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Original Research Article

Attitude of Healthcare Workers toward Modern Assisted Reproductive Technologies

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Abstract: ***Background***: This study aimed to assess the attitude of Jordanian healthcare workers (HCWs) toward modern assisted reproductive technologies (ARTs), including gamete donation and sex selection. ***Design and Methods***: The HCWs from three municipalities in Jordan were randomly selected to participate in a self-administered, cross-sectional survey. The study settings included hospitals and clinics in the public and private health sectors. Logistic regression analysis was used to examine the association of demographic characteristics and fertility experience with the attitude toward modern ARTs. ***Results***: A total of 382 HCWs were included in the study. Most participants did not support the donation of fertilized or unfertilized eggs for any purpose (86.4% and 75.4%, respectively). Overall, only 39.3% and 42.9% of the respondents supported the use of *in vitro* fertilization and intrauterine insemination for sex selection, respectively. Religious considerations were the main reason (71.1%) for the negative attitude toward ARTs. However, more supportive attitude was observed among male participants and medical doctors. Logistic regression analysis showed that none of the variables were significantly associated with the attitude toward sex selection and gamete donation. ***Conclusion***: The use of ARTs was generally more acceptable for sex selection than for gamete donation. The attitude of HCWs was primarily driven by religious beliefs, which typically shape the cultural values and the acceptance of such technologies. Additionally, sex and profession seem to play a significant role in shaping the attitude of HCWs toward ARTs.

Keywords: Assisted reproductive technologies; gamete donation; healthcare workers; intrauterine insemination; in vitro fertilization; reproduction.

INTRODUCTION

Assisted reproductive technologies (ARTs) have helped thousands of couples across the world to conceive and start families. They have also helped decrease the incidence of high-risk pregnancies and infant mortality. Indeed, ARTs can help prevent family break-ups and avert the psychosocial consequences of not having children [1, 2]. ART includes *in vitro* procedures that handle both human oocytes and sperm for the purpose of conception or sex determination [3].

The application of ARTs in the Islamic world has been delayed for many years as Islamic jurisprudence prohibits the involvement of any party other than the wife and husband in conception. Thus, Islamic tenets do not permit the use of donor gametes or embryos [4]. However, other ARTs were recently adopted and accepted in the Islamic world, including *in vitro* fertilization (IVF) and intrauterine insemination (IUI). However, these two techniques entail the use of cells or organs of only the husband and wife to be accepted by the Islamic view.

Islam is the major religion in Jordan, accounting for 97.2% of the total population (predominantly Sunnis). Christians (mainly Greek Orthodox) account for 2.2% of the population [5]. Both religions have strict views on ARTs and only permit the use of these techniques in certain circumstances [6]. Jordan represents a major destination for medical tourism in the region. The first IVF facility in Jordan was established in 1986 [7]. Currently, ARTs offer many advanced and innovative treatment options, such as gamete donation, surrogacy, and sex selection technologies. Many of these technologies are legal in Jordan, except for surrogacy and gamete donation.

Currently, two procedures are used for sex selection: preimplantation genetic diagnosis (PGD) and intrauterine insemination (IUI). In PGD, the fertilized egg is genetically biopsied to detect sex-linked disorders prior to its implantation back into the uterus. On the other hand, IUI entails the placement of sperm inside a woman's uterus to facilitate fertilization. Both procedures are widely used [8-10]. However, Islamic tenets disapprove the use of sex selection for nonmedical indications. The Islamic Fiqh Council has instructed that PGD should only be used for the prevention of sex-linked disorders or to protect women from high-risk pregnancies but not for social reasons [4, 11]. Another argument stated that maintaining a balanced sex ratio in the family for harmony is permissible and not completely prohibited in Islam [4, 12]. However, third-party involvement is completely prohibited by Islam; thus, gamete or sperm donation is not permitted. Muslim countries abide by these Islamic rules, and therefore, any form of donation for reproduction is not permissible. The allowance of donation of oocytes or sperm varies among countries. For example, oocyte donation is not allowed in Jordan, Egypt, Morocco, Saudi Arabia, and Turkey but is allowed in Iran.

