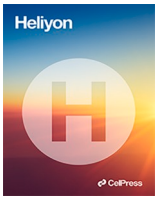
Heliyon 10 (2024) e34428

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Irrational parenthood cognition and infertility stigma among infertile women: A cross-sectional study in Changsha, China

Qin Tang [a,b], Xiu Zhou [a], Nan Wang [a], Xiangzi Qian [a,*]

[a] Obstetrics Department, The Third Xiangya Hospital, Central South University, Changsha City, Hunan Province, China
[b] Nursing Department, The Third Xiangya Hospital, Central South University, Changsha City, Hunan Province, China

ARTICLE INFO

Keywords:
Irrational parenthood cognition
Infertility
Stigma
Women
China

ABSTRACT

Background: Stigma is among the most prevalent and disturbing consequences of being infertile among women, yet it remains unknown whether fertility stigma is affected by irrational parenthood cognitions (IPC). The current study aimed to assess IPC, infertility stigma, and their interrelationship among a group of Chinese women referred to an infertility center in Changsha, Hunan, China.

Methods: A cross-sectional study was conducted among 376 women seeking treatment for infertility in Changsha City, China. Pearson correlation test was used to explore the association between IPC and infertility stigma, while multivariate linear regression was used to explore the independent influencing factors of infertility stigma.

Results: Participants had a mean score of 42.41 ± 13.03 for IPC and 62.89 ± 24.50 for ISS. IPC was highly correlated with infertility stigma with a large effect size ($r = 0.55$, $p < 0.001$). Multivariate linear regression showed that patients' infertility stigma was positively associated with IPC ($\beta = 1.06$, $p < 0.001$) while negatively associated with education ($\beta = -5.4$, $p = 0.036$) and disclosure of infertility ($\beta = -8.39$, $p = 0.001$) ($R^2 = 36$ %). In addition, various influencing factors were identified for the four dimensions of infertility stigma.

Conclusion: This study is the first to identify a positive association between irrational parenthood cognitions and infertility stigma among infertile women in China. Our findings provide useful guidance for the future development of effective anti-stigma intervention programs among infertile women.

1. Introduction

Infertility is a significant public health concern affecting 8%–12 % of reproductive-aged couples worldwide [1]. The incidence of infertility is expected to increase to 7.7 million by 2025 despite the advancement of reproductive technology [2]. Infertility is a disease of the reproductive system characterized by the failure to achieve a clinical pregnancy after 12 months or more of regular, unprotected sexual intercourse or due to an impairment of a person's capacity to reproduce either as an individual or with their partner [3]. A recent study showed an increasing trend in the global prevalence and disease burden of infertility in 195 countries and territories throughout the period from 1990 to 2017 [4]. In the United States, the prevalence of infertility among married females aged 15–44 years was reported to be 6 % [5]. In China, the prevalence of infertility among couples of reproductive ages was 25 %, and almost half

* Corresponding author. 138 Tongzipo Road, Yuelu District Changsha, Hunan, 410013, China.
E-mail address: xiangziqian077@gmail.com (X. Qian).

https://doi.org/10.1016/j.heliyon.2024.e34428
Received 13 February 2024; Received in revised form 22 April 2024; Accepted 9 July 2024
Available online 10 July 2024

of them had not sought medical help [6].

Infertility is among the most devastating experiences and has been described as a significant life crisis among the affected couples, especially for women who are deemed as taking the primary responsibility of childbirth [7]. In many cultures, childbearing is central to a woman's identity, such that womanhood and motherhood are seen as synonymous identities and experiences [8]. This viewpoint is predominant in some Eastern cultures, which emphasize motherhood as the most crucial role of a woman, to stabilize her status in the family and to maintain her marriage with the spouse [9]. Not having children may be considered as not fulfilling the expectations of society's standard of being a woman [10]. Infertile women have been shown to suffer from high levels of physical, mental, and sexual violence [11]. As a result, infertile and childless women have been reported to have significantly higher psychological distress and lower quality of life compared to the general population [12,13].

Stigma is one of the most critical and disturbing consequences of being infertile among women [14,15]. Infertility stigma is characterized by the negative self-perception of an infertile woman, a sense of alienation, insult, and isolation from society, as well as negative self-perceptions about the behaviors of others [16,17]. The prevalence of self-stigma among infertile women was reported to be as high as 64 % in southern Ghana [18] and 69.19 % in China [15]. Similarly, high levels of stigma have also been reported in other studies [19–21]. It has been well established in the literature that infertility stigma was associated with a wide range of adverse health outcomes, including low self-esteem, low self-efficiency, failure in coping, and social isolation, which all contributed to high psychological distress such as depression and anxiety, and even suicide ideation [22–25]. In addition, infertile women with high stigma were less likely to seek treatment and more likely to discontinue treatment even if they sought treatment [26,27]. Studies have shown that nearly half of infertile women would not seek treatment out of the stigma, which may further aggravate their condition [28–30]. It is thus essential to understand the levels and influencing factors of stigma among infertile women to guide targeted and effective interventions to improve their general well-being.

