



Psychological distress in subsequent pregnancy among women with a history of pregnancy loss: A latent profile analysis

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ABSTRACT

Background: Women who have undergone pregnancy loss can experience a range of psychological distress during subsequent pregnancies; however, the outcomes may vary based on individual circumstances.

Objective: To explore the potential patterns of psychological distress for pregnant women with a history of pregnancy loss, and to investigate the impact of factors related to pregnancy loss on these patterns.

Methods: From October 2022 to August 2023, the participants were recruited from four medical centers in Guangdong Province, China. They completed a questionnaire survey comprising sociodemographic and obstetric characteristics, the Perceived Stress Scale-4 (PSS-4), the Impact of Event Scale-Revised (IES-R), the Pregnancy-related Anxiety Questionnaire-Revised 2 (PRAQ-R2), and the Patient Health Questionnaire-9 (PHQ-9). Latent profile analysis was used to determine optimal patterns of psychological distress. The logistic regression was conducted to assess the associations between the number of pregnancy loss, types of pregnancy loss, inter-pregnancy interval, and distinct psychological distress patterns.

Results: A total of 446 pregnant women with a history of pregnancy loss were included for formal analysis. Three distinct profiles were identified, namely the "mild psychological distress" (34.1 %), "moderate psychological distress" (57.8 %), and "severe psychological distress" (8.1 %). Recurrent pregnancy loss was associated with increased risks of both moderate (adjusted odds ratio [aOR] 2.45, 95 % confidence interval [CI]: 1.42–4.24; $P = 0.001$) and severe psychological distress (aOR 2.93, 95 % CI: 1.25–6.83; $P = 0.013$). Furthermore, compared to women who conceived after 6 months of pregnancy loss, those who conceived within 6 months of pregnancy loss were more likely to be categorized into the group of moderate psychological distress (aOR 2.00, 95 % CI: 1.21–3.30; $P = 0.007$).

Conclusions: Approximately two-thirds of pregnant women with a history of pregnancy loss exhibit moderate to severe psychological distress. Such individuals could benefit from early screening and targeted psychological interventions, particularly those who have encountered recurrent pregnancy loss and those who conceive shortly after a pregnancy loss.

Introduction

Pregnancy loss, encompassing miscarriage, stillbirth, and termination for medical reasons (TFMR), affects approximately 25–30 % of women during their reproductive years (Robinson, 2014; Quenby et al., 2021). Existing evidence suggests that women who have undergone pregnancy loss are susceptible to various mental health issues such as posttraumatic stress disorder (PTSD), anxiety, and depression (Herbert et al., 2022; Farren et al., 2020). Some studies have reported that the

majority of women intend to conceive again within a relatively short period, with over 60 % successfully achieving pregnancy within one year following the loss (Murphy et al., 2021; Regan et al., 2019; Tessema et al., 2022). However, these psychological issues could persist and even accumulate over time, consequently leading to deleterious effects on maternal well-being and fetal growth (Blackmore et al., 2011; Schliep et al., 2022).

Previous studies have focused on examining the psychological outcomes for women during and immediately following pregnancy loss,

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with a relatively limited exploration of the psychological distress during their subsequent pregnancies (Donegan et al., 2023). In some qualitative interviews, it has been found that these women experienced considerable stress during subsequent pregnancies due to concerns about the potential recurrence of fetal loss (Campbell-Jackson et al., 2014; Simmons and Goldberg, 2011; de Andrade et al., 2021). At times, they also engaged in a process of rumination over previous situations of fetal loss and had to endure distressing nightmares associated with these experiences (Donegan et al., 2023; Van et al., 2023). Furthermore, the hormonal fluctuations and physiological burdens during pregnancy could exacerbate the emotional instability for these women, consequently increasing the risk of antenatal anxiety and depression (Biaggi et al., 2016). Even after successfully delivering a healthy baby, women who have undergone pregnancy loss may still exhibit high levels of psychological distress (Blackmore et al., 2011).

