


Knowledge, Attitudes, and Practices Toward Unexplained Recurrent Pregnancy Loss Among Afflicted Women

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Background: To explore the knowledge, attitudes, and practices (KAP) regarding recurrent pregnancy loss (RPL) of women with unexplained RPL.

Methods: This cross-sectional study enrolled women with unexplained RPL in the Reproductive Medicine Centre of Shanxi Maternal and Child Health Hospital between August 28th and September 28th, 2024. Data were collected through a self-designed questionnaire encompassing sociodemographic characteristics and three dimensions of KAP.

Results: A total of 485 valid questionnaires were included, with knowledge, attitude, and practice scores of 13.05 ± 6.24 , 39.30 ± 3.09 , and 41.11 ± 4.37 , respectively. The multivariable logistic regression analysis showed that knowledge scores (OR = 1.05, 95% CI: 1.02–1.09, $P = 0.001$; beneficial), attitude scores (OR = 1.30, 95% CI: 1.20–1.41, $P < 0.001$), and urban residence (OR = 0.64, 95% CI: 0.41–0.99, $P = 0.049$) were independently associated with the proactive practice. The structural equation modeling (SEM) showed that knowledge directly ($\beta = 0.20$, $P = 0.001$) and indirectly ($\beta = 0.15$, $P < 0.001$) influenced practices.

Conclusion: Women with unexplained RPL demonstrated insufficient knowledge, moderate attitude, and proactive practice towards RPL. Targeted educational interventions could be needed to enhance knowledge related to RPL, which may help women form proper expectations toward pregnancy.

Keywords: knowledge, attitude, practice, recurrent pregnancy loss, cross-sectional study

Introduction

Recurrent pregnancy loss (RPL) refers to multiple spontaneous abortions with the same spouse within a period after pregnancy and affects approximately 3% of all couples.¹ However, the definition of RPL in terms of the number of abortions and gestational weeks varies among different countries and regions, and there is no consensus.² RPL may be related to advanced maternal age, parental chromosomal abnormalities, hormonal and metabolic dysfunctions, heritable and/or acquired thrombophilia, maternal autoantibodies, certain uterine abnormalities, infections, sperm quality, and lifestyle issues.³ In addition, no identifiable cause can be found in 40%–50% of patients, leading to a diagnosis of unexplained RPL.³ Because the etiology is unknown and clinical interventions are not targeted, satisfactory pregnancy outcomes are difficult to achieve in the unexplained RPL population.

In addition to potential physical complications, such as intrauterine infection, RPL can also have an impact on the psychological well-being of women and their spouses. Indeed, women with RPL are highly susceptible to depression and emotional stress.^{4–6} It means that RPL can be both physically and psychologically devastating to a woman and her partner, creating a significant financial and emotional burden for the family and society. Fortunately, some of the risk factors associated with RPL can be prevented and controlled, such as smoking, alcohol abuse, obesity, and underweight.^{7,8} Still, adopting proper lifestyle habits, identifying reproductive methods that could increase the likelihood of pregnancy, learning to cope with RPL, and knowing who and when to consult are necessary to achieve the best

outcomes but require proper knowledge and attitude. It is necessary to evaluate this knowledge and attitude to be able to design interventions to improve them and adapt the clinical approach accordingly.

The knowledge, attitude, and practice (KAP) theory suggests that knowledge forms the basis for behavior change, while beliefs and attitudes drive behavior change.^{9,10} Therefore, improving the knowledge of women of childbearing age about RPL may be beneficial in protecting their health and that of the fetus and increasing the success rate of pregnancy. However, to the best of our knowledge, there are only a few reports describing the KAP on pregnancy loss (PL) in different populations, such as university students, women, midwives, or doctors in other countries.^{11–14} Only one study focused on the KAP towards RPL among women with unexplained RPL in Lanzhou (China).¹⁵ In particular, exploring the KAP among patients with unexplained RPL is more meaningful, as they may be more stressed due to the unknown etiology. In addition, unexplained RPL may have a greater impact on some Chinese women due to cultural factors.

Therefore, this study aimed to investigate the KAP regarding RPL among women with unexplained RPL.

Methods

Study Design and Participants

This cross-sectional study enrolled women with unexplained RPL between August 28th and September 28th, 2024, in the Reproductive Medicine Centre of Shanxi Maternal and Child Health Hospital. Inclusion criteria were 1) 20–49 years old and 2) two or more consecutive PLs with the same sexual partner before 28 weeks of gestation. Those with previous surgical abortion and medication abortion were excluded.