Irrational parenthood cognitions (IPC) is a relatively new term developed within the past two decades to indicate specific, irrational cognitions concerning the need and desire to have children in order to have a happy life [31]. Irrational parenthood cognitions (IPC) are dynamic, multifactorial, and complicated experiences affected by social, family, and individual factors [12]. Cultural context, ethnicity, and religion may affect people's knowledge and attitudes toward infertility, leading to various levels of IPC [32,33]. Additionally, infertile couples, especially those in Asian countries, are under tremendous social and family pressure to carry on their family bloodlines and family names, further contributing to their IPC [34]. Furthermore, the high costs, long duration, and uncertainty related to infertility treatment and assisted reproductive technologies may cause significant stress to infertile couples, resulting in substantial IPC [35]. These irrational ideas can lead to significant emotional, psychological, behavioral, and social problems in infertile couples, negatively affecting their marital relationship and quality of life [36]. A study conducted by Fardiazer et al. [12] demonstrated a strong negative correlation between irrational parenthood cognitions and quality of life. Another recent study conducted by SafaeiNezhad et al. [36] showed a significant positive correlation between irrational parenthood cognitions and destructive behaviors of marital relationships among infertile women. Previous research also identified a strong association between irrational parenthood cognitions and depression [37].

However, to the best of our knowledge, no study has ever investigated the correlation between irrational parenthood cognitions and infertility stigma among Chinese infertile women in the literature. The current study was thus conducted to fill in the research gap by examining the levels of irrational parenthood cognitions and infertility stigma, as well as exploring their associations among a group of Chinese women referred to an infertility center in Changsha, Hunan, China.

2. Methods

2.1. Participants

This cross-sectional study was conducted from October 2020 to January 2021 in the following three hospitals: the Third Xiangya Hospital of Central South University, the Reproductive & Genetic Hospital of Citic-Xiangya, and the Hunan Maternity and Child Health Care Hospital. The convenience sampling method was adopted to consecutively recruit 376 infertile women seeking treatment in the three hospitals. Inclusion criteria included: (1) age $\geq$18 years old; (2) meeting the infertility diagnosis of no pregnancy after 12 months or more of regular, unprotected sexual intercourse; (3) being able to read and communicate; (4) consent to participate in the study. Those who were unable to complete the questionnaire due to illiteracy or serious physical or mental illness were excluded from the study. The sample size was calculated according to the form for cross-sectional study: $n = Z^2\ P\ (1-P)/E^2$, where P (the proportion of patients that had irrational parenthood cognition) was estimated at 50 %, Z was set as 1.64 at a confidence interval of 90 %, the allowable error was set as 10 %. Considering a rejection or loss-to-follow-up rate of 20 %, we expanded our minimum sample size requirement to 326.

2.2. Procedures

Ethical approval of the study was granted by the institutional review boards of the XX University (kuai22063). Patients were approached by trained nurses during their visits/stay in the ward and introduced to the study purpose, procedure, benefits, and risks. They were also informed that all data would be collected anonymously and used for research purposes only. After providing written informed consent, the eligible participants were invited to complete a battery of questionnaires through the online questionnaire platform— Questionnaire Star (https://www.wjx.cn/m/90935884.aspx). The patients accessed the online questionnaires by scanning the WeChat QR code, which was set to be filled only once for one IP address to ensure the authenticity of the data source. The

questionnaires were also set to ensure no inconsistencies, missing items, or logic errors. The researchers recovered the survey results through the questionnaire system.

2.3. Measurements

Data were collected using standardized questionnaires, which included two parts. The first part included sociodemographic information such as age, race, educational level, employment status, residence, duration of married life, household monthly income, the only-child status of the patients and their husbands, and family living structure. This part also included clinical information regarding their infertility and treatment, such as length of infertility, duration of treatment, history of abortion, number of treatments, number of embryos implanted for the current treatment, and disclosure status of their infertility. The second part of the questionnaire included inventories developed to assess irrational parenthood cognitions and infertility stigma among infertile subjects, each described below:

Irrational parenthood cognitions Irrational parenthood cognitions were assessed by the 14-item Irrational parenthood cognitions (IPC) scale developed by Fekkes et al. [31] in the Netherlands to evaluate the patient's need and desire to have children for a happy life. The IPC is a unidimensional scale measuring 14 various aspects of parenthood cognitions. Participants are asked how much they agree

Table 1
IPC and ISS scores by sample characteristics (n = 376).

