Women's Knowledge and Awareness of the Effect of Age on Fertility in Kazakhstan

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Abstract: An accurate understanding of reproductive facts is essential for appropriate decision making regarding whether, when, and how to conceive. The objective of this study was to investigate women's knowledge of how age affects fertility and their knowledge about the effectiveness for assisted reproductive technologies for treating fertility. A cross-sectional study was conducted including women seeking fertility treatment at the University Medical Center, Nur-Sultan, Kazakhstan in 2018–2019. Patients were interviewed with a structured questionnaire. Socio-demographic, clinical characteristics, and knowledge and awareness about the implications of aging for fertility (advanced maternal age (AMA)) and pregnancy outcomes using fertility treatments (assisted reproductive technologies ((ART)) and the sum of both scores total knowledge score (TKS). TKS mean was 7.7 (SD = 2.1), AMA was 5.0 (SD = 1.5), and ART was 2.7 (SD = 1.5). No socio-demographic factors correlated with lower knowledge. Fertility knowledge was found to be low. No differences were found associated with socio-economic level, although they were identified in women with certain types of infertility and a history of gynecological problems. Delaying childbearing based on incorrect perceptions of female fertility could lead to involuntary childlessness. Health education regarding fertility has to be part of broader health promotion programs to enhance awareness of the effect of age on fertility.

Keywords: advanced age; fertility; infertility; delaying childbearing

1. Introduction

An accurate understanding and knowledge of reproductive facts is essential for women and couples appropriate decision making regarding whether, when, and how to conceive. Identifying gaps in knowledge, including prevalent myths and misconceptions, attitudes, and practices, of women of reproductive age before planning and conceiving a pregnancy is important to optimize reproductive and pregnancy outcomes [1]. Likewise, understanding how women access information about reproductive health can highlight opportunities for enhanced communication and information dissemination.

The "postponement transition" [2,3], with couples having children in a period when women's fecundity is in decline, is associated with the period of the lowest fertility observed [4]. Although some global determinants may explain this delay, like the introduction of contraceptive methods that made women increasingly able to control their reproduction [5], there may likely be specific factors in different countries and different contexts. Although the widespread availability of assisted reproductive technologies (ART), such as in vitro fertilization (IVF), has helped many couples realize their dream of parenthood, they cannot fully compensate for the age-dependent loss of fecundity because the success rates of these techniques sharply decrease with age [6] Fertility awareness studies have demonstrated the general lack of awareness of the age-related relationship of the risk of infertility and overestimating both women's fecundity at older ages as well as the rates of success of IVF [7–9].

From a demographic perspective, Kazakhstan is a relatively young country. The majority of the population belongs to younger age groups (the average age is 29 years), 26.7% of the population are women of fertile age [10]. The fertility rate (total births per woman) in Kazakhstan decreased significantly from 4.6 in 1960 to 2.8 in 2015 [11]. However, the average age of women at first birth increased significantly, from 23 years in 1990 to 27.6 years in 2010, and 28.5 in 2017, approaching the level of Eastern European countries, and deviating from that of Central Asia countries [12]. That information suggests that the frequency of infertility caused by the advanced age of the mother may rise in the country in the coming years. There are lack of studies reporting the frequency of infertile marriage for the republic of Kazakhstan, which has been estimated to vary from 12 to 15.5% [13].

The objective of this study was to investigate women's knowledge of how age affects fertility as well as their knowledge about the effectiveness for assisted reproductive technologies for treating fertility; and to examine the association between women's fertility-related knowledge to socio-demographic factors, medical history, and lifestyle behaviors.

2. Materials and Methods

2.1. Study Design and Setting

This is a cross-sectional study carried out at the IVF Unit of the Clinical Academic Department of Women's Health, National Research Center of Mother and Child Health, University Medical Center (UMC), Nur-Sultan.

2.2. Eligibility Criteria

Inclusion criteria were (1) came for a consultation to the IVF unit due to infertility from various regions of Kazakhstan, (2) were over 18 years old, and (3) able to answer questions in Kazakh, Russian, or English.

