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Oocyte and ovarian tissue cryopreservation in European countries: statutory background, practice, storage and use†

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STUDY QUESTION: What is known in Europe about the practice of oocyte cryopreservation (OoC), in terms of current statutory background, funding conditions, indications (medical and 'non-medical') and specific number of cycles?

SUMMARY ANSWER: Laws and conditions for OoC vary in Europe, with just over half the responding countries providing this for medical reasons with state funding, and none providing funding for 'non-medical' OoC.

WHAT IS ALREADY KNOWN: The practice of OoC is a well-established and increasing practice in some European countries, but data gathering on storage is not homogeneous, and still sparse for use. Ovarian tissue cryopreservation (OtC) is only practiced and registered in a few countries.

STUDY DESIGN, SIZE, AND DURATION: A transversal collaborative survey on OoC and OtC, was designed, based on a country questionnaire containing information on statutory or professional background and practice, as well as available data on ovarian cell and tissue collection, storage and use. It was performed between January and September 2015.

PARTICIPANTS/MATERIALS, SETTING AND METHODS: All ESHRE European IVF Monitoring (EIM) consortium national coordinators were contacted, as well as members of the ESHRE committee of national representatives, and sent a questionnaire. The form included national policy and practice details, whether through current existing law or code of practice, criteria for freezing (age, health status), availability of funding and the presence of a specific register. The questionnaire also included data on both the number of OoC cycles and cryopreserved oocytes per year between 2010 and 2014, specifically for egg donation, fertility preservation for medical disease, 'other medical' reasons as part of an ART cycle, as well as for 'non-medical reasons' or age-related fertility decline. Another question concerning data on freezing and use of ovarian tissue over 5 years was added and sent after receiving the initial questionnaire.

MAIN RESULTS AND THE ROLE OF CHANCE: Out of 34 EIM members, we received answers regarding OoC regulations and funding conditions from 27, whilst 17 countries had recorded data for OoC, and 12 for OtC. The specific statutory framework for OoC and OtC varies from absent to a strict frame. A total of 34 705 OoC cycles were reported during the 5-year-period, with a continuous increase. However, the accurate description of numbers was concentrated on the year 2013 because it was the most complete. In 2013, a total of 9126 aspirations involving OoC were reported from 16 countries. Among the 8885 oocyte aspirations with fully available data, the majority

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or 5323 cycles (59.9%) was performed for egg donation, resulting in the highest yield per cycle, with an average of 10.4 oocytes frozen per cycle. OoC indication was 'serious disease' such as cancer in 10.9% of cycles, other medical indications as 'part of an ART cycle' in 16.1%, and a non-medical reason in 13.1%. With regard to the use of OoC, the number of specifically recorded frozen oocyte replacement (FOR) cycles performed in 2013 for all medical reasons was 14 times higher than the FOR for non-medical reasons, using, respectively, 8.0 and 8.4 oocytes per cycle. Finally, 12 countries recorded storage following OtC and only 7 recorded the number of grafted frozen/thawed tissues.

LIMITATIONS, REASONS FOR CAUTION: Not all countries have data regarding OoC collection, and some data came from voluntary collaborating centres, rather than a national authority or register. Furthermore, the data related to use of OoC were not included for two major players in the field, Italy and Spain, where numbers were conflated for medical and non-medical reasons. Finally, the number of cycles started with no retrieval is not available. Data are even sparser for OtC.

WIDER IMPLICATIONS OF THE FINDINGS: There is a need for ART authorities and professional bodies to record precise data for practice and use of OoC (and OtC), according to indications and usage, in order to reliably inform all stakeholders including women about the efficiency of both methods. Furthermore, professional societies should establish professional standards for access to and use of OoC and OtC, and give appropriate guidance to all involved.

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Introduction

Oocyte cryopreservation (OoC) practice is increasing in Europe and worldwide, and has been described as 'women's emancipation set in stone' (Homburg *et al.*, 2009), especially since the advent of the more efficient vitrification technique (Rienzi *et al.*, 2010). It is of importance to cancer patients, or any woman whose ovarian reserve is endangered by a medical condition and/or its treatment. It can also be important to women as a possible backup method or 'insurance' to ameliorate their chances of conception when postponing pregnancy. Furthermore, since the American Society for Reproductive Medicine removed the 'experimental label' (Practice committee, 2013) and the American Society of Clinical Oncology (Loren *et al.*, 2013) updated its guidelines with regard to both OoC and ovarian tissue cryopreservation (OtC), the practice has further grown worldwide.