In recent decades, most research endeavors have assessed the psychological well-being of pregnant women at a population-wide level (Lazarides et al., 2023; McCarthy et al., 2015). However, these studies tend to disregard the inherent heterogeneity within the population, thereby impeding the identification of vulnerable subgroups in need of targeted interventions (Pei et al., 2022). Moreover, there is little consensus on the impact of factors related to prior pregnancy loss, especially the time interval between the previous pregnancy loss and subsequent conception, on the psychological well-being of pregnant women (Lazarides et al., 2023; Davoudian et al., 2021). Current international guidelines suggest waiting for at least 6 months after a miscarriage before attempting another pregnancy, but these recommendations are primarily based on the occurrence rate of adverse pregnancy outcomes and lack consideration for mental health outcomes (Louis et al., 2019).

Latent profile analysis (LPA) is a person-centered and empirical methodology designed to discern homogeneous subpopulations within a population (Sinha et al., 2021). Using this methodology, we explored the distinct patterns of psychological distress among pregnant women with a history of pregnancy loss based on a set of indicators including post-traumatic stress, perceived stress, anxiety and depression. Additionally, we also investigated the associations between pregnancy loss factors and these identified patterns.

Methods

Participants and procedures

This cross-sectional study was conducted between October 2022 and August 2023 at three tertiary hospitals and one community hospital in Guangdong Province, China. The inclusion criteria for participants were as follows: (1) aged 18 years or older, (2) in the first trimester of pregnancy, (3) having a single intrauterine pregnancy, (4) having experienced miscarriage, stillbirth, or TFMR, and (5) expressing willingness to participate in this study. Individuals diagnosed with severe pregnancy complications, a history of psychological disorders, or those currently receiving psychological therapy were excluded. The first and second authors of this study were responsible for on-site recruitment. Upon obtaining informed consent from eligible participants, they promptly distributed electronic versions of self-report questionnaires to the participants. Ultimately, a total of 508 pregnant women participated in this study, out of which 446 effectively completing the survey, culminating in a valid response rate of 87.8 %.

Measures

Sociodemographic information

Participants self-reported their age, educational background (with or without a college/university degree), monthly household income per capita ($\leq$ ¥5000, ¥5001–10,000, ¥10,001–15,000, $\geq$ ¥15,001), marital status (married or other), number of children (0, 1, or $\geq$ 2), smoking

history (yes or no), alcohol consumption history (yes or no), sleep quality (poor, fair, or good), and adverse life events within the past 2 years (e.g., illness, injury, bereavement, and stress) (yes or no).

Obstetric characteristics

The data pertaining to previous pregnancy losses, including the number of losses (1 or $\geq$ 2), the most recent types of losses (miscarriage, stillbirth, or TFMR), and their corresponding dates, were corroborated through review of medical records. Recurrent pregnancy loss was defined as the occurrence of two or more losses, which could be interspersed with live births (Practice Committee of the American Society for Reproductive Medicine, 2020). The time interval between the date of previous pregnancy loss and the date of conception of current pregnancy was calculated and categorized as either $\leq$ 6 months or $>$ 6 months. Furthermore, we collected some information about the current pregnancy, which included pregnancy intention (intended or unintended pregnancy), method of conception (natural conception or assisted reproductive technology), and the presence of pregnancy complications (yes or no).

Psychological stress

The Perceived Stress Scale-4 (PSS-4) is a concise tool for self-evaluation of control and confidence in handling stressful situations in the past month (Lee, 2012). It consists of 4 items scored on a 5-point Likert scale, with reverse coding for 2 items. The total score ranges from 0 to 16, with higher scores indicating higher levels of stress. The reliability of PSS-4 has been confirmed within the pregnant women (Lee, 2012), with a Cronbach's alpha coefficient of 0.718 in this study.

Posttraumatic stress

The Impact of Event Scale-Revised (IES-R) is employed to evaluate posttraumatic stress symptoms resulting from previous pregnancy loss (Creamer et al., 2003). The IES-R comprises 22 items distributed over 3 dimensions (8 items for intrusions, 8 items for avoidance, and 6 items for hyperarousal). The total score ranges from 0 to 88, with scores of at least 33 indicating probable presence of PTSD (Creamer et al., 2003). The IES-R has been extensively utilized to evaluate trauma responses among perinatal women (Ayers et al., 2016), with a Cronbach's alpha coefficient of 0.912 in this study.