2.3. Data Sources and Measurements

A questionnaire consisting of 38 open-ended questions were given to women. The questionnaire was designed after reviewing previous works on fertility awareness and modified by the reproductive specialists participating in this work according to patient population and level of understanding in a Kazakh set up [14,15]. Kazakhstan is a bilingual country, so the questionnaire was available both in Russian and Kazakh languages.

2.4. Study Size

All women who met inclusion criteria, throughout a period of two years (2018–2019) were invited to participate.

2.5. Quantitative Variables

Knowledge of women was ascertained with 13 statements exploring two different sub-domains: their knowledge on the effect of advanced maternal age on pregnancy outcomes, (AMA score) and

their knowledge on the success of assisted reproductive techniques (ART score). A final total score was obtained (total knowledge score (TKS)), which was the sum of the knowledge of the 2 previously mentioned sub-domains, AMA and ART. Participants' answers were categorized as correct or incorrect responses based on whether the statement was true or false. For the 3 scores, higher scores indicating more accurate knowledge about fertility, aging, and ART outcomes. TKS had a possible range of 0–13 points, AMA ranged from 0 to 7, while ART knowledge score ranged = 0–6.

The questionnaire also interrogated women about their knowledge and awareness of the relationship between age and fertility and pregnancy outcomes after 35 years, as well as regarding the rates of success of existing treatments of infertility. Medical information and data concerning IVF outcomes were obtained from medical records.

The following data obtained/confirmed by medical records review and questionnaires: demographic (socio-economic status, education level), biomedical (age, comorbid conditions, Body Mass Index (BMI)), previous pregnancies, history of prior IVF/ART, and infertility duration), lifestyle perception (stress, attitude, prayer, and health behaviors).

2.6. Statistical Methods

A description of the variables included was conducted as well as bivariate analysis including the association of the means values of AMA, ART, and TKS scores with the demographic, biomedical, and lifestyle variables.

2.7. Ethics Considerations

Ethical approval was obtained from the Institutional Research Ethics Committee of UMC, protocol #6 of the session of 17th September of 2015.

3. Results

3.1. Demographic Characteristics

Data was available from 236 women who provided the informed consent and completed a questionnaire. Socio-demographic data and clinical characteristics of these women are presented in Table 1. The mean age of woman was 34.8 years (SD = 7.9 years). 73.4% had at least a university degree and 30.9% of the sample reported income levels > 1 million tenge (2500 US$). The main sources of information regarding fertility were their doctors (51.7%) and the Internet (45.3%).

A total of 48.7% of the women indicated more than five years duration of infertility. Male factor (21.2%) and tubal problems (28.0%) were the two most frequent causes of infertility reported by women answering the questionnaire. 81.8% of them had started infertility treatment when they were below 30.

3.2. Behavior and Lifestyles

Table 2 shows results that describe lifestyles women responding to the questionnaire. It is to mention the low proportion of them that indicated that exercise regularly (60%) or practice yoga (89%). Nevertheless, there was a high prevalence of women who are non-smokers (89%) and have normal weight (64%). There was also a low proportion of women practicing yoga or acupuncture, most indicated to have a regular use of mobile phones. The majority of women engaged in prayer, had a positive attitude, as well as avoided stress. A high percentage of women reported limiting even completely physical activity after implantation (63%).

Table 1. Socio-demographic and clinical characteristics of the sample analyzed.

Socio-Demographic and Clinical Variables		Frequency	%
Age	≤35	144	62.1
	35–37	41	17.4
	38–40	20	8.5
	41–42	12	5.1
	43+	16	6.8
Duration of infertility	<3 Years	66	28.0
	3–5 Years	44	18.6
	>5 Years	115	48.7
Fertility diagnosis	Age factor	22	9.3
	Endometriosis	27	11.4
	Male factor	50	21.2
	Ovulatory	21	8.9
	Tubal	66	28.0
	Uterine	10	4.2
	Unexplained	43	18.2
Education	Elementary	8	3.5
	High school	53	23.1
	Bachelor	123	53.7
	Master/Doctorate	45	19.7
Income (Tenge)	<500,000	99	43.0
	0.5–1 million	60	26.1
	1–2 million	38	16.5
	>2 million	33	14.3
Source of information on fertility and pregnancy	Internet	107	45.3
	Television	6	2.5
	Newspapers	7	3.0
	Doctor	122	51.7
	Family	40	16.9
When started planning pregnancy	<25	104	45.0
	26–30	85	36.8
	30–35	28	12.1
	>35	14	6.1

Table 2. Reported behavior and lifestyles of analyzed sample.