A substantial number of oocytes are increasingly cryopreserved in Europe, but only a few countries collect specific detailed data for this purpose. The total number of ovarian tissue biopsies or ovaries cryopreserved in Europe is unknown, and it is difficult to accurately inform women about the efficiency of the method, more specifically used prior to cancer treatment in children or adolescents where stimulation for OoC is not possible.

The medical indications for OoC are both general and ART specific. General medical indications include mostly women whose cytotoxic cancer treatment threatens their ovarian reserve or whose medical pathology presents a similar danger. This is the case for severe endometriosis (Somigliana *et al.*, 2015), genetic disorders such as mosaic Turner's syndrome (Oktay *et al.*, 2015), or severe Crohn's disease necessitating cytotoxic drugs. Such 'medical indications' for OoC avoid ethical debates about the nature of the embryo and its cryopreservation (ESHRE Ethics and Law TF 1, 2001; ESHRE Ethics and Law TF 2, 2001), or legal disputes about embryo transfer when a couple breaks up (Evans, ECHR, 2007). They may also present the advantage of avoiding the need for egg donation when the recovered patient wishes for a pregnancy at a later stage. Other medical but ART-specific indications accepted in current practice include emergency freezing in IVF when sperm is not available on the day of oocyte retrieval, prevention of ovarian hyperstimulation syndrome (OHSS) or accumulation of oocytes either in cases of poor responders or to increase their availability for PGD (Argyle *et al.*, 2016). A recent indication is also being developed in transgender people, in case of female to male change (Wallace *et al.*, 2014; De Roo *et al.*, 2016). Furthermore, improved efficiency thanks to vitrification has led to the creation of donor egg banks which simplifies the logistics of egg donation and avoids the need to match donor's and recipient's cycles, and alleviates waiting lists (Cobo *et al.*, 2010).

In contrast, the other indication, variously labelled as 'non-medical', 'social' or 'elective' because of age-related loss of oocytes has led to vigorous semantic debates. These debates include ethical issues, as respect of women's autonomy, as well as social concerns of equity (ESHRE TF 18, 2012) and public funding. It is important to keep in mind that medicine must do as little harm as possible, and pregnancy at a later age involves more complications and costs. Indeed, the postponement of first pregnancy in the late last century and the beginning of this century is well documented (Mills *et al.*, 2011), as are the many socio-cultural reasons linked by scholars in social sciences to changes in the female gender roles with better access to contraception, and access to further education and career opportunities (Baldwin *et al.*, 2015). This is also described by women who are thinking of electively cryopreserving oocytes (Stoop *et al.*, 2011a,b), when they spend more time in education aiming at a fulfilling career, and voice concerns of not having yet met the appropriate future father of their wanted family. It appears however, that both women, whatever their level of education (Lucas *et al.*, 2015), and professionals tend to underestimate age-related fertility decline (Yu *et al.*, 2016).

Vitrification and the possibility for women to 'put eggs on ice' efficiently have made many press headlines, especially in the non-medical context, but there are few specific national data, although collection

has started or is planned in some countries. This uneven recording of information reinforces the need for large databases about collection and use of OoC, in order to assess whether OoC will prove to be a panacea or a delusion (Lockwood, 2011). Indeed a recent review summarizing the history, techniques, indications and outcome of OoC stresses 'the real need to monitor what is being done, … and the success rates achieved' (Argyle *et al.*, 2016) and points out there is still a need to obtain wider quantitative and qualitative information.