The attitude of healthcare workers (HCWs) toward ARTs can play a key role in influencing the acceptance of ARTs among the general public. With the increasing demand for ARTs for the treatment of infertility or sex selection, it is important to investigate if HCWs are receptive to all new procedures, especially those which may seemingly conflict with cultural or religious values. Thus, this study sought to assess the attitude of HCWs in Jordan toward ARTs. To date, this is the first such study to address this issue in Jordan.

DESIGN AND METHODS

Design and settings

This was a cross-sectional study targeting HCWs at healthcare facilities in three randomly selected municipalities in Jordan: Amman, Irbid, and Al-Karak, representing the middle, north, and south of Jordan, respectively. In each municipality, public and private hospitals, health centers, and private clinics were randomly selected. In total, 8 hospitals, 40 clinics, and 40 healthcare centers that offer gynecology/obstetrics services were selected. The hospitals selected in the municipality of Amman included two public hospitals, one private hospital, and one university hospital. One public hospital and one private hospital each were selected in the municipalities of Irbid and Al-Karak. HCWs at the participating health facilities were invited to participate in the study by completing a self-administered questionnaire.

Sampling and data collection

Sampling of HCWs was conducted anonymously. The inclusion criterion was any HCW (regardless of specialty or job title) working in Jordan, either in the public or private sector. These HCWs included medical doctors, medical residents, medical technicians, dentists, pharmacists, nurses, and midwifes. The exclusion criteria were HCWs employed in management or educational roles; those not directly involved in patient care; medical and nursing students; and those who did not agree to provide informed consent.

A multi-stage probability sampling (stratified sampling, not proportionate to size) method was employed. In the first stage, healthcare facilities were divided into clusters according to region (north, middle, and south Jordan); of these, three municipalities were randomly selected in each cluster (Irbid, Amman, and Al-Karak). In the second stage, the healthcare facilities were stratified according to sector (public or private), and in the third stage, the HCWs were stratified according to specialty (medical specialists, residents, general practitioners, dentists, pharmacists, nurses, midwifes, and medical technicians). All HCWs at the selected facilities were informed about the purpose of the study and invited to participate. Oral consent of the participants was obtained prior to starting the survey. A total of 550 HCWs were invited to participate in the study; of these, 382 agreed to participate and completed the survey (response rate: 69.4%).

Data collection instrument

The survey consisted of a self-administered questionnaire that contained 33 closed-ended questions. The questionnaire was anonymous, short (time required for completion: approximately 5 min), and optional. The questions were adapted from other studies and modified based on the study objectives [13–17]. The questionnaire consisted of 24 items that included sociodemographic information, self-experience with conception and childbearing, and attitude toward ARTs: sex selection, gamete donation, and donation of fertilized oocyte for research purposes. Each item had three response options: agree, cannot decide, and disagree.

To validate the content of the questionnaire, it was first reviewed by 10 experts (gynecologists, public health professionals, and epidemiologists). The modified version of the questionnaire was then pilot-tested on 20 HCWs to further assess its validity and applicability. The pilot tested participants were not included in the survey results.

Statistical Analysis

Data were analyzed using IBM SPSS software version 23. Categorical variables were expressed as frequency (percentage), and continuous variables were expressed as mean ± standard deviation. The chi-squared test of independence was used to assess the association between items of attitude toward ARTs and sex, job title, and specialty of the respondent. Logistic regression was applied to examine the association of demographic information and childbearing experience with attitude toward sex selection and gamete donation. P-values of <0.05 were considered indicative of statistical significance.