Variables	IPC			ISS		
	N	**%**	M ± SD	P	M ± SD	P
Demographic characteristics						
Age	M ± SD (range): 31.21 ± 4.66 (20–46)					
<35	305	81.12	42.75 ± 13.00		62.74 ± 24.21	
≥35	71	18.88	40.94 ± 13.15	0.2941	63.55 ± 25.88	0.8019
Ethnicity						
Han	331	88.03	42.02 ± 12.98		61.90 ± 23.87	
Minority	45	11.97	45.29 ± 13.21	0.114	70.20 ± 27.93	**0.0328**
Education						
Below college	249	66.22	43.39 ± 13.42		66.16 ± 24.27	
College & above	127	33.78	40.47 ± 12.05	**0.0397**	56.49 ± 23.78	**<0.001**
Residence						
Rural	143	38.03	42.97 ± 13.64		66.17 ± 23.03	
Urban	233	61.97	42.06 ± 12.66	0.5108	60.88 ± 25.20	**0.042**
Household Income (RMB/month)						
<5000	153	40.69	44.01 ± 14.38		65.43 ± 25.61	
≥5000	223	59.31	41.78 ± 12.43		61.79 ± 23.74	0.0959
Years of marriage, M ± SD (range): 4.50 ± 4.18 (0–23)						
<5	244	64.89	41.97 ± 12.55		62.02 ± 23.08	
≥5	132	35.11	42.75 ± 13.41	0.5658	63.57 ± 25.60	0.5421
Currently living with husband						
No	92	24.47	42.65 ± 14.01		64.32 ± 25.54	
Yes	284	75.53	42.33 ± 12.72	0.8358	62.43 ± 24.19	0.5219
Only child						
No	293	77.93	42.06 ± 13.01		62.51 ± 23.70	
Yes	83	22.07	43.61 ± 13.11	0.3396	64.24 ± 27.26	0.5703
Husband only child						
No	251	66.76	42.96 ± 13.12		63.75 ± 23.89	
Yes	125	33.24	41.30 ± 12.84	0.2474	61.16 ± 25.71	0.3344
Clinical characteristics						
Abortion history						
No	210	55.85	42.25 ± 12.92		62.10 ± 24.77	
Yes	166	44.15	42.61 ± 13.22	0.7902	63.89 ± 24.19	0.4848
Infertility duration, years M ± SD (range): 3.14 ± 2.59						
<5	301	80.05	42.09 ± 13.10		61.73 ± 23.81	
≥5	75	19.95	43.70 ± 12.78	0.3400	67.53 ± 26.78	0.0666
Treatment duration, years, M ± SD (range): 2.65 ± 1.46						
<1	257	68.35	41.64 ± 13.47		61.95 ± 24.42	
≥1	119	31.65	44.07 ± 11.93	0.0928	64.92 ± 24.66	0.2761
Number of treatments						
1	221	58.78	41.59 ± 13.21		62.15 ± 23.87	
2	73	19.41	41.16 ± 12.43		61.66 ± 25.77	
≥3	82	21.81	45.71 ± 12.68	**0.0332**	65.98 ± 25.09	0.4319
Number of Embryos						
1	283	75.27	42.06 ± 12.79		61.42 ± 24.56	
2	93	24.73	43.47 ± 13.75	0.3638	67.37 ± 23.90	**0.0422**
Disclosure of infertility						
No	87	23.14	38.37 ± 13.81		65.54 ± 23.95	
Yes	289	76.86	43.62 ± 12.56	**0.0009**	62.09 ± 24.65	0.2506

Abbreviations: IPC: Irrational parenthood cognitions; ISS: Infertility Stigma Scale.

with each item on a 5-point Likert scale from 1 = "completely disagree" to 5 = "completely agree." The total score ranges from 14 to 70, with a higher score indicating a stronger need for a child just to have a happier life. The IPC was first translated into Chinese by Li et al. [38] in 2016 and showed good reliability and validity. In the current study, the IPC demonstrated good internal consistency with a Cronbach alpha of 0.92.

Infertility stigma Infertility stigma was assessed by the Infertility Stigma Scale (ISS) developed by Fu et al. [15] to measure perceived stigma for women who were coping with a diagnosis and treatment for infertility. The ISS includes 27 items under four subscales: self-devaluation (7 items), social withdrawal (5 items), public stigma (9 items), and family stigma (6 items) to measure various aspects of infertility stigma related to infertility. Participants are asked how much they agree with each item on a 5-point Likert scale from 1 = "totally disagree" to 5 = "totally agree." The total score ranges from 27 to 135, with a higher score indicating a higher level of perceived stigma for infertility. In the current study, the IPC demonstrated good internal consistency with a Cronbach alpha of 0.98 for the total scale and 0.89–0.96 for its four subscales.

2.4. Statistical methods

Data were analyzed using STATA software version 15.0. Scales and indices were tested for reliability. Continuous variables were presented by means and standard deviations, while categorical variables were described by numbers and percentages. Two-sample independent t-tests and ANOVA analyses were used to compare patients' IPC and ISS scores with different characteristics. Pearson correlation was used to determine the degree of association between IPC and ISS. Based on Cohen's [39] guidelines, a correlation coefficient (r) of 0.1, 0.3, and 0.5 indicates small, medium, and large effect sizes, respectively. Finally, we performed multivariate linear regression analysis to investigate the correlates of stigma infertility and its four dimensions with sociodemographic, clinical, and irrational parenthood cognitions as independent variables. Statistical significance was set at $p < 0.05$.

3. Results

3.1. IPC and ISS scores by sample characteristics

A total of 425 patients were screened for inclusion, and 26 were excluded due to ineligibility, including illiteracy (n = 4), unfavorable physical status (n = 15), and unfavorable mental status (n = 7). Of the 399 patients who met the inclusion criteria and were invited to participate in the study, 14 refused participation, and 9 dropped out during the survey, leading to 376 completing the questionnaire, which satisfied the sample size requirement. Overall, 94.0 % (376/399) of the eligible patients participated in the survey.