With regard to OtC, the technique has been used both for children/adolescents (Wallace *et al.*, 2016) and adults. In adults, there is as yet no consensus as to which approach (OoC or OtC) is optimal, although, with regard to the urgency of starting chemotherapy, timeliness is often the decisive factor. Whilst the first attempt at autotransplantation of frozen thawed ovarian tissue dates from 2001 (Oktay *et al.*, 2001), and the first live birth was published in 2004 (Donnez *et al.*, 2004), OtC nowadays allows a realistic chance of pregnancy after gonadotoxic therapy, by orthotopic or heterotopic retransplantation of ovarian tissue stored before cancer treatment.

The purpose of the present study was to improve the general knowledge of OoC and OtC rules and practice in Europe: first, to obtain information on legal or professional codes of practice, indications, and reimbursement of the treatment, and second to collect data on numbers of cycles performed and oocytes stored by indication and by country.

Materials and Methods

A collaboration between two ESHRE groups, the Special Interest Group for Socio Cultural Aspects of Infertility (SCAIF) and the European IVF Monitoring (EIM) was started in 2014, with three members of each group planning the study and its protocol, and designing a two part questionnaire (see Supplementary Data). In the first part, we asked whether OoC was submitted or not to a law or code of practice (COP), whether regulations concerned or not women's age, civil status, medical indications: serious disease (woman, child-adolescent), other medical indication (poor ovarian reserve, poor responders, OHSS risk, PGD/PGS) and egg donation. A specific question concerned OoC authorization for non-medical indications, and if it was reimbursed or not. In the second part, we also asked for both the number of cycles performed and oocytes retrieved in total and by main indications since 2010. All 'other' medical indications were grouped as a single item for simplicity. The survey was conducted during 2015, and at the end of 2015, data were also sought about OtC through a short second questionnaire (see Supplementary Data). The questionnaires were sent to all national coordinators of the EIM register in early 2015, and to members of the ESHRE committee of national representatives. Whenever possible, further information was sought, such as in the UK where more recent data were obtained through a Freedom of Information (FOI) request, which according to the FOI Act 2000 compels public bodies to answer a question within 3 weeks.

All data were sent to ESHRE Central office. A descriptive analysis was performed after tabulation. Analysis comprised a description of national regulations (questionnaire part 1) and then a description of the practice reported by countries having filled out part 2. The number of cycles reported during the whole period was described per year, allowing for a trend estimation. However, several countries did not report data every year, either because OoC was not practiced, or not recorded between 2010 and 2012. Furthermore, the questionnaire was sent too early to get all data for the year 2014. Thus, the detailed description by indication was performed on the year 2013 where data were the most comprehensive.

Results

Overall, amongst the 34 countries contributing to EIM, the Part 1 questionnaire was completed in 27 countries, whilst Part 2 of the OoC questionnaire was only completed in 17, and the OtC questionnaire in 12.

Regulatory background and funding

Regulations

The picture is far from homogeneous in Europe, and varies from strict legislation forbidding non-medical indications to allowing both medical and non-medical indications, mostly by not excluding the latter (Table I). In 12 countries, no specific regulation for OoC existed, while 14 countries rely on a law (of which 6 have a COP) and 1 (Romania) only on a COP. Many have a register for ART but, in 2015, there were two national registers where the number of OoC cycles was available, whilst four more are planned in the near future, such as in Denmark, Italy, and the Netherlands during 2016, or France (2017). With regard to the UK, aggregated data for 2013 were included in the most recent annual report (HFEA Annual Results, www.hfea.gov.uk), but there are no plans to present them more specifically according to indications in the near future.

Criteria and conditions for freezing

Only seven countries specified a minimum or maximum age limit, applying to both medical and non-medical indications in Belgium (below 45 years), Denmark (<46 years), Germany (20–49 years) and Spain (>18 years), whilst in France (18–42 years), Malta (25–42 years) and Slovenia (<45 years), it applies to medical indications only as storing for non-medical reasons is either not practiced or not allowed (Table I). Only three countries specifically forbid non-medical OoC, Austria, France (except for egg donors with no children, since spring 2016) and Malta. Most other countries practicing non-medical freezing do so in a context of the absence of specific law. Furthermore, the rules for non-medical freezing may depend on a professional society decision. In Denmark, cryopreserved oocytes may be kept initially for 5 years and the cryopreservation period is extendable for medical reasons; moreover, oocytes can be donated to research, but not for reproduction, with further written consent.