Pregnancy-related anxiety

The Pregnancy-related Anxieties Questionnaire-Revised 2 (PRAQ-R2) is a specialized tool designed for assessing pregnancy-related anxieties (Xie et al., 2022). This instrument comprises 10 items and 3 dimensions (worries about bearing a handicapped child, concern about own appearance, and fear of giving birth). The total score ranges from 10 to 50, with higher scores indicating higher levels of pregnancy-related anxiety. The PRAQ-R2 has been validated in a sample of pregnant Chinese women (Xie et al., 2022), with a Cronbach's alpha coefficient of 0.853 in this study.

Depressive symptoms

The Patient Health Questionnaire-9 (PHQ-9) is one of the most widely used instruments for measuring perinatal depressive symptoms (Zhong et al., 2014). Its nine items align with the nine Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria for a major depressive episode. The total score ranges from 0 to 27, with depressive symptoms defined as a threshold greater than or equal to 5 and probable major depression as a cutoff value greater than or equal to 10 (Manea et al., 2012). In this study, the PHQ-9 demonstrated a Cronbach's alpha of 0.874.

Statistical analysis

Continuous variables were described as median (interquartile range, IQR) and categorical variables were presented as frequencies and percentages. LPA approach was conducted to identify potential patterns of

psychological distress based on the symptom scores across post-traumatic stress, perceived stress, anxiety and depression. We began with a one-profile model and gradually increased the number of profiles in the model until we found the best fitting model (Sinha et al., 2021). The lower values observed for Akaike information criterion (AIC), Bayesian information criterion (BIC), and adjusted Bayesian information criterion (aBIC) suggest a more appropriate fit for the model. Entropy is employed for assessing the classification accuracy, and a commonly accepted criterion is that entropy should exceed 0.80. Statistically significant differences in Lo-Mendell-Rubin likelihood ratio test (LMR) and

bootstrapped likelihood ratio test (BLRT) indicate that K-profile model is better than the K-1-profile model (Sinha et al., 2021; Tein et al., 2013). Following the identification of the optimal model, Kruskal-Wallis H tests were performed to compare symptom scores of posttraumatic stress, perceived stress, anxiety, and depression among distinct patterns of psychological distress.

Furthermore, the differences in sociodemographic and obstetric characteristics of participants were also compared by χ^2 test, Fisher's exact test, and Kruskal-Wallis H test as appropriate. Subsequently, multinomial logistic regression was used to assess the associations

Table 1

Sociodemographic and obstetric characterization of the study participants.