Table 1 shows the patients' demographic and clinical characteristics and comparisons of their IPC and ISS scores by these characteristics. The patients had a mean age of 31.21 ± 4.66, with most under 35 (81.12 %). They had been married for an average of 4.50 ± 4.18 years, with most under five years (64.89 %). Most were of Han ethnicity (88.03 %), with an education level of below college (66.22 %), of urban residence (61.97 %), with a household income of ≥5000 RMB/month (59.31 %), and currently living with their husbands (75.53 %). Only 22.07 % of the patients and 33.24 % of their husbands were the only children of their parents. As for fertility-related clinical characteristics, over half of the patients had no history of abortion (55.85 %). Their mean infertility duration and treatment duration were 3.14 ± 2.59 years and 2.65 ± 1.46 years, respectively. Most had been infertile for less than five years (80.05 %), in treatment for less than one year (68.35 %), had one treatment (58.75 %), and had one embryo implanted (75.27 %). Among the 376 patients, 87 kept their infertility secret (23.14 %). Among the remaining 289 patients who have disclosed their infertility status, most only disclosed to someone close (77.51 %).

Further comparisons of the IPC scores by the above characteristics showed significant differences in education, number of treatments, and disclosure of infertility. Patients with below college education (43.39 ± 13.42 vs. 40.47 ± 12.05, p = 0.040), received three and more treatments (45.71 ± 12.68 vs 41.59 ± 13.21/41.16 ± 12.43, p = 0.033), and disclosed infertility status (43.62 ± 12.56 vs 38.37 ± 13.81, $p < 0.001$) had significantly higher IPC scores than their counterparts, indicating more irrational parenthood cognitions in those groups. Further comparisons of the ISS scores by patient characteristics showed significant differences in ethnicity, education, residence, and number of embryos. Patients with minority ethnicity (70.20 ± 27.93 vs. 61.90 ± 23.87, p = 0.0328), below college education (66.16 ± 24.27 vs. 56.49 ± 23.78, $p < 0.001$), of rural residence (66.17 ± 23.03 vs. 60.88 ± 25.20, p = 0.042), and with two embryos implanted (67.37 ± 23.90 vs. 61.42 ± 24.56, p = 0.0422) had significantly higher ISS scores than their

Table 2
Correlations between IPC and ISS scores.

	M ± SD	1	2	3	4	5	6
1. IPC	42.41 ± 13.03	1					
2. ISS	62.89 ± 24.50	0.552[a]	1				
3. Self-devaluation	15.91 ± 6.93	0.554[a]	0.907[a]	1			
4. Social withdrawal	12.77 ± 5.00	0.532[a]	0.871[a]	0.763[a]	1		
5. Public stigma	20.39 ± 8.99	0.468[a]	0.951[a]	0.787[a]	0.773[a]	1	
6. Family stigma	13.82 ± 5.83	0.485[a]	0.910[a]	0.756[a]	0.706[a]	0.856[a]	1

Abbreviations: IPC: Irrational parenthood cognitions; ISS: Infertility Stigma Scale.
[a] $P < 0.001$.

counterparts, indicating more infertility stigmain those groups.

3.2. Correlations between IPC and ISS scores

Table 2 shows the scores and correlations among the IPC, ISS, and its four subscales. Patients' irrational parenthood cognitions were at a moderately high level, with a mean IPC score of 42.41 ± 13.03 out of a total score of 70. Patients' infertility stigma regarding their infertility status was at a moderate level, with a mean ISS score of 62.89 ± 24.50 out of a total score of 135. The mean values of the self-devaluation, social withdrawal, public stigma, and family stigma subscales were 15.91 ± 6.93, 12.77 ± 4.99, 20.39 ± 8.99, and 13.82 ± 5.83, respectively.

The IPC score was significantly and positively correlated with the ISS score ($r = 0.55$, $p < 0.001$), indicating that patients with more irrational parenthood cognitions also experienced higher levels of perceived stigma. Regarding the four subscales of ISS, the IPC score was significantly and positively correlated with self-devaluation ($r = 0.554$, $p < 0.001$), social withdrawal ($r = 0.532$, $p < 0.001$), public stigma ($r = 0.468$, $p < 0.001$), and family stigma ($r = 0.485$, $p < 0.001$). All these findings implied that patients with more irrational parenthood cognitions had lower self-evaluation, had higher social withdrawal, and experienced more stigma from the public and family. In addition, the total IPC scale and its four subscales were highly correlated with each other, with correlation coefficients ranging from 0.71 to 0.95 ($p < 0.001$).

3.3. Correlates of infertility stigma

Multivariate linear regression analyses were conducted to examine the independent influencing factors of infertility stigma and its four subscales, with demographic characteristics, clinical characteristics, and irrational parenthood cognitions as independent variables. Specifically, demographic characteristics included age, ethnicity, education, residence, household income, years of marriage, currently living with the husband, being the only child, and whether the husband is the only child. Clinical characteristics included abortion history, infertility duration, treatment duration, number of treatments, number of Embryos, and disclosure of infertility. No outliners were identified, and the variance inflation factor (VIF) values of the independent variables ranged from 1.02 to 1.52, which were all below 5, indicating no collinearity. The errors of the independent variables followed a normal distribution, with their variance being constant across all levels of the independent variables. These results suggested that the assumptions of linear regression were satisfied.

