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Poor knowledge of age-related fertility decline and assisted reproduction among healthcare professionals

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KEY MESSAGE
Healthcare professionals should be provided with the information and materials needed to better counsel patients about their fertility. By increasing their knowledge, these professionals would address subfertile patients in a timely manner, and social oocyte freezing would be offered at ages when success rates are optimal.

A B S T R A C T

Reproduction is a matter of concern for individuals and society due to the postponement of childbearing, and healthcare professionals are the main source of information and counselling. This study aims to evaluate how knowledgeable healthcare professionals are about fertility and assisted reproduction, and to explore attitudes towards social oocyte freezing. A cross-sectional study was performed with 201 professionals (gynaecologists, physicians and nurses) from four public centres in Spain. Participants completed a survey about fertility, IVF, oocyte donation (OD) and social oocyte freezing, between May 2013 and March 2014. Reported mean age limits for pregnancy were 39.5 ± 4.5 (spontaneously), 43.7 ± 5.2 (IVF) and 49.0 ± 6.5 (OD). Gynaecologists reported a younger limit for spontaneous and IVF pregnancies ($P < 0.001$); 36.1% reported a limit for a spontaneous pregnancy >39, compared with 77.3% of other physicians and 72.9% of nurses. Regarding social oocyte freezing, 41.8% of gynaecologists thought it should be offered to every young woman, versus 62.7% of other physicians and 48.9% of nurses ($P = 0.041$). In conclusion, gynaecologists are more knowledgeable about fertility and assisted reproduction, while more restrictive towards social oocyte freezing. Knowledge and attitudes could influence the quality of information and counselling given to patients.

Introduction

Difficulties in achieving pregnancy naturally are becoming more common, given the contemporary tendency to postpone childbearing to later in life (Schmidt et al, 2012). Reproduction at older ages is becoming a matter of concern for individuals (Hvidman et al., 2015); healthcare professionals should be competent to deal with this issue by having an accurate knowledge about both age-related fertility decline and the options currently available to mitigate infertility risk, such as social oocyte freezing.

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Reproduction, including but not limited to family planning, preconception care, infertility and assisted reproductive technologies, is a topic usually discussed with healthcare professionals, who are the preferred source of medical information regarding fertility among the general population, more so even than the rising reliance upon the internet and mass-media resources (Lundsberg et al., 2014; McCree et al., 2006; Nagler et al., 2010; Teixeira et al., 2014). Therefore, healthcare professionals play a clear role in providing health information and reproductive counselling to both patients and the general population. However, reproductive knowledge has been shown to be lower than desirable in university populations, including medical students (Bretherick et al., 2010; Chan et al., 2015; Hashiloni-Dolev et al., 2011; Nouri et al., 2014; Rovei et al., 2010; Sedlecky et al., 2011) and obstetrics and gynaecology residents (Yu et al., 2016), as well as in female healthcare professionals such as nurses, midwives and medical doctors (Mortensen et al., 2012). Moreover, the study by Bonetti *et al.* revealed a low perception among assisted reproductive technology professionals of their own infertility risk, despite having in-depth knowledge of human fertility and infertility treatments (Bonetti et al., 2008).

Overall, healthcare professionals are aware that age-related infertility exists, but are not able to pinpoint when fertility starts to decline and overestimate the chances of achieving a pregnancy (either naturally or through assisted reproductive technologies). In the study by Yu et al. (2016), most of the gynaecology residents surveyed agreed that age-related fertility decline needs to be discussed during the well woman annual examination. Conversely, informing women about social oocyte freezing as an option to maintain the quality of oocytes at a younger age is still controversial. Although oocyte vitrification is an efficient option for elective fertility preservation in women in their early thirties (Cobo et al., 2016; Stoop et al., 2014), there is disagreement among professionals about the application of oocyte vitrification to postpone motherhood for other than medical reasons (von Wolff et al., 2015; Yu et al., 2016).

The objective of the present study is to evaluate knowledge about age-related female fertility decline and the comprehension of assisted reproductive technology possibilities and limitations in healthcare professionals outside of assisted reproductive technologies, and to explore the attitudes of these said professionals towards social oocyte freezing.