Variables	Overall (N = 446)	Psychological distress patterns			χ^2 /H	P value
		Mild distress (n = 152)	Moderate distress (n = 258)	Severe distress (n = 36)		
Age					1.293	0.524
< 35 years	349 (78.3)	123 (80.9)	197 (76.4)	29 (80.6)		
≥ 35 years	97 (21.7)	29 (19.1)	61 (23.6)	7 (19.4)		
Educational background					0.690	0.708
With a college/university degree	177 (39.7)	62 (40.8)	103 (39.9)	12 (33.3)		
without a college/university degree	269 (60.3)	90 (59.2)	155 (60.1)	24 (66.7)		
Monthly household income per capita					6.876	0.032
≤ ¥5000	102 (22.9)	31 (20.4)	63 (24.4)	8 (22.2)		
¥5001–10,000	196 (43.9)	56 (36.8)	123 (47.7)	17 (47.2)		
¥10,001–15,000	87 (19.5)	37 (24.3)	44 (17.1)	6 (16.7)		
≥ ¥15,001	61 (13.7)	28 (18.4)	28 (10.9)	5 (13.9)		
Marital status					0.280	0.882
Married	414 (92.8)	141 (92.8)	240 (93.0)	33 (91.7)		
Other	32 (7.2)	11 (7.2)	18 (7.0)	3 (8.3)		
Smoking history					1.788	0.425
Yes	23 (5.2)	8 (5.3)	15 (5.8)	0 (0.0)		
No	423 (94.8)	144 (94.7)	243 (94.2)	36 (100.0)		
Alcohol consumption history					1.602	0.469
Yes	66 (14.8)	18 (11.8)	42 (16.3)	6 (16.7)		
No	380 (85.2)	134 (88.2)	216 (83.7)	30 (83.3)		
Sleep quality					8.047	0.018
Poor	110 (24.7)	32 (21.1)	67 (26.0)	11 (30.6)		
Fair	209 (46.9)	63 (41.4)	127 (49.2)	19 (52.8)		
Good	127 (28.5)	57 (37.5)	64 (24.8)	6 (16.7)		
Adverse life events					0.557	0.802
Yes	44 (9.9)	13 (8.6)	28 (10.9)	3 (8.3)		
No	402 (90.1)	139 (91.4)	230 (89.1)	33 (91.7)		
Number of children					12.444	0.002
0	216 (48.4)	57 (37.5)	140 (54.3)	19 (52.8)		
1	187 (41.9)	74 (48.7)	100 (38.8)	13 (36.1)		
≥ 2	43 (9.6)	21 (13.8)	18 (7.0)	4 (11.1)		
Pregnancy intention					2.084	0.353
Intended pregnancy	326 (73.1)	117 (77.0)	182 (70.5)	27 (75.0)		
Unintended pregnancy	120 (26.9)	35 (23.0)	76 (29.5)	9 (25.0)		
Method of conception					5.688	0.053
Natural conception	392 (87.9)	141 (92.8)	219 (84.9)	32 (88.9)		
Assisted reproductive technology	54 (12.1)	11 (7.2)	39 (15.1)	4 (11.1)		
Pregnancy complications					3.646	0.122
Yes	22 (4.9)	5 (3.3)	13 (5.0)	4 (11.1)		
No	424 (95.1)	147 (96.7)	245 (95.0)	32 (88.9)		
Number of pregnancy loss					13.583	0.001
1	335 (75.1)	130 (85.5)	181 (70.2)	24 (66.7)		
≥ 2	111 (24.9)	22 (14.5)	77 (29.8)	12 (33.3)		
Types of pregnancy loss					7.108	0.115
Miscarriage	364 (81.6)	131 (86.2)	207 (80.2)	26 (72.2)		
Stillbirth	21 (4.7)	4 (2.6)	16 (6.2)	1 (2.8)		
Termination for medical reasons	61 (13.7)	17 (11.2)	35 (13.6)	9 (25.0)		
Inter-pregnancy interval					7.066	0.028
≤ 6 months	128 (28.7)	32 (21.1)	86 (33.3)	10 (27.8)		
> 6 months	318 (71.3)	120 (78.9)	172 (66.7)	26 (72.2)		
PSS-4 score	5.00 (4.00, 7.00)	4.00 (3.00, 5.00)	6.00 (5.00, 7.00)	8.00 (6.00, 8.00)	148.083	< 0.001
IES-R score	22.00 (15.00, 28.00)	13.50 (10.00, 17.75)	25.00 (20.00, 29.00)	37.00 (35.00, 43.00)	221.301	< 0.001
PRAQ-R2 score	30.00 (24.00, 35.00)	23.00 (19.25, 26.00)	32.00 (29.00, 36.25)	38.00 (34.00, 40.75)	225.586	< 0.001
PHQ-9 score	5.00 (3.00, 7.00)	2.00 (2.00, 3.00)	5.00 (4.00, 7.00)	15.00 (12.25, 16.00)	232.231	< 0.001

Notes. Data are described as the median (interquartile range, IQR) or frequency (percentage).

PSS-4, Perceived Stress Scale 4; IES-R, Impact of Event Scale - Revised; PRAQ-R2, Pregnancy-related Anxiety Questionnaire - Revised 2; PHQ-9, Patient Health Questionnaire-9.

between pregnancy loss factors and the patterns of moderate and severe psychological distress with mild psychological distress as the reference. Covariates with a *p*-value less than 0.10 in the univariate analysis were included for model adjustment.

Statistical analyses were performed using SPSS 26.0 and Mplus 8.3 software. *P*-values <0.05 (two-sided) were considered statistically significant.

Results

Characteristics of the study participants

The median (IQR) age of the participants was 31.0 (28.0–34.0) years and 39.7 % of the participants had college/university degrees. In the previous pregnancy, most of participants (81.6 %) experienced miscarriage, and only a small proportion experienced stillbirth (4.7 %) or TFMR (13.7 %). Nearly a quarter of participants (24.9 %) reported a history of recurrent pregnancy loss. Besides, 28.7 % of participants conceived again within 6 months following a pregnancy loss. More details about the characteristics of the study participants were presented in Table 1.

