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ART in Europe, 2014: results generated from European registries by ESHRE[†]

The European IVF-monitoring Consortium (EIM)[‡] for the European Society of Human Reproduction and Embryology (ESHRE)

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STUDY QUESTION: What are the European trends and developments in ART and IUI in 2014 as compared to previous years?

SUMMARY ANSWER: The 18th ESHRE report on ART shows a continuing expansion of both treatment numbers in Europe and more variability in treatment modalities resulting in a rising contribution to the birth rates in most participating countries.

WHAT IS KNOWN ALREADY: Since 1997, ART data generated by national registries have been collected, analysed by the European IVF-monitoring (EIM) Consortium and reported in 17 manuscripts published in *Human Reproduction*.

STUDY DESIGN, SIZE, DURATION: Continuous collection of European data by the EIM for ESHRE. The data for treatments performed in 2014 between 1 January and 31 December in 39 European countries were provided by national registries or on a voluntary basis by clinics or professional societies.

PARTICIPANTS/MATERIALS, SETTING, METHODS: From 39 countries and 1279 institutions offering ART services, a total of 776 556 treatment cycles, involving 146 148 with IVF, 362 285 with ICSI, 192 027 with frozen embryo replacement (FER), 15 894 with PGT, 56 516 with egg donation (ED), 292 with IVM and 3404 with frozen oocyte replacement (FOR) were reported. European data on IUI using husband/partner's semen (IUI-H) and donor semen (IUI-D) were reported from 1364 institutions offering IUI in 26 countries and 21 countries, respectively. A total of 120 789 treatments with IUI-H and 49 163 treatments with IUI-D were included.

MAIN RESULTS AND THE ROLE OF CHANCE: In 14 countries (17 in 2013), where all institutions contributed to their respective national registers, a total of 291 235 treatment cycles were performed in a population of ~208 million inhabitants, corresponding to 1925 cycles per million inhabitants (range: 423–2978 per million inhabitants). After treatment with IVF the clinical pregnancy rates (PR) per aspiration and per transfer were marginally higher in 2014 than in 2013, at 29.9 and 35.8% versus 29.6 and 34.5%, respectively. After treatment with ICSI the PR per aspiration and per transfer were also higher than those achieved in 2013 (28.4 and 35.0% versus 27.8 and 32.9%, respectively). After FER with own embryos the PR continued to rise, from 27.0% in 2013 to 27.6% in 2014. After ED a similar trend was observed with PR reaching 50.3% per fresh transfer (49.8% in 2013) and 48.7% for FOR (46.4% in 2013). The delivery rates (DR) after IUI

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[‡]EIM Committee 2017–2019: chairman: C.D.; chairman elect: C.W.; past chairman: C.C.-J. members: M.K., E.M., T.M., G.S., J.S. and S.V., V.G. is a science manager at ESHRE Central Office, Brussels. See also Appendix for contributing centres and contact persons representing the data collection programmes in the participating European countries.

The main results of this report were presented at the annual ESHRE congress in Geneva, July 2017.

remained stable at 8.5% after IUI-H (8.6% in 2013) and at 11.6% after IUI-D (11.1% in 2013). In IVF and ICSI together, 1, 2, 3 and ≥4 embryos were transferred in 34.9, 54.5, 9.9 and in 0.7% of all treatments, respectively (corresponding to 31.4%, 56.3, 11.5% and 1% in 2013). This evolution in embryo transfer strategy in both IVF and ICSI resulted in a singleton, twin and triplet DR of 82.5, 17.0 and 0.5%, respectively (compared to 82.0, 17.5 and 0.5%, respectively, in 2013). Treatments with FER in 2014 resulted in a twin and triplet DR of 12.4 and 0.3%, respectively (versus 12.5 and 0.3% in 2013). Twin and triplet DR after IUI were 9.5 and 0.3%, respectively, after IUI-H (in 2013:9.5 and 0.6%) and 7.7 and 0.3% after IUI-D (in 2013: 7.5 and 0.3%).

LIMITATION, REASONS FOR CAUTION: The method of data collection and reporting varies among European countries. The EIM receives aggregated data from various countries with variable levels of completeness. Registries from a number of countries have failed to provide adequate data about the number of initiated cycles and deliveries. As long as incomplete data are provided, the results should be interpreted with caution.

WIDER IMPLICATIONS OF THE FINDINGS: The 18th ESHRE report on ART shows a continuing expansion of treatment numbers in Europe. The number of treatments reported, the variability in treatment modalities and the rising contribution to the birth rates in most participating countries point towards the increasing impact of ART on reproduction in Europe. Being the largest data collection on ART, the report gives detailed information about ongoing developments in the field.

STUDY FUNDING/COMPETING INTEREST(S): The study has no external funding and all costs are covered by ESHRE. There are no competing interests.

Key words: IVF / ICSI / IUI using partner's semen / IUI using donor semen / egg donation / frozen embryo replacement / insemination / surveillance / vigilance / registry

Introduction

This is the 18th annual report of the European IVF-monitoring Consortium (EIM) under the umbrella of ESHRE containing the data on ART reported by 39 participating European countries in 2014 (Supplementary Data).

Seventeen previous reports, all published in 'Human Reproduction' (https://www.eshre.eu/Data-collection-and-research/Consortia/EIM/Publications.aspx), covered treatment cycles from 1997 to 2013. As in previous reports, the printed version contains the five most relevant tables. Nineteen additional Supplementary tables are available online. The settings of the data are consistent with those published in the previous reports, allowing good comparison with earlier trends.

Materials and Methods

Aggregated data on various forms of ART were provided by 39 European countries, covering the following treatment modalities: IVF, ICSI, frozen embryo replacement (FER), egg donation (ED), IVM, and pooled data on preimplantation genetic testing (PGT) and frozen oocyte replacement (FOR). In addition, data on IUI using either husband's/partner's semen (IUI-H) or donor semen (IUI-D) were included. The report includes treatments started between 1 January and 31 December in 2014. Data on pregnancies and deliveries are derived from follow-up of the treatments performed in 2014. Each national register is informed about the need to obtain signed informed consent prior to the initiation of infertility treatment from each infertile individual for whom data have to be reported to the national registry.

For the collection of the data, the national representatives of 41 countries were asked to fill out questionnaires and data were transmitted through a software package, specially designed for the requirements of this data collection (Dynamic Solutions, Barcelona, Spain). The same sets of data as in 2013, consisting of six different modules, were requested as in 2014. The software performs all calculations automatically and evaluates the plausibility of all results. If inconsistencies are detected, the administrator of the ESHRE central office (V.G.) contacts the national representative for clarifications.

The data were assembled similarly as in the previous reports making the results comparable. As usual, footnotes to the tables provide additional information on diverging results reported by individual countres, when applicable.

The terminology used was based on the glossary of The International Committee for Monitoring Assisted Reproductive Technology (ICMART) (Zegers-Hochschild et al., 2017).

Results

Participation and data completeness

In Table I the number of institutions or clinics offering ART services and those performing IUI are listed together with all available treatment modalities. In comparison to the 2013 data (Calhaz-Jorge et al., 2017) not only the numbers of reporting clinics has increased (1169 in 2013 to 1279 in 2014, +9.5%), but also the overall number of reported treatments (686 271 in 2013 to 776 556 in 2014, +13.1%). Among the 51 European countries, nine are not members of the EIM Consortium (Supplementary Table SI), most being very small countries not offering ART services. Bosnia-Herzegovina resumed their participation. Armenia became a member of the EIM Consortium but has not yet provided any data to the Consortium, and neither did Turkey and Slovakia. Among the 42 members, 39 have sent in their data (92.9%) and in 14 countries (35.8%) all ART centres have reported complete data sets. Currently, 1280 clinics report their data (87.6% of all known clinics in Europe, 85.4% in 2013). The European countries with the largest treatment numbers in 2014 are Spain (109 275 treatments), Russia (94 985), France (90 434) and Germany (81 177).