Funding

With regard to funding, OoC is free for medical reasons in 14 (just over half) responding countries, either through direct state funding or a compulsory insurance system such as in the Netherlands (Table I). Non-medical OoC is never funded by any state system. The UK allows cryopreservation for 10 years, renewable with further consent 'if there is a serious risk of permanent infertility' up to the age of 55 years, and is free in the National Health Service for medical reasons.

Number of cycles performed and oocytes retrieved for OoC during 2010–2014

In total, 34 753 OoC cycles were reported during the 5-year-period among 17 countries with available data, with a progressive annual increase, except in 2014 where the report was incomplete (Table II). During the period 2010–2013, this increase was partly due to an increase in seven countries, (Belgium, Czech Republic, France, Germany, Greece, UK and Ukraine) and new developments in five

Table I Regulations, indications, and funding for OoC in 2015 for 27 European countries.

Country	Specific regulation	ART register		Indications for freezing			Funding	
		General	OoC*	Age (years)	Medical	Non-medical	Medical	Non-medical
Austria	Law	Yes	No	No	Yes	Forbidden	No	No
Belarus	No	No	No	No	Yes	No	No	No
Belgium	No	Yes	Yes	<45	No	No	Yes	No
Bulgaria	No	No	No	No	Yes	Yes	No	No
Czech Republic	No	Yes	No	No	No	No	Yes	No
Denmark	Law	Yes	*2016*	<46	Yes	No	Yes	No
Estonia	No	No	No	No	No	No	No	No
Finland	Law	Yes	No	No	No	Yes	Yes	No
France	Law/COP	Yes	*2017*	18–42	Yes	Forbidden**	Yes	No
Germany	Law/COP	Yes	Yes	20–49	Yes	Yes	No	No
Greece	No	No	No	No	No	No	No	No
Hungary	Law	Yes	No	No	Yes	No	No	No
Italy	Law	Yes	*2016*	No	Yes	Yes	Yes	No
Ireland	No	No	No	No	No	No	Yes	No
Lithuania	No	No	No	No	No	No	No	No
Malta	Law/COP	Yes	No	25–42	Yes	Forbidden	Yes	No
Netherlands	Law/COP	No	*2016*	No	Yes	Yes	Yes	No
Norway	Law	Yes	No	No	Yes	No	Yes	No
Romania	COP	Yes	No	No	No	No	No	No
Russia	No	No	No	No	Yes	No	No	No
Slovakia	No	No	No	No	No	No	No	No
Slovenia	Law	No	No	<45	Yes	No	Yes	No
Spain	Law	Yes	No	>18	No	No	Yes	No
Sweden	No	Yes	No	No	No	No	Yes	No
Switzerland	Law/COP	Yes	No	No	No	No	No	No
UK	Law/COP	Yes	No	No	No	No	Yes	No
Ukraine	No	No	No	No	Yes	Yes	No	No

OoC, oocyte cryopreservation; COP, code of practice.
*Dates later than 2015 mean a specific registry is planned (putative date in italics).
**Except for childless egg donors who may self cryo-preserve some oocytes since 2016.

countries (Belarus, Finland, Hungary, Malta and Switzerland), whereas the numbers were fluctuating in four countries (Estonia, Italy, Slovenia and Spain). Data were too inconsistent to be presented for Romania. It also can be noticed that the greatest user of OoC was Spain, with fluctuating data during 2010–2013, followed by UK and France. In 2014, even with incomplete data available, there has been a significant increase in Spain, UK and Ukraine.

Number of OoC cycles performed in 2013 according to indications

OoC was performed in all countries who had data for 2013 ($n = 17$) (Table III). In six countries, including Finland, France and Spain, the total number of OoC cycles performed was not accompanied by the number of oocytes retrieved. The UK published specific data by indication for their annual report in 2011, but has since stopped. More recent data were thus obtained through a FOI request.

A total of 9126 specific OoC cycles were performed in the 16 countries with available data, out of a total of 343 025 ART aspirations (or 2.7% of all aspirations), with Spain performing 61.6% of all. Indications were reported for 8885 cycles (97.4%). Overall, 59.9% OoC specific cycles were performed for egg donation, whilst the proportion of cycles performed for serious disease, other medical indications and non-medical reasons were respectively 10.9%, 16.1% and 13.1% of the total number of OoC cycles.