Behavior and Lifestyles Variables		Frequency	%
Exercise	No exercise	141	59.5
	<1 h a week	39	16.5
	1–3 h a week	47	19.8
	>4 h a week	10	4.2
Yoga	Once a week	201	89.3
	2–6 times a week	15	6.7
	7 days a week	9	4.0
Rest after	Normal activity	81	37.2
	Limiting strenuous activity and exercise	106	48.6
	Complete bed rest	31	14.2
Rest before (man)	Normal activity	26	51.0
	Limiting strenuous activity and exercise	22	43.1
	Complete bed rest	3	5.9
Acupuncture	Yes	12	5.2
	No	217	94.8
Weight	Underweight	21	8.9
	Normal weight	150	63.6
	Overweight	57	24.2
	Obese	8	3.4
Stress	Avoiding stress	140	59.3
	Having stress	96	40.7
Attitude	Positive	212	91.4
	Negative	20	8.6
Prayer	Engaging in prayer	155	66.0
	No prayer	80	34.0
Cellular phone	Limited use	50	21.4
	Regular use	184	78.6
Smoking	Not smoking	211	89.4
	<5 years	19	8.1
	>5 years	6	2.5

3.3. Knowledge of the Reproductive Consequences of Aging and Reproductive Technologies

Participants' knowledge of the reproductive consequences of aging and ART are shown in Table 3. These results indicate that women were more aware and had better knowledge regarding the consequences of childbearing at advanced ages (AMA) than of ART. In all, 63 to 85% of women responded correctly each of the seven statements about AMA. The question with the highest correct answers was: Most women knew that ART is associated with multiple gestations (69%). Questions with a percentage of correct answers below 30% were: After infertility treatment, stillbirths/fetal deaths are more common and After infertility treatment, the risk of genetic problems in the baby is higher.

The quantitative data for those responses showed that TKS mean was 7.7 (SD = 2.1). AMA knowledge scores mean was 5.0 (SD = 1.5) and ART knowledge scores mean was 2.7 (SD = 1.5). Figure 1 presents the results obtained for total knowledge scores. In total, 14% of women (36) answered correctly all seven AMA questions. In contrast, only 2% of women (6) answered correctly all six of the ART questions. Only 1 woman provided correct answers to all 13 correctly 13 questions (Figures 2 and 3).

Table 3. Knowledge about fertility and reproductive technologies: correct responses and percentage of women with correct answers.

Knowledge Score		Frequency	%
AMA Score			
Miscarriage is less after 35 common after 35 years old	False	163	69.1
Women are healthier during pregnancy because they are more mature after 35 years old	False	167	70.8
It is harder to get pregnant after 35 years old	Correct	199	84.7
Cesarean section is more common after 35 years old	Correct	171	73.7
Stillbirths/fetal deaths are less common after 35 years old	False	160	69.6
The risk of genetic problems in the baby is higher after 35 years old	Correct	148	63.5
Women have more medical problems during pregnancy after 35 years old	Correct	176	74.6
After infertility treatment, miscarriage rates are higher	Correct	83	35.8
ART Score			
Women have fewer problems like diabetes and high blood pressure after infertility treatment	False	136	59.1
Cesarean section is more common after infertility treatment	Correct	138	59.7
Stillbirths/fetal deaths are more common after infertility treatment	Correct	65	28.3
There are more twins and triplets after infertility treatment	Correct	159	68.8
The risk of genetic problems in the baby is higher after infertility treatment	Correct	64	27.7

AMA: Knowledge of the effect of Advanced Maternal Age on pregnancy outcomes; ART: Knowledge of the success of Assisted Reproductive Techniques.
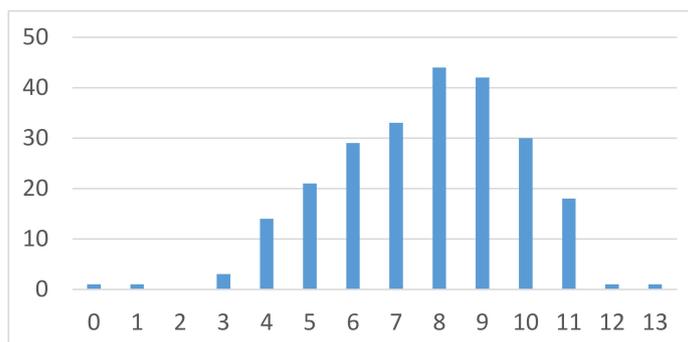