RESULTS

Participant characteristics

Table 1 illustrates the characteristics of the study population (N = 382). Most participants were women (n = 230, 60.2%). The mean age of the participants was 35.3 $\pm$ 9.9 years. Most participants were Muslim (n = 365, 95.5%), married (n = 267, 69.9%), medical doctors (n = 161, 42.1%), and employed in public hospitals (n = 175, 45.8%). The mean duration of professional experience of the participants was 10.5 $\pm$ 8.25 years (range, 1–30 y).

Participants' experience with conception, childbearing, and ARTs

About two-thirds (67.0%) of the respondents had children. One-fifth (n = 68, 17.8%) of the respondents reported a history of difficulty in conception. Among them, 46 (12.0%) reported a previous experience with use of ART and 16 (4.2%) reported that they conceived their children using ART; accounting for approximately one-third (34.7%) of couples that used ART. Most respondents (n = 350 or 95.4%) reported knowing someone who experienced infertility or subfertility (Table 2). The mean family size of the married participants was 4.17 ± 1.7 individuals, whereas the mean size of the families in which participants grew up was 7.97 ± 1.8.

Participants' attitude toward modern ARTs

Based on their attitude toward the use of ARTs, the participants were categorized into two groups. The first group (n = 150, 39.3%) supported the use of IVF for sex selection, whereas the other group (n = 152, 39.8%) did not support it. The remaining participants responded with either cannot decide or no response (Table 3). A comparable result was observed with respect to the attitude toward the use of IUI for sex selection (Table 3). However, the participants did not support the donation of fertilized or unfertilized eggs for any purpose. Moreover, they believed that the donor and recipient should not be anonymous to each other.

Tables 4, 5, and 6 illustrate the relationship of sex, job title, and specialty with attitude toward modern ARTs, respectively. Sex and job title were significantly associated with several aspects of ARTs ($p < 0.05$), including allowing donation of fertilized eggs in Jordan, donation of unfertilized eggs to treat couples with infertility, donation of fertilized eggs for research, and donation of fertilized eggs to couples with infertility. However, the specialty of the participants (gynecology, pediatrics, or other specialties) was not significantly associated with the attitude toward ARTs, except for the use of IUI for sex selection ($p = 0.038$).

Multinomial regression analysis showed that none of the demographic characteristics or the factors related to experience with fertility, which reported in Table 2, was statistically significant ($p > 0.05$).

Table 1: Characteristics of the study population

Characteristics		Frequency	Percent
Sex	Male	152	39.8
	Female	230	60.2
	Total	382	100.0
Religion	Islam	365	95.5
	Christianity	11	3.0
	Other	2	0.6
	No response	4	0.9
	Total	382	100.0
Place of residence	City	313	81.9
	Village	67	17.5
	No response	2	0.6
	Total	382	100.0
Place of work	Health center	38	9.9

	Public hospital	175	45.8
	Private hospital	95	24.9
	University hospital	31	8.1
	Private clinic	31	8.1
	No response	12	2.2
	Total	382	100.0
Marital status	Single	95	24.9
	Married	267	69.9
	Separated	16	4.2
	Widowed	4	1.0
	Total	382	100.0
Specialization	Nurse	123	32.2
	Midwifery	16	4.2
	General practitioner	49	12.8
	Resident	44	11.5
	Specialist	68	17.8
	Technician	22	5.8
	Dentist	13	3.4
	Pharmacist	17	4.5
	No response	30	8.3
	Total	382	100.0
What is your specialty (both residents and specialists)?	Gynecologist	55	14.4
	Pediatrician	20	5.2
	Other specialty	75	19.6
	Total	150	39.3

Table 2: Participants' experience with conception, childbearing, and assisted reproductive technologies

