Knowledge of ovarian reserve and reproductive choices

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Abstract

Objective To determine the factors that influence the reproductive choices of health care professionals, and to assess whether knowledge of ovarian reserve would modify those choices.

Method A cross-sectional survey utilizing anonymous questionnaires that assessed demographics, knowledge, attitudes

Capsule Health care professionals would modify their personal reproductive choices with increased knowledge regarding their own or their partner's ovarian reserve.

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and choices of female and male health care professionals between the ages of 20–55 ($N=185$) who work at an academic medical center

Result(s) Of the 185 respondents, 75 % were female, 35 % were residents and 35 % were married. Among those who were delaying childbearing 39 % wanted to complete their education, 25 % had no identified partner, 10 % were too active professionally and 4 % could not afford children at the time. If testing of the individual or individual's partner indicated diminished ovarian reserve, 48 % of those responding would try to have a child sooner, 21 % would opt for oocyte cryopreservation, 7 % would try to find a partner sooner, 7 % would pursue adoption, and 3 % would select embryo cryopreservation. Only 14 % would not actively pursue treatment or make lifestyle changes. These results varied significantly with marital status but did not differ between participants with and without children. Similarly, choices did not vary significantly with religious belief or ethnicity.

Conclusion(s) Increased information about a woman's reproductive reserve would lead individuals to modify life choices. Physicians caring for reproductive-age women and men should inquire about their childbearing plans, and educate those who are postponing childbearing regarding the normal pattern of reproductive decline.

Keyword Ovarian reserve · Family planning · Health care professionals

Introduction

A substantial determinant of a woman's reproductive potential is her ovarian reserve, a complex clinical phenomenon influenced by age, genetics, and environmental factors. It is dependent on the size of the ovarian follicular pool and the quality of the oocytes, and declines with increasing age,

resulting in a decrease in a woman's reproductive function over time [1]. This decline is irreversible; its trajectory determines the likelihood of fertility at any given age and the timing of the menopausal transition. Coincident with increasing media attention on age-related declines in fertility, there has been a well-publicized trend among many women to postpone childbearing until relatively late in reproductive life [2–5]. As a result, an increasing number of women are having their first child after age 35 [6–10]. While most women expect to have children at some point [11–13], many women have competing professional priorities that may lead to a delay in childbearing until a time when fertility has diminished [6–9, 14]. For those women, knowing when their fertility will wane could allow for a more informed reproductive choice [15].

Several modalities are available to assess a woman's ovarian reserve, including ultrasonography assessment of ovarian antral follicle counts and serum tests, namely follicle-stimulating hormone (FSH) and anti-mullerian hormone (AMH) levels. Although there are some limitations for each of these modalities, they can be helpful when used as an adjunct for counseling women who are considering whether to attempt pregnancy or to delay childbearing. There are data to suggest that women would alter childbearing plans, including proactively advancing personal relationships and accessing fertility preservation techniques, if they felt their fertility was limited [16–18].

A particular population of interest is health professionals, who are more likely to delay childbearing in pursuit of degrees and career advancement yet would be expected to have a greater understanding of fertility than the general population. Two recent survey studies highlighted the difficulties that many female physicians face when attempting pregnancy: one sampled a group of female surgeons [19] and the other sent questionnaires to a cohort of female physicians who had graduated from medical school between the years 1995–2000 [18]. Both cohorts reported higher rates of infertility than the general population as well as increased use of assisted reproductive technologies. In the survey by Clark et al. [18], participants also stated that they would likely have modified their reproductive choices had they been better informed. Similarly, our survey focuses on determining health professionals' level of understanding of ovarian reserve. However, rather than focusing on female physicians alone, we surveyed a wide range of health professionals and included male participants, as they also anticipate and desire parenthood and play a key role regarding childbearing choices within families [20–22], although their knowledge regarding age-related fertility is often limited [23]. In addition, rather than asking retrospectively, we sought to determine how an individual's knowledge of ovarian reserve could potentially influence life choices in a prospective fashion (timing of marriage, childbearing, gamete/embryo cryopreservation, etc.).