The study was ethically approved by the ethics committee of the Shanxi Maternal and Child Health Hospital. Completing the consent form online was mandatory to have access to the questionnaire.

Questionnaire

The questionnaire was designed with reference to the related literature review and Chinese expert consensus on the diagnosis and management of recurrent spontaneous abortion (2022),¹⁶ the ACOG Guidelines for early pregnancy loss,¹⁷ and the ESHRE guideline: RPL.¹⁸ The first draft of the questionnaire was designed and then pilot-tested on a small scale ($n = 29$) with a Cronbach's alpha coefficient of 0.858, indicating good internal reliability.

The final questionnaire was in Chinese and included four sections with 48 items in total ([Supplement questionnaire](#)). The demographic information included 15 items; the knowledge section included 12 items, the attitude included 11 items, and the practice included 10 items. Winter-hardiness was the self-reported capacity to bear low outside temperatures. For the knowledge items, it was scored 2 points for “completely comprehended”, 1 point for “partially comprehended”, and 0 points for “not comprehended”, and the possible score range was 0–24. The attitude and practice items were scored, ranging from very positive (5 points) to very negative (1 point) according to the degree of positivity. Item A3 did not involve an obvious positive or negative attitude, which was only presented as a separate categorical variable, and the possible score for attitudes and practices ranged from 10–50.

Questionnaire Distribution and Quality Control

The data were collected through an online questionnaire hosted on Sojump (<http://www.sojump.com>). To ensure a diverse sample, the survey was distributed to participants both in the clinic and through social media platforms like WeChat, utilizing convenience sampling. Using an online questionnaire facilitated efficient and cost-effective data collection, allowing participants to complete the survey at their convenience and in the privacy of their homes. This likely contributed to a higher response rate and greater accuracy of the data. Moreover, the combination of clinical and social media recruitment strategies helped to capture a broad range of participants with diverse experiences and backgrounds.

Sample Size

The sample size was calculated using the formula for cross-sectional studies:

$$n = \left(\frac{z_{1-\alpha/2}}{\delta} \right)^2 \times p \times (1 - p)$$

$\alpha=0.05$

$Z_{1-\alpha/2}=1.96$ when $\alpha=0.05$

degree of variability of $p=0.5$ to maximize the required sample size

δ (admissible error)=5%

Hence, the theoretical sample size was 480 to include an extra 20% to allow for subjects lost during the study.

Statistical Analysis

STATA 17.0 (Stata Corporation, College Station, TX, USA) was used for statistical analysis. The continuous variables were expressed as Mean \pm SD, and the categorical variables were expressed as n (%). The continuous variables conformed to a normal distribution and were tested using the *t*-test or ANOVA. Pearson correlation was used to analyze the correlation between knowledge, attitude, and practice. Those with a score of more than 80% of the total score were considered to have good knowledge (>20 points), a positive attitude (>40 points), and proactive practice (>40 points).^{9,19} Multivariable analysis was performed to explore the factors that influence good knowledge, positive attitudes, and proactive practices. Variables with $P < 0.05$ in the univariable logistic regression analysis were included in the multivariable logistic regression analysis. A structural equation modeling (SEM) analysis was performed to observe the correlations among KAP. The hypotheses for the SEM were (1) knowledge directly influences attitude, (2) attitude directly influences practice, and (3) knowledge directly and indirectly influences practice. All statistical analyses were performed using a two-sided test. Two-sided $P < 0.05$ were considered statistically significant.

Results

A total of 491 questionnaires were collected, of which six questionnaires with illogical responses were excluded, resulting in 485 valid questionnaires (98.78%). More than half of the participants were 30–35 years old (260, 53.61%), 235 (48.45%) had a BMI of 18.5–24 kg/m², 156 (32.16%) had a BMI of 24–28 kg/m², 478 (98.56%) were married, 483 (99.59%) were Chinese Han, 302 (32.27%) were living in urban areas, 267 (55.05%) had a bachelor's degree, 228 (47.01) were employed, 30 (6.19%) had medical insurance, and 253 (52.17%) were relatively not or not all winter hardy (Table 1). Among them, 48.87% had polycystic ovary syndrome, 23.92% had insulin resistance, 6.8% had diabetes mellitus, 1.03% had autoimmune diseases, 7.42% had thyroid disorders, and 8.25% had uterine fibroids. Among the participants, 215 (44.33%) and 270 (55.67%) had 2 and >3 pregnancies, respectively, 114 (23.51%) had at least one successful childbirth, 371 (76.49%) and 114 (23.51%) had 2 and ≥ 3 spontaneous abortions, respectively, 75 (15.46%) had at least one medication abortion, and 67 (13.81%) had at least one surgical abortion (Table 1).