Number of oocytes retrieved

The number of oocytes was very unevenly reported in 2013 by 14 countries (Table III). The total number ($n = 23\,655$) was reported by 11 countries (9.1 per aspiration) and the number by indication by 13 countries, furthermore differing according to the four indications. For instance, only Greece and the UK provided the fullest data for all indications, whilst only 5 countries reported this number for oocyte

Table II OoC cycles in 17 participating countries during 5 years.

Countries	2010	2011	2012	2013	2014**
Belarus	NA	0	NA	3	NA
Belgium	10	49	310	386	NA
Czech Rep	68	220	344	471	202
Estonia	1	6	0	4	8
Finland	NA	NA	NA	23	NA
France	NA	NA	451	798	NA
Germany	120	130	141	235	227
Greece*	8	9	10	34	34
Hungary*	NA	NA	2	5	2
Italy	286	554	415	477	358
Malta	0	0	NA	41	20
Romania	NA	NA	NA	NA	NA
Slovenia	9	18	14	16	27
Spain	ND	5612	6452	5620	6670
Switzerland	NA	NA	NA	48	NA
UK	332	458	593	810	1063
Ukraine	11	27	91	155	265
Total:17	845	7083	8823	9126	8876

NA, not available.
*Greece and Hungary: data on OoC from six and five centres, respectively.
**Incomplete data at the end of the study.

donation (OD), 6 for serious disease, 10 for other medical indications and 6 for non-medical indication. Unfortunately, Spain, a major player in the field of OoC for OD started to record the number of oocytes retrieved in OD cycles only in 2014. Thus, in this restricted and uneven sample, the highest average yield of oocytes was found in case of OD (10.4; SD 2.3), followed by serious disease (8.3; 1.3), non-medical (7.6; 0.4) and 'other medical' ART indications (5.9; 3.3).

Use of cryopreserved oocytes

These data were too poorly reported to be presented in a table. For medical indications, 13 countries reported 773 cycles, of which 10 included the number of thawed oocytes ($n = 3823$). With regard to non-medical OoC use, only four countries reported 53 cycles, of which three reported the use of 365 oocytes. Moreover, Spain reported medical and non-medical indications together.

Storage and use of ovarian tissue

While 24 questionnaires were returned, only 12 countries recorded storage of ovarian tissue. Data were unavailable in 7 countries and these techniques were not practiced in 5. By the end of 2014, Germany, France and Denmark had recorded the highest number of stored ovarian tissue samples between 2010 and 2014 (Table IV). With regard to OtC use, only 10 countries had data. During 2013, the year with most complete data, the total number of samples stored and samples used were, respectively, 1055 and 52.

Discussion

Data quality

The quality of data is very variable according to countries. Indeed, whilst the EIM group has added a question concerning the use of cryopreserved oocytes in ART cycles (Kupka *et al.*, 2016), only some countries have started recording data in professional national registers, mostly as summaries. Furthermore, until recently, this was mostly in the context of egg donation, such as in Spain, or of spare oocytes from ART cycles when the Italian law was restrictive and banned embryo freezing (Benagiano and Gianaroli, 2004). On the whole, we had good data for 15 out 17 countries on numbers of specific OoC cycles performed. After Spain, the UK, France, Italy, Czech Republic and Belgium are also major players in the field. Spain, however, performed more than 60% of all OoC cycles reported in 2013, and the next important player in the field, France, performed 8.7% of cycles.

However, data on the number of oocytes retrieved according to indications were incomplete. It is therefore impossible to speculate on the different yields of oocytes per cycle and per indication, although fuller data, especially from Spain in the case of OD, should enable this in the near future.

With regard to OtC, the major player is Germany with the highest number of biopsies and grafts of all reported, performed between 2010 and 2014, followed by France (in the period 2010–2013), but data were not complete or not available nationally in some countries such as the UK where the practice is patchy (Davies, personal communication, 2016).

What can be inferred from the data for OoC and OtC?