As shown in Table 3, three factors remained significant for the total ISS scale after controlling all other potential confounders: education, disclosure of infertility, and irrational parenthood cognitions. College and above education ($\beta = -5.4$, $p = 0.036$) and disclosure of infertility status ($\beta = -8.39$, $p = 0.001$) were associated with lower perceived stigma, while increased irrational parenthood cognitions ($\beta = 1.06$, $p < 0.001$) were associated with higher perceived stigma. The infertility stigma score was 5.4 points lower in women with college and above education than those with below college education. The infertility stigma score was 8.39 points lower in women who disclosed their infertility status than those who did not. In addition, every one-point increase in the

Table 3
Factors associated with patients' infertility stigma: multivariable linear regression.

Dependent Variables	Independent Variables	B	SE	95 % CI	P
ISS (R^2=36 %)	Education (Below college as reference)				
	College and above	−5.4	2.57	(-10.44,-0.35)	**0.036**
	Disclosure of infertility (no as reference)				
	Yes	−8.39	2.60	(−13.50, −3.28)	**0.001**
	IPC	1.06	0.08	(0 0.89, 1.22)	**<0.001**
Self-devaluation (R^2=35 %)	Disclosure of infertility (no as reference)				
	Yes	−2.61	0.74	(-4.06, −1.06)	**<0.001**
	IPC	0.30	0.02	(0.25, 0.35)	**<0.001**
Social withdrawal (R^2=33 %)	Education (Below college as reference)				
	College and above	−1.20	0.54	(-2.26, −0.14)	**0.027**
	IPC	0.20	0.02	(0.16, 0.24)	**<0.001**
Public stigma (R^2=31 %)	Education (Below college as reference)				
	College and above	−2.04	0.98	(-3.97, −0.12)	**0.038**
	Disclosure of infertility (no as reference)				
	Yes	−3.29	0.98	(-5.23, −1.36)	**0.001**
	IPC	0.36	0.03	(0.29, 0.42)	**<0.001**
Family stigma (R^2=31 %)	Years of marriage (<5 years as reference)				
	≥5	1.41	0.69	(0.04, 2.77)	**0.044**
	Disclosure of infertility (no as reference)				
	Yes	−1.34	0.64	(-2.60, −0.08)	**0.037**
	IPC	0.24	0.02	(0.19, 0.28)	**<0.001**

Abbreviations: IPC: Irrational parenthood cognitions, ISS: Infertility Stigma Scale.
Note: The following independent variables were included in the model but with no statistical significance and were thus not listed in the table: age, ethnicity, residence, household income, years of marriage, living with the husband, the only child, whether the husband is the only child. abortion history, infertility duration, treatment duration, number of treatments, and number of Embryos.

irrational parenthood cognition score was associated with a 1.06-point increase in the infertility stigma score. The regression model explained 36 % of the total variance in infertility stigma, indicating a medium to large effect size.

In addition, slightly different influencing factors were identified for the four dimensions of infertility stigma. For the subscale of self-devaluation, disclosure of infertility status ($\beta = -2.61$, $p < 0.001$) was associated with lower self-devaluation, while increased irrational parenthood cognitions ($\beta = 0.30$, $p < 0.001$) were associated with higher self-devaluation. The regression model explained 35 % of the total variance in self-devaluation, indicating a medium to large effect size.

For the subscale of social withdrawal, college and above education ($\beta = -1.20$, $p = 0.027$) was associated with lower social withdrawal, while increased irrational parenthood cognitions ($\beta = 0.20$, $p < 0.001$) were associated with higher social withdrawal. The regression model explained 33 % of the total variance in social withdrawal, indicating a medium to large effect size.

For the subscale of public stigma, college and above education ($\beta = -2.04$, $p = 0.038$) and disclosure of infertility status ($\beta = -3.29$, $p = 0.001$) were associated with lower public stigma, while increased irrational parenthood cognitions ($\beta = 0.36$, $p < 0.001$) were associated with higher public stigma. The regression model explained 31 % of the total variance in public stigma, indicating a medium to large effect size.

For the subscale of family stigma, disclosure of infertility status ($\beta = -1.34$, $p = 0.037$) was associated with lower family stigma, while over five years of marriage ($\beta = 1.41$, $p = 0.044$) and increased irrational parenthood cognitions ($\beta = 0.36$, $p < 0.001$) were associated with higher family stigma. The regression model explained 31 % of the total variance in family stigma, indicating a medium to large effect size.

4. Discussion

4.1. Summary of the findings

To the best of our knowledge, this is the first study to explore the association between irrational parenthood cognitions and infertility stigma in a Chinese population of infertile women. Our major findings are that the mean scores of IPC and ISS were 42.41 ± 13.03 and 62.89 ± 24.50, respectively, indicating moderate to high levels of irrational parenthood cognitions and infertility stigma. Irrational parenthood cognitions were highly correlated with infertility stigma, with a large effect size. Multivariate linear regression showed that patients' infertility stigma was significantly positively associated with irrational parenthood cognitions while negatively associated with college and above education and disclosure of infertility. In addition, we identified different influencing factors among distinct dimensions of infertility stigma. These findings provide important and valuable information and reference for future research and intervention programs to provide targeted support to reduce infertile women's stigma and improve their general well-being.