The mean score of knowledge, attitude, and practice were 13.05 ± 6.24 (possible range: 0–24), 39.30 ± 3.09 (possible range: 10–50), and 41.11 ± 4.37 (possible range: 10–50), respectively. The knowledge score varied among those with different BMI ($P = 0.005$), pregnancy history ($P = 0.012$), childbirth history ($P = 0.002$), residence ($P = 0.010$), education ($P < 0.001$), work status ($P = 0.043$), medical insurance ($P = 0.010$), autoimmune diseases ($P < 0.001$), and transportation options ($P = 0.005$). As for the attitude score, there were differences among participants with different spontaneous abortion histories ($P = 0.001$), surgical abortion histories ($P = 0.023$), monthly income ($P = 0.010$), medical insurance ($P = 0.007$), and winter hardness ($P = 0.034$). However, differences in practice scores were only found in participants with different BMI ($P = 0.007$) and education ($P = 0.026$) (Table 1).

The three knowledge items most commonly “completely comprehended” by participants were: “Exposure to harmful chemicals, radiation, and other environmental factors increases the risk of miscarriage” (K6) at 65.57%, “Couples with recurrent pregnancy loss (RPL) should correct unhealthy lifestyles and environments” (K7) at 64.74%, and “Smoking, alcohol abuse, obesity, and other unhealthy lifestyles increase the risk of miscarriage” (K5) at 63.30%. In contrast, the least understood items were: “Autoimmune diseases related to RPL include antiphospholipid syndrome, lupus, and others” (K4) at 13.40%, “What is RPL” (K1) at 14.02%, and “The causes of RPL are complex, involving immune factors, thrombophilia, anatomical issues, and more” (K3) at 21.03% (Supplement Table 1).

Regarding attitudes, 60.00% believed RPL significantly impacted family harmony (A2), and 94.64% supported comprehensive screening for RPL causes (A7). A strong majority (92.16%) wanted to learn more about RPL (A11), and 89.90% aimed to maintain a healthy lifestyle (A9) (Supplement Table 2). In practice, only 61.03% reported an