Reporting methods and size of the clinics

Among the countries with complete coverage of data reporting there is a clear preponderance of registries to which reporting is compulsory (13 out off 15), although among those countries with incomplete data sets six require compulsory data reporting by the local national health

authorities (Supplementary Table SIII). Mainly in countries with incomplete coverage, personal initiatives continue to play a major role (seven countries), as do medical organizations (in 13 countries).

Aggregate data submission by single ART institutions to the respective national registries is still the most commonly used method (8 in 17 countries with full coverage, 16 in 25 countries with incomplete coverage) (Supplementary Table SIII). Individual cycle reporting is being carried out in seven countries with full data coverage and in nine countries with incomplete coverage of the reported cycles.

There is a large variability in the size of reporting institutions, as defined by the number of treatment cycles (Supplementary Table SII).

Table I Treatment frequencies after ART in European countries in 2014.

Country	IVF clinics in the country												Cycles/million*	
	IVF clinics	Included IVF clinics	IUI labs	Included IUI labs	IVF	ICSI	FER	PGD	ED	IVM	FOR	All	Women 15-45	Population
Albania	8	1	8	1	0	96	44	0	11	0	2	153		
Austria	30	28			897	4773	1656					7326		
Belarus	5	4	8	4	1512	1064	130	25	8	0	0	2739		
Belgium	18	18	34	29	3220	13 457	10 677	581	853		57	28 845	13 568	2510
Bosnia-Herzegovina					0	531	67	0	0	0	0	598		
Bulgaria	32	4	0		388	4199	1230	37	460	0		6314		
Croatia	13	7	15	13	897	865	311	0	0	0	42	2115		
Cyprus	7	6			212	933	316	28	250			1739		
Czech Republic	42	42				13 280	9059	1552	4868			28 759	13 919	2694
Denmark	21	21	58	55	6542	5322	3898	126	256	0	23	16 167	15 449	2884
Estonia	5	5	5	5	636	1183	887	0	178	0	0	2884	12 828	2304
Finland	19	19	24	24	2484	2066	3384	21	687	0		8642	8831	1566
France	101	100	191	188	20 638	40 295	27 214	1039	1047	201		90 434		
Germany	133	129			13 672	45 612	21 893					81 177		
Greece	44	44	44	44	3359	12 404	3216	481	4622	4	34	24 120	12 162	2240
Hungary	13	11			1184	3866	437	20	119			5626		
Iceland	1	1	1	1	189	166	241	0	110	0	0	706	10 344	2978
Ireland	7	3	7	3	623	505	385	0	0			1513		
Italy	200	200	362	362	7695	48 010	9501	1895	156		1639	68 896	6173	1109
Kazakhstan	23	6	23	6	1013	1286	974	179	484	0	1	3937		
Latvia	5	3	5	3	462	480	301	3	144			1390		
Lithuania	6	4	7	4	200	152	29					381		
Macedonia	9	5	9	5	388	1457	117		25			1987		
Malta	2	2	2	0	0	135	0	0	0	0	41	176	2218	423
Moldova	4	3	7	3	250	501	86	0	6	0	0	843		
Montenegro	5	4	5	4		425	17					442		
Norway	10	10	9	9	3167	2959	4799			0	0	10 925	10 662	2054
Poland	37	29		30	899	13 735	7775	325	756	24	80	23 594		
Portugal	25	25	26	26	2228	3433	1556	69	493	1	6	7786	3844	718
Romania	19	13	19	13	1201	1218	843		93		2	3357		
Russia	167	133		133	29 136	38 334	19 524	2013	5619	45	314	94 985		
Serbia	18	1	18	1	126	147	5	0	0	0	0	278		
Slovenia	3	3	3	3	936	2441	1288	8	8	1	2	4684	12 959	2375
Spain	245	225	349	272	5491	46 100	21 007	5242	30 576	14	845	109 275		
Sweden	17	16		0	5938	5894	5771	263	347			18 213		
Switzerland	29	27			930	4519	4473					9922		
The Nederlands	13	13			6537	7578	10 505	521				25 141	8098	1472

Continued

Table I *Continued*

Country	IVF clinics in the country												Cycles/million*	
	IVF clinics	Included IVF clinics	IUI labs	Included IUI labs	IVF	ICSI	FER	PGD	ED	IVM	FOR	All	Women 15-45	Population
Ukraine	38	32	18	18	1886	8629	4806	496	1144		22	16 983		
UK	82	82	107	107	21 212	24 235	13 595	970	3196	2	294	63 504	5278	980
All	1456	1279	1364	1366	146 148	36 2285	192 017	15 894	56 516	292	3404	776 556	7623	1927

Bosnia Herzegovina consists of two parts: the Federation part and the Republic of Srpska.
Treatment cycles in IVF and ICSI refer to initiated cycles.
For Albania, Austria, Belgium, Czech Republic, France, Germany, Iceland, Latvia, Lithuania, Macedonia and Montenegro treatment cycles refer to aspirations. For Austria, Belgium and France the total number of initiated cycles was only available for IVF and ICSI together, being 5993, 19 570 and 68 202, respectively.
For the Czech Republic, no distinction between IVF and ICSI is made. All cycles are counted as ICSI. For Belgium there are 766 aspiration cycles for which it is not known whether IVF or ICSI was performed.
Treatment cycles in FER refer to thawings.
For Czech Republic, Finland, Hungary, Romania, Sweden and The Netherlands treatment cycles refer to transfers.
Treatment cycles in PGD contain both fresh and frozen cycles and refer to initiated cycles in the fresh cycles (except for Finland and Hungary where it refers to aspirations) and thawings in the frozen cycles (except for The Netherlands where it refers to transfers).
Treatment cycles in ED refer to donation cycles and contain fresh and frozen cycles.
ED fresh: For France, Iceland and Latvia treatment cycles refer to aspirations, for Italy it refers to transfers. ED FOR: For France and Italy treatment cycles refer to transfers. ED FER: For Finland, France, Italy, Romania and Sweden treatment cycles refer to transfers.
Treatment cycles in IVM refer to aspirations.
Treatment cycles in FOR refer to thawings.
Women of reproductive age and population were found at the following link: http://www.census.gov/population/international/data/idb/region.php

Clinics with cycle numbers between 200 and 499 are the most common (29.6%). When compared to previous EIM reports, there is an ongoing trend towards more large institutions (≥1000 cycles, 18.3% in 2014 versus 17.8% in 2013 and 16.9% in 2012).

Seventeen countries (Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Italy, Kazakhstan, Macedonia, Norway, Poland, Portugal, Spain, Sweden, Switzerland and UK) reported some kind of data validation process.

Public access to individual clinic data was available only in nine countries: Albania, Estonia, Ireland, Macedonia, Romania, Slovenia, Spain, Sweden and the UK. Pharmaceutical industries or professional societies provided additional financial support for the national registration in 26 countries. In five countries the centres covered part of the expenses, while in five countries (Albania, Federation of Bosnia and Herzegovina, Poland, Switzerland, The Netherlands) all the expenses were covered by the centres alone. This information is missing in eight countries.