4.2. Sample characteristics

The typical demographic profile of the infertile women in our study corresponds to a young woman living in urban cities with a below college education who has been married for less than five years. Their typical clinical profile corresponds to a woman who has been infertile and seeking treatment for about three years, receiving one treatment and with one embryo implanted. The demographic and clinical characteristics of the infertile women in our study were generally consistent with those of other studies [12,14,15,36]. In addition, most of the patients had disclosed their infertility status to others, mainly close ones, a finding that has rarely been reported in previous studies. The high disclosure rate may be due to the difficulty of hiding the truth of not having children in a Chinese culture where childbearing has been considered a major and most important expected outcome of marriage [9]. Another explanation may be related to the fact that all patients were already in treatment for infertility since seeking treatment indicates disclosure of infertility [28].

4.3. Correlates of infertility stigma

One major finding of the study was that, for the first time, we identified a positive association between infertile women's irrational parenthood cognitions and perceived infertility stigma, with a large effect size. Such an association remained significant even after controlling for all potential demographic and clinical characteristics, indicating a robust and stable effect of irrational parenthood cognitions on perceived infertility stigma. Infertile women with higher irrational parenthood cognitions had a stronger desire to have a child for a happier life and were more likely to see themselves as useless without a child, which may lead to higher levels of perceived stigma. A closer look at the item scores of the IPC scale showed the highest-scored three items were "1. Having a child is the most important thing in life", "2. A life without children is useless and empty", and "14. One would want to do anything to get pregnant", which further explained the high association between the irrational parenthood cognitions and perceived infertility stigma. These findings suggest that an essential step towards reducing infertile women's infertility stigma is to decrease their irrational parenthood cognitions. Future intervention programs on improving infertile women's mental health may benefit from focusing on changing their irrational parenthood cognitions, which were more modifiable and could be improved through education and cognitive therapy.

Our study also showed that infertile women with lower education had higher perceived stigma, a finding consistent with previous studies [18,27]. Interestingly, a population-based study in China has demonstrated that lower education is a risk factor for infertility [6]. Females with low education levels usually lack reproductive health literacy, which may put them at high risk of pregnancy-related problems that may lead to infertility [6]. In addition, less educated infertile women have less knowledge and insight into infertility and its treatment, which may contribute to more irrational parenthood cognitions and higher infertility stigma [40]. Furthermore, lower

education symbolizes lower socio-economic status and less economic independence, which are associated with more irrational parenthood cognitions and stigma [40]. All those findings suggest education should be strengthened among females to prevent infertility, reduce irrational parenthood cognitions, and alleviate infertility stigma [19,30].

The finding that disclosure of infertility status was associated with decreased stigma was consistent with the bulk of literature showing the benefits of disclosure, which included greater social support, better physical and mental health, and lower stigma [41]. Another explanation may be that those with lower infertility stigma are more likely to disclose their infertility status to others, indicating a bidirectional relationship between disclosure and stigma. Our findings suggest that appropriate disclosure of infertility status to close ones may be beneficial to reduce their infertility stigma and promote their mental well-being.

Furthermore, our study showed slight differences in the influencing factors of the four dimensions of infertility stigma, with IPC being the only variable consistently associated with all four infertility subscales. In addition, education was negatively related to social withdrawal and public stigma. Disclosure of infertility was negatively associated with self-devaluation, public stigma, and family stigma. Finally, years of marriage were positively associated with family stigma, which may be explained by the accumulative effect of prolonged relationship tension and family conflict caused by infertility. Our findings suggest that while IPC should be prioritized for anti-stigma intervention, various strategies may be adopted to address distinct aspects of infertility stigma.

4.4. Limitations

The study had several limitations. First, we used a convenience sample of infertile women from three hospitals in Hunan Province, and our results may need further external validation in future studies using a more representative sample from various areas of China. Second, we only studied the irrational parenthood cognitions and perceived infertility stigma of infertile females, which may be significantly different from that of infertile males. Future studies may benefit from including both infertile males and females to explore the gender differences. Third, our sample was recruited from a clinic where all participants were already receiving treatment; it is likely that infertile females on treatment may have lower irrational parenthood cognitions and perceived infertility stigma than those who never seek treatment, which warrants future research. Fourth, we used a cross-sectional study design and cannot establish a causal relationship between the stigma and its correlates, which needs to be tested in future longitudinal study designs.

4.5. Clinical implications

Our study makes a unique contribution to the infertility literature by identifying the significant positive association between irrational parenthood cognitions and infertility stigma, which provides helpful guidance for the development of effective anti-stigma intervention programs and paves the way for future infertility research. As irrational parenthood cognitions are relatively more modifiable and amenable to psychoeducational interventions, future intervention efforts toward decreasing stigma and improving the well-being of infertile women may benefit from reducing irrational parenthood cognitions through education and psychological therapy. Additionally, our study also helps physicians to identify infertile women who are at high risk of experiencing infertility stigma and thus provide timely and effective support or referral services to this vulnerable patient group. Specifically, strengthening education and training, providing cognitive therapy, and encouraging appropriate disclosure could all contribute to the alleviation of stigma related to infertility. In addition, various strategies should be adopted to address different components of self-stigma when designing targeted intervention programs.