Materials and methods

Study population

This was a cross-sectional study carried out between May 2013 and March 2014. The study questionnaires were filled in anonymously by 201 healthcare professionals in four public primary care centres in Barcelona, Spain, in the context of a lecture about fertility, assisted reproductive technologies and social oocyte freezing, independently scheduled for each centre. Participation in both lecture and survey were voluntary. The surveys were collected before the lecture started. The study did not require ethical committee approval.

Survey

The survey included the socio-demographic characteristics of the participants and questions measuring participants' knowledge of age-related infertility and assisted reproductive technologies, and their attitudes towards social oocyte freezing. The seven questions considered for this study were: Q1. Up to what age could a woman get pregnant easily and spontaneously? Q2. Up to what age could a woman get pregnant through assisted reproductive technologies using her own oocytes? Q3. Up to what age could a woman get pregnant through assisted reproductive technologies using donor oocytes? Q4. Should social oocyte freezing be offered to all young women? Q5. From which age should social oocyte freezing be offered? Q6. Up to what age should social oocyte freezing be offered? Q7. Should social oocyte freezing be financed by the public health system? The questions were open-ended, and so because of this, in order to evaluate fertility knowledge differences between groups, we established a cut-off for correct answers to each question (considering as correct a reported age ≤ cut-off, and as incorrect > cut-off), based on the literature and current common practice in Spain: 39 years for a spontaneous pregnancy, 45 years for a pregnancy through IVF and 50 years for a pregnancy through oocyte donation (OD) (American College of Obstetricians and Gynecologists Committee on Gynecologic Practice, 2014; Baird *et al*, 2005; Dunson et al., 2004; Ethics Committee of the American Society for Reproductive Medicine, 2013; Gleicher et al., 2014; Leridon, 2004; Practice Committee of the American Society for Reproductive Medicine, 2006). It is worth noting that we chose the cut-off of 39 years for a spontaneous pregnancy because it is known there is a marked decrease in women's fertility starting from their mid-30s, but it remains difficult to establish an unequivocal cut-off between 35 and 39 years (Dunson et al., 2004; Leridon, 2004).

Statistical analysis

Differences between professional categories were tested by ANOVA and chi-squared tests. Furthermore, the effect of the healthcare category on the percentage of correct answers to each question was modelled by logistic regression, controlled for age, gender, parity, working and relationship status. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 22, IBM Corp., USA). A *P*-value of <0.05 was set as statistically significant.

Results

Demographic characteristics

The 201 healthcare professionals were classified into three professional categories: gynaecologists (n = 72), physicians other than gynaecologists, hereinafter 'physicians' (n = 78) and nurses (n = 51). It should be noted that family physicians (n = 32) constituted 41.0% of physicians included in our study. Demographic characteristics overall and by professional category are listed in **Table 1**. Gynaecologists were the youngest category but the proportion of stable work and stable relationship in this group did not differ compared with the other two. Significantly more nurses were female ($P < 0.001$), had children ($P = 0.015$) and were older ($P < 0.001$) than physicians and gynaecologists. Family physicians were comparable to other physicians regarding demography (data not shown).

Fertility and age

Reported mean age limits for spontaneous pregnancy (Q1), pregnancy through IVF (Q2) and pregnancy through OD (Q3) were 39.5 (SD 4.5), 43.7 (SD 5.2) and 49.0 (SD 6.5) years, respectively, with

Table 1 – Demographic characteristics overall and by professional category.

	Overall (*n* = 201)	Gynaecologists (*n* = 72)	Other physicians (*n* = 78)	Nurses (*n* = 51)	*P*-value
Age, mean (SD)	42.7 (11.0)	37.4 (11.1)	43.9 (9.2)	48.5 (9.9)	<0.001
Children, *n* (%)	121 (60.5)[a]	36 (50.0)	47 (60.3)	38 (76.0)	0.015
Number of children, mean (SD)	1.7 (0.9)	1.8 (1.0)	1.8 (1.0)	1.7 (0.6)	NS
Age at first child, mean (SD)	30.6 (5.0)	30 (5.1)	32.1 (4.9)	29.5 (4.6)	0.049
Age at last child, mean (SD)	33.8 (3.7)	34.0 (3.4)	35.3 (3.6)	32.5 (3.6)	0.009
Female, *n* (%)	153 (76.1)[a]	50 (69.4)	53 (68.8)	50 (98.0)	<0.001
Spanish, *n* (%)	180 (89.6)	66 (91.7)	67 (85.9)	47 (92.2)	NS
Permanent work, *n* (%)	174 (88.8)[a]	63 (90.0)	66 (86.8)	45 (90.0)	NS
Long-term relationship, *n* (%)	161 (83.0)[a]	60 (88.2)	61 (80.3)	40 (80.0)	NS