Table 1 Demographic Characteristics and KAP Scores

	n (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean \pm SD	P	Mean \pm SD	P	Mean \pm SD	P
Total	485 (100)	13.05 \pm 6.24		39.30 \pm 3.09		41.11 \pm 4.37	
Age			0.079		0.165		0.181
<30	126 (25.98)	11.98 \pm 5.66		39.56 \pm 3.06		40.52 \pm 4.24	
30–35	260 (53.61)	13.27 \pm 6.17		39.31 \pm 3.13		41.41 \pm 4.21	
>35	99 (20.41)	13.79 \pm 6.98		38.89 \pm 2.98		41.06 \pm 4.89	
BMI			0.005		0.080		0.007
<18.5	17 (3.51)	15.23 \pm 4.96		40.05 \pm 1.81		42.70 \pm 3.45	
[18.5–24)	235 (48.45)	13.55 \pm 6.31		39.57 \pm 3.17		41.67 \pm 3.99	
[24–28)	156 (32.16)	13.04 \pm 6.17		38.94 \pm 3.06		40.69 \pm 4.52	
\geq 28	77 (15.88)	11.01 \pm 6.06		39.01 \pm 3.04		39.88 \pm 4.99	
Marital Status			0.858		0.398		0.888
Unmarried	1 (0.21)	9 \pm 0		35 \pm 0		39 \pm 0	
Married	478 (98.56)	13.06 \pm 6.26		39.31 \pm 3.10		41.10 \pm 4.39	
Divorced	3 (0.62)	12.66 \pm 8.14		38.33 \pm 1.52		42.33 \pm 1.52	
Widowed	3 (0.62)	12 \pm 1.73		38.66 \pm 1.15		41.66 \pm 2.88	
Pregnancy (times)			0.012		0.696		0.424
2	215 (44.33)	12.22 \pm 6.21		39.34 \pm 3.00		40.98 \pm 4.12	
\geq 3	270 (55.67)	13.70 \pm 6.19		39.25 \pm 3.15		41.20 \pm 4.56	
Successful childbirth (times)			0.002		0.051		0.072
0	371 (76.49)	12.56 \pm 6.03		39.16 \pm 3.05		40.92 \pm 4.39	
\geq 1	114 (23.51)	14.73 \pm 6.71		39.74 \pm 3.17		41.76 \pm 4.23	
Spontaneous abortion			0.216		0.001		0.432
2	371 (76.49)	12.86 \pm 6.23		39.58 \pm 2.96		41.19 \pm 4.33	
\geq 3	114 (23.51)	13.64 \pm 6.26		38.36 \pm 3.29		40.84 \pm 4.49	
Medication abortion			0.253		0.241		0.508
0	410 (84.54)	12.89 \pm 6.25		39.33 \pm 3.16		41.21 \pm 4.21	
\geq 1	75 (15.46)	13.88 \pm 6.18		39.08 \pm 2.64		40.54 \pm 5.17	
Surgical abortion			0.453		0.023		0.827
0	418 (86.19)	13.13 \pm 6.29		39.42 \pm 3.00		41.09 \pm 4.33	
\geq 1	67 (13.81)	12.47 \pm 5.91		38.49 \pm 3.50		41.17 \pm 4.66	
Ethnicity			0.534		0.201		0.174
Han	483 (99.59)	13.03 \pm 6.25		39.30 \pm 3.09		41.09 \pm 4.37	
Other	2 (0.41)	15.5 \pm 3.53		37 \pm 1.41		45 \pm 2.82	
Residence			0.010		0.948		0.447
Non-Urban	183 (37.73)	12.10 \pm 5.57		39.37 \pm 3.18		41.30 \pm 4.32	
Urban	302 (62.27)	13.61 \pm 6.56		39.24 \pm 3.03		40.99 \pm 4.40	
Education			<0.001		0.968		0.026
Middle School and below	89 (18.35)	10.78 \pm 5.98		39.28 \pm 3.30		39.96 \pm 4.58	
High School/Technical secondary school	107 (22.06)	12.33 \pm 5.65		39.35 \pm 3.09		41.04 \pm 4.13	
Junior College/Bachelor's degree	267 (55.05)	13.97 \pm 6.37		39.26 \pm 3.03		41.41 \pm 4.42	
Master's degree and above	22 (4.54)	14.40 \pm 5.95		39.45 \pm 2.98		42.36 \pm 3.21	
Work			0.043		0.446		0.723
Employed	228 (47.01)	13.81 \pm 6.55		39.20 \pm 2.89		40.93 \pm 4.62	
Full-time housewife	77 (15.88)	12.79 \pm 6.28		39.68 \pm 3.51		41.48 \pm 4.61	
Other	180 (37.11)	12.18 \pm 5.71		39.25 \pm 3.13		41.17 \pm 3.92	

(Continued)

Table 1 (Continued).

	n (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean \pm SD	P	Mean \pm SD	P	Mean \pm SD	P
Monthly income (RMB)			0.206		0.010		0.338
<5000	303 (62.47)	12.67 \pm 6.21		38.98 \pm 3.14		41.22 \pm 4.50	
5000–10,000	118 (24.33)	13.82 \pm 6.00		39.75 \pm 2.94		41.12 \pm 4.08	
>10,000	64 (13.2)	13.35 \pm 6.74		39.92 \pm 2.93		40.53 \pm 4.26	
Medical insurance			0.010		0.007		0.120
Yes	30 (6.19)	10.3 \pm 5.35		38.16 \pm 3.40		39.83 \pm 4.40	
No	455 (93.81)	13.22 \pm 6.26		39.37 \pm 3.05		41.19 \pm 4.36	
History of diseases							
None	455 (93.81)	12.58 \pm 6.34	0.194	39.38 \pm 3.17	0.405	41.30 \pm 4.55	0.277
Polycystic ovary syndrome	237 (48.87)	12.63 \pm 5.80	0.392	39.57 \pm 3.18	0.383	40.99 \pm 3.99	0.552
Insulin resistance	116 (23.92)	15.69 \pm 5.87	0.016	38.90 \pm 2.83	0.603	41.42 \pm 4.08	0.791
Diabetes mellitus	33 (6.8)	13.8 \pm 2.77	0.763	36.6 \pm 3.28	0.067	40.2 \pm 7.15	0.938
Autoimmune diseases	5 (1.03)	18.58 \pm 5.73	<0.001	38.44 \pm 2.70	0.086	42.05 \pm 3.80	0.199
Thyroid disorders	36 (7.42)	12.85 \pm 5.89	0.724	39.52 \pm 2.64	0.726	41.5 \pm 4.27	0.396
Uterine fibroids	40 (8.25)	14.06 \pm 6.52	0.180	38.73 \pm 3.19	0.146	40.34 \pm 4.78	0.203
Other	61 (12.58)	12.15 \pm 6.86	0.169	38.95 \pm 3.46	0.403	40.25 \pm 4.59	0.160
Frequent commuting methods			0.005		0.591		0.362
Walking	61 (12.58)	13.95 \pm 6.84		39.37 \pm 3.18		41.93 \pm 3.48	
Bicycle	8 (1.65)	16.37 \pm 6.09		39.5 \pm 4.65		40.62 \pm 4.74	
Electric scooter	170 (35.05)	11.81 \pm 6.08		39.02 \pm 3.15		40.43 \pm 4.91	
Driving	141 (29.07)	14.27 \pm 6.19		39.39 \pm 2.86		41.25 \pm 4.29	
None	105 (21.65)	12.61 \pm 5.83		39.54 \pm 3.11		41.56 \pm 3.87	
Winter-hardy			0.666		0.034		0.636
Not at all	85 (17.53)	13.57 \pm 6.82		39.50 \pm 3.09		41.04 \pm 5.05	
Relatively not	168 (34.64)	12.42 \pm 5.70		38.75 \pm 3.07		40.77 \pm 4.70	
Moderate	162 (33.4)	13.30 \pm 6.55		38.93 \pm 3.19		41.48 \pm 4.13	
Relatively	53 (10.93)	12.91 \pm 5.99		39.59 \pm 2.99		40.90 \pm 4.21	
Very	17 (3.51)	13.15 \pm 6.88		40.13 \pm 2.78		40.83 \pm 5.42	