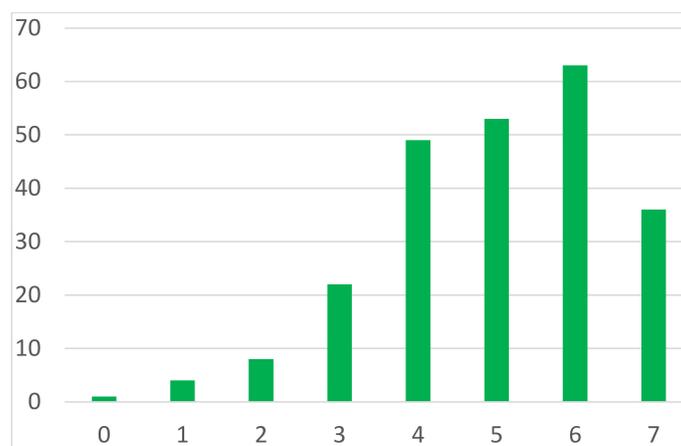**Figure 1.** Distribution of values of Total Knowledge Score.

Figure 2. Distribution of values of AMA score. AMA: Knowledge of the effect of Advanced Maternal Age on pregnancy outcomes.
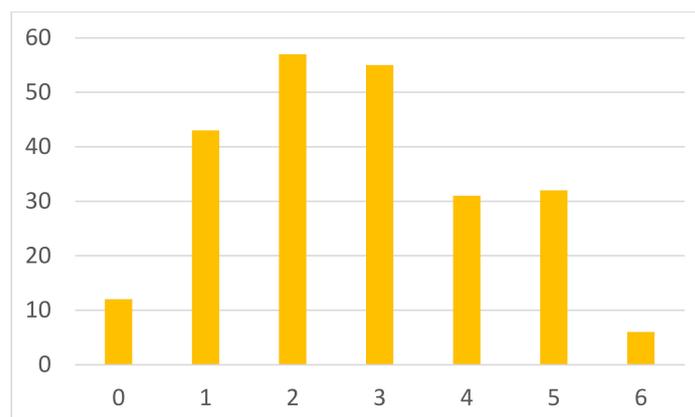
Figure 3. Distribution of values of ART Knowledge. ART: Knowledge of the success of Assisted Reproductive Techniques.

ART knowledge was only associated with three types of leading infertility diagnosis: male factor (3.10), ovulatory problems (3.57) and tubal factor (2.92). Women indicating a history of gynecological problems, showed a higher AMA knowledge (5.80). No influence was found of any other socio-economic factors on knowledge on AMA or ART (Table 4).

Table 4. Values of Knowledge Scores, TKS, AMA, and ART.

Socio-Demographic and Clinical Variables		TKS	AMA	ART
Mean		7.71	4.99	2.62
Diagnosis	Age factor	7.23	4.86	2.36
	Endometriosis	7.44	5.00	2.44
	Male factor	8.24 *	5.14	3.10 *
	Ovulatory	8.90 *	5.33	3.57 *
	Tubal	7.58	4.66	2.92 *
	Uterine	7.20	4.30	2.90
	Unexplained	7.78	5.19	2.58
Source of information	Internet	7.90	5.12	2.78
	Television	8.17	5.88	2.33
	Newspapers	7.71	4.57	3.14
	Doctor	7.67	5.11	2.56
	Family	7.60	5.33	2.28
Age	≤35	7.81	5.04	2.77
	35–37	7.68	5.02	2.66
	38–40	7.35	4.85	2.50
	41–42	8.33	5.17	3.17
	43+	6.94	4.50	2.44
Duration of infertility	<3 Years	7.62	4.89	2.73
	3–5 Years	8.07	5.18	2.89
	>5 Years	7.64	4.99	2.65
Education	Elementary	8.38	6.13	2.25
	High school	7.81	5.06	2.75
	Bachelor	7.73	4.89	2.84
	Master/Doctorate	7.60	5.11	2.49
Income (Tenge)	<500,000	7.72	4.86	2.87
	0.5–1 million	7.33	5.00	2.33
	1–2 million	8.05	5.21	2.84
	>2 million	8.09	5.12	2.97