Latent patterns of psychological distress

The fit statistics of the models were presented in Table 2. When compared to the 2-profile model, the 3-profile model demonstrated lower values for AIC, BIC, and aBIC. The entropy value also exceeded 0.8 within the 3-profile model. The LMR value for the 4-profile model was not statistically significant, indicating that the 4-profile model is not better than the 3-profile model. As a result, the 3-profile model was considered to be the optimal fit for the data. Based on the observed score levels, these three profiles were labeled as "mild psychological distress," "moderate psychological distress," and "severe psychological distress," constituting 34.1 %, 57.8 %, and 8.1 % of the participants, respectively (Fig. 1). There were statistically significant differences in the scores of IES-R, PSS-4, PRAQ-R2, and PHQ-9 among the three groups ($P < 0.001$), as shown in Table 1.

Associations of pregnancy loss factors with psychological distress patterns

The results of multinomial logistic regression analysis were presented in Table 3. In the adjusted models, recurrent pregnancy loss was found to be associated with increased risks of both moderate (adjusted odds ratio [aOR] 2.45, 95 % confidence interval [CI]: 1.42–4.24; $P = 0.001$) and severe psychological distress (aOR 2.93, 95 % CI: 1.25–6.83; $P = 0.013$) when compared to once pregnancy loss. Women who conceived within 6 months of pregnancy loss, compared with those who conceived after 6 months of pregnancy loss, were more likely to be categorized into the moderate psychological distress group (aOR 2.00, 95 % CI: 1.21–3.30; $P = 0.007$). Furthermore, a significant association was observed between TFMR and severe psychological distress in univariate logistic regression analysis (OR 2.67, 95 % CI: 1.07–6.63; $P = 0.035$), but this association did not achieve statistical significance in the multivariate logistic regression model (aOR 2.36, 95 % CI: 0.92–6.09; $P = 0.075$).

Table 2

Model fit indices for latent profiles of psychological distress.

Number of latent profiles	AIC	BIC	aBIC	Entropy	LMR	BLRT
1	10,742.164	10,774.967	10,749.578	–	–	–
2	10,436.550	10,489.855	10,448.598	0.813	0.023	< 0.001
3	10,242.108	10,315.913	10,258.789	0.819	< 0.001	< 0.001
4	10,183.110	10,277.418	10,204.425	0.848	0.242	< 0.001

Notes. AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, adjusted Bayesian information criterion; LMR, Lo-Mendell-Rubin likelihood ratio test; BLRT, bootstrapped likelihood ratio test.

Discussion

To our knowledge, this study is the first to explore distinct patterns of psychological distress among women with a history of pregnancy loss during subsequent pregnancies by using LPA. Our findings revealed three patterns of psychological distress, with approximately two-thirds of the sampled women categorized into the moderate-to-severe psychological distress group. Furthermore, recurrent pregnancy loss and conception within 6 months following a pregnancy loss were found to be risk factors for increased psychological distress during subsequent pregnancies.

Previous studies have also observed similar instances of psychological heterogeneity within the general pregnant population (Pei et al., 2022; Haviland et al., 2021). However, in contrast to these findings, the current investigation reveals a notably higher prevalence of moderate to severe psychological distress among our participants. Of particular concern are individuals experiencing severe psychological distress, as indicated by their median scores significantly exceeding the normative values and even the established thresholds across the four screening instruments employed in this study (Lee, 2012; Creamer et al., 2003; Ayers et al., 2016; Xie et al., 2022; Zhong et al., 2014; Manea et al., 2012). These individuals would greatly benefit from comprehensive clinical interviews and timely psychological interventions administered by qualified professionals (Wojcieszek et al., 2018). Additionally, a substantial proportion of our participants belong to the cohort of pregnant women undergoing moderate psychological distress. The current gestational period presents a valuable window of opportunity for intervening to alleviate and prevent further escalation of psychological burdens in this population (Donegan et al., 2023).