Whilst the data are not full or exhaustive, this study is the first to present a set of OoC data for a large number of European countries. We collected 9126 OoC aspirations from 17 countries in 2013, representing around 2.3% of all ART aspirations, yielding a total number of 23655 oocytes cryopreserved. This activity has also been growing over the last 5 years.

The total number of OtC performed in 12 countries in 2013 can only be compared as a whole with the 9126 OoC cycles for the same year. Different countries emphasize the use of either method, but some groups, such as the network FertiProtekt in German-speaking countries (Germany, Austria, Switzerland) (FertiPROTEKT, 2016) have elected to concentrate on OtC. This group, following the international Guidelines of the American Society of Clinical Oncology (ASCO), recommends that all women up to the age of 40 years who undergo gonadotoxic therapy should be counselled about fertility preserving techniques by specialized physicians (von Wolff *et al.*, 2011). Data collection in this network is now internet based and can summarize activities from more than 140 units of reproductive medicine, with a recent publication including the results of 95 orthotopic transplantations of ovarian tissue after cytotoxic treatment (Van der Ven *et al.*, 2016). FertiProtekt represents a valuable model, together with the case of Denmark, which also performs a large number, especially taking into account the small size of this country population.

Table III General data on OoC practice in Europe, year 2013 (total 17 countries).

Countries	Total numbers			Numbers per OoC indications			
	Total ART aspirations	OoC aspirations	Oocytes number	OD cycles/ oocytes	Serious disease cycles/oocytes	Other medical cycles/oocytes	Non-medical cycles/oocytes
Belarus	2000	3	7	0/0	0/0	3/7	0/0
Belgium	19 590	386	3750	NA	NA	NA	366/2698
Czech Rep	18 574	471	5799	169/2178	NA	302/451	NA
Estonia	1836	4	31	0/0	0/0	2/23	2/8
Finland	4861	23	NA	NA	NA	NA	NA
France	62 235	798	NA	NA	324/NA	474/NA	0/0
Germany	56 075	235	1350	NA	NA	NA	NA
Greece	NA	34	203	2/14	10/35	8/105	7/33
Hungary[a]	3535	5	36	*0/0*	NA	4/27	NA
Italy	50 174	477	3689	0/0	152/1456	296/1999	29/234
Malta	100	41	NA	0/0	0/0	41/NA	NA
Romania	2156	NA	NA	45/240	NA	NA	NA
Slovenia	3668	16	210	0/0	9/135	7/75	0/0
Spain	54 129	5620	NA	4853/NA	262/1970	8/60	497/3738
Switzerland	4964	48	NA	NA	41/NA	NA	7/NA
UK	46 421	810	7042	118/1099	165/1366	270/2462	257/2115
Ukraine	12 707	155	1538	136/1354	3/21	16/163	0/0
Total: 17	343 025	9126	23 655	5323/4885	966/4983	1431/5372	1165/8826

Malta data represent number of patients and not cycles.
OD, oocyte donation.
[a]Hungary: data on OoC from five centres only.

