknown	0	0
Lost to FU during first trimester	8	12
First trimester loss		
Miscarriage	104	117
Vanishing/miscarriage multiplets		
Twin to singleton	11	11
Triplet to twin	2	2
Triplet to singleton	2	4
Quadruplet to twin	0	0
Reduction of multiple pregnancies		
Quadruplet to twin	2	4
Triplet to twin	4	4
Triplet to singleton	2[b]	4
Twin to singleton	6	6
Ongoing pregnancies (>12 weeks)	**1005**	**1231**
Second trimester loss		
Miscarriage	4	4
TOP	10[c]	11
Lost to FU during second or third trimester	41	47
Deliveries	**950**	**1169**
Singletons	737	737
Twins	207	414
Triplets	6	18

[a]Subclinical pregnancy defined as pregnancy without any other clinical signs, but positive serum hCG.
[b]One triplet resulted in a singleton owing to reduction of one fetus and vanishing of another fetus.
[c]Two ultrasound abnormalities, one spina bifida and hydrocephaly and one cystic hygroma. Amnios, 47,XY,+21, 47,XYY, microdeletion 18, two fetus with trisomy 13.

Misdiagnoses

Table XIIIa summarizes the misdiagnoses reported for data I–X. For data XI, as for data X, no misdiagnoses were reported. The Consortium has published a paper on the possible causes of misdiagnosis in PGD (Wilton *et al.*, 2009). In addition, the Consortium is currently working on two studies looking at follow-up testing of untransferred embryos (Study 1 for amplification-based testing, Study 2 for FISH-based testing). The eventual publications from these studies should further elucidate the pitfalls of testing single or only a few cells from preimplantation embryos.

Success of individual centres

Figure 1 shows the pregnancy rate for each centre for data XI. The pregnancy rate ranges from 0 to 100% with the average being 21.27%. Although it could be expected that centres carrying out lower numbers of cycles may have lower rates owing to less experience, the findings indicate that some of the most active centres fall below the average 21.27% pregnancy rate and even have pregnancy rates lower than some of the centres performing few cycles.

Table IXa Method of delivery and gestational age, data collection I–X.

	Total	Singletons	Twins	Triplets
No deliveries	4140[a]	3182[a]	921[a]	37
Method of delivery				
Vaginal	1671	1497	172	2
Caesarian	1979	1315	635	29
Vaginal and Caesarian	7	2	5	0
Unknown	483	368	109	6
Term at delivery				
Preterm	1104	491	588	25
Term	2690	2435	251	5
Unknown	345	256	81	7

[a]For one twin there was only partial information: pregnancy was reported as a twin, the birth and baby as a singleton.

Table IXb Method of delivery and gestational age, data XI.

	Total	Singleton	Twin	Triplet
No. deliveries	891[a]	691	195	5
Method of delivery				
Vaginal	448	401	47	0
Caesarean	429	280	144	5
Vaginal and Caesarean	2	0	2	0
Unknown	12	10	2	0
Term at delivery				
Preterm	257	103	149	5
Term	633	587	46	0
Post term	1	1	0	0
Unknown	0	0	0	0

[a]Out of 950 deliveries in total, in 59 data regarding delivery were lacking.

Discussion

This 11th report of the ESHRE PGD Consortium demonstrates a slight decrease (~4%) in the number of PGD cycles, with

Table Xa Confirmation of diagnosis per fetal sac, data collection I–X.