		Frequency	**Percent**
Do you have children?	No	114	29.8
	Yes	256	67.0
	Expecting a baby	6	1.6
	No response	6	1.6
	Total	382	100
What is the size of the family in which you grew up?	Five or less people	32	8.4
	More than five	348	91.1
	No response	2	0.5
	Total	382	100
What is the size of your current family if you are married?	Five or less people	222	58.1
	More than five	63	16.5
	No response or not married yet	97	25.4
	Total	382	100
If you have children, how did you conceive them?	Naturally	249	65.2
	Using assisted reproductive technologies	16	4.2
	No response or did not have children yet	117	30.6
	Total	382	100
Have you ever had difficulty in conceiving children?	No	212	55.5
	Sometimes	29	7.6
	Yes	39	10.2
	No response or did not have children yet	102	26.7
	Total	382	100
Do you know people who have faced problems in conceiving?	No	17	4.5
	Yes	350	95.4
	No response	15	3.9
	Total	382	100
Have you ever used means of assisted fertilization?	No	240	62.8
	Yes	46	12.0
	No response or did not have children yet	96	25.1
	Total	382	100

Table 3: Participant's attitudes toward other modern assisted reproductive technologies

	Response	Frequency	Percent
I support the use of in vitro fertilization for sex selection	No	152	39.8
	Cannot decide	78	20.4
	Yes	150	39.3
	No response	2	0.6
	Total	382	100
I support the use of intrauterine insemination for sex selection	No	145	38.0
	Cannot decide	68	17.8
	Yes	164	42.9
	No response	5	1.3
	Total	382	100
I support the donation of unfertilized eggs to treat couples with infertility	No	288	75.4
	Cannot decide	50	13.1
	Yes	41	10.7
	No response	3	0.8
	Total	382	100
I support the donation of sperm to couples who are unable to fertilize due to absence of sperm	No	318	83.2
	Cannot decide	31	8.1
	Yes	30	7.9
	No response	3	0.8
	Total	382	100
I support the donation of fertilized eggs in Jordan	No	330	86.4
	Cannot decide	30	7.9
	Yes	19	5.0
	No response	3	0.8
	Total	382	100
I support the donation of fertilized eggs for research	No	227	59.4
	Cannot decide	66	17.3
	Yes	86	22.5
	No response	3	0.8
	Total	382	100
I support the donation of fertilized eggs to couples with infertility	No	308	80.6
	Cannot decide	45	11.7
	Yes	27	7.1
	No response	2	0.6
	Total	382	100
I support that the donor of fertilized eggs is known to the child	No	169	44.2
	Cannot decide	124	32.5
	Yes	75	19.6
	No response	14	3.7
	Total	382	100
I support that the donor of fertilized eggs is unknown to the recipients	No	225	58.9
	Cannot decide	112	29.3
	Yes	27	7.1
	No response	18	4.7
	Total	382	100
I support that the recipients of fertilized eggs should be unknown to donors	No	226	59.2
	Cannot decide	115	30.1
	Yes	24	6.3
	No response	17	4.5
	Total	365	95.5

Table 4: Association of sex with attitudes toward modern assisted reproductive technologies