[a] Missing values ranged from 1 (gender, children) to 7 (relationship).
NS = not statistically significant.

significant differences between groups for Q1 and Q2 (both $P < 0.001$), but not for Q3. Detailed answers to the three questions overall and by professional category are described in **Table 2**, while counts and percentages of correct answers are presented in **Table 3**. Overall, gynaecologists were more accurate and correct in their answers than other physicians and nurses; for example, 26 (36.1%) gynaecologists reported an age limit for a spontaneous pregnancy over 39 years, compared with 58 (77.3%) physicians and 35 (72.9%) nurses ($P < 0.001$). Similarly, the percentages of reported ages for an IVF pregnancy over 45 were 4.3%, 27.6% and 37.8% and for an OD pregnancy over 50 were

Table 2 – Detailed answers to each question, overall and by professional category.

	Overall (*n* = 201)[a]	Gynaecologists (*n* = 72)	Other physicians (*n* = 78)	Nurses (*n* = 51)	*P*-value
Q1. Limit of age for a spontaneous pregnancy	39.5 (4.5)	37.5 (2.8)	40.8 (5.1)	40.4 (4.6)	<0.001[b]
Mean (SD), [min–max]	[25–60]	[25–45]	[29–60]	[25–55]	
Q2. Limit of age for a pregnancy through IVF	43.7 (5.2)	41.0 (3.4)	45.1 (6.1)	45.6 (4.2)	<0.001[b]
Mean (SD), [min–max]	[28–70]	[28–50]	[33–70]	[40–55]	
Q3. Limit of age for a pregnancy through OD	49.0 (6.5)	48.1 (5.8)	49.5 (7.2)	49.8 (6.4)	NS[b]
Mean (SD), [min–max]	[30–80]	[40–80]	[38–70]	[40–70]	
Q4. Social oocyte freezing should be offered to every young woman, *n* (%)	97 (51.9)	28 (41.8)	47 (62.7)	22 (48.9)	0.041[c]
Q5. Age from which social oocyte freezing should be offered, *n* (%)					NS[c]
No lower limit	20 (10.8)	8 (11.4)	7 (10.0)	5 (11.1)	
From 18 years	106 (57.3)	39 (55.7)	42 (60.0)	25 (55.6)	
From 30 years	50 (27.0)	20 (28.6)	16 (22.9)	14 (31.1)	
Opposed to social oocyte freezing	9 (4.9)	3 (4.3)	5 (7.1)	1 (2.2)	
Q6. Age up to which social oocyte freezing should be offered, *n* (%)					0.002[c]
35 years	69 (36.5)	33 (47.1)	26 (35.1)	10 (22.2)	
38 years	38 (20.1)	20 (28.6)	10 (13.5)	8 (17.8)	
40 years	74 (39.2)	15 (21.4)	33 (44.6)	26 (57.8)	
Opposed to social oocyte freezing	8 (4.2)	2 (2.9)	5 (6.8)	1 (2.2)	
Q7. Social oocyte freezing should be financed by the public health system, *n* (%)	55 (29.9)	13 (19.4)	23 (31.9)	19 (42.2)	0.031[c]

[a] Questions with missing answers were Q1 (6 missing), Q2 (10 missing), Q3 (12 missing), Q4 (14 missing), Q7 (17 missing).
[b] One-way ANOVA.
[c] Chi-squared test.
NS = not statistically significant; OD = oocyte donation.

Table 3 – Univariate analysis. Number and percentage of answers by professional category.

	Overall (*n* = 201)	Gynaecologists (*n* = 72)	Other physicians (*n* = 78)	Nurses (*n* = 51)	*P*-value[a]
Q1 ≤ 39	76/195 (39.0)	46/72 (63.9)	17/75 (22.7)	13/48 (27.1)	<0.001
Q2 ≤ 45	150/191 (78.5)	67/70 (95.7)	55/76 (72.4)	28/45 (62.2)	<0.001
Q3 ≤ 50	156/189 (82.5)	66/71 (93.0)	56/75 (74.7)	34/43 (79.1)	0.001

[a] Chi-squared test.
Q1: Limit of age for a spontaneous pregnancy.
Q2: Limit of age for a pregnancy through IVF.
Q3: Limit of age for a pregnancy through oocyte donation.