Method	Result			
	n	Normal	Abnormal	Failed
Prenatal diagnosis				
FISH				
CVS	118	115[a]	3[b]	0
Amniocentesis	673[c]	653[a,c]	17[d]	3
Ultrasound	1223[c]	1208	14[c,e]	1
Unknown	3	3	0	0
Total	2014[f]	1979	34	4
PCR				
CVS	171	167	4[g]	0
Amniocentesis	240	227	12[h]	1
Ultrasound	37	34	3	0
Unknown	2	2	0	0
Total	448[f]	429	18	1
Post-natal diagnosis				
FISH				
Karyo miscarriage	107	54	53[i]	0
Karyo post-natal	235	232	4	0
FISH microdeletion	2	2	0	
Physical examination	1363	1358	6[j]	0
Karyo post-natal + physical examination	18	18	0	0
Unknown	2[k]	2[k]	0	0
Total	1727	1666	63	0
PCR				
Karyotype miscarriage	8	6	2	0
DNA test miscarriage	2	2	0	0
DNA test post-natal	122	121	1	0
Sweat test	8	8	0	0
Physical examination	104	103	1	0
Karyotype	16	15	1[l]	0
Karyotype + DNA	5	4	1[m]	0
Karyotype + physical examination	31	31	0	0
Hearing test	3	3	0	0
Algo test	2	2	0	0

Continued

Table Xa *Continued*

Method	Result			
	n	Normal	Abnormal	Failed
Unknown	21	21	0	0
Total	322	316	6	0

[a]Total three miscarriages after normal outcome amniocentesis (1 FISH, 2 PCR), one miscarriage after normal outcome CVS (FISH).
[b]XY,+21 → TOP (AS maternal age, repeated IVF failure); two Trisomies 21, TOP (PGD for reciprocal translocation).
[c]Three fetal sacs with abnormalities on ultrasound (enlarged lateral ventricle, cardiopathy, hydrocephalus) with normal result on amniocentesis.
[d]9% mosaic XY/XXY (FISH AS), abnormal chromosome 15 and skeletal displasia → TOP (AS maternal age); mosaic: 46,XY/47, XY + 18 → TOP (AS repeated IVF failures); 21 trisomy → TOP (AS maternal age, repeated IVF failures). One twin 46,XY, inv(1)(p13q14), ongoing pregnancy, resulting in healthy boy and girl (FISH for maternal inv(1)(p12q23)); trisomy 21, TOP (AS maternal age and repeated IVF failures); trisomy 21, TOP (PGD sexing for XL Alport syndrome); 47,XYY, ongoing pregnancy (PGD for reciprocal translocation); 46,XX,15p+, ongoing pregnancy, resulting in a birth of baby girl, no abnormalities reported (AS).
[e]Encephalocele → TOP (AS repeated miscarriage); hemivertebrae, hypolastic cerebellum, hydrocephaly → TOP; cystic hygroma one twin miscarriage → ongoing singleton (rec. translocation FISH). Abnormality in bladder, CVS showed normal karyotype, pregnancy resulting in miscarriage (reciprocal translocation); one twin hydrops fetalis, TOP, other twin miscarriage but normal CVS result (AS); tricuspid atresia on ultrasound, TOP (SS for male).
[f]Three fetal sacs had PCR and FISH at PGD.
[g]47,XY,+13 → TOP (PCR: not affected by Zellweger).
[h]Monozygous twin affected with Finnish Nefrosis, TOP (PGD for beta-thal).
[i]Mosaic 4n/2n (AS oocyte donation recurrent miscarriage); trisomy 20 (AS maternal age recurrent miscarriage); 92,XXXX (AS maternal age repeated IVF failures); 47,XX,+10 (AS recurrent miscarriages maternal age); 46,XY/45,X0 (AS oocyte donation); 45,X,t(2;4)(q11.2;q13) (FISH reciprocal translocation); 47,XY,t(11;22)(q23;q11.2),+16[11]/46,XY,t(11;22)[7] (FISH reciprocal translocation); trisomy 21, confirmation after TOP (AS maternal age and repeated IVF failures); 46XX, 16q+ (AS maternal age); trisomy 15 (AS maternal age); Trisomy 17 (AS recurrent miscarriages); 45,XO (FISH Robertsonian translocation); trisomy 12 (AS maternal age); embryo 46,XX, umbilical cord mosaic 47,XX,+14/48,XX,+14,+17 (AS maternal age); 45,XO (FISH reciprocal translocation); trisomy 8 (AS recurrent miscarriages); trisomy 21 (AS maternal age).
[j]Misdiagnosis after gender selection for X-linked retinitis pigmentosa: male.
[k]Two children had unknown check and karyotype.
[l]Misdiagnosis PGD for tuberous sclerosis 2 (TSC2): duodenal stenosis secondary to annular pancreas, possible giant cell astrocytoma at the foramen of Monroe, intracardial tuberomas, TSC2 in newborn confirmed.
[m]One girl of twin affected with congenital abnormalities related to 10% mosaic trisomy 9, other baby healthy (PCR SCA3).