Number of treatment cycles per technique and availability

In 2014 a total number of 776 556 treatment cycles were reported to EIM (90 285 more than in 2013, +13.1%) (Table I). Since the beginning of its activities EIM has now recorded a total of more than 8 million treatments with ART leading to the birth of nearly 1.5 million infants (Table II). The most common technique is ICSI (362 285 cycles, 46.6%) followed by FER (192 017, 24.7%) and IVF (146 148, 18.8%). Compared to 2013, all treatment modalities numbers have increased, except frozen oocyte replacement (FOR). The steepest increase in treatment numbers since 2013 is observed in PGT (+62.3%) and ED (+40.4%). A number of countries reported fewer treatment cycles (Croatia, Cyprus, Estonia, Germany, Hungary, Iceland, Ireland, Kazakhstan, Moldova, Montenegro, Slovenia, Sweden and the UK). Croatia, Germany, Hungary and Modova had fewer clinics participating. Two countries reported a large increment in treatment numbers (Russia and Spain), both with many more ART institutions participating in the data collection.

Table II Number of institutions offering ART services, treatment cycles and infants born after ART in Europe, 1997–2014.

Year	Countries	Clinics	Cycles	Cycle increase (%)	Infants born
1997	18	482	203 225		35 314
1998	18	521	232 225	+14.3	21 433
1999	21	537	249 624	+7.5	26 212
2000	22	569	275 187	+10.2	17 887
2001	23	579	289 690	+5.3	24 963
2002	25	631	324 238	+11.9	24 283
2003	28	725	365 103	+12.6	68 931
2004	29	785	367 056	+0.5	67 973
2005	30	923	419 037	+14.2	72 184
2006	32	998	458 759	+9.5	87 705
2007	33	1029	493 420	+7.7	96 690
2008	36	1051	532 260	+7.9	107 383
2009	34	1005	537 463	+1.0	109 239
2010	31	991	550 296	+2.4	120 676
2011	33	1314	550 296	+11.3	134 106
2012	34	1354	609 973	+4.9	143 844
2013	38	1169	686 271	+7.2	149 466
2014	39	1279	776 556	+13.1	170 163
Total			8 010 527		1 478 452

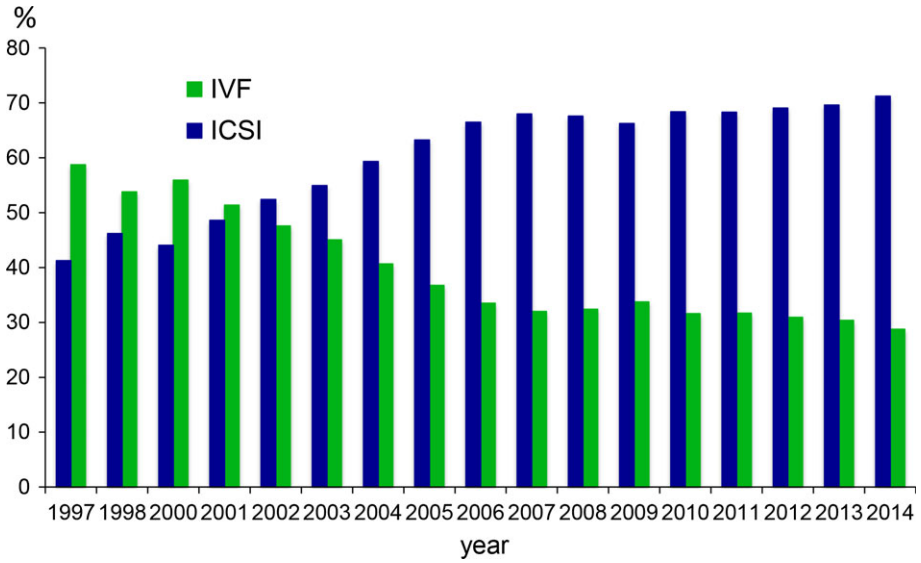

Figure 1 Proportion of IVF versus ICSI in Europe, 1997–2014.

Among the total of 508 433 fresh treatments (ICSI+IVF), 71.3% were performed with ICSI, showing a rise of +1.66% compared with 2013. The preponderance of ICSI over conventional IVF has become more pronounced in recent years (Fig. 1).

As in previous years, with 192 017 treatments, FER is rapidly gaining ground (+24.1%) but the relative proportion to fresh treatments was stable (37.8% in 2014 and 38.3% in 2013), Switzerland being the country with the highest proportion of FER (82.1%) and Serbia with the lowest (1.8%).

Availability of ART in any particular country is calculated by dividing the number of treatment cycles by the number of women of reproductive age (15–45 years) (Supplementary Table SIV). Availability can only be calculated in the 14 countries with full coverage. In those 14 countries a huge variability in availabilty was observed, ART being most available in Denmark, and least available in Malta. As a result the proportion of newborns resulting from ART born in Denmark was 6.4% of all newborns in that country and 0.9% in Malta.

Pregnancies and deliveries after treatment

Table III lists pregnancy rates (PR) and delivery rates (DR) after IVF or ICSI and after FER (regardless of the technique). As in previous reports, data on the number of initiated cycles were incomplete. For that reason we calculated outcome data per aspiration. All 39 participating countries were able to provide pregnancy and delivery data after aspiration, but seven countries failed to provide those after FER (completeness rate: 82.5%). Complete coverage data on both pregnancies and deliveries were provided by 14 countries (Supplementary Table SIV). As shown in Table II, the number of infants born after any method was not provided in five countries (completeness rate: 87.5%). As in earlier reports, the PR and DR (all treatment modalities included) varied significantly from one country to another, PR ranging from 17.1 to 53.1%, DR ranging from 7.9 to 37.8% (except Hungary, reporting no deliveries per aspiration for ART). After FER the DR varied between 5.1 and 41.2%.

Taking all data together (Table II), the PR per aspiration were similar in both IVF and ICSI, 29.3 and 27.2%, respectively, as were the DR, 22.3 and 20.1%, respectively. The PR and DR after thawing of embryos were 27.6 and 19.3%, respectively. The total number of ART infants born in 2014 after all techniques amounted to 170 163, a marked increase of 13.8% (total number of children born in 2013: 149 466).

For the first time, information about 'freeze all' cycles was collected (Supplementary Table SV). Freeze all was carried out at the oocyte level in eight countries (20.5%), and at the embryonic level in 18 countries (46.1%). The registered data demonstrate that freeze all was the decision in 3080 (0.6%) of all IVF+ICSI cycles (at the oocyte level) and in 23 567 (4.8%) at the embryonic level.

Detailed accounts of cycle numbers, aspirations, transfers, pregnancies, and deliveries in IVF, ICSI and FER (after both IVF and ICSI) are given in the Supplementary Tables SV–SVII.

ED data are given by 22 of 39 participating countries (55%) (Supplementary Table SVIII). In most of the other countries this technology is not being performed for legal reasons. Most donation cycles were carried out in Spain, Russia and the Czech Republic, with 12 632, 3672 and 4924 cycles, respectively. Some of 29 965 ED cycles were carried out with freshly collected oocytes (22, 100%), some with frozen oocytes (FOR). PR were only available per embryo transfer (ET), but were considerably higher with freshly donated oocytes (50.3%) than after thawing of oocytes (37.7%). The differences among countries were considerable, ranging between 15.1 and 66.7%. A total of 17 259 deliveries were counted, which considerably exceeds the 11 861 deliveries counted in 2013 (+45.5%). This increment is due to higher numbers of reported deliveries in Spain (+45.1%) and Russia (+47.4%).