Table 4 – Multivariate analysis. Association of professional category and answer to each question.

			95% CI		
		OR	Lower	Upper	*P*-value[a]
Q1 ≤ 39	Clinician versus gynaecologist	0.16	0.72	0.36	<0.001
	Nurse versus gynaecologist	0.18	0.07	0.50	0.001
	Age	0.99	0.95	1.03	NS
	Children	0.89	0.36	2.18	NS
	Gender	0.58	0.24	1.39	NS
	Stable work	2.25	0.70	7.26	NS
	Stable relationship	0.39	0.15	1.03	NS
Q2 ≤ 45	Clinician versus gynaecologist	0.15	0.04	0.54	0.004
	Nurse versus gynaecologist	0.10	0.02	0.44	0.002
	Age	0.94	0.89	0.99	0.011
	Children	2.66	0.90	7.82	NS
	Gender	0.77	0.27	2.21	NS
	Stable work	1.53	0.40	5.81	NS
	Stable relationship	1.06	0.36	3.07	NS
Q3 ≤ 50	Clinician versus gynaecologist	0.18	0.05	0.61	0.006
	Nurse versus gynaecologist	0.20	0.04	0.94	0.041
	Age	0.93	0.87	0.98	0.007
	Children	4.07	1.19	13.94	0.025
	Gender	0.32	0.11	0.93	0.036
	Stable work	0.88	0.17	4.72	NS
	Stable relationship	1.12	0.35	3.64	NS

[a] Logistic regression.
Q1: Limit of age for a spontaneous pregnancy.
Q2: Limit of age for a pregnancy through IVF.
Q3: Limit of age for a pregnancy through oocyte donation.
CI = confidence interval; NS = not statistically significant; OR = odds ratio.

7.0%, 25.3% and 20.9%, for gynaecologists, other physicians and nurses, respectively. After adjustment for age, gender, parity, working and relationship status, physicians and nurses remained less knowledgeable than gynaecologists for the three questions (**Table 4**).

It is worth noting that the subgroup of family physicians answered the two questions about assisted reproductive technologies better than other physicians who were not gynaecologists, with a number and percentage of correct answers of 26 (78.8%) versus 29 (67.4%) for Q2 and 29 (90.6%) versus 27 (62.8%) for Q3 ($P = 0.006$). On the other hand, family physicians answered Q1 worse than other physicians, 6 (18.8%) versus 11 (25.6%), although this difference was not statistically significant.

Social oocyte freezing

Gynaecologists were more conservative regarding oocyte vitrification, with 41.8% considering that social oocyte freezing should be offered to every young woman, versus 62.7% of other physicians and 48.9% of nurses ($P = 0.041$). Over half of participants in the three groups (57.3% overall) agreed on offering social oocyte freezing from 18 years (legal age in Spain). We found discordant answers on the upper age limit for social oocyte freezing to be offered; most gynaecologists (47.1%) would not offer social oocyte freezing past 35 years, while 44.6% of other physicians and 57.8% of nurses would offer it up to 40 years. A small number of participants reported being opposed to social oocyte freezing: 3 gynaecologists (4.3%), 5 from other physicians (7.1%) and 1 nurse (2.2%). Finally, 19.4% of gynaecologists considered that social oocyte freezing should be financed by the public health system, versus 31.9% of other physicians and 42.2% of nurses ($P = 0.031$).

Discussion

Our results indicate that, with the exception of gynaecologists, healthcare professionals outside of assisted reproductive technologies are not knowledgeable about female fertility and IVF (either autologous or heterologous). Previous studies showed that medical students (Nouri et al., 2014) and female healthcare professionals (Mortensen et al., 2012) are aware of age-related infertility, but are not able to identify precisely when female fertility starts to decline. This also seems true in our population of physicians other than gynaecologists, and nurses, where the question about the age limit for spontaneous pregnancy (Q1) received the least correct answers. As many as 77.3% of physicians and 72.9% of nurses reported the age limit for a spontaneous pregnancy as over 39 years, compared with 36.1% of gynaecologists. Reported age limit for a spontaneous pregnancy was not influenced by a participant's age, as gathered from the multivariate analysis. Moreover, the older the respondent, the lower the likelihood of answering correctly questions about age limits for IVF, either with a woman's own, or donor, oocytes (Q2 and Q3). This could be explained because older participants may be less familiar with assisted reproductive technologies (especially if they are not performing it), similar to previous studies showing that younger family physicians were more knowledgeable about human papilloma virus screening than older ones, who were not used to performing this test (Jain et al., 2006).