Notes: Statistically significant P-values are shown in bold.

Abbreviations: BMI, body mass index; RMB, renminbi.

optimistic attitude post-loss (P3), but over 85% took preventive actions such as avoiding alcohol (P4), harmful chemicals (P6), maintaining a balanced diet (P7), and dressing warmly (P8) ([Supplement Table 3](#)).

A correlation analysis was performed to assess the relationship between knowledge, attitude, and practice score. It was shown that the knowledge score and the attitude score were positively correlated ($r = 0.261$, $P < 0.001$), and the knowledge score and the practice score were also positively correlated ($r = 0.280$, $P < 0.001$).

Table 2 Correlation

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.261 ($P < 0.001$)	1	
Practice	0.280 ($P < 0.001$)	0.416 ($P < 0.001$)	1

Notes: Statistically significant P-values are shown in bold.

Additionally, there was a positive correlation between attitude and practice scores ($r = 0.416$, $P < 0.001$) (Table 2).

The multivariable logistic regression analysis showed that experienced successful childbirth (OR = 5.41, 95% confidence interval (CI): 2.55–11.40, $P = 0.001$; beneficial), autoimmune diseases (OR = 8.31, 95% CI: 3.55–19.4, $P < 0.001$; beneficial), and commuting using an electric scooter (OR = 0.36, 95% CI: 0.15–0.86, $P = 0.021$; detrimental) were independently associated with sufficient knowledge. The knowledge scores (OR = 1.07, 95% CI: 1.03–1.10, $P < 0.001$; beneficial), >3 spontaneous abortions (OR = 0.45, 95% CI: 0.27–0.71, $P = 0.001$; detrimental), with medical insurance (OR = 3.72, 95% CI: 1.45–9.50, $P = 0.006$; beneficial), and being relatively winter hardy (OR = 2.21, 95% CI: 1.02–4.77, $P = 0.043$; beneficial) were independently associated with attitudes. Moreover, the knowledge scores (OR = 1.05, 95% CI: 1.02–1.09, $P = 0.001$; beneficial), attitude scores (OR = 1.30, 95% CI: 1.20–1.41, $P < 0.001$; beneficial), and urban residence (OR = 0.64, 95% CI: 0.41–0.99, $P = 0.049$; detrimental) were independently associated with practice (Table 3).