Age distribution

As in previous reports, the age distribution of women treated with IVF and ICSI varied among different countries (Supplementary Tables SIX and SX). Not all countries were able to provide data on the age distribution in ICSI and in IVF, some because no IVF treatments were

Table III Results after ART in 2014.

Country	IVF				ICSI			FER				
	Initiated cycles IVF + ICSI	Aspirations	Pregnancies per aspiration (%)	Deliveries per aspiration (%)	Aspirations	Pregnancies per aspiration (%)	Deliveries per aspiration (%)	Thawings FER	Pregnancies per thawing (%)	Deliveries per thawing (%)	ART infants	ART infants per national births (%)
Albania	96				96	39.6	35.4	44	38.6	31.8	62	
Austria		897	32.8	28.1	4773	31.5	27.4	1656	34.0	29.5	4634	5.7
Belarus	2576	1451	37.2	30.5	1059	40.4	37.8	130	32.3	18.5	1093	0.9
Belgium		3220	26.6	19.4	13 457	25.6	18.5	10 677	23.4	16.5	5763	4.6
Bosnia-Herzegovina	531				520	30.2	21.9	67	29.8	17.8	166	
Bulgaria	4587	225	24.4	18.2	3940	20.8	15.3	1230	33.8	26.7	1246	1.8
Croatia	1762	1314	18.7	14.1	1658	22.4	16.4	311	26.7	17.4	569	
Cyprus	1145	203	36.0	22.2	897	37.2	25.1	316	37.7	30.1		
Czech Republic	13 280				12 864	27.5	18.0				6234	5.7
Denmark	11 864	6233	22.5	19.5	5319	26.5	23.5	3898	22.1	19.0	3613	6.4
Estonia	1819	625	26.9	20.6	1175	24.9	19.4	887	13.8	8.2	548	4.0
Finland	4550	2327	29.2	22.0	1999	23.9	18.7				1807	3.1
France		20 638	23.8	18.9	40 295	25.0	20.2	27 214	21.3	15.7	19 113	2.3
Germany	59 284	13 672	28.8	20.6	45 612	28.1	20.6	21 893	23.6	16.2	14 976	2.1
Greece	15 763	2799	31.2	17.1	11 945	29.8	16.2	3216	33.0	17.4	5409	5.9
Hungary	5050	1179	28.8	0.0	3857	25.0	0.0					
Iceland		189	30.2	23.8	166	27.1	22.9	241	27.8	18.3	163	3.7
Ireland	1128	507	43.8	34.9	460	40.9	33.5	385	31.9	20.8	469	0.7
Italy	55 705	6898	23.2	16.2	43 896	21.0	14.0	9501	25.8	18.4	11 272	2.2
Kazakhstan	2299	916	36.0	23.6	1105	41.0	25.0	974	39.9	26.9	864	
Latvia		462	25.8	18.2	480	19.8	7.9	301	23.3	15.0	163	
Lithuania		200	35.5	31.0	152	31.6	27.6	29	24.1	20.7	133	0.4
Macedonia		388	53.1	14.4	1457	41.2	23.3	117	18.8	5.1	483	
Malta	135				125	28.8	27.2				41	0.9
Moldova	751	246	40.7	31.7	492	43.5	31.7	86	32.6	26.7		
Montenegro	425				422	25.6	21.6	17	47.1	41.2	118	1.6
Norway	6126	3125	30.0	24.6	2909	28.3	23.8	4799	13.9	10.4		
Poland	14 634	884	30.9	26.9	13 615	30.5	20.9	7775	29.1	17.7	5203	1.4
Portugal	5661	2146	32.0	23.7	3303	27.7	21.3	1556	32.2	23.0	2155	2.6
Romania	2419	1163	39.0	27.8	1184	36.3	28.3				1147	0.6
Russia	67 470	28 297	32.2	23.4	37 301	27.5	19.6	19 524	36.2	23.4	25 034	1.3
Serbia	273	116	30.2	27.6	144	37.5	29.9	5	80.0	80.0	103	0.2

Slovenia	3377	895	36.2	28.6	2378	25.1	19.4	1288	29.8	23.1	1124	5.4
Spain	51 591	4935	28.8	19.7	41 417	26.9	18.6	21 007	32.0	20.0	27 320	6.4
Sweden	11 832	5575	29.8	24.1	5560	27.1	22.3				4332	3.8
Switzerland	5449	824	25.5	19.2	4095	22.7	16.7	4473	19.7	13.4	1688	2.0
The Nederlands	14 115	5851	30.0	21.5	6936	31.7	23.8				3042	1.7
Ukraine	10 515	1825	40.4	29.5	8206	35.6	27.5	4806	40.2	31.6		
UK	45 447	18 765	32.2	28.1	24 110	33.2	29.4	13 595	31.7	27.4	20 076	2.6
All	421 659	138 990	29.3	22.3	349 379	27.2	20.1	162 018	27.6	19.3	170 163	2.1

Bosnia Herzegovina consists of two parts: the Federation part and the Republic of Srpska.
Total rates refer to these countries where all data were reported for the given technique:
†ART infants also include ED.
For IVF and ICSI there were for Belarus, Croatia, Czech Republic, Finland, Germany, Greece, Latvia, Lithuania, Macedonia, Poland, Portugal, Romania, Russia and Spain respectively 75, 3, 6, 886, 10, 22, 8, 49, 38, 15, 6, 62, 1019 and 2 deliveries with unknown outcome. These were accepted as singletons to calculate the ART infants.
For FER there were for Austria, Czech Republic, Finland, France, Greece, Latvia, Lithuania, Macedonia, Poland, Romania and Russia, respectively, 488, 7, 694, 5, 8, 45, 2, 3, 28, 21 and 283 deliveries with unknown outcome. These were accepted as singletons to calculate the ART infants.
For ED there were for Czech Republic, Finland, Greece, Latvia, Romania, Russia and Spain respectively 5, 149, 2, 6, 7, 126 and 1022 deliveries with unknown outcome. These were accepted as singletons to calculate the ART infants.
For PGD there were for Latvia, Russia and Spain, respectively, 1, 25 and 841 deliveries with unknown outcome. These were accepted as singleton to calculate the ART infants.

carried out. The highest percentage of women aged 40 years and older undergoing aspiration for IVF was found in Greece (as in 2013), whereas the highest percentage of women aged <34 years was found in Ukraine and in Poland (as in 2013). Also in ICSI the highest percentage of women aged 40 years and older undergoing aspiration was found in Greece, whereas the highest percentage of women undergoing aspiration aged <34 years was recorded in Albania (as in 2013). Overall the well known age-dependent decline of the reported PR and DR was very similar in IVF and ICSI, but the differences among countries were considerable.

Although the age-related decline was present in FER cycles as well (Supplementary Table SXI), the outcome data of FER were generally higher than in the fresh cycles. In contrast, in ED donation cycles (Supplementary Table SXII) age of the recipient women did not impact on PR or on DR.

Number of embryos transferred and multiple births

The number of embryos transferred after IVF and ICSI together are presented in Table IV. Although the specific number of elective single embryo transfers cannot be identified, the number of transfers of only one embryo per cycle continues to rise, whereas the number of transfers of three or more embryos per cycle decreases (Fig. 2). The number of countries with more than 50% single embryo transfers has risen from six in 2013 to eight in 2014 (Austria, Belgium, Czech Republic, Denmark, Finland, Iceland, Poland and Sweden). The countries with more than 40% of transfers with three embryos were Bosnia-Herzegovina (Republik of Srpska), Lithuania and Serbia. In Greece 7.4% of transfers were carried out with four or more embryos.