Table 4. *Cont.*

Socio-Demographic and Clinical Variables		TKS	AMA	ART
Medical history	None	7.53	4.90	2.63
	One or more IVF	7.19	4.57	2.62
	History of gynecologic problems	8.30	5.80 *	2.50
	Ovarian surgery	7.94	5.50	2.44
When started planning a pregnancy	<25	7.61	4.95	2.66
	26–30	7.94	5.19	2.75
	30–35	7.29	4.57	2.71
	>35	7.71	4.93	2.79

TKS: Total Knowledge Score; AMA: Knowledge of the effect of Advanced Maternal Age on pregnancy outcomes; ART: Knowledge of the success of Assisted Reproductive Techniques. *: $p < 0.05$.

4. Discussion

To our knowledge this is the first prospective study to evaluate fertility knowledge and awareness among reproductive-age women attending a fertility clinic in Kazakhstan. This large and comprehensive survey has identified relevant knowledge gaps and misconceptions surrounding reproductive health and fertility [16]. Moreover, no significant associations were found in those gaps in knowledge, though, related to the socio-demographic or lifestyle variables that were analyzed in this work [17]. Only women who reported certain medical conditions associated with infertility or personal antecedents of gynecological problems were found to have a better knowledge of the expected benefits of infertility treatments and of the effect of advanced age on fertility, respectively.

Our results confirm findings from previous work conducted in Kazakhstan that showed how women's health knowledge regarding reproductive health, labor, and delivery was low and needed attention [18]. Further, there is evidence that females in Kazakhstan do not have a clear understanding of the influence of age on the decline of fertility, and about the lower chances of conception at advanced ages [19]. This lack of knowledge is a significant barrier for informed decision making.

Since Malthus, the postponement of marriage and childbearing has been seen as a natural demographic response to economic hardships and social upheavals [20]. Infertility is a global health problem that affects millions, in high, middle, and low-income countries. Kazakhstan is one of the five Central Asian countries that achieved independence in 1991. The dramatic and generalized socioeconomic and political crisis that followed the collapse of the socialist system produced unique demographic responses in the former Soviet Union republics, including Kazakhstan. Although delayed fertility is not yet a significant problem in Kazakhstan, the trend towards delaying the age at first birth calls for the need to educate women and enhance awareness of the risk of age on fertility to have realistic expectations of the benefits of IVF is essential in counseling the patient who desires pregnancy.

Two variables of socio-economic level were considered in this study: income and education. Of both, only income appeared to have a non-significant effect on an increase in AMA knowledge but no for ART [21,22]. As for income, 30.9% of the sample reported income levels > 1 million tenge (2500 US$). The average salary in Kazakhstan in 2019 was 195 thousand tenge (≈$450) and 308 thousand tenge (≈$770) in Nur-Sultan. That means that our sample had a higher economic level than the average in the country and the city. ART is not fully covered by public health insurance in Kazakhstan (KZ), as the government only reimburses the costs of women's out-of-pocket payments for some socially vulnerable groups; having financial resources to access a costly procedure did not have an impact on a higher awareness of the relationship between aging and fertility.

Level of education has been suggested as a strong determinant of socio-economic position in Kazakhstan [23]. 97% of our participants had at least a high school education, while this proportion is 85% overall in Kazakhstan. Although our sample may have a higher economic and educational level than the country average either an association with knowledge was identified.

In this study, women have a fair understanding of the influence of advanced age on infertility, as reflected by their responses in the AMA score. Nevertheless, they showed a significant lack of knowledge of ART that may reflect the high expectations that women had on the role and possibilities of IVF. Interestingly, women with certain infertility diagnoses [24,25] had a higher knowledge of ART [26]. Although overall AMA knowledge showed reasonable levels, it may be improved, as only one of the items (After age 35, it is harder to get pregnant) was correctly responded by more than 80% of women. ART levels of knowledge were overall too low, except for women who reported previous gynecological problems: only women with previous clinical disorders had a higher knowledge of infertility.