Reflections from the mosaic of policies

Legislation, professional codes and access are more of a patchwork than uniform in Europe. In several countries, availability of OoC is only for the various medical reasons outlined, and in all countries public funding is reserved for such indications. It has been argued, however, that the margin between medical and non-medical indications may be blurred (ESHRE TF Ethics and law 15, 2008), and it is necessary to further refine 'medical' indications, especially in the case of poor ovarian reserve, generally considered a disease before 40 years of age and not afterwards. It appears that until now the definition of 'non-medical', sometimes called 'social' is made by exclusion, an important distinction, as no country provides public funding for this. Worse, there is no general agreement for what constitutes a genuine medical indication, as exemplified by the case of a young woman who was refused state funding in the UK after chemotherapy for severe ulcerative colitis severely endangered her reproductive future (Mc Donagh, 2014). The distinction between medical and non-medical indications is relevant to all countries, but access to the technique may be impeded by funding even if the law itself is open to all possibilities. For instance, in the UK, ART law has enabled access for single women and same sex couples since 1990, (HFE Act 1990, revised 2008) and all indications for OoC are allowed, but funding varies between regions even for medical reasons, making access subject to regional decisions. This disagrees with the National Institute for Clinical Excellence (NICE) recommendations of three cycles for all patients (NICE, 2013). The Human Fertilisation and Embryology Authority register has full coverage of ART cycles nationally, but there are no separate national data on provisions in cancer patients as yet (Davies, 2016, personal communication). In France, access to ART is restricted to medical indications (infertility or serious risk of disease transmission) and has public funding nationally. However, a recent modification was passed in order to promote gamete donation because of an important lack of donors who were required to already have children (Décret no 2015-1281 du 13 octobre 2015). This decree allows young women without children to give eggs but also implies that they have to be offered self-freezing of a number of oocytes according to the available number given to others (Arrêté du 24 décembre 2015 pris en application de l'article L. 2141–1 du code de la santé publique). This makes a new exception allowing a non-medical indication for OoC. Finally, some women are already travelling outside their own country for elective 'social' freezing, another form of cross-border reproductive care, in order to obtain this possible insurance on their reproductive future, as the practice may be illegal at home (Shenfield *et al.*, 2010), especially if there are no medical indications warranting state funding. This applies to French women going to Belgium (Stoop, personal communication, 2016), Spain or the UK, and is another example of women exercising their autonomy in reproductive choices or out of necessity (ESHRE TF ethics and law 15, 2008).

The importance of terminology

The terminology for non-medical OoC has been discussed widely. Some authors proposed the terms 'social' (Mertes and Pennings, 2011), or 'elective cryopreservation to defer childbearing' (ASRM practice committee, 2013),

Table IV Number of OtC and ovarian graft procedures in 12 countries in 2010–2014.

Country	Ovarian tissue cryopreservation		Ovarian tissue graft	
	2013	2010–2014	2013	2010–2014
Austria	33	147	0	1
Belgium	103	624	8	23
Denmark	65	346	14	34
Estonia	8	38	NA	0
Finland	10	57	0	4
France	277	1096	10	29*
Germany	396	1499	16**	69**
Italy	98	399	1	11
Netherlands	13	56	0	5***
Norway*	13	100	0	3
Slovenia	1	14	0	0
Switzerland	38	98	3	6
Total	1055	4474	52	185

*2014 data not included.
**Data from one centre only.
***Data from 2012 only.

preferring to point out the inevitable biology of 'age-related fertility decline' for women. In this aspect, the proposition of freezing for 'anticipated gamete exhaustion' (Stoop *et al.*, 2015) stresses the biological and preventative nature of this deliberate step taken by women against the ills of nature (Stoop *et al.*, 2014). Whatever the terminology, and in both 'Oocyte Cryopreservation for age related fertility loss' (Dondorp and De Wert, 2009; Ethics and law TF 15, 2008) and for medical reasons, accurate data are relevant to women, practitioners and policy-makers alike.

Conclusion

This study is the first presenting the conditions for storage and use, and available data for OoC cycles and number of cryopreserved oocytes, as well as OtC in most European countries, and means to be a trigger and motivator to continue collection of these data prospectively. It was found that, for the time being at least, equitable access to OoC for women with medical indications is patchy in Europe, and that there is no funding for age-related non-medical reasons. Indeed in our data, the main reason for storage was for use in egg donation, with similar numbers of cycles for medical indications, ART cycles and non-medical reasons. The practice of non-medical OoC still raises a lot of ethical and social–cultural issues, including access (Mertes and Pennings, 2012), public policy for child care enabling women to have children when their fertility is optimal, and education of young women (and men) about the natural decline of ovarian reserve with age (Stoop *et al.*, 2014). Information must also point out the lower ART efficiency after the age of 35 years (Cobo *et al.*, 2016). The development of non-medical indications requires forward thinking from all stakeholders, such as healthy women thinking about what has been portrayed as a possible insurance of their reproductive future, but does not carry with it any certainty for success. Accurate information is paramount, whether for patients as well as patients' organizations and policy-makers. A website with information can be a useful tool (Avraham *et al.*, 2014). Most importantly, the choice made by all stakeholders should be backed up by verifiable information supported by data from professionals (Bastings *et al.*, 2014), and professional societies.