Additional details about the pregnancy and delivery data are given in Supplementary Tables SXIII and SXIV. The recorded incidence of pregnancy loss was 15.5% after IVF + ICSI (in 2013: 16.8%) and 18.6% after FER (in 2013: 19.8%). The recorded loss to follow-up was 9.9% after IVF + ICSI (in 2013: 8.3%) and 7.3% after FER (in 2013: 9.7%).

Twin and triplet deliveries were similar after IVF+ICSI treatments and after FER. Those countries with the highest proportion of single embryo transfers also had the lowest twin and triplet DR (the lowest in Sweden, 4.2 and 0.1%, respectively) in fresh cycles. The countries still proceeding with the transfer of three or more embryos in fresh cycles present with DR of twins ranging between 18.2% (Lithuania) and 29.6% (Bosnia-Herzegovina, Republik of Srpska), and with DR of triplets ranging between 1.2% (Greece) and 1.8% (Lithuania). Interestingly, Lithuania with higher numbers of transfers of three and more embryos in fresh cycles did not report any twin or triplet deliveries after FER.

Regarding ED, of 15 749 deliveries with information regarding multiplicity, 3675 were twins (23.3%) and 56 were triplets (0.4%) (data not presented in tables).

Perinatal risks and complications

Data on premature deliveries were availabe from 20 European countries. The incidence of premature delivery is listed according to the number of newborns in Supplementary Table SXV. The prematurity data from fresh IVF and ICSI, of FOR and of ED are listed together. In singleton pregnancies the incidence of extreme preterm birth (gestational weeks 20–27) reached 2.1% (1.3% in 2013), 4.1% in twin

Table IV Number of embryos transferred after ART and deliveries in 2014.

Country	IVF + ICSI								FER		
	Transfers	1 embryo (%)	2 embryos (%)	3 embryos (%)	4+ embryos (%)	Deliveries	Twin (%)	Triplet (%)	Deliveries	Twin (%)	Triplet (%)
Albania	92	4.3	76.1	19.6	0.0	34	20.6	0.0	14	21.4	0.0
Austria	6616	57.3	42.1	0.5	0.0	4092	13.0	0.1	0		
Belarus	2389	11.1	61.1	27.9	0.0	843	22.1	1.3	24	16.7	4.2
Belgium	14 196	56.6	36.0	6.5	0.9	3112	10.0	0.2	1765	8.7	0.2
Bosnia-Herzegovina	510	13.7	45.5	39.8	1.0	114	27.2	2.6	12	25.0	0.0
Bulgaria	2669	29.2	49.5	18.2	3.0	644	11.3	0.0	329	12.2	0.0
Croatia	2383	48.4	48.9	2.7	0.0	439	11.9	0.2	68	11.8	0.0
Cyprus						0			0		
Czech Republic	10 542	61.3	36.9	1.8	0.0	2311	11.1	0.2	1808	9.9	0.1
Denmark	9556	54.6	41.6	3.8	0.0	2467	10.5	0.4	740	8.8	0.0
Estonia	1613	32.5	58.5	8.9	0.0	357	15.4	0.3	73	13.7	0.0
Finland	3735	79.8	20.2	0.0	0.0	886			694		
France	47 761	40.1	54.1	5.5	0.3	12 030	15.7	0.2	4285	9.2	0.2
Germany	51 769	18.6	70.5	10.9	0.0	12 203	21.4	0.6	3538	14.3	0.7
Greece	11 515	16.5	41.7	34.4	7.4	2413	23.7	1.2	558	20.0	1.5
Hungary	4584	19.1	57.4	20.3	3.2	0			0		
Iceland	303	56.1	43.9	0.0	0.0	83	4.8	0.0	44	11.4	0.0
Ireland	854	41.0	57.8	1.2	0.0	331	14.8	0.3	80	8.8	0.0
Italy	39 768	25.8	46.6	25.2	2.3	7277	19.8	1.2	1747	9.8	0.3
Kazakhstan						273	17.9	0.7	250	16.0	0.0
Latvia	774	34.6	63.2	2.1	0.0	122	20.2	0.0	45		
Lithuania	344	14.2	42.7	43.0	0.0	104	18.2	1.8	6	0.0	0.0
Macedonia						369	26.0	0.6	12	11.1	0.0
Malta	114					34	20.6	0.0	0		
Moldova						0			0		
Montenegro	384	20.3	40.6	37.8	1.3	91	20.9	0.0	7	14.3	0.0
Norway						0			0		
Poland	12 372	54.0	44.9	1.1	0.0	3090	11.7	0.2	1378	6.7	0.1
Portugal	4269	24.6	72.5	2.9	0.0	1210	20.5	0.2	358	15.4	0.6
Romania	2105	12.6	55.8	28.3	3.4	658	24.8	1.5	214	21.2	2.6
Russia	53 655	28.6	63.3	7.6	0.4	13 921	21.5	0.6	4575	16.6	0.2
Serbia	225	20.4	37.8	41.8	0.0	75	29.3	1.3	4	0.0	0.0
Slovenia	2758	42.4	56.4	1.2	0.0	718	10.6	0.3	297	8.4	0.0
Spain	34 342	25.4	68.2	6.4	0.0	8676	19.4	0.3	4193	15.5	0.2
Sweden	9294	79.9	20.1	0.0	0.0	2585	4.2	0.1	1444	3.0	0.1
Switzerland	3977	27.5	60.2	12.3	0.0	842	17.3	0.6	600	14.3	0.3
The Netherlands						2913	4.2	0.1	1559	3.0	0.0
Ukraine	8207	21.0	57.4	21.2	0.4	2791	25.5	0.4	1520	2.03	0.0
UK	38 842	45.6	50.5	3.9	0.0	12 357	14.3	0.2	3730	13.9	0.3
All*	382 517	34.9	54.5	9.9	0.7	100 465	17.0	0.5	35 971	12.4	0.3

Bosnia Herzegovina consists of two parts: the Federation part and the Republic of Srpska.
*Totals refer only to these countries where data on number of transferred embryos and on multiplicity were reported.

pregnancies (2.9% in 2013) and 7.9% in triplet pregnancies (8.3% in 2013). A high incidence of very premature birth rates (gestational weeks 28–32) was found in twin pregnancies: 15.5% (in 2013: 9.2%) and in triplet pregnancies: 32.4% (in 2013: 31.2%). Term delivery (≥37 weeks) was 77.1% delivered in singleton pregnancies, 41.8% in twin pregnancies and 12.7% in triplet pregnancies, all similar to the results achieved in 2013. Interestingly, since the beginning of the recording of this item the premature DR (<37 weeks) of singleton pregnancies calculated per embryo transfer has remained similar to the premature DR of twin pregnancies (Fig. 3).