Materials and methods

After approval by the institutional IRB, health care professionals at Maimonides Medical Center were asked to complete an anonymous questionnaire containing 34 items. Participants, both male and female, between the ages of 20 and 55 were included in the study. Individuals were approached directly and asked to complete the questionnaire; all individuals who were approached agreed to participate. The questionnaire elicited information regarding: demographics (7 questions), family status, marital and childbearing intentions (11 questions), history of infertility (2 questions), knowledge about a woman's "biological clock" and ovarian reserve, and whether respondents would change their reproductive plans if there was evidence of diminishing fertility (14 questions). A multiple choice response format was used for most questions. For questions regarding the time frame in which they planned marriage or pregnancy, the options were: <6 months, 6 months to 1 year, 1–2 years, 2–5 years, and >5 years. A small number of the demographic questions were open ended (e.g., list your medical specialty).

The survey required approximately 10 min to complete. A group of investigators knowledgeable in the area of survey development and life span fertility drafted the survey. This survey was piloted with a small number ($n=20$) of reproductive aged medical, midwifery and PA students, and modified to incorporate their feedback. During the 6 month study period from Dec 2009 to May 2010, individuals were approached and asked to complete the questionnaire; we estimated that we would need 100 applicants to be included in the study, but everyone approached agreed to participate and a total of 185 participants were recruited (this final number does not include the 20 pilot survey respondents). Descriptive statistics (means, standard deviations, and proportions) were collected. Categorical variables were analyzed using Chi-squared and Fisher's exact test; a p -value of <0.05 was considered statistically significant.

Results

Demographic features

Table 1 shows the demographic data. The median age was 29 years, with women comprising 74.6 % ($n=138$) of participants. The majority of respondents were residents (34.6 %, $n=64$), with the most well-represented specialty being Obstetrics and Gynecology (18.2 %, $n=22$). While white was the most common response to the question of ethnicity 47.5 % ($n=87$) respondents identifying themselves as such, there was also fair representation of Asian, Southeast Asian and African-American populations. Most respondents were Christian

Table 1 Demographics of survey respondents ($n=185^*$)

	N	%
Age		
20-29 y	105	57.4
30-39 y	52	28.4
40-49y	16	8.7
50-59y	10	5.5
Gender		
Female	138	74.6
Male	47	25.4
Occupation		
Medical Students	59	31.9
Resident physicians	64	34.6
Attending	14	7.6
Nurses	25	13.5
Midwife and Physician assistant	8	4.3
Other	15	8.1
Specialty		
Obstetrics and gynecology	22	18.2
Medicine	21	17.4
Emergency Medicine	19	15.7
Pediatrics	10	8.3
Anesthesia	7	5.8
Surgery	9	7.4
Radiology	8	6.6
Psychiatry	8	6.6
Medicine and surgery	6	5.0
Other (Dental, Orthopedics, Neurology, Research, PMR, Midwifery)	11	9.0
Ethnicity		
Asian	32	17.5
African American	17	9.3
Caucasian	87	47.5
Hispanic	6	3.3
Indian	25	13.7
Other	16	8.7
Religion		
Christian	81	44.0
Judaism	30	16.3
Hinduism	24	13.0
Islam	10	5.4
Atheist	11	6.0
Other	28	15.2
Degree of religious belief		
Somewhat religious [1–3]	68	39.3
Religious [4–7]	72	41.6
Very religious [8–10]	33	19.1
Marriage		
Unmarried	119	64.3
Married	66	35.7
Dating		

Table 1 (continued)

	N	%
Currently dating	71	59.6
Not dating	48	40.3
Children		
Have children	50	27.3
Do not have children	133	72.7
Future children		
Desire more children	20	35.1
Do not desire more children	37	64.9

(44 %, $n=81$), although only 19 % ($n=33$) identified themselves as being very religious.

Relationship status and the proportion of participants with children were assessed. 36 % ($n=66$) of respondents were married. Among the unmarried participants ($n=119$), 60 % ($n=71$) were dating and 84 % ($n=105$) intended to wed at some point in their future (although not necessarily their current partner), with a median time to anticipated marriage of 3 y. 72 % of respondents ($n=133$) did not yet have children; 118 of these individuals wanted to have a child in the future, 3 did not desire children (12 did not respond to the question). Among those individuals who were childless but intending to parent in the future, 39 % of participants stated that they wanted to complete their education first, 25 % didn't have an identified partner, 10 % were too occupied professionally, 4 % said they couldn't afford children at the current time, and 22 % offered other reasons (e.g., not prepared to start a family).