ESHRE could be one of the major players in this process, with the possibility to inform all stakeholders about the reality of the chances of having a child born after OoC (and/or OtC), and a better appraisal of efficiency, as OoC (and OtC) cannot be more than a partial insurance against age-related fertility decline, varying in efficiency with indications and age. With an increase of reliable data, ART professionals should hopefully be able to better assess objectively the efficiency of this method of fertility preservation so that women and funding bodies may make an informed decision about using it as a back-up to natural fertility when circumstances demand it.

Supplementary data

Supplementary data are available at *Human Reproduction Open*.

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V.G. and J. de M. performed the calculations. F.S. wrote the paper. All other co-authors reviewed the paper and made appropriate corrections and suggestions for improvement. Finally, members of ESHRE's Executive Committee made further corrections and improvements. This paper represents a fully collaborative work.

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Conflict of interest

None declared.

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SUPPLEMENTARY DATA

ESHRE study on oocyte cryopreservation (OoC) in Europe Country regulations and funding

Country:

Contact person:

Telephone: email:

Is there a specific national regulation for OoC ☐ No; ☐ Yes

- If yes, from: ☐ statutory authority; ☐ professional society (name: ……)
- If from statutory authority, is there : ☐ a law; ☐ a code of practice; ☐both
- Other: please specify:

Are there any criteria for freezing: ☐ No; ☐ Yes; if yes, specify:

- Woman's age: ☐ No; ☐ Yes; if Yes, specify: from ☐☐ to ☐☐
- Civil status: ☐ No criteria; ☐ Married/ in relationship; ☐ single
- ☐ Medical indications
  - ☐ Serious disease of woman
  - ☐ Serious disease of adolescent
  - ☐ Predicted poor ovarian reserve/poor responders
  - ☐ OHSS risk
  - ☐ For PGD/PGS, other reason (specify)
  - ☐ Egg donation

☐ Authorized for non-medical indications

Funding available:

Medical reasons: ☐free/state; ☐ personal insurance; ☐No; ☐ retrieval ☐storage

Non-medical reasons: ☐free/state; ☐ personal insurance; ☐No; ☐ retrieval; ☐storage

Does the regulation cover other aspects?

- Method of cryopreservation: ☐ vitrification; ☐ slow freezing; ☐ both ; ☐ no
- Type of straws: ☐open; ☐ closed; ☐ both ; ☐no
- Patients' counselling: ☐ No; ☐ Yes

Is there a national ART register (tick box) or separate OoC register (tick box)

☐Already in place: since (year) /____/____/____/____/

☐Planned: For when? (year): /____/____/____/____/

☐ If exists or planned: ☐Based on individual data; ☐ Based on data summaries ☐ No national register, clinic data only ;

OoC data in your country

General numbers		2010	2011	2012	2013	2014
Total number of aspirations in the country (IVF+ OD+ PGD)	Cycles					
Aspirations for OoC	Cycles					
Total number cryopreserved oocytes	Oocytes					
Vitrified oocytes	Oocytes					
'Slow freeze' oocytes	Oocytes					
Indications		**2010**	**2011**	**2012**	**2013**	**2014**
Egg donation*	Cycles					
	Oocytes					
Serious disease*	Cycles					
	Oocytes					
(Other) medical reasons* (describe at the bottom of the page)	Cycles					
	Oocytes					
Non-medical reasons (social freezing)	Cycles					
	Oocytes					
Use of cryopreserved oocytes		**2010**	**2011**	**2012**	**2013**	**2014**
Medical reasons	Cycles					
	Oocytes					
Non-medical reasons	Cycles					
	Oocytes					

*If unavailable numbers for specific medical reasons, put the overall number of medical reasons in (other) medical reasons.
Note: If no data in specific years, please put N/A (not applicable) in the corresponding column.

Ovarian tissue cryopreservation (OtC) data in your country

General numbers	2010	2011	2012	2013	2014
Ovarian tissue biopsy/cortex/whole ovary cryopreservation					
Ovarian tissue graft procedures					

Notes: If no data in specific years, please put N/A (not applicable) in the corresponding column.
If 'Not practiced': please put NP.