On the one hand, inaccurate knowledge of the fertility decrease with age may have an impact on the intention to have children past the age of 35, intentions which are common among highly educated people (Lampic et al., 2006; Machado et al., 2014; Peterson et al., 2012;

Skoog Svanberg et al., 2006; Virtala et al., 2011), including female healthcare professionals (Mortensen et al., 2012). It should be noted that, although we have considered 39 years as the limit for a spontaneous pregnancy, there is a marked decrease in the chance of getting pregnant between 35 and 39 years of age (Dunson et al., 2004; Leridon, 2004). On the other hand, the reported age limits for IVF and OD pregnancies reflect an overestimation of assisted reproductive technologies success, as seen in previous studies (Daniluk and Koert, 2013; Hashiloni-Dolev et al., 2011; Mortensen et al., 2012; Sabarre et al., 2013; Yu et al., 2016), which may have an impact on patient education and accessibility to assisted reproductive technologies in the public healthcare system. The fact that we have included professionals outside of assisted reproductive technologies is one of the strong points of our study because their knowledge of fertility decline and a timely referral of sub-fertile patients to a specialist is essential for assisted reproductive technologies. However, there is no universal agreement about age cut-offs for each treatment among assisted reproductive technology professionals (Klitzman, 2016); therefore, our definitions of 'correct' and 'incorrect' answers (≤45 years for IVF and ≤ 50 years for OD) should be interpreted with caution, and clinicians should follow the recommendations given in current guidelines (American College of Obstetricians and Gynecologists Committee on Gynecologic Practice, 2014). We acknowledge that the subjective definition of cut-offs is a limitation of this study; to mitigate this bias, we also report a detailed description of the answers including average, standard deviation and range for each question. We also need to take into account that this study was carried out in only one country, Spain, where women can access IVF, OD or social oocyte freezing regardless of their relationship state and sexual preference. Therefore, our results may not be generalized to other European countries with more restrictive legislation on assisted reproductive technologies.

In this study, 4.9% of participants were opposed to social oocyte freezing, although this percentage may not be representative of healthcare professionals because participants in the study attended a voluntary lecture about fertility, assisted reproductive technologies and social oocyte freezing, and may be more favourable to these techniques and better informed than others. Among the participants in favour of social oocyte freezing, it is interesting that most gynaecologists would offer it to women until the ages of 35 – 38, according to the age when both a woman's fertility (Dunson et al., 2004) and the success rates of the technique (Cobo et al., 2016) start to decline markedly, while other physicians and nurses would offer it up to the age of 40. Again, these answers could reflect inaccurate knowledge of fertility decline with age and over-optimism regarding IVF. It would be useful to provide primary care professionals with trusted resources about fertility, assisted reproductive technologies and social oocyte freezing addressed to healthcare professionals (for their own knowledge) and addressed to patients (for 'information prescription'), as suggested in previous publications (Hodes-Wertz et al., 2013; Petropanagos et al., 2015; Rupert et al., 2014; Whittington et al., 2004; Wyndham et al., 2012).

Healthcare professionals other than gynaecologists do not seem to be knowledgeable about women's fertility and assisted reproductive technologies, and to hold less restrictive views towards social oocyte freezing. It is necessary for physicians other than gynaecologists – especially primary care physicians, who are frequently in the front line when it comes to fertility and reproduction queries from patients – and nurses to know how female fertility is affected by age, and to be able to identify assisted reproductive technology limitations and social oocyte freezing possibilities, in order to refer patients to fertility specialists for appropriate treatment in a timely manner. Both inaccurate knowledge and personal attitudes based on mistaken beliefs could influence the quality of information and counselling given to patients. Further studies are needed to explore primary care physicians' awareness of age limits for pregnancy and assisted reproductive technology limitations, but also the compliance with current recommendations as to when to refer patients to a fertility specialist for IVF or social oocyte freezing (i.e. essentially according to the age of the woman).

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