Table Xb Confirmation of diagnosis per fetal sac, data collection XI.

Method	*n*	Result		
		Normal	Abnormal	Failed
Prenatal diagnosis				
FISH				
CVS	20	18	2[a,b]	0
Amniocentesis	76	75	1[c]	0
Ultrasound	224	224	0	0
Total	320	317	3	0
PCR				
CVS	30	29	1[d]	0
Amniocentesis	32	30	2[e,f]	0
Ultrasound	4	3	1[g]	0
Total	66	62	4	0
Post-natal diagnosis				
FISH				
Karyo miscarriage	19	5	13[h]	1
Karyo post-natal	12	11	1[i]	0
Physical examination	247	247	0	0
Karyo post-natal + physical examination	9	9	0	0
Unknown	1	1	0	0
Total	288	273	14	1
PCR				
Karyo miscarriage	5	2	2[j]	1
Physical examination	13	13	0	0
DNA test post-natal	37	36	1[k]	0
Karyo post-natal	0	0	0	0
Karyo post-natal + physical examination	0	0	0	0
DNA-test + karyo	1	1	0	0
Other	2[l]	2	0	0
Total	58	54	3	1

[a]TOP because of trisomy 13 (AS maternal age).
[b]TOP of two fetus of a triplet because of misdiagnosis (unspecified). These two fetuses were monozygotic, the third fetus of the triplet was ongoing and resulted in the term birth of a healthy male (AS repeated IVF failures).
[c]TOP because of 47,XYY (Robertsonian translocation).
[d]TOP because of trisomy 13 (CF/congenital bilateral absence of vas deferens: CBAVD).
[e]TOP because of trisomy 21 (X-linked retinoschizis).
[f]TOP because of microdeletion 18 (CF/CBAVD).
[g]TOP because of ultrasound abnormalities, i.e. spina bifida and hydrocephalus (CMT type 1a).
[h]47,XX,+4 (AS severe male factor), two times trisomy 7 (twin pregnancy, AS recurrent miscarriages), trisomy 10 (AS maternal age), three times 47,XX,+14 [one twin pregnancy (AS maternal age and recurrent miscarriages], one twin pregnancy of which the karyotyping of the second fetus failed (AS maternal age and recurrent IVF failures), trisomy 16 (AS maternal age and repeated IVF failures), chromosomal abnormality 18 (AS recurrent miscarriages), 47,XY,+20 (AS maternal age), trisomy 21 (reciprocal translocation), 92,XXXX (AS repeated IVF failures), 92,XXYY (AS maternal age and repeated IVF failures).
[i]Weak gonosomales mosaicism (AS recurrent miscarriages).
[j]Trisomy 9 (haem B), trisomy 16 (CF/CBAVD).
[k]Expansion DMPK gene (myotonic dystrophy type 1).
[l]Sweat test (CF/CBAVD).

subsequent pregnancies and babies. This is most likely a function of slightly fewer centres supplying data (four less centres submitted data for Collection XI). There were still two levels of membership of the Consortium; full membership for centres who submit annual data and associate membership for centres who cannot submit data (including new clinics, IVF units who work with a diagnostic laboratory that is a member of the Consortium). Associate centres performing PGD must send in summary data. For data XI, very few associate centres (4) sent in summary data and so these data were not included in this report. Most associate centres are satellite PGD centres that work with many IVF centres and they have reported that they cannot obtain information about the IVF cycles. Therefore, we have amended the information we will collect from associate centres to just include basic data on the diagnosis. The Consortium is aware that these satellite centres can send in more extensive data than only the summary data but most of the time not the complete data (as do full members). Therefore, the category 'transport members' has to be adopted. The data requested from these centres need to be set for future data collections.