Complications of various steps of ART, such as ovarian hyperstimulation syndrome (OHSS), haemorrhage, infections and maternal deaths, were reported by 31 countries (Supplementary Table SXVI). With 2040 cases, OHSS was the most common reported complication

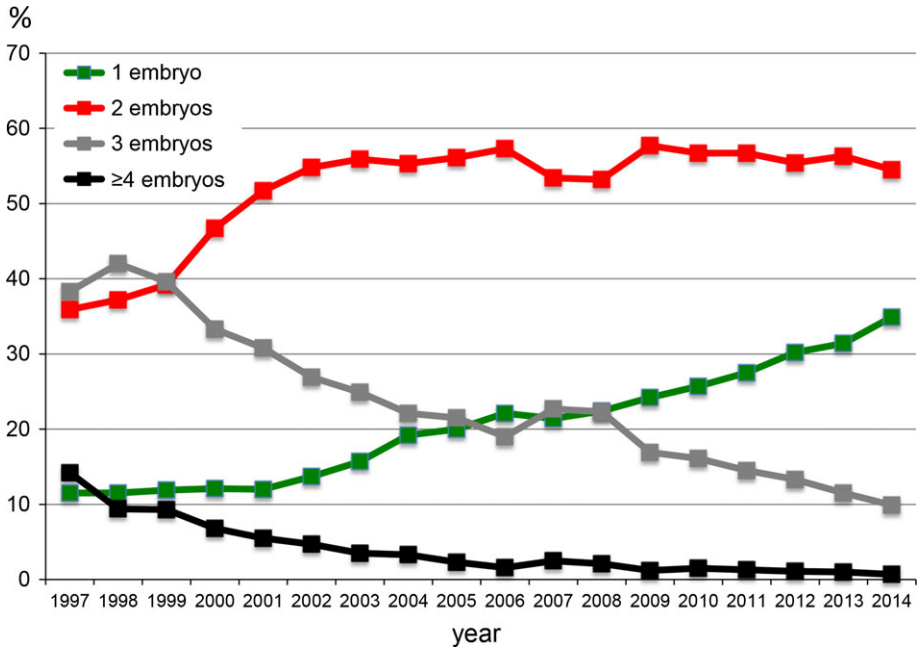

Figure 2 Number of embryos transferred in IVF and ICSI during fresh cycles in Europe, 1997–2014.

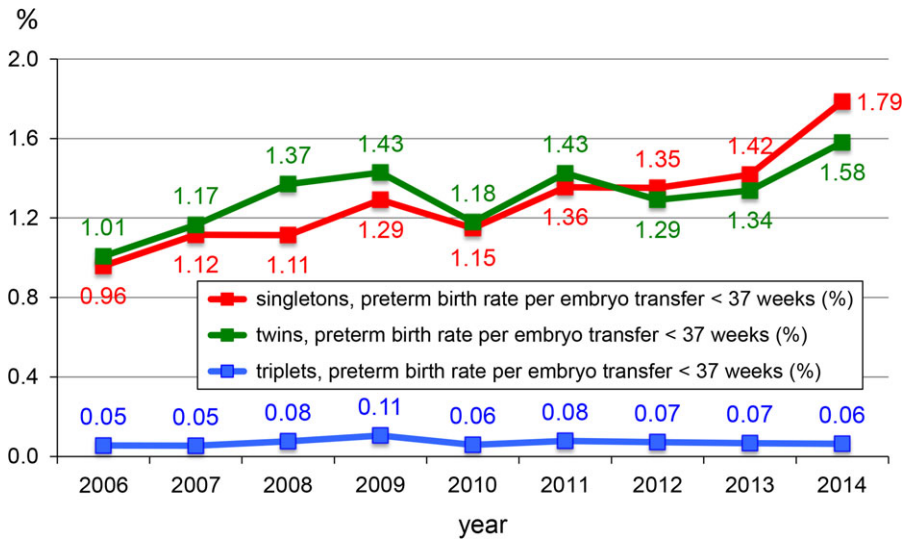

Figure 3 Evolution of the proportion of premature deliveries (<37 weeks of gestation) in singleton, twin and triplet pregnancies in Europe, 2006–2014.

of ART (incidence rate: 0.3% of all reported cycles). Other complications were much rarer, such as haemorrhage (0.1% of all treatment cycles), infections (0.01%) and maternal death (3 per 700 000 treatment cycles). Two cases of maternal death occurred in the context of pregnancy and delivery (aortic dissection in a pregnant Turner syndrome patient, amniotic fluid embolism). Another patient died of sudden heart failure 1 day before oocyte collection.

Foetal reductions were reported from 16 countries and were performed in 0.07% of all treatment cycles. Most foetal reductions were reported in the UK, Spain and Russia.

PGT/PGT-A

PGT (PGT for monogenic disorders or structural rearrangements) and PGT-A (PGT for aneuploidy) activities were reported from 22 countries (20 in 2013, 19 in 2012). The number of treatment cycles was 15 894 (2.05% of all ART treatments, Table I), which compared to 2013 represents a drastic rise in treatment numbers (+6103). These involved 13 460 fresh cycles and 2434 thawings, resulting in 6269 fresh and 2021 frozen embryo transfers. In total, 2538 pregnancies (42.5% per transfer) and 2024 deliveries (32.3% per transfer) resulted from fresh cycles. Corresponding figures for FER were 801 (41.8% per transfer) and 619 (30.8% per transfer). The main contributor was Spain with 5242 cycles. A more detailed survey of PGT/PGT-A activities can be found in the annual reports of the ESHRE PGT consortium (De Rycke *et al.*, 2017).

IVM

A total of 292 treatments with IVM were reported from eight countries (247 in 2013, 421 in 2012) (Table I). Most IVM cycles were recorded in France and Russia. A total of 124 transfers resulted in 28 pregnancies and 17 deliveries. France accounted for 68.8% of immature oocyte aspirations, but reported only 53 transfers (26.4%) and 10 deliveries after IVM.

FOR

FOR was reported by 16 countries (12 in 2013) and this accounted for 3404 thawing cycles (6611 in 2013) (Table I), 2655 transfers, 790 pregnancies and 548 deliveries. The vast majority was carried out in Italy (1639 treatments) and in Spain (845 treatments).

IUI

Data on IUI with husband semen (IUI-H, Supplementary Table SXVII) and using donated semen (IUI-D, Supplementary Table SXVIII) were collected by 1364 institutions in 25 and 21 countries, respectively. Spain was the most active country in both treatment modalities. All together, 120 789 treatments with IUI-H resulted in 9533 deliveries (7.92%), whereas 49 163 treatments with IUI-D in 5061 deliveries (10.3%), similar to results reported in 2013. In all three age groups most pregnancies led to singleton deliveries (90.3% in IUI-H, 92.2% in IUI-D). The twin and triplet DR were generally low (Table V), depending on the age of the treated patient and were similar to those reported in previous years (twin deliveries: 8.8 and 7.3%, respectively; triplet deliveries: 0.4 and 0.3%, respectively).

Sum of fresh and FER ('cumulative') DR

Supplementary Table SXIX provides us with an estimate (not a true rate, as the data set presented here is cross-sectional) of a cumulative DR, calculated from the fresh embryo transfers and those carried out after thawing. The data are presented based on the sum of the fresh and FER deliveries and the number of aspirations of the same year as the denominator. As no data on deliveries were available from Hungary, we were able to calculate cumulative DR from the data of 38 countries (35 countries in 2013). Whereas in all data taken together the DR after the fresh cycle amounted to 20.5%, the cumulative DR was 28.1% (a rise of 1.2% compared to 2013). The countries with the highest benefit resulting from FER were Finland (+16.0%), Ukraine (+15.2%), Albania (+14.6%), the Czech Republic (+14.0%), Kazakhstan (+13%) and Sweden (+13.0%). The countries with the lowest benefit resulting from FER were Malta (+0%) and Macedonia (+0.3%).

Cross-border reproductive care

Fifteen countries reported data on cross-border patients: Albania, Belarus, Croatia, Denmark, Finland, Greece, Iceland, Macedonia, Malta, Poland, Portugal, Serbia, Slovenia, Spain and Switzerland. A total of 17 160 cycles were reported, 36.4% of which involved IVF/ICSI with the couple's own gametes, while 45.6% were ED and 17.4% were IVF or ICSI with semen donation. Additionally, 8021 IUI with sperm donation were registered. Information regarding the countries of origin was very incomplete and not reliable enough to obtain any conclusive information. The main reasons reported by patients were to have access to a technique not legally available in their home countries (53.2%) or to seek a higher quality treatment (17.0%).