Table 3 Multivariable Logistic Regression Analysis of Knowledge, Attitude, and Practice

		Multivariate Logistic Regression	
		OR (95% CI)	P
Knowledge	BMI		
	<18.5		
	[18.5–24)	1.81 (0.29,11.1)	0.521
	[24–28)	1.63 (0.25,10.4)	0.604
	≥ 28	1.28 (0.18,9.15)	0.800
	Pregnancy (times)		
	2		
	≥ 3	0.83 (0.40,1.71)	0.627
	Successful childbirth (times)		
	0		
	≥ 1	5.41 (2.55,11.4)	<0.001
	Residence		
	Non-Urban		
	Urban	1.73 (0.89,3.38)	0.105
	Education		
	Middle School and below		
	High School/Technical secondary school	1.11 (0.35,3.44)	0.856
	Junior College/Bachelor's degree	2.34 (0.80,6.81)	0.118
	Master's degree and above	2.25 (0.48,10.5)	0.300
	Work		
	Employed		
	Full-time housewife	0.90 (0.33,2.47)	0.846
	Other	0.90 (0.41,1.99)	0.806
	Medical insurance		
	No		
	Yes	3.31 (0.41,26.6)	0.259
	Autoimmune diseases		
	No		
	Yes	8.31 (3.55,19.4)	<0.001
	Frequent commuting methods		
	Walking		
	Bicycle	3.16 (0.55,18.0)	0.196
	Electric scooter	0.36 (0.15,0.86)	0.021
	Driving	0.61 (0.27,1.37)	0.233
	None	0.49 (0.16,1.45)	0.20

(Continued)

Table 3 (Continued).

		Multivariate Logistic Regression	
		OR (95% CI)	P
Attitude	Knowledge scores	1.07 (1.03,1.10)	<0.001
	Spontaneous abortion		
	2		
	≥3	0.45 (0.28,0.71)	0.001
	Surgical abortion		
	0		
	≥1	0.67 (0.38,1.17)	0.161
	Monthly income (RMB)		
	<5000		
	5000–10,000	1.38 (0.87,2.17)	0.165
	>10,000	1.63 (0.90,2.95)	0.100
	Medical insurance		
Practice	No		
	Yes	3.72 (1.45,9.50)	0.006
	Winter-hardy		
	Not at all		
	Relatively not	1.03 (0.59,1.80)	0.901
	Moderate	1.23 (0.70,2.16)	0.452
	Relatively	2.21 (1.02,4.77)	0.043
	Very	0.96 (0.32,2.93)	0.956
	Knowledge scores	1.05 (1.02,1.09)	0.001
	Attitude scores	1.30 (1.20,1.41)	<0.001
	BMI		
	<18.5		
	[18.5–24)	0.44 (0.09,2.04)	0.297
	[24–28)	0.26 (0.05,1.23)	0.092
	≥28	0.33 (0.06,1.64)	0.180
	Residence		
	Non-Urban		
	Urban	0.64 (0.41,0.99)	0.049

Notes: Statistically significant P-values are shown in bold.

Abbreviations: BMI, body mass index; RMB, renminbi.

The SEM showed that knowledge directly influenced attitudes ($\beta = -0.31$, $P < 0.001$), attitudes directly influenced practice ($\beta = -0.51$, $P < 0.001$), and knowledge directly ($\beta = 0.20$, $P = 0.001$) and indirectly ($\beta = 0.15$, $P < 0.001$) influenced practices (Figure 1 and Table 4).

Discussion

The results showed that women with unexplained RPL demonstrated insufficient knowledge, moderate attitude, and proactive practice towards RPL. The SEM showed that knowledge directly and indirectly influenced practices. These findings highlight the need for targeted educational interventions to enhance knowledge, which could subsequently improve attitudes and practices related to RPL management.

Women with unexplained RPL may experience increased stress due to the unknown etiology of RPL. This study investigated the KAP toward RPL among these individuals and demonstrated a gap between the optimal level of knowledge about RPL and the clinical reality among women with unexplained RPL. Although there was a lack of research on knowledge of RPL specifically, previous studies have highlighted gaps in knowledge regarding reproductive health information in different populations.^{20–22} San et al¹¹ reported that university students lacked knowledge and had common misunderstandings about reproductive health information related to pregnancy loss (PL). Similarly, previous