5. Conclusions

This study is the first to identify a positive association between irrational parenthood cognitions and infertility stigma among infertile women in China. In addition, lower education and disclosure of infertility were associated with more infertility stigma, and different factors are associated with various dimensions of infertility stigma. These findings provide useful guidance for the development of effective anti-stigma intervention programs among infertile women, which may be realized through reducing their irrational parenthood cognitions, strengthening education and training, as well as encouraging disclosure.

Ethical statement

Ethical approval was obtained from the Institutional Review Committee of the Third Xiangya Hospital of Central South University (kuai22063). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants provided written informed consent before the study.

Funding

This work was funded by a grant from the Project of guiding innovation of clinical medical technology in Hunan Province of China (Grant Number 2021SK53709) in support of Dr. Nan Wang.

Consent for publication

NA.

Data availability statement

The data associated with the study has not been deposited into a publicly available repository, and will be made available from the corresponding author at xiangziqian077@gmail.com upon reasonable request.

CRediT authorship contribution statement

Qin Tang: Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Xiu Zhou:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Nan Wang:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation. **Xiangzi Qian:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no competing interests.

Acknowledgments

The authors would like to thank all the patients for their participation in this study, and the staff from the Third Xiangya Hospital of Central South University, the Reproductive & Genetic Hospital of Citic-Xiangya, and the Hunan Maternity and Child Health Care Hospital for their collaboration and support.

References

[1] M. Vander Borght, C. Wyns, Fertility and infertility: Definition and epidemiology, Clin. Biochem. 62 (2018) 2–10.
[2] M.N. Mascarenhas, S.R. Flaxman, T. Boerma, S. Vanderpoel, G.A. Stevens, National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys, PLoS Med. 9 (2012) e1001356.
[3] F. Zegers-Hochschild, G.D. Adamson, S. Dyer, C. Racowsky, J. de Mouzon, R. Sokol, L. Rienzi, A. Sunde, L. Schmidt, I.D. Cooke, J.L. Simpson, S. van der Poel, The international glossary on infertility and fertility care, 2017, Fertil. Steril. 108 (2017) 393–406.
[4] H. Sun, T.T. Gong, Y.T. Jiang, S. Zhang, Y.H. Zhao, Q.J. Wu, Global, regional, and national prevalence and disability-adjusted life-years for infertility in 195 countries and territories, 1990-2017: results from a global burden of disease study, 2017, Aging (Albany NY) 11 (2019) 10952–10991.
[5] A. Chandra, C.E. Copen, E.H. Stephen, Infertility and Impaired Fecundity in the United States, 1982-2010: Data from the National Survey of Family Growth. Natl Health Stat Report, 2013, 1-18, 1 pp. following 19.
[6] Z. Zhou, D. Zheng, H. Wu, R. Li, S. Xu, Y. Kang, Y. Cao, X. Chen, Y. Zhu, S. Xu, Z.J. Chen, B.W. Mol, J. Qiao, Epidemiology of infertility in China: a population-based study, BJOG 125 (2018) 432–441.
[7] E.W. Freeman, A.S. Boxer, K. Rickels, R. Tureck, L. Mastroianni Jr., Psychological evaluation and support in a program of in vitro fertilization and embryo transfer, Fertil. Steril. 43 (1985) 48–53.
[8] M. McMahon, Engendering Motherhood: Identity and Self-Transformation in Women's Lives, Guilford Press, 1995.
[9] A.Y. Loke, P.L. Yu, M. Hayter, Experiences of sub-fertility among Chinese couples in Hong Kong: a qualitative study, J. Clin. Nurs. 21 (2012) 504–512.
[10] A.L. Greil, K. Slauson-Blevins, J. McQuillan, The experience of infertility: a review of recent literature, Sociol. Health Illness 32 (2010) 140–162.
[11] Y. Wang, Y. Fu, P. Ghazi, Q. Gao, T. Tian, F. Kong, S. Zhan, C. Liu, D.E. Bloom, J. Qiao, Prevalence of intimate partner violence against infertile women in low-income and middle-income countries: a systematic review and meta-analysis, Lancet Global Health 10 (2022) e820–e830.
[12] Z. Fardiazar, L. Amanati, S. Azami, Irrational parenthood cognitions and health-related quality of life among infertile women, Int. J. Gen. Med. 5 (2012) 591–596.
[13] B. Hanson, E. Johnstone, J. Dorais, B. Silver, C.M. Peterson, J. Hotaling, Female infertility, infertility-associated diagnoses, and comorbidities: a review, J. Assist. Reprod. Genet. 34 (2017) 167–177.
[14] A. Capik, M. Aksoy, E. Yilmaz, F. Yilmaz, Infertility Stigma Scale: a psychometric study in a Turkish sample, Psychiatr. Care 55 (2019) 328–335.
[15] B. Fu, N. Qin, L. Cheng, G. Tang, Y. Cao, C. Yan, X. Huang, P. Yan, S. Zhu, J. Lei, Development and validation of an infertility stigma scale for Chinese women, J. Psychosom. Res. 79 (2015) 69–75.
[16] L.O. Gonzalez, Infertility as a transformational process: a framework for psychotherapeutic support of infertile women, Issues Ment. Health Nurs. 21 (2000) 619–633.
[17] A.K. Sternke Ea, Perceptions of women with infertility on stigma and disability, Sex. Disabil. 33 (2015) 3–17.
[18] E.S. Donkor, J. Sandall, The impact of perceived stigma and mediating social factors on infertility-related stress among women seeking infertility treatment in Southern Ghana, Soc. Sci. Med. 65 (2007) 1683–1694.
[19] M. Taebi, N. Kariman, A. Montazeri, H. Alavi Majd, Infertility stigma: a qualitative study on feelings and experiences of infertile women, Int J Fertil Steril 15 (2021) 189–196.
[20] R.N. Ergin, A. Polat, B. Kars, D. Oztekin, K. Sofuoglu, E. Caliskan, Social stigma and familial attitudes related to infertility, Turk J Obstet Gynecol 15 (2018) 46–49.
[21] L.M. Whiteford, L. Gonzalez, Stigma: the hidden burden of infertility, Soc. Sci. Med. 40 (1995) 27–36.
[22] R. Yokota, T. Okuhara, H. Okada, E. Goto, K. Sakakibara, T. Kiuchi, Associations between stigma, cognitive appraisals, coping strategies and stress responses among Japanese women undergoing infertility treatment, Healthcare (Basel) 10 (2022).
[23] R. Yokota, T. Okuhara, H. Okada, E. Goto, K. Sakakibara, T. Kiuchi, Association between stigma and anxiety, depression, and psychological distress among Japanese women undergoing infertility treatment, Healthcare (Basel) 10 (2022).
[24] Z. Kaya, U. Oskay, Stigma, hopelessness and coping experiences of Turkish women with infertility, J. Reprod. Infant Psychol. 38 (2020) 485–496.