Although this study did not explicitly explore women's expectations with IVF, the international literature on this topic is quite consistent with the low results in ART knowledge we identified: women's expectations are much higher than real success rates [27]. The concept of chance and percentage does not seem to be clear to them; although, after a treatment failure their expectations are likely to be more real [28,29].

The majority of respondents in our study identify women's health providers and the internet as their preferred source of information regarding their reproductive health and conception. Nevertheless, only women with certain gynecological and fertility conditions show higher knowledge. The lack of specific associations between knowledge and socio-economic and educational backgrounds indicates the need for comprehensive health education strategies to overcome this limited knowledge.

The Internet is a common source of fertility-related information. Social media is viewed as a potential effective avenue for dissemination of messages about fertility. In this study, there was no clear evidence yet that the use of internet applications was associated with improving women's fertility knowledge [30]. The quality of the information available in the internet has raised some concerns as it may even have possible negative impacts [31]. Using appropriate channels in social media may also be tested to improve women's knowledge. It is not absent of challenges, but health education has to be contextualized to the realities of younger generations. Further research is warranted to identify how to take advantage of internet applications to educate women about their own fertility.

Physicians have to be a critical source for improving women's fertility knowledge [32]. Primary care professionals are in an ideal position to identify women at risk and initiate early investigations and treatments with the goal of optimizing patients' fertility outcomes and quality of life [33]. Doctors should provide women with appropriate information on the effect on aging on the fecundity. Education and enhanced awareness of the effect of age on fertility is essential in counseling. These difficult conversations encourage women to take ownership of decisions related to future pregnancy plans while respecting their reproductive autonomy [34,35].

In a selected group of highly educated and with high economic status [36] Kazakh women attending a university medical center to receive specialized fertility treatment, there is a need to improve their low knowledge regarding the effects of age on fertility and on the benefits of ART. Studies conducted in other countries with regional links to Kazakhstan, have found similar results: limited awareness of the risk that age poses for reduced fertility and an overestimation of the chances of becoming pregnant, clearly reflecting complex factors that influence delayed childbearing [1,15,37–39].

Our work has some limitations related with the source of information, a convenience sample obtained from women referred both from urban as from several regional centers to UMC hospital, a tertiary care university-affiliated center, located in Nur-Sultan, the capital city, for receiving infertility diagnosis and treatment, that have to be considered to interpret these results. Our sample cannot be considered to be representative of the whole Kazakhstan population of women, only of those participating in the survey, a convenience sample which is probably biased having a more educated and more affluent group of participating women. It may be then hypothesized that existing knowledge and awareness of fertility would not be higher overall in the country than what was identified in our study.

Another limitation is that no information on women's residence or ethnic origin was collected. Kazakhstan is a large, diverse, and multi-ethnic country, and still faces a rural–urban health divide.

A wide range of cultural, behavioral, religious, and other peculiarities may influence women's reproductive behavior and reflect different phases of demographic transition among the different ethnic groups. Urban residence has been found in Kazakhstan to be associated with a higher awareness, treatment and control of chronic conditions, suggesting a role of urbanized lifestyle and access to health care [40]. Health knowledge and values may be different among those populations. It is relevant to mention that women who reported obtaining fertility information from their family were the only variable associated with lower AMA knowledge.

5. Conclusions

This work found low levels of knowledge of the effect of age on fertility as well as very low knowledge regarding the expected benefits of assistive technologies. Increased knowledge about reproduction is essential to enable women to make informed choices, avoiding unwanted pregnancies, preserving fertility, and enhancing preconception health. Health education regarding fertility has to be part of broader health promotion programs aimed towards women and men, in which overall healthy lifestyles choices are promoted, including healthy eating and active behavior, avoiding smoking and alcohol, as well as advising on taking prenatal vitamin with folic acid. These interventions would have to combine both targeting social media as well as healthcare settings and should be integrated across levels of care and clinical settings, allowing ongoing patient communication and timely follow-up, which have been identified as barriers when accessing specialist fertility care and ensuring people have a realistic view of fertility treatment from the start.

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