Discussion

This is the 18th annual report of the combined activities of the European national registries collecting data on ART. The EIM Consortium, from 1997 to 2014, has reported on more than 8 million treatments (8 010 527) leading to the birth of nearly 1.5 million infants (1 478 452). A comprehensive review of the first 15 years of EIM (from 1997 to 2011) was recently published (Ferraretti *et al.*, 2017).

The present collected data summarizes the totality of the data collections provided by 39 European countries (38 in 2013), as Bosnia-Herzegovina joined the consortium. Data are still not available from Azerbaijan, Georgia and Kosovo. Slovakia and Turkey are members of the EIM Consortium, but were not able to participate. Another group of small European countries never participated in the Consortium, such as Andorra, Armenia, Liechtenstein, Luxemburg, Monaco, San Marino and The Vatican, most of them not offering independent ART services. The level of completeness at the national level has risen to 92.9%, and at the level of the reporting clinics to 87.5%, both a substantial increase as compared to previous years.

Fourteen countries were able to provide data sets for all registered clinics (Supplementary Table SIV), but the quality of data sets varies much from one country to another. A good example are discrepancies on the definition of a treatment: initiated treatment or collection of oocytes. Whereas data on aspirations were available from 34 countries (87.2%), those on initiated cycles were from 33 (or 32) countries (84.6 or 82.0%), both not necessarily the same countries. Only in 27

Table V IUI with husband (IUI-H) or donor (IUI-D) semen in 2014.

Country	IUI-H						IUI-D					
	Cycles	Deliveries	Deliveries (%)	Singleton (%)	Twin (%)	Triplet (%)	Cycles	Deliveries	Deliveries (%)	Singleton (%)	Twin (%)	Triplet (%)
Albania	54	5	9.3	80.0	20.0	0.0						
Austria												
Belarus	409	69	16.9	96.9	3.1	0.0	5	3	60.0	100.0	0.0	0.0
Belgium	12 933	753	5.8	95.1	4.9	0.0	8281	615	7.4	95.8	4.1	0.2
Bosnia-Herzegovina	184	13	7.1	92.3	7.7	0.0						
Bulgaria	1018	105	10.3	97.1	2.9	0.0	241	31	12.9	96.8	3.2	0.0
Croatia	1224	51	4.2	100.0	0.0	0.0						
Cyprus												
Czech Republic												
Denmark	10 016	1211	12.1	89.3	9.5	1.2	10 141	781	7.7	93.2	6.4	0.4
Estonia	150	10	6.7	100.0	0.0	0.0	145	7	4.8	100.0	0.0	0.0
Finland	3226	278	8.6	93.5	6.5	0.0	1176	150	12.8	94.7	5.3	0.0
France	52 731	5343	10.1	89.4	10.3	0.3	3618	660	18.2	88.5	10.9	0.6
Germany												
Greece	4924	363	7.4	93.1	6.6	0.3	605	58	9.6	91.2	7.0	1.8
Hungary												
Iceland												
Ireland	631	51	8.1	86.3	13.7	0.0	166	26	15.7	92.3	7.7	0.0
Italy	23 866	1529	6.4	90.1	9.5	0.3	37	1	2.7	100.0	0.0	0.0
Kazakhstan	620	9	1.5	100.0	0.0	0.0	94	3	3.2	100.0	0.0	0.0
Latvia	149	8	5.4	100.0	0.0	0.0	143	5	3.5	100.0	0.0	0.0
Lithuania	450	30	6.7	72.2	27.8	0.0						
Macedonia	1144	41	3.6				2	0				
Malta												
Moldova												
Montenegro	128	15	11.7	100.0	0.0	0.0						
Norway	238	30	12.6	93.3	6.7	0.0	530	81	15.3	95.1	4.9	0.0
Poland	9738	656	6.7	93.3	6.6	0.2	1699	172	10.1	95.2	4.8	0.0
Portugal	2089	212	10.1	89.1	10.9	0.0	199	33	16.6	75.0	25.0	0.0
Romania	1817	139	7.6	91.4	8.6	0.0	481	43	8.9	81.4	18.6	0.0
Russia	10 178	1107	10.9	93.4	6.6	0.0	3793	597	15.7	95.1	4.5	0.3
Serbia	349											
Slovenia	662	59	8.9	84.7	15.3	0.0	1	0				
Spain	28 204	2705	9.6	87.9	11.5	0.6	11 973	1640	13.7	89.1	10.6	0.3
Sweden							870	122	14.0	94.3	5.7	0.0
Switzerland												
The Netherlands												
Ukraine	1764	184	10.4	91.8	8.2	0.0	321	50	15.6	94.0	6.0	0.0
UK	6430						4681	643	13.7	93.6	5.9	0.5
All*	175 326	14 976	8.5	90.0	9.5	0.3	49 202	5721	11.6	92.0	7.7	0.3

Bosnia Herzegovina consists of two parts: the Federation part and the Republic of Srpska.
*Total refers to these countries where data were reported and mean percentage were computed on countries with complete information.
Poland: For IUI-H and IUI-D there were respectively 282 and 63 pregnancies with unknown outcome.

countries (69.2%) were we able to obtain information about both the number of initiated cycles and the number of oocyte collections. Other countries have failed to report treatment endpoints, most notably delivery outcome data were availabe only in 39 countries after fresh cycles and after FER (97.4%). Underreporting of treatment numbers may lead to overestimation of the efficacy outcome of the offered treatments. Improvements in the quality of the retrieved data sets may still be achieved. This may possibly be achieved through the organization of external audits both in the offices of the national registries and in the local IVF clinics, as exemplified by Switzerland (Van den Bergh et al., 2005) and by the European Liver Transplant register (Karam et al., 2003). However, the introduction of such an external auditing system would require an enormous financial and logistic effort, which can only be performed successfully with support of the national and European authorities.

The steady rise in the observed treatment numbers may be a motivation to improve stringency in the monitoring of the treatments. Whereas in 2013, 686 271 treatments with various forms of ART were reported to EIM (Calhaz-Jorge et al., 2016, 2017), these numbers rose to 776 556 in 2014 (Table II). Close to two-thirds of this increase results from a basic change in the Spanish registry, which now provides nearly complete data sets (78 182 treatments in 2013 to 109 275 treatments in 2014). In addition, the Russian centres contributed with 94 985 treatments in 2014 (in 2013: 67 861). A total of 136 436 deliveries led to the birth of 170 163 infants, representing 2.1% of all children born in Europe (Table III). Due to differences in access to ART, the relative proportion of children born after ART may vary from 0.2% in Serbia to 6.4% in Denmark. These numbers have a significant impact on demography and should therefore be of interest to all stakeholders.

Data collection can only be optimized in the presence of good governance. Compulsory data collection systems have been shown previously to be more effective than voluntary systems, but personal initiative still played a decisive role in seven countries. The countries with the lowest participation of IVF institutions were Serbia (1 of 18), Albania (1 of 8), Bulgaria (4 of 32), Croatia (7 of 13) and Ireland (3 of 7). Except in Croatia, none of these countries benefited from a compulsory data registration. Coherent and systematic data registration and monitoring of all treatment outcomes should become mandatory in ART and be considered as an indicator of excellent quality of care and good governance.