The detrimental effects of a history of recurrent pregnancy loss on the psychological well-being of peripartum women, extensively documented in the literature (Quenby et al., 2021; Herbert et al., 2022), were further substantiated by the findings of this study. Moreover, our study has found that a short inter-pregnancy interval, specifically conceiving again within 6 months, can impact the level of psychological distress encountered by women during subsequent pregnancies. One potential explanation is that individuals who are not afforded sufficient time to navigate through their grief and loss might undergo a reactivation of emotions during a new pregnancy, leading to the persistence of adverse emotions and elevated stress levels (Donegan et al., 2023). Although this finding requires further replication in a larger sample, it raises crucial considerations for both couples and healthcare providers concerning the optimal timing for attempting conception following a pregnancy loss (Louis et al., 2019). Surprisingly, the types of pregnancy loss do not appear to be independent factors influencing the patterns of psychological distress. However, we should be cautious with the conclusion as the sample sizes of stillbirth and TFMR in our study are relatively limited, potentially insufficient for the detection of statistically significant differences.

This study has some limitations that should be considered. Firstly, the participants in this study were recruited through convenience sampling, which could introduce selection bias. Secondly, our analysis focused on a limited set of factors related to pregnancy loss. There are additional variables, such as gestational age at the time of pregnancy loss, that may account for variations in the degree of psychological

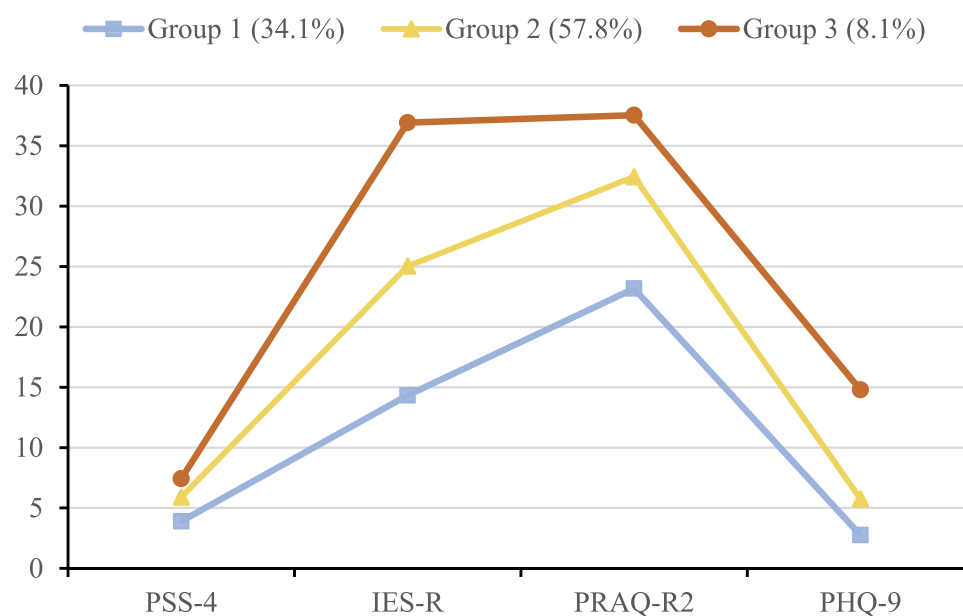


Fig. 1. Latent profile plot of psychological distress with three groups.

Notes. PSS-4, Perceived Stress Scale 4; IES-R, Impact of Event Scale - Revised; PRAQ-R2, Pregnancy-related Anxiety Questionnaire - Revised 2; PHQ-9, Patient Health Questionnaire-9.

Table 3

Univariate and multivariate logistic regression analyses of pregnancy loss factors for association with psychological distress.

Pregnancy loss factors	Univariate analysis vs mild distress (Unadjusted models)				Multivariate analyses vs mild distress (Adjusted models)			
	Moderate distress		Severe distress		Moderate distress		Severe distress	
	OR (95 % CI)	P value	OR (95 % CI)	P value	aOR (95 % CI)	P value	aOR (95 % CI)	P value
Number of pregnancy loss (reference: 1)								
≥ 2	2.51 (1.49–4.25)	0.001	2.96 (1.29–6.76)	0.010	2.45 (1.42, 4.24)	0.001 ^a	2.93 (1.25, 6.83)	0.013 ^a
Types of pregnancy loss (reference: miscarriage)								
Stillbirth	2.53 (0.83, 7.34)	0.103	1.26 (0.14, 11.73)	0.839	2.24 (0.67, 7.45)	0.190 ^b	0.92 (0.09, 9.13)	0.945 ^b
Termination for medical reasons	1.30 (0.70, 2.42)	0.402	2.67 (1.07, 6.63)	0.035	1.16 (0.60, 2.23)	0.659 ^b	2.36 (0.92, 6.09)	0.075 ^b
Inter-pregnancy interval (reference: > 6 months)								
≤ 6 months	1.88 (1.17, 2.99)	0.008	1.44 (0.63, 3.30)	0.385	2.00 (1.21, 3.30)	0.007 ^c	1.75 (0.73, 4.17)	0.208 ^c

Notes. OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio.