Attitude		Sex		Total N (%)	p- value
		Male N (%)	Female N (%)		
I support the use of intrauterine insemination for sex selection	No	64 (42.4%)	81 (35.8%)	145 (38.5%)	0.436
	Cannot decide	26 (17.2%)	42 (18.6%)	68 (18.0%)	
	Yes	61 (40.4%)	103 (45.6%)	164 (43.5%)	
I support the donation of fertilized eggs in Jordan	No	123 (80.9%)	207 (91.2%)	330 (87.1%)	0.008
	Cannot decide	16 (10.5%)	14 (6.2%)	30 (7.9%)	
	Yes	13 (8.6%)	6 (2.6%)	19 (5.0%)	
I support the use of in vitro fertilization for sex selection	No	67 (44.4%)	85 (37.3%)	152 (40.1%)	0.169
	Cannot decide	24 (15.9%)	53 (23.2%)	77 (20.3%)	
	Yes	60 (39.7%)	90 (39.5%)	150 (39.6%)	
I support the donation of unfertilized eggs to treat couples with infertility	No	102 (67.5%)	186 (81.6%)	288 (76.0%)	0.001
	Cannot decide	22 (14.6%)	28 (12.3%)	50 (13.2%)	
	Yes	27 (17.9%)	14 (6.1%)	41 (10.8%)	
I support the donation of sperm to couples who are unable to conceive due to absence of sperm	No	120 (78.9%)	198 (87.2%)	318 (83.9%)	0.023
	Cannot decide	13 (8.6%)	18 (7.9%)	31 (8.2%)	
	Yes	19 (12.5%)	11 (4.8%)	30 (7.9%)	
I support the donation of fertilized eggs for research	No	87 (57.2%)	140 (61.7%)	227 (59.9%)	0.038
	Cannot decide	21 (13.8%)	45 (19.8%)	66 (17.4%)	
	Yes	44 (28.9%)	42 (18.5%)	86 (22.7%)	
I support the donation of fertilized eggs to couples with infertility	No	113 (74.3%)	195 (85.9%)	308 (81.3%)	0.010
	Cannot decide	22 (14.5%)	22 (9.7%)	44 (11.6%)	
	Yes	17 (11.2%)	10 (4.4%)	27 (7.1%)	
I support that the donor of fertilized eggs is unknown to the recipients	No	80 (54.8%)	145 (66.5%)	225 (61.8%)	0.074
	Cannot decide	54 (37.0%)	58 (26.6%)	112 (30.8%)	
	Yes	12 (8.2%)	15 (6.9%)	27 (7.4%)	
I support that the recipients of fertilized eggs should be unknown to donors	No	79 (54.5%)	147 (66.8%)	226 (61.9%)	0.049
	Cannot decide	56 (38.6%)	59 (26.8%)	115 (31.5%)	
	Yes	10 (6.9%)	14 (6.4%)	24 (6.6%)	
I support that the donor of fertilized eggs is known to the child	No	72 (48.3%)	97 (44.3%)	169 (45.9%)	0.001
	Cannot decide	60 (40.3%)	64 (29.2%)	124 (33.7%)	
	Yes	17 (11.4%)	58 (26.5%)	75 (20.4%)	

Table 5: Association of job title with attitudes toward modern assisted reproductive technologies

Attitude		Job title			Total N (%)	P-value
		Nurse or midwife N (%)	Medical doctor N (%)	Other medical professionals N (%)		
I support the use of intrauterine insemination for sex selection	No	52 (37.40%)	75 (42.40%)	13 (39.40%)	140 (40.10%)	0.1
	Cannot decide	35 (25.20%)	27 (15.30%)	3 (9.10%)	65 (18.60%)	
	Yes	52 (37.40%)	75 (42.40%)	17 (51.50%)	144 (41.30%)	
I support the donation of fertilized eggs in Jordan	No	129 (92.10%)	148 (83.10%)	30 (93.80%)	307 (87.70%)	0.032
	Cannot decide	10 (7.10%)	17 (9.60%)	1 (3.10%)	28 (8.00%)	
	Yes	1 (0.70%)	13 (7.30%)	1 (3.10%)	15 (4.30%)	
I support the use of in vitro fertilization for sex selection	No	54 (38.60%)	78 (44.10%)	14 (42.40%)	146 (41.70%)	0.067
	Cannot decide	39 (27.90%)	28 (15.80%)	4 (12.10%)	71 (20.30%)	
	Yes	47 (33.60%)	71 (40.10%)	15 (45.50%)	133 (38.00%)	
I support the donation of unfertilized eggs to treat couples with infertility	No	110 (78.60%)	130 (73.40%)	28 (84.80%)	268 (76.60%)	0.066
	Cannot decide	21 (15.00%)	21 (11.90%)	4 (12.10%)	46 (13.10%)	
	Yes	9 (6.40%)	26 (14.70%)	1 (3.00%)	36 (10.30%)	