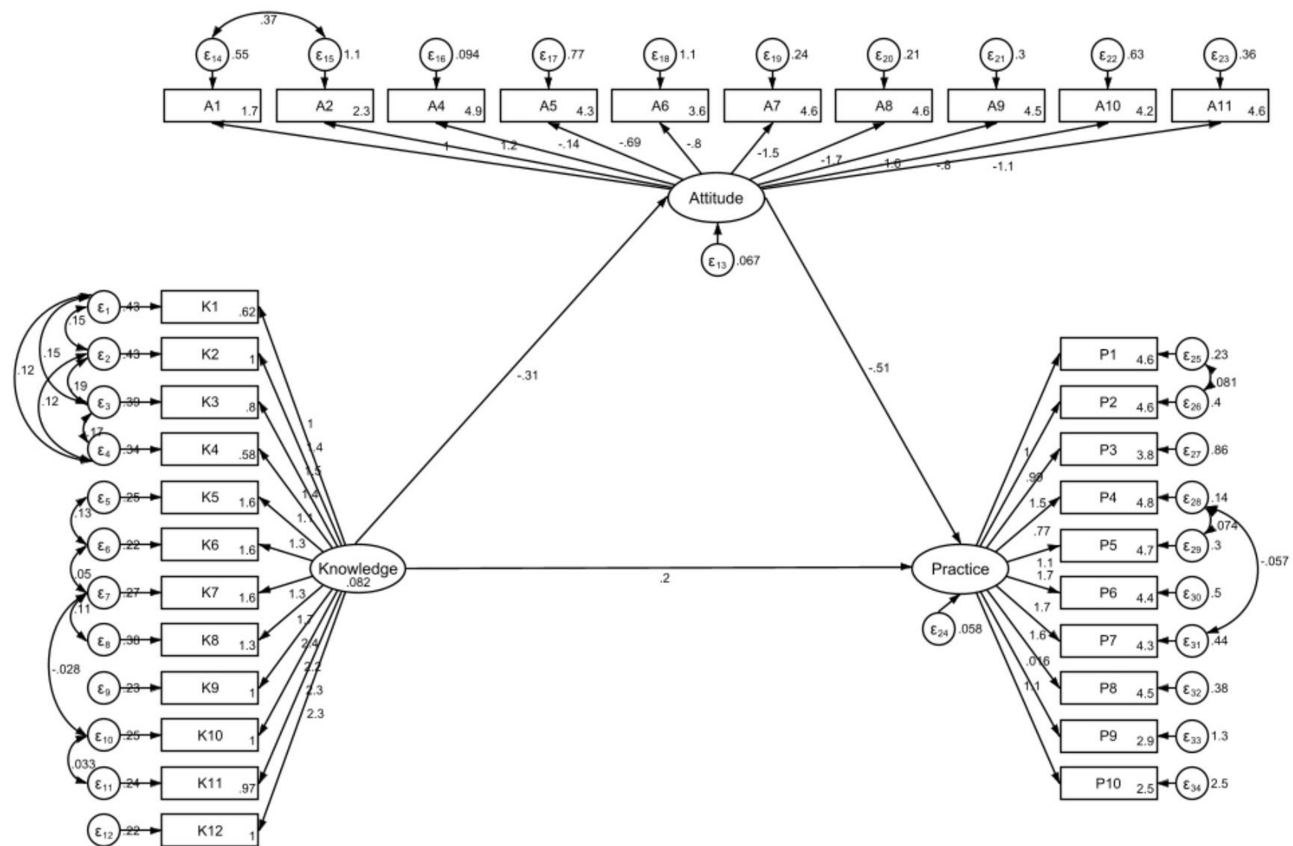


Figure 1 SEM for KAP.

studies have shown insufficient knowledge about PL among medical professionals.^{14,23} In the present study, the knowledge items with the lowest understanding rate were mainly related to the definition and causes of RPL. It might be because RPL is a specialized term in the medical field, and its definition has not been standardized, which may be of less concern to the general public. Moreover, the causes of RPL are complex and include factors such as immune issues, thrombophilia risk factors, abnormal anatomical structure of the female reproductive tract, endocrine abnormalities, and embryo chromosome abnormalities, which can be difficult for women to understand.²⁴ The socioeconomic level is a well-known determinant of health literacy.^{25,26} Notably, in line with previous studies, the results of this study also showed that a lower knowledge score was found in those who had not experienced successful childbirth and were not driving to work, suggesting targeted health literacy education about RPL for these individuals. Furthermore, having an autoimmune disease was independently associated with a higher knowledge, probably because patients must have

Table 4 Sem

Model Paths		Total Effects		Direct Effect		Indirect Effect	
		β (95% CI)	P	β (95% CI)	P	β (95% CI)	P
Asum <- Psum <-	Ksum	-0.31(-0.45, -0.16)	<0.001	-0.31(-0.45, -0.16)	<0.001		
	Asum	-0.51(-0.73, -0.29)	<0.001	-0.51(-0.73, -0.29)	<0.001		
	Ksum	0.36(0.21, 0.51)	<0.001	0.20(0.08, 0.32)	0.001	0.15(0.07, 0.24)	<0.001

Notes: Statistically significant P-values are shown in bold.

a higher understanding of their condition to manage it and are aware of its potential impact on reproductive outcomes.^{27,28} Riding a motorcycle during pregnancy has been shown to increase the risk of injury and pregnancy loss.²⁹ Accordingly, those women showed lower knowledge.