Fertility knowledge

In regards to basic knowledge about fertility, 164 (89.6 %) of the respondents believed that women have a “biological clock,” and 151 (81.6 %) of respondents thought there was a test available for measuring egg supply. When asked if they would utilize a test of ovarian reserve if one was available and could tell them if they were at risk for diminished ovarian reserve, 82 (47 %) of the female respondents stated that they would undergo testing and 113 (65 %) respondents would encourage other woman to have the test. Males and females felt similarly regarding those choices (Table 2). When asked at what age a female should have ovarian reserve checked, 5 % of respondents answered <25 yrs; 6 % 25-29 yrs; 27.5 % 30-34 yrs; 46 % 35-39 yrs; and 15.5 % 40 yrs and over; the median suggested age was 35 yrs.

There was no significant difference between physicians ($n=137$) and non-physicians ($n=48$) in knowledge regarding the idea of “biological clock” or testing for ovarian reserve. Similarly, there was no difference between those groups in the amount of money they would be willing to spend for egg or

Table 2 Participants knowledge/attitude regarding ovarian reserve testing

	Females, <i>n</i> (%)	Males, <i>n</i> (%)	<i>P</i> -value*
Health professionals aware of testing for OR	115 (83 %)	36 (77 %)	0.38
Respondents believing that biological clock exists	121 (89 %)	43 (92 %)	0.78
Respondents who would have test performed or encourage female partner to	82 (47 %)	44 (52 %)	0.51
Respondents who would pay out of pocket for OR testing	64 (49 %)	16 (40 %)	0.37

*Chi-squared testing; OR=Ovarian reserve

embryo cryopreservation. Participants who were not in the field of Ob/Gyn had similar knowledge regarding the “biological clock” and ovarian reserve, but were significantly less likely to be familiar with specific tests (e.g., AMH; $p=0.0006$).

Ovarian testing and life choices

Table 3 summarizes how ovarian reserve testing would influence life choices. The majority of respondents (48 %) would try to have a child sooner than originally planned if tests of reproductive function showed that they had a limited amount of fertile time left. Interestingly, as outlined in Table 4, respondents with children had similar responses to those with no children. However, there was a significant difference between married and unmarried individuals, with unmarried individuals more likely to select oocyte cryopreservation or adoption (Table 5).

When comparing physicians with non-physicians, both groups made similar choices and there was no statistically significant difference between the populations ($p=0.36$). Ethnicity and religiosity also did not appear to alter decision-making (Tables 6 and 7, respectively).

Table 3 Impact of the results of ovarian reserve on reproductive choices

	<i>N</i>	%
Attempt pregnancy earlier than planned	81	47.9
Greater effort in finding partner	11	6.5
Oocyte cryopreservation	36	21.3
Embryo cryopreservation	5	3.0
Use of donor sperm	2	1.2
Adoption	11	6.5
No further action	23	13.6

Table 4 Impact of the results of ovarian reserve on reproductive choices (respondents with children vs. no children)

	Children, <i>n</i> (%)	No children, <i>n</i> (%)
Try to have a child sooner	25 (58.1 %)	56 (46.7 %)
Greater effort in finding partner	2 (4.7 %)	9 (7.50 %)
Oocyte cryopreservation	8 (18.6 %)	28 (23.3 %)
Embryo cryopreservation	1 (2.3 %)	3 (2.5 %)
Adoption	1 (2.3 %)	10 (8.3 %)
No further action	6 (14 %)	14 (11.7 %)

P-value: 0.70 (Fisher’s exact test; option of “use of donor sperm” omitted due to low response rate)

Discussion

This study examined the knowledge of health professionals and trainees regarding fertility, and how this knowledge could potentially influence their personal life decisions and family planning behaviors. We chose to study health professionals and trainees for two reasons: we anticipated that their understanding would be greater than that of the lay public, and they would be representative of a group that might delay childbearing in pursuit of professional goals. In fact, 49 % gave education and job-related explanations for not having had children yet. We found that the participants were generally knowledgeable about the basics of fertility (about 90 % knew there was a “biologic clock” and that testing for ovarian reserve was possible). And participants provided a reasonable estimate for the age at which initiation of ovarian reserve testing would be appropriate, with the median suggested age being 35 years. While other studies have not specifically asked about ovarian reserve testing, the tendency of participants in those reports reflects a general belief that fertility does not begin declining until the age of 40 or 45 [5, 17]. This has been particularly true for male participants in past studies, who have demonstrated less knowledge than their female counterparts when questioned about fertility, childbearing, and ART [4].