I support the donation of sperm to couples who are unable to conceive due to absence of sperm	No	124 (88.60%)	139 (78.10%)	31 (96.90%)	294 (84.00%)	0.001
	Cannot decide	13 (9.30%)	15 (8.40%)	1 (3.10%)	29 (8.30%)	
	Yes	3 (2.10%)	24 (13.50%)	0 (0.00%)	27 (7.70%)	
I support the donation of fertilized eggs for research	No	90 (64.70%)	96 (53.90%)	26 (78.80%)	212 (60.60%)	0.004
	Cannot decide	28 (20.10%)	30 (16.90%)	1 (3.00%)	59 (16.90%)	
	Yes	21 (15.10%)	52 (29.20%)	6 (18.20%)	79 (22.60%)	
I support the donation of fertilized eggs to couples with infertility	No	119 (85.60%)	138 (77.50%)	29 (87.90%)	286 (81.70%)	0.033
	Cannot decide	15 (10.80%)	22 (12.40%)	4 (12.10%)	41 (11.70%)	
	Yes	5 (3.60%)	18 (10.10%)	0 (0.00%)	23 (6.60%)	
I support that the donor of fertilized eggs is unknown to the recipients	No	84 (61.80%)	101 (60.10%)	23 (69.70%)	208 (61.70%)	0.369
	Cannot decide	45 (33.10%)	50 (29.80%)	9 (27.30%)	104 (30.90%)	
	Yes	7 (5.10%)	17 (10.10%)	1 (3.00%)	25 (7.40%)	
I support that the recipients of fertilized eggs should be unknown to donors	No	89 (64.50%)	98 (58.70%)	22 (66.70%)	209 (61.80%)	0.063
	Cannot decide	43 (31.20%)	52 (31.10%)	11 (33.30%)	106 (31.40%)	
	Yes	6 (4.30%)	17 (10.20%)	0 (0.00%)	23 (6.80%)	
I support that the donor of fertilized eggs is known to the child	No	66 (48.20%)	77 (45.30%)	16 (48.50%)	159 (46.80%)	0.78
	Cannot decide	42 (30.70%)	63 (37.10%)	10 (30.30%)	115 (33.80%)	
	Yes	29 (21.20%)	30 (17.60%)	7 (21.20%)	66 (19.40%)	

Table 6: Association of physicians' specialty with attitudes toward modern assisted reproductive technologies