Table XIa Data on live-born children, data collection I–X.

Total children born		4047[a]
Sex		
Male		2274
Female		2519
Unknown		254
Mean birthweight (g)		
Singletons	3219	2779
Twins	2386	1565
Triplets	1893	73
Mean birth length (cm)		
Singletons	50	1827
Twins	46	929
Triplets	45	22

[a]Numbers in the right column indicate the number of newborns for whom the information is available.

Table XIb Data on children born, data collection XI.

Total children born		1016	
Sex			
Male		510	
Female		495	
Unknown		11	
Mean birthweight (g)			
Singletons		3234	($n = 606/649$)[a]
Twins		2363	($n = 313/352$)
Triplets		1706	($n = 9/15$)
Mean birth length (cm)			
Singletons		49.8	($n = 408/649$)
Twins		47.9	($n = 189/352$)
Triplets		38.0	($n = 1/15$)
Mean head circumference (cm)			
Singletons		34.5	($n = 151/649$)
Twins		32.3	($n = 56/352$)
Triplets		27.0	($n = 3/15$)
Apgar scores[b] after 1 min	Singletons	Twin	Triplet
Good[c]	212	91	1
Poor[c]	9	14	2
Apgar scores after 5 min			
Good[c]	213	96	1
Poor[c]	4	7	2
Apgar scores after 10 min			
Good[c]	103	45	2
Poor[c]	2	2	1

[a]Numbers in parenthesis indicate the number of newborns for whom the information is available out of the total number of newborns.
[b]Exclusive stillborns, see Supplementary data, Table SXIIb.
[c]Good is defined as ≥7 and poor as <7.

As always, the centres who submit data have access to the raw data, while the associate centres will be allowed to participate in the annual Consortium meetings and they are sent the quarterly Consortium newsletter.

Besides data collection, the Consortium is involved with a number of activities through the working groups.

There are five Working Groups within the PGD Consortium: Molecular Methods (Chair Francesco Fiorentino), Misdiagnosis and Monitoring (Chair Jan Traeger-Synodinos), Accreditation (Chair Katerina Vesela), Database (chair Céline Moutou) and Array-Based PGD (Chairs Dagan Wells and Leeanda Wilton). The Molecular Methods working group continues to develop a database of primers and protocols to aid Full and Transport Member laboratories in developing custom PGD testing methods for patients desiring testing for monogenic disorders. The Misdiagnosis and Monitoring working group continues to work on publication of the follow-up data from amplification-based and FISH-based PGD tests. This paper will be a landmark paper discussing the follow-up of untransferred embryos following PGD testing. The Accreditation working group held a very successful workshop in conjunction with Eurogentest in Athens, Greece entitled Towards Accreditation of a PGD Laboratory. Another workshop of the same name will be held next year in Istanbul in the Fall. The Database working group is still working on an online version of the current database in order to facilitate the input of PGD data for the centres. They also work on a statistical paper covering all data collections since the beginning of the PGD Consortium. ESHRE are considering to support an official guidelines document for Array-Based PGD, a proposal was submitted to the Executive Committee. The working group for this guideline is being developed at the moment. Also from the Array-Based PGD working group, a new external quality assessment (EQA) scheme is being developed to assess array-based PGD testing quality around the world. This EQA, following a pilot study, will be open to any laboratories using array-based technology to assess aneuploidy in human embryos.

Four updated ESHRE Guidelines on the Best Practice in PGD were published in 2011 (Harton *et al.*, 2011a,b,c,d). These Guidelines cover individual portions of PGD, including Set Up and Organization of a PGD centre, Amplification-based PGD, FISH-based PGD and Embryology as it relates to PGD and PGS. As noted above, a new Guidelines group is being developed now to offer advice on the best practice on array-based PGD.