Table 5 Impact of the results of ovarian reserve on reproductive choices (married vs. unmarried)

	Married, <i>n</i> (%)	Unmarried, <i>n</i> (%)
Try to have a child sooner	37 (63.8 %)	44 (41.5 %)
Oocyte cryopreservation	9 (15.5 %)	27 (25.5 %)
Embryo cryopreservation	2 (3 %)	3 (3 %)
Adoption	1 (1 %)	10 (9.4 %)
No further action	8 (13.8 %)	12 (11.3 %)

P-value: 0.03 (Fisher’s exact test; note: options of “seeking partner sooner” and “use of donor sperm” omitted due to low response rate)

Table 6 Impact of the results of ovarian reserve on reproductive choices based on ethnicity

	Caucasian, <i>n</i> (%)	Asian, <i>n</i> (%)	African-American, <i>n</i> (%)	Indian, <i>n</i> (%)
Try to have a child sooner	39 (49 %)	11 (36 %)	7 (41 %)	17 (68 %)
Oocyte cryopreservation	8 (10 %)	4 (13 %)	4 (24 %)	2 (8 %)
Embryo cryopreservation	20 (25 %)	9 (30 %)	4 (24 %)	1 (4 %)
Adoption	5 (6 %)	2 (6 %)	1 (6 %)	2 (8 %)
No further action	4 (5 %)	3 (10 %)	0	3 (12 %)

P-value: 0.23 (Fisher's exact test; note: options of "seeking partner sooner" and "use of donor sperm" omitted due to low response rate)

However, we found no differences in fertility knowledge based on gender, which likely reflects the medical background of the cohort, and an improved knowledge base. Even rudimentary knowledge may contribute to a better understanding of fertility; in a survey of Israeli undergraduate students, those in the health field had more accurate knowledge of age-dependent fertility decline [24]. Despite this, only 11 % of all the students questioned understood that genetic motherhood from the mid-40s onward is highly unlikely.

Importantly, study participants indicated that if they were found to be at risk for diminished ovarian reserve, the majority would alter their life plans, including advancing plans for childbearing or considering oocyte/embryo cryopreservation or even adoption. This finding is particularly noteworthy since at the same time that there is an expanding scientific and lay literature highlighting age-related declines in fertility, there is a trend among women to postpone childbearing until relatively late in their reproductive life [2–5]. From 1970 to 2006, the proportion of first births to women aged 35 y and over increased nearly eight times [25–27]. This trend is not unique to the U.S., having also been noted in other industrialized regions such as Canada [6, 7], Europe [8, 28, 29], and Australia [9, 30]. For those women choosing to delay pregnancy, assessing ovarian reserve and personalized risk assessment of subfertility and infertility could allow for more informed decisions about when to attempt to have children [15] or to consider oocyte/embryo cryopreservation. Indeed, surveys of

subfertile/infertile women requiring ART to become pregnant have demonstrated that these women would have appreciated more information at an earlier age regarding the implications of delayed childbearing [16, 17]. The same was even true for a group of female university students who stated that they would change their life plans accordingly, including proactively advancing personal relationships and accessing fertility preservation techniques should they be found to have diminished ovarian reserve [5]. These studies, in conjunction with ours, highlight the need for realistic disseminated information on the topic of ovarian reserve. This would help to counteract some of the unrealistic expectations that have been purported by media outlets; for example, in a survey of women over the age of 40 who conceived using IVF, 28 % cited misleading media reports of pregnancies in older celebrity women as contributing to their mistaken belief in robust fertility until a more advanced age [17]. Similarly, a survey of patients who pursued social oocyte cryopreservation found that patients sensed that popular media falsely portrayed the upper age limit for natural conception [31].