The annual EIM reports have been valuable to detect and monitor ongoing trends in ART. Whereas treatment numbers of IVF, IVM and FOR have appeared to be stable in recent years, those of ICSI, ED, FER and PGT have been on the rise. The predominance of ICSI over IVF has been observed in previous reports (Calhaz-Jorge et al., 2017). The rise in treatment numbers with FER fits well to the current trend towards segmentation of ART (Devroey et al., 2011) including 'freeze all' cycles. This is the first report containing data on 'freeze all' cycles.

The steady rise in the demand for PGT may well be attributed to the availability of arays for genetic testing, with PGT-A numbers increasing from 4% in 2010 to 20% in 2013 (De Rycke et al., 2017), and now replacing less effective forms of chromosome analysis, such as fluorescent in situ hybridization (Mastenbroek et al., 2007). The report of the PGD consortium of ESHRE has demonstrated that the bulk of PGD consists of aneuploidy screening (De Rycke et al., 2017) and the demand/offer for that sort of treatment seems to be rising constantly, despite the current lack of prospective randomized clinical trials substantiating the benefits and specific indications for this technology (Sermon et al., 2016; Harper et al., 2018).

Another trend visible from the annual EIM reports is the lower numbers of embryos transferred per treatment cycle resulting in fewer multiple deliveries. The number of embryo transfers with only one embryo continues to rise (Fig. 2) and, in parallel, the numbers of twin and triplet deliveries decline. Interestingly, whereas the proportion of premature deliveries of twins and triplets remains similar to previous years, the proportion of premature deliveries (<37 weeks) of singletons per embryo transfer has risen from 0.96% in 2006 to 1.79% in 2014 (Fig. 3). The reason for this steady increase in premature singleton deliveries remains speculative, but all these findings point towards the need for continuous and prospective follow-up of all activities in ART.

Other severe adverse events, such as infection and haemorrhage complicating oocyte retrieval, but also maternal death, continue to occur. Three cases of maternal death were reported in 2014, all within the context of ongoing pregnancies (incidence rate: 1.59/100 000 pregnancies). The latter seem to be underreported, as an earlier Dutch survey has demonstrated a much higher incidence of maternal death within the context of ART. Indeed, an incidence of maternal mortality of 6/100 000 directly related to IVF and of 42.5/100 000 pregnancies resulting from ART, mainly in twin pregnancies (Braat et al. 2010) was reported. Underreporting of adverse events leads to an overestimation of the safety of the treatment. Although the number of reported foetal reductions has risen from 416 to 526 in 2014 (reported to be performed in 16 countries), these numbers most likely are also drastically underreported. Without this intervention, the number of high order multiple deliveries would be higher, but with current technology developments in ART (including elective single embryo transfer and cryostorage of remaining oocytes or embryos) multiple pregnancies and related complications should be avoidable today.

The practice of freezing oocytes and embryos is on the rise and that can be clearly seen in the steep rise of the number of recorded FER treatments, which in 2014 for the first time exceeded that of conventional IVF (i.e. 192 017 versus 146 148, Table I). Earlier studies have shown that singleton newborns born from fresh treatments have lower birthweights than those born after a thawing cycle (De Geyter et al., 2006; Henningsen et al., 2011). Recently, the incidence of neonates born large for gestational age has been shown to be significantly more prevalent in FER cycles (Pinborg et al., 2010, 2014; Luke et al., 2017). Although the EIM data set cannot provide data on this particular potential adverse effect of ART, the EIM datasets will continue to monitor the relative importance of FER within the context of ART.

The EIM data sets also reveal large differences in access to infertility treatment in the various participating European countries. The World Health Organization (WHO) has defined 'infertility' as a 'disease of the reproductive system' and as a 'disability' and access to medical treatment has been issued as a human right. In contrast to those basic principles, the number of treatments with either form of ART varies greatly between European countries. This is best exemplified in those countries with complete coverage (Supplementary Table SIV). Not only the number of cycles per million inhabitants varies between 423 in Malta and 2978 in Iceland, but also the relative number of infants born from ART treatments. The ESHRE Capri Group has estimated that ~1500 couples with infertility per million inhabitants should be

treated with ART per year (ESHRE Capri Group, 2001). Even among the 14 countries with complete coverage five countries did not fulfil that requirement in 2014 (35.7%) and these countries might be thought to belong to the more advanced ones. Transparency in data both at the national level but also, for comparison purposes, at the international level may be particularly helpful in convincing politicians and health care authorities to undertake measures in improving access to treatment.

Until today the data collection handled by the EIM Consortium has been cross-sectional and based on annual data reporting. Cumulative data analysis has only been possible within the frame of 1 year. The EIM Consortium has come far to push the completeness of the European data collection beyond 90%, as first demonstrated in the 2014 data sets, described here. Increasingly, infertility treatments are being fragmented into small treatment units that may easily cross the time frame of cross-sectional data collections, which points to the need for developing new surveillance tools. A concept for prospective follow-up of infertility treatment has therefore been elaborated earlier (De Geyter *et al.*, 2016).

So far the annual reports published by the EIM consortium, including the present 18th report, have been limited to being purely descriptive. The organization of the data collection, as carried out by the EIM Consortium, may be further developed towards medical surveillance and vigilance. Surveillance is defined by the continuous and systematic collection of health data (here related to ART and its outcome) needed for the analysis and interpretation of trends in medical care with a special focus on safety. Surveillance in medical care goes far beyond considering the results of prospective randomized trials, in which very selected cohorts of patients are recruited and treated under well-controlled conditions. Register-based data have their value by being less biased by predefined selection criteria. They reflect to a much larger extent real-life conditions and for that reason have the capacity to give a more realistic picture of the outcome results. However, real surveillance can only be achieved with more or less complete data sets, in which underreporting is avoided. That goal can best be achieved if data submission to the national registries is made compulsory.

Medical surveillance may also be used for the establishment of vigilance. Vigilance aims at detecting serious or less serious adverse events resulting from medical activities. Through the increasing trend towards replacing fewer embryos per treatment cycle, present-day ART has been successful in reducing the incidence of multiple delivery and the EIM annual reports have been able to make this trend visible and this increases the awareness on the usefulness of such practice. In addition, a more novel development is the adoption of the principle of 'freeze all' and the delayed thawing and transfer of frozen embryos, which has already resulted in an upsurge of the number of FER cycles. All these trends are expected to lower the incidence of other common complications, such as OHSS and foetal reduction. Other adverse events may still occur and need to be registered, because vigilance does not only consist of merely recording adverse events, but also the assessment of underlying causes and proper understanding of the mechanisms leading to the adverse events, which ultimately may lead to the formulation of preventive measures as part of an ongoing quality management development.

As shown here, one in 50 children born in Europe are the result of ART treatments. Practitioners, professional bodies, and national and European political bodies have a duty to realize that such therapies require appropriate logistic and financial support in order to set up compulsory national reporting electronic databases, ideally a pan-European centralized data collection, to monitor both the efficiency and safety of therapy and also the long-term health of children born after treatment. The creation of a unique individual patient European coding system will ensure all aspects of an ever increasing spectrum of ART care can be measured and analysed thus ensuring full surveillance and vigilance. The time is now. The concept of evolving the current cross-sectional register towards prospective surveillance and vigilance of care in ART will take years to become real and will require top down support from national and supranational health care authorities. Such a concept can only be supported by all stakeholders of ART, including the patients, and should be motivated to provide care with excellence.

Supplementary data

Supplementary data are available at *Human Reproduction* online.

Authors' roles

V.G. performed the calculations. CDG wrote the article. All other co-authors reviewed the final article and made appropriate corrections and suggestions to improve it. In all, this document represents a fully collaborative work.

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Conflict of interest

There are no competing interests.

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