^a Models were adjusted for monthly household income, sleep quality, number of children, and method of conception.

^b Models were adjusted for monthly household income, sleep quality, number of children, method of conception, and number of pregnancy loss.

^c Models were adjusted for monthly household income, sleep quality, number of children, method of conception, number of pregnancy loss, and types of pregnancy loss.

distress. Thirdly, while the overall sample size in this study is sufficient for conducting a LPA (Tein et al., 2013), the sample size within each group, particularly within the high psychological distress group, is relatively small. This may result in insufficient statistical power to detect subtle differences of participant characteristics. Fourth, the cross-sectional nature of the study limits our ability to make causal inferences. Finally, we only examined participants' psychological well-being during early pregnancy, failing to capture their psychological trajectories throughout the entire pregnancy. Future studies tracking the psychological changes of individuals within each group would yield invaluable insights into the long-term implications of distinct distress patterns.

Conclusion

In summary, we applied LPA to disclose three patterns of psychological distress among pregnant women with a history of pregnancy loss. Approximately two-thirds of these women exhibited moderate and severe psychological distress. Healthcare professionals should provide tailored interventions and stepped-care models to support these women, particularly targeting those with a history of recurrent pregnancy loss or those conceiving shortly after a pregnancy loss. Future longitudinal research is needed to clarify the psychological distress trajectories throughout the perinatal period.

Ethical statement

This study has been approved by the ethical committee of Southern

Medical University (no. 2022-43) and all participants provided informed consent forms before completing the questionnaires.

CRediT authorship contribution statement

Xiangping Luo: Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. **Bizhen Chen:** Data curation, Investigation, Writing – original draft, Writing – review & editing. **Qiaoqiao Shen:** Conceptualization, Formal analysis, Methodology, Project administration, Software, Supervision, Writing – review & editing.

Declaration of Competing Interest

All authors declare no potential conflicts of interest.