Regarding the attitude towards RPL, most participants agreed that comprehensive and systematic cause screening and psychological adjustment were critical for managing RPL. They were willing to learn more about RPL and maintain a healthy lifestyle. It may be a positive sign for reducing the incidence of RPL and improving the prognosis of RPL, as poor lifestyles such as alcohol consumption, smoking, and caffeine abuse can increase the risk of RPL.³⁰ Research has shown that being underweight or having a BMI over 25 contributes significantly to the incidence of RPL in the general population by 1.2-fold, highlighting the importance of weight control in reducing the risk of RPL.³¹ The participants in this study believed that participants believed RPL caused significant psychological and financial pressure, consistent with another study.³² Positive reappraisal coping intervention (PRCI) is a low-cost, convenient, and easily deliverable intervention that may provide effective support for women with RPL.³³ Another randomized controlled trial (RCT) study found that meditation and mindfulness reduced perceived stress in women with RPL, providing new insights beyond standard supportive care programs.³⁴ Furthermore, only a minority of participants in this study believed that female factors mainly caused RPL. Indeed, it has been established that semen quality is also a critical factor in RPL. Thus, this correct understanding among women was beneficial for reducing their psychological stress.

In contrast to the inadequate knowledge score, the practice score was the highest among the three dimensions and exceeded 80% of the total theoretical scores, indicating a proactive practice in daily life among women with unexplained RPL. More than 85% of the participants reported taking measures to increase their chances of a successful pregnancy, such as quitting smoking and drinking, maintaining a healthy and balanced diet, wearing warm clothes, and appropriate exercises. As previously mentioned, these self-regulation interventions were helpful in improving pregnancy outcomes for women with RPL.^{30,31}

It was understandable that only around 60% of the participants reported feeling optimistic after experiencing RPL, which could be a significant shock for any expectant mother or family. Interestingly, those with ≥ 3 spontaneous abortions, no medical insurance, and not at all winter hardy had lower attitude scores, suggesting that these populations may face additional challenges. Ambient temperature and the capacity to bear it were associated with the pregnancy outcomes.³⁵ A greater financial burden due to RPL could be involved, as well as pessimism regarding achieving pregnancy.³⁶ In addition, the correlation, multivariable logistic regression, and SEM analyses revealed that the knowledge and attitude scores influenced practice. Thus, promoting public education on RPL-related knowledge and encouraging the formation of a correct and positive attitude towards RPL may contribute to further improving the practice among this population. Educational and motivational interventions should be designed for patients with difficulties conceiving to improve their KAP toward RPL and help them form appropriate expectations toward pregnancy. Such interventions should be tested in future studies. Nevertheless, emphasis should be made on the need for additional research to understand the causes and mechanisms of RPL to determine proper management and treatment methods. Women with RPL also need adequate psychological support to help them deal with the difficult situation.

Limitations

The current study has several limitations that need to be acknowledged. Firstly, the data collection mainly relied on self-reported questionnaires, which may increase the possibility of interviewer and response biases and recall bias. Secondly, as research advances, some women diagnosed with unexplained RPL because of normal examinations may find the etiology, leading to discrepancies between our findings and those of future unexplained RPL populations. Additionally, this study did not extensively explore other factors that may associated with the behaviors of women with unexplained RPL, such as communication factors that could impact participants' practice, including seeking information, using the media, or processing information. Thirdly, the study was cross-sectional, and causality could not be determined. Fourthly, all KAP studies are at risk of the social desirability bias, ie, the tendency to respond to what is known as preferable to think or do instead of what is actually thought or done.^{37,38}

Conclusion

Women with unexplained RPL demonstrated insufficient knowledge, moderate attitude, and proactive practice towards RPL. Targeted educational interventions could be needed to enhance knowledge related to RPL, which may help women form proper expectations toward pregnancy.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

Ethics Approval and Consent to Participate

The study adheres to the Declaration of Helsinki and was ethically approved by the ethics committee of the Shanxi Maternal and Child Health Hospital (No. IRB-KY-2021-001). The questionnaire was completed online. The first page was the informed consent form. Completing the consent form online was mandatory to have access to the questionnaire. All methods were performed in accordance with the relevant guidelines and regulations.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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