Not surprisingly, given different social circumstances, there was a difference between married and unmarried individuals as to how ovarian reserve testing would alter their reproductive plans. However, participants selected similar choices regardless of their ethnicity or religiosity. The lack of difference among participants regardless of ethnicity may, in part, reflect the medical background of the cohort, as there are certainly racial disparities when examining the general population and in those who pursue ART and IVF [32, 33]. However, the fact that respondents of varying religious backgrounds made comparable decisions is similar to the findings in a survey by Kessler et al., in which there were no disparities in women seeking fertility treatment based on religious choice [32]. As the authors note, this may be due to the importance that most religions place on parenthood and family values.

In this study, both physicians with non-physicians had a similar knowledge base regarding fertility and had similar responses regarding reproductive choices. However, it should be noted that female physicians are at particular risk for becoming patients themselves at IVF practices. Several studies have documented the increased use of ART among female physicians compared to the general population, much of it

Table 7 Reproductive choices based on religiosity

	Not very religious, <i>n</i> (%)	Moderately religious, <i>n</i> (%)	Very religious, <i>n</i> (%)
Try to have a child sooner	28 (44 %)	34 (50 %)	16 (52 %)
Oocyte cryopreservation	16 (25 %)	15 (22 %)	6 (20 %)
Adoption	5 (8 %)	3 (4 %)	1 (3 %)
No further action	9 (14 %)	8 (12 %)	2 (7 %)
Greater effort in finding partner	2 (5 %)	8 (12 %)	3 (10 %)

P-value: 0.68 (Fisher's exact test; note: options of "embryo cryopreservation" and "use of donor sperm" omitted due to low response rate)

related to delayed childbearing and older age at conception [18, 19, 34]. A recent nationwide survey of female physicians graduating between the years 1995–2000 found that 25 % had been diagnosed with infertility, with 43.9 % being “quite bit” to “very much” surprised about their new diagnosis [18]. Similar to our study, the majority (28 %) of respondents would have attempted to conceive earlier and a proportion would have contemplated oocyte/embryo cryopreservation (7.2 %), although nearly 18 % would have considered a different specialty altogether or even would have decided not to go into the field of medicine (3.6 %). The tendency to delay childbearing in female physicians was nicely illustrated in a survey study of 424 residents, in which 41 % of male residents vs 27 % of female residents intended to have children during residency ($p=0.01$) (35). Based on the questionnaire, this difference was largely attributable to perceived career threats on the part of the female trainees.

These recent studies in conjunction with ours highlight the need for education of the general population and physicians alike. While concrete evidence of impending infertility would be actionable, as reflected in our survey results, such evidence is not yet practically available. The current modalities for assessing ovarian reserve can be used as a guide for directing treatment. However, no single test or algorithm has been found to be predictive of pregnancy for couples and there is no “screening” method to assess women at risk for subfertility at an earlier age than in the general population. Our results suggest that improving these tests, to the point at which they may be sufficiently reliable to be the basis of life-altering decisions would be highly advantageous. It also suggests that professional organizations should start to consider the appropriate place of those tests in the context of routine reproductive health visits. It would seem reasonable to inquire about a woman’s childbearing desires and plans, and to introduce the possibility of testing (once the technique is sufficiently reliable) if the woman is at some risk of reduced fertility, and if she states that results suggesting as much would be meaningful to her. In addition, for women who are considering delaying childbearing and who are long-term users of oral contraceptives, it should be noted that the typical parameters used to assess ovarian reserve may be affected by oral contraceptive (OCP) use. Patients should be counseled accordingly, as their AMH levels and antral follicle count may be falsely lowered with OCP use, while the FSH level may be suppressed [8, 35].

Our study has both strengths and weaknesses. The diversity of our study made it difficult to perform significant statistical sub-analyses; however, it does increase the generalizability to the diverse U.S. population as a whole. The survey was only disseminated to participants at a single, urban hospital but as stated previously, this was far from a homogenous population. It also uniquely captured the attitudes of health professionals, as opposed to much of the literature, which assesses attitudes

of the general population with regards to fertility or specifically surveys women seeking fertility treatment.

Clinical implications

In conclusion, this study demonstrates that increased information about a woman’s reproductive reserve would lead individuals to modify life choices. We should continue to improve modalities for assessing reproductive reserve and developing algorithms that can be used prospectively. Physicians caring for reproductive-age women and men should inquire about their childbearing plans, and educate those who are postponing childbearing regarding the normal pattern of reproductive decline.

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