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References

- Ayers, S., Bond, R., Bertullies, S., et al., 2016. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. *Psychol. Med.* 46 (6), 1121–1134.
- Biaggi, A., Conroy, S., Pawlby, S., et al., 2016. Identifying the women at risk of antenatal anxiety and depression: a systematic review. *J. Affect. Disord.* 191, 62–77.
- Blackmore, E.R., Cote-Arsenault, D., Tang, W., et al., 2011. Previous prenatal loss as a predictor of perinatal depression and anxiety. *Br. J. Psychiatry* 198 (5), 373–378.
- Campbell-Jackson, L., Bezance, J., Horsch, A., 2014. A renewed sense of purpose": mothers' and fathers' experience of having a child following a recent stillbirth. *BMC Pregn. Childb.* 14, 423.
- Creamer, M., Bell, R., Failla, S., 2003. Psychometric properties of the impact of event scale - revised. *Behav. Res. Ther.* 41 (12), 1489–1496.
- Davoudian, T., Gibbins, K., Cirino, N.H., 2021. Perinatal loss: the impact on maternal mental health. *Obstet. Gynecol. Surv.* 76 (4), 223.
- de Andrade, A.W., Demontigny, F., Zeghiche, S., et al., 2021. Experience of hope: an exploratory research with bereaved mothers following perinatal death. *Women Birth* 34 (4), e426–e434.
- Donegan, G., Noonan, M., Bradshaw, C., 2023. Parents experiences of pregnancy following perinatal loss: an integrative review. *Midwifery* 121, 103673.
- Farren, J., Jalmbrant, M., Falconieri, N., et al., 2020. Posttraumatic stress, anxiety and depression following miscarriage and ectopic pregnancy: a multicenter, prospective, cohort study. *Am. J. Obstet. Gynecol.* 222 (4), 361–367.
- Haviland, M.J., Nilnil, Y.I., Cabral, H.J., et al., 2021. Adverse psychosocial factors in pregnancy and preterm delivery. *Paediatr. Perinat. Epidemiol.* 35 (5), 519–529.
- Herbert, D., Young, K., Pietrusinska, M., et al., 2022. The mental health impact of perinatal loss: a systematic review and meta-analysis. *J. Affect. Disord.* 297, 118–129.
- Lazarides, C., Moog, N.K., Verner, G., et al., 2023. The association between history of prenatal loss and maternal psychological state in a subsequent pregnancy: an ecological momentary assessment (EMA) study. *Psychol. Med.* 53 (3), 855–865.
- Lee, E.H., 2012. Review of the psychometric evidence of the perceived stress scale. *Asian Nurs. Res. (Korea. Soc. Nurs. Sci.)* 6 (4), 121–127.
- Louis, J.M., Bryant, A., Ramos, D., et al., 2019. Interpregnancy care. *Am. J. Obstet. Gynecol.* 220 (1), B2–B18.
- Manea, L., Gilbody, S., Mcmillan, D., 2012. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. *CMAJ* 184 (3), E191–E196.
- Mccarthy, F.P., Moss-Morris, R., Khashan, A.S., et al., 2015. Previous pregnancy loss has an adverse impact on distress and behaviour in subsequent pregnancy. *BJOG* 122 (13), 1757–1764.
- Murphy, M., Savage, E., O'Donoghue, K., et al., 2021. Trying to conceive: an interpretive phenomenological analysis of couples' experiences of pregnancy after stillbirth. *Women Birth* 34 (5), e475–e481.
- Pei, Y., Chen, Q., Zhang, Y., et al., 2022. Factors associated with the mental health status of pregnant women in China: a latent class analysis. *Front. Public Health* 10, 1017410.
- Practice Committee of the American Society for Reproductive Medicine, 2020. Definitions of infertility and recurrent pregnancy loss: a committee opinion. *Fertil. Steril.* 113 (3), 533–535.
- Quenby, S., Gallos, I.D., Dhillon-Smith, R.K., et al., 2021. Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. *Lancet* 397 (10285), 1658–1667.
- Regan, A.K., Gissler, M., Magnus, M.C., et al., 2019. Association between interpregnancy interval and adverse birth outcomes in women with a previous stillbirth: an international cohort study. *Lancet* 393 (10180), 1527–1535.
- Robinson, G.E., 2014. Pregnancy loss. *Best Pract. Res. Clin. Obstet. Gynaecol.* 28 (1), 169–178.
- Schliep, K.C., Hinkle, S.N., Kim, K., et al., 2022. Prospectively assessed perceived stress associated with early pregnancy losses among women with history of pregnancy loss. *Hum. Reprod.* 37 (10), 2264–2274.
- Simmons, H.A., Goldberg, L.S., 2011. High-risk' pregnancy after perinatal loss: understanding the label. *Midwifery* 27 (4), 452–457.
- Sinha, P., Calfee, C.S., Delucchi, K.L., 2021. Practitioner's guide to latent class analysis: methodological considerations and common pitfalls. *Crit. Care Med.* 49 (1), e63–e79.
- Tein, J.Y., Coxe, S., Cham, H., 2013. Statistical power to detect the correct number of classes in latent profile analysis. *Struct. Equ. Model.* 20 (4), 640–657.
- Tesema, G.A., Haberg, S.E., Pereira, G., et al., 2022. Interpregnancy interval and adverse pregnancy outcomes among pregnancies following miscarriages or induced abortions in Norway (2008-2016): a cohort study. *PLoS Med.* 19 (11), e1004129.
- Van, P., Gay, C.L., Lee, K.A., 2023. Prior pregnancy loss and sleep experience during subsequent pregnancy. *Sleep Health* 9 (1), 33–39.
- Wojcieszek, A.M., Boyle, F.M., Belizan, J.M., et al., 2018. Care in subsequent pregnancies following stillbirth: an international survey of parents. *BJOG* 125 (2), 193–201.
- Xie, T., Han, L., Wu, J., et al., 2022. Psychometric evaluation of the pregnancy-related anxiety questionnaire-revised 2 for Chinese pregnant women. *Midwifery* 112, 103411.
- Zhong, Q., Gelaye, B., Rondon, M., et al., 2014. Comparative performance of Patient Health Questionnaire-9 and Edinburgh Postnatal Depression Scale for screening antepartum depression. *J. Affect. Disord.* 162, 1–7.