[25] E. Yilmaz, F. Kavak, The effect of stigma on depression levels of Turkish women with infertility, Psychiatr. Care 55 (2019) 378–382.
[26] R.J. Cook, B.M. Dickens, Reducing stigma in reproductive health, Int. J. Gynaecol. Obstet. 125 (2014) 89–92.
[27] D. Kamaradova, K. Latalova, J. Prasko, R. Kubinek, K. Vrbova, B. Mainerova, A. Cinculova, M. Ociskova, M. Holubova, J. Smoldasova, A. Tichackova, Connection between self-stigma, adherence to treatment, and discontinuation of medication, Patient Prefer. Adherence 10 (2016) 1289–1298.
[28] S.J. Dyer, International estimates on infertility prevalence and treatment seeking: potential need and demand for medical care, Hum. Reprod. 24 (2009) 2379–2380, author reply 2380-2383.
[29] J. Boivin, L. Bunting, J.A. Collins, K.G. Nygren, International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care, Hum. Reprod. 22 (2007) 1506–1512.
[30] Y. Che, J. Cleland, Infertility in Shanghai: prevalence, treatment seeking and impact, J. Obstet. Gynaecol. 22 (2002) 643–648.
[31] M. Fekkes, S.E. Buitendijk, G.H. Verrips, D.D. Braat, A.M. Brewaeys, J.G. Dolfing, M. Kortman, R.A. Leerentveld, N.S. Macklon, Health-related quality of life in relation to gender and age in couples planning IVF treatment, Hum. Reprod. 18 (2003) 1536–1543.
[32] H. Nouman, Y. Benyamini, Religious women's coping with infertility: do culturally adapted religious coping strategies contribute to well-being and health? Int. J. Behav. Med. 26 (2019) 154–164.
[33] S. Howe, J.M. Zulu, J. Boivin, T. Gerrits, The social and cultural meanings of infertility for men and women in Zambia: legacy, family and divine intervention, Facts Views Vis Obgyn 12 (2020) 185–193.
[34] S. Nasim, S. Bilal, M. Qureshi, Psycho-social aspects of infertility-a review of current trends, Prof. Med. J. 26 (2019) 1537–1541.
[35] R. Ozturk, K. Herbell, J. Morton, T. Bloom, "The worst time of my life": treatment-related stress and unmet needs of women living with infertility, J. Community Psychol. 49 (2021) 1121–1133.
[36] A. SafaeiNezhad, M.M. Vakili, L. Ebrahimi, R. Kharaghani, Reproductive variables and correlation between irrational parenthood cognition and destructive behaviors of marital relationship in infertile women, Preventive Care in Nursing and Midwifery Journal 7 (2017) 1–8.
[37] L. Farzadi, A. Ghasemzadeh, Two main independent predictors of depression among infertile women: an Asian experience, Taiwan. J. Obstet. Gynecol. 47 (2008) 163–167.
[38] L. Jianan, Psychological Intervention of Female Infertility Patients Involved in Medical Social Work [D], Nanjing University, 2016.
[39] J. Cohen, A power primer, Psychol. Bull. 112 (1992) 155–159.
[40] L. Farzadi, A. Ghasemzadeh, Z. Bahrami-Asl, H. Shirdel, Predictors of irrational parenthood cognitions in an Iranian group of infertile women, PLoS One 10 (2015) e0070239.
[41] G. Camacho, M.A. Reinka, D.M. Quinn, Disclosure and concealment of stigmatized identities, Curr Opin Psychol 31 (2020) 28–32.