From the 10 data collections, the Consortium now has detailed data on 33 271 cycles and 5063 babies born after PGD/PGS.

The large amount of detailed information which the Consortium has collected is unique and studies are underway to analyse many aspects of the data in more depth.

Supplementary data

Supplementary data are available at http://humrep.oxfordjournals.org/.

Table XIIIa Summary of misdiagnosis from data I to X.

Indication	Method used	PND-post-natal	Outcome	Reported in
Monogenics				
DM1	PCR	PND	TOP	I
β-thal	PCR	PND	TOP	II
β-thal	PCR	PND	TOP	VIII
Familial amyloid polyneuropathy	PCR	PND	Born	IV
CF	PCR	PND	Born	II
CF (one of twins)	PCR	Post	Born	IV
CMT1A	PCR	PND	Born	Cycle reported in V but misdiagnosis in VII
SMA	PCR	Post	Born	Cycle reported in IV but misdiagnosis in VII
CMT1A (twins)	PCR	PND	TOP of both twins	VII
FRAXA	PCR	PND	Born	VIII
Sexing for X-linked disease				
46,XY in retinitis pigmentosa	PCR	PND	Born	IV
46,XY in DMD twin	PCR	PND	TOP of one twin	III
45,X, Haem A	FISH	PND	TOP	IV
46,XY, Haem A	FISH	Post	Born	VIII
Translocations				
Trisomy 13 after 45,XY,der(13;14)(q10;q10)	FISH	Miscarriage	Miscarried	VI
47,XX,+der(22)t(11;22)(q23.3;q11.2)mat	FISH	PND	TOP	III
46,XY,der(15)t(13;15) (q25.1;q26.3)pat	FISH	PND	TOP	VII
PGS				
47,XXX	FISH	PND	Lost to FU	VII
45,X	FISH	PND	Miscarriage	VIII, reported in IX
Trisomy 16 after first PB biopsy only	FISH	Miscarriage	Miscarriage	VI
Trisomy 16 after first PB biopsy only	FISH	Miscarriage	Miscarriage	V
Trisomy 16	FISH	Miscarriage	Miscarriage	VI
Trisomy 16	FISH	Miscarriage	Miscarriage	VI
Trisomy 21	FISH	Post	Born	III
Trisomy 21	FISH	PND	TOP	IX
Trisomy 21	FISH	PND	TOP	IX
46,XY/47,XY+18	FISH	PND	TOP	IX
Social Sexing				
Requested male but female fetus	FISH	PND	TOP	III

PND, prenatal diagnosis. The numbers in the last column indicate the PGD Consortium report number.

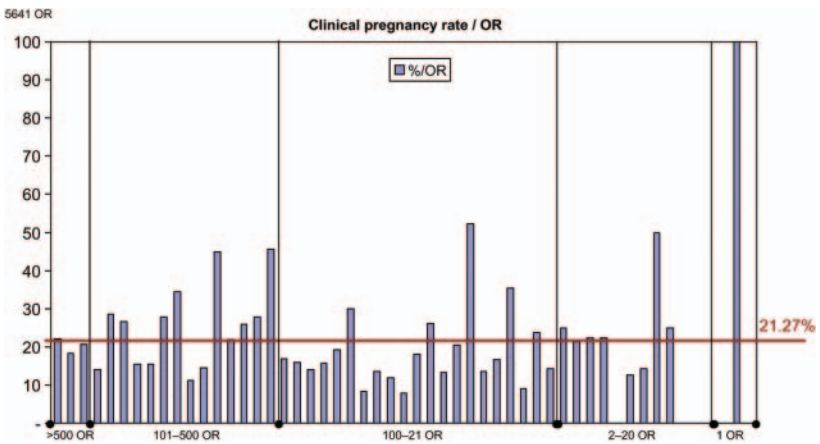

Figure 1 Pregnancy rate per centre.

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