Attitude		**Physicians specialty**			**Total N (%)**	**P-value**
		Gynecologist N (%)	**Pediatrician N (%)**	**Other specialty N (%)**		
I support the use of intrauterine insemination for sex selection	No	11 (20.8%)	9 (45.0%)	28 (37.8%)	48 (32.7%)	0.038
	Cannot decide	6 (11.3%)	2 (10.0%)	15 (20.3%)	23 (15.6%)	
	Yes	36 (67.9%)	9 (45.0%)	31 (41.9%)	76 (51.7%)	
I support the donation of fertilized eggs in Jordan	No	47 (87.0%)	18 (90.0%)	61 (81.3%)	126 (84.6%)	0.554
	Cannot decide	3 (5.6%)	2 (10.0%)	9 (12.0%)	14 (9.4%)	
	Yes	4 (7.4%)	0 (0.0%)	5 (6.7%)	9 (6.0%)	
I support the use of in vitro fertilization for sex selection	No	11 (20.4%)	9 (45.0%)	30 (40.0%)	50 (33.6%)	0.095
	Cannot decide	11 (20.4%)	3 (15.0%)	16 (21.3%)	30 (20.1%)	
	Yes	32 (59.3%)	8 (40.0%)	29 (38.7%)	69 (46.3%)	
I support the donation of unfertilized eggs to treat couples with infertility	No	43 (79.6%)	15 (75.0%)	54 (72.0%)	112 (75.2%)	0.417
	Cannot decide	6 (11.1%)	1 (5.0%)	13 (17.3%)	20 (13.4%)	
	Yes	5 (9.3%)	4 (20.0%)	8 (10.7%)	17 (11.4%)	
I support the donation of sperm to couples who are unable to conceive due to absence of sperm	No	45 (83.3%)	15 (75.0%)	60 (80.0%)	120 (80.5%)	0.240
	Cannot decide	7 (13.0%)	1 (5.0%)	8 (10.7%)	16 (10.7%)	
	Yes	2 (3.7%)	4 (20.0%)	7 (9.3%)	13 (8.7%)	
I support the donation of fertilized eggs for research	No	26 (49.1%)	14 (70.0%)	39 (52.0%)	79 (53.4%)	0.530
	Cannot decide	10 (18.9%)	3 (15.0%)	16 (21.3%)	29 (19.6%)	
	Yes	17 (32.1%)	3 (15.0%)	20 (26.7%)	40 (27.0%)	
I support the donation of fertilized eggs to couples with infertility	No	45 (84.9%)	17 (85.0%)	55 (73.3%)	117 (79.1%)	0.372
	Cannot decide	5 (9.4%)	1 (5.0%)	14 (18.7%)	20 (13.5%)	
	Yes	3 (5.7%)	2 (10.0%)	6 (8.0%)	11 (7.4%)	
I support that the donor of fertilized eggs is unknown to recipients	No	26 (59.1%)	15 (75.0%)	46 (62.2%)	87 (63.0%)	0.741
	Cannot decide	13 (29.5%)	4 (20.0%)	19 (25.7%)	36 (26.1%)	
	Yes	5 (11.4%)	1 (5.0%)	9 (12.2%)	15 (10.9%)	
I support that the recipients of fertilized	No	27 (60.0%)	14 (70.0%)	47 (65.3%)	88 (64.2%)	0.918
	Cannot decide	14 (31.1%)	4 (20.0%)	19 (26.4%)	37 (27.0%)	

eggs should be unknown to the donors	Yes	4 (8.9%)	2 (10.0%)	6 (8.3%)	12 (8.8%)	
I support that the donor of fertilized eggs is known to the child	No	20 (44.4%)	11 (55.0%)	32 (43.2%)	63 (45.3%)	0.649
	Cannot decide	16 (35.6%)	4 (20.0%)	21 (28.4%)	41 (29.5%)	
	Yes	9 (20.0%)	5 (25.0%)	21 (28.4%)	35 (25.2%)	

DISCUSSION

The importance of ARTs in enhancing fertility cannot be overemphasized. Globally, an estimated 219,000–246,000 new births are facilitated/assisted by ARTs every year [4]. HCWs play an important role in promoting the acceptance of ARTs among the general public as well as in advocating for policies that facilitate such techniques, which likely contribute to the wellness of the population.

In this study, the overall attitude toward ARTs was negative, except for sex selection. Moreover, male participants and medical doctors showed a higher preference for the use of ARTs. This indicates that sex and profession may influence the attitude toward medical and health-related ethical issues.

Medical doctors were significantly more supportive of the use of ARTs for different purposes than other HCWs ($p < 0.05$) (Tables 3 and 5). Owing to their more advanced training and knowledge level, medical doctors have a more comprehensive understanding of modern technologies in medicine, including their risks and benefits. Additionally, their medical careers rely on the use of technologies for treating and enhancing the wellness of patients, including improving fertility.

Sex-based differences in attitudes toward ARTs were obvious in this study. Men were significantly more supportive of the use of ARTs than women, including the donation of fertilized eggs to infertile couples ($p = 0.010$). Similar differences were reported in previous studies. In a Canadian study, both men and women expressed willingness to use IVF or IUI if necessary. However, men were more supportive of the use of donated eggs and/or embryos than women [18]. In another large study that included >6,000 participants from several European countries, men were more supportive of IVF than women [19]. Women seem to prefer smaller families than their male counterparts [20].

Countries differ in their recognition of ART procedures based on the sociocultural milieu, religious/spiritual politics, and perceptions of morality [1, 7, 17, 19, 21-25]. For instance, oocyte endowment is not allowed in many Islamic countries [25]. In this study, neither oocyte donation nor sperm donation was acceptable among participants, even if these offered the only hope for infertile couples. According to Islamic tenets, a child conceived from artificial insemination with the husband's ejaculate is allowed, and considered a legal descendant of the couple. Owing to the sanctity of the bond between the wife and husband, involvement of a third party in the marital functions of sex and breeding is not allowed. Thus, Islam does not allow for third-party donors by any means [4, 11].

In this study, the respondents were more supportive of sex selection technologies over other modern ARTs. This reflects the local sociocultural, religious, ethical, and legal values of the participants. Legally, sex selection is permitted in Jordan. However, the Islamic Fiqh Council prohibits sex selection specifically for social reasons but allows it for medical indications [4, 11]. This concept of sex preference is not restricted to Arabic culture but extends to other Asian societies such as India and China [4]. Sex selection for nonmedical reasons has garnered worldwide attention as it may cause gender bias and lead to undesired changes in the sex ratio [13, 26]. A study has reported that sex selection can help support women and their families in family planning and preventing unwanted pregnancies [15]. A study conducted in several Westem countries revealed a general opposition to the use of sex selection for family balancing or sex selection based on the cost or inconvenience of the treatment [26]. In contrast, in another study, 29% of geneticists across 37 countries favored the use of prenatal diagnosis for couples who only had girls and wanted a boy [27]. Similarly, physicians working in an infertility clinic in Jordan recommended the use of sex selection technologies such as preimplantation genetic diagnosis (PGD) for couples who had two or more girls but no boys [28]. Additionally, a study by Al-Akour *et al.*, illustrated that many Jordanian pregnant women were in favor of sex selection [29]. However, a majority of these pregnant women rejected the use of PGD. On the other hand, a study that assessed the attitude of graduating medical doctors toward the use of sex selection techniques in Jordan, most participants (70.8%) were in favor of restricted use of sex selection techniques and stated their unwillingness to use them [14].

Limitations

The response rate in this study was lower than expected owing to the sensitive nature of the subject of this study. The small sample size may limit the generalizability of the findings, increasing the probability of type 2 errors, and reducing the study power. Also, our results may have been affected by sampling bias because the distribution of different specialties among the study population did not reflect their actual distribution in hospitals, clinics, and healthcare centers. Thus, the

proportions based on the distribution of personnel were not considered during sampling and only the total required sample size was considered, regardless of the discipline or specialty. Another issue is that ARTs are only provided in private hospitals, with the exception of the university hospitals, which provide some ART services. Therefore, comparing the attitude of HCWs in the private sector to that of HCWs in the public sector, for instance, might cause some bias in preference and a possible restriction in range.

CONCLUSIONS

The use of ARTs was generally more acceptable for sex selection than for gamete donation. The attitude of HCWs in Jordan was primarily driven by religious beliefs. The more supportive attitude observed among male participants and medical doctors toward ARTs emphasizes the significant effect of sociodemographic factors on certain attitudes despite the ethical or cultural burdens they might carry. However, further studies on public perceptions are required to understand and gauge the general attitude toward modern ARTs in the Jordanian community.

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Authors' contributions

RS and MF conceptualized the study. RS, NA, MF and YK designed the study and formatted the questionnaire, NA collected the data. RS, NA, YK analyzed the data and prepared the results. RS, NA, and MA prepared the manuscript.

Patient Consent for Publication: NA

Conflicts of Interest: The authors declare that there is no conflict of interest regarding the publication of this article.

Ethics Approval and Consent to Participate

The study was approved by the institutional review board at Jordan University of Science & Technology (Ethical approval # 20200131). The committee waived the need for a written consent since the study is based on a questionnaire filled on an anonymous voluntary basis.

Data Availability: Data and additional study information is available upon request.

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