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Association between pelvic floor–related fears and delivery mode preference in primigravid women: a cross-sectional study

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Abstract

Objective

To evaluate the relationship between specific pelvic floor–related fears and mode of delivery preference in primigravid women, and to determine the independent effect of these fears on cesarean preference.

Design, Setting, Population:

Cross-sectional group-comparative study conducted at a tertiary obstetrics center including 510 primigravid women at 32–35 weeks of gestation. Participants were classified into three groups based on delivery preference: vaginal, cesarean, and undecided.

Methods

Pelvic floor–related fears were assessed using a structured scale with four subscales. A total concern score (0–40) was calculated. Associations between delivery preference and fear scores were analyzed using appropriate statistical methods.

Main Outcome Measures:

Primary outcome was preference for cesarean delivery. The main exposure variable was the total concern score; subscale scores were evaluated secondarily.

Results

The total concern score differed significantly across delivery preference groups ($p = 0.002$) and was higher among women preferring cesarean delivery. Significant differences were observed for fears of urinary incontinence ($p = 0.001$) and perineal deformity ($p = 0.015$), while other subscales were not significant. ROC analysis showed limited discriminatory performance (AUC = 0.586; 95% CI: 0.531–0.641; $p = 0.003$). In multivariate analysis, a total concern score ≥ 25.5 independently increased the likelihood of cesarean preference (OR = 1.41; 95% CI: 1.01–2.08; $p = 0.048$).

Conclusions

Pelvic floor–related fears significantly influence delivery preferences in primigravid women, with the total concern score emerging as an independent predictor of cesarean preference. Addressing these fears during antenatal care may support informed decision-making and help reduce non-medically indicated cesarean rates.

Introduction

Cesarean section rates have increased significantly on a global scale in recent years and have exceeded recommended limits in many countries(1). According to current data, 21% of births worldwide are performed via cesarean section. If the current rate continues, the estimated cesarean section rate in 2030 will be 28.5%, with projections indicating that this rate could reach 60% or higher in some regions(2). This increase is associated with heightened risks of maternal morbidity, infection, and bleeding, as well as placental complications in subsequent pregnancies; furthermore, potential adverse effects on neonatal outcomes are increasingly coming to the forefront(3, 4) .

It is acknowledged that the rise in cesarean section rates cannot be explained solely by obstetric indications, and that maternal preferences are becoming increasingly decisive(5). This suggests that the choice of delivery method is shaped not only by clinical necessity but also by individual perceptions, expectations, and fears.

While the relationship between fear of childbirth and the preference for cesarean section has been established in the literature, the impact of specific concerns regarding pelvic floor function on this preference has been examined only to a limited extent(6). In particular, concerns regarding conditions such as perineal deformity, urinary incontinence, and sexual dysfunction are potential factors that could influence the perception of childbirth in primigravid women without prior obstetric experience(7–9). However, these fears have generally been addressed separately and have not been evaluated together within a quantitative framework during pregnancy. Current measurement tools cover only specific aspects of these areas, and there is no standardized approach that comprehensively assesses the relationship between multidimensional fears related to the pelvic floor and the choice of delivery method. In this context, the systematic examination of specific fears related to pelvic floor function is important for better understanding maternal decision-making processes and identifying areas for intervention aimed at reducing non-medically indicated cesarean section rates.

Turkey is one of the countries with the highest cesarean section rates among Organisation for Economic Co-operation and Development (OECD) member states, and it is believed that cesarean delivery on maternal request (CDMR) accounts for a significant portion of these high rates(10–12).

Despite growing interest in determinants of delivery preference, multidimensional pelvic floor–related fears have not been systematically evaluated using a composite scoring approach in primigravid women. In this context, the present study investigated the association between specific pelvic floor–related fears and mode of delivery preference in a high cesarean rate setting such as Turkey, and assessed their independent contribution to preference for cesarean delivery.

Methods

Study Design

This observational cross-sectional study was conducted at a tertiary obstetrics center between December 2025 and June 2026. The study included primigravid women at 32–35 weeks of gestation attending routine antenatal care.

Participants

Eligible participants were singleton primigravid women between 32 and 35 weeks of gestation who provided informed consent. Women with major fetal anomalies, significant maternal systemic disease, previous pelvic floor surgery, or obstetric conditions indicating cesarean delivery (e.g., placenta previa, PAS spectrum, vasa previa) were excluded to minimize confounding. No formal sample size calculation was performed; all eligible participants during the study period were included.

Data collection and measurement

Pelvic floor–related fears were assessed using a structured questionnaire developed for the present study, comprising four domains: pelvic organ prolapse/vaginal laxity, sexual dysfunction, urinary incontinence, and perineal deformity. Each domain was rated on a 0–10 scale, and a composite “total concern score” (range: 0–40) was calculated. (Supplementary File 1)

As no validated instrument currently exists to comprehensively assess multidimensional pelvic floor–related fears in relation to delivery preference, this composite scoring approach was developed based on clinically relevant domains identified in prior literature and was used as a hypothesis-generating instrument.

The questionnaire was developed specifically for the present study and has not been previously published. An English-language version of the questionnaire is provided as Supplementary File 1.

Variables

The primary outcome was preferred mode of delivery (vaginal, cesarean, undecided).

The main exposure variable was the total concern score. Secondary variables included subscale scores and maternal characteristics such as age, body mass index (BMI), educational level, household income, place of residence (urban/rural), and type of healthcare financing.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as n (%) for categorical variables and as mean ± standard deviation and median (minimum–maximum) for continuous variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test and histograms. For variables

showing a normal distribution, one-way analysis of variance (ANOVA) was used; for those not showing a normal distribution, the Kruskal–Wallis test was used. Bonferroni correction was applied in post-hoc analyses. The Pearson chi-square test or Fisher's exact test was used to compare categorical variables. The performance of the total concern score in predicting cesarean delivery was evaluated using ROC curve analysis. Univariate and multivariate logistic regression analyses were performed to identify factors influencing cesarean delivery. A p-value of < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval

was obtained from the Clinical Research Ethics Committee of Gazi Yaşargil Training and Research Hospital (Approval No: 699; Date: 07 November 2025). All procedures involving human participants were performed in accordance with the ethical standards of the institutional research committee, the Declaration of Helsinki, and relevant guidelines and regulations. Written informed consent was obtained from all participants. As Silvan Dr Yusuf Azizoğlu State Hospital does not have an independent clinical research ethics committee, ethical approval was obtained from the Clinical Research Ethics Committee of Gazi Yaşargil Training and Research Hospital, which serves as the authorized regional ethics committee for surrounding state hospitals.

Results

Participant characteristics and sociodemographic characteristics

A total of 510 primigravid women were included in the study. While the age distribution of participants was predominantly concentrated in the younger age group, 37.6% were in the 18–25 age range, 34.3% in the 26–30 age range, 20.6% in the 31–35 age range, and 7.5% in the 36–40 age range. In terms of educational level, high school graduates (37.5%) constitute the largest group of participants, followed by middle school graduates (31.2%) and elementary school graduates (18.6%); university graduates account for 11.4%, and individuals with graduate-level education account for 1.4%. The participants' average body mass index was determined to be 26.76 ± 4.01. In terms of place of residence, the vast majority of individuals live in a urban areas (86.7%), while 13.3% reside in a rural areas. Regarding household income, 58.2% of participants had an income between 1 and 2 times the minimum wage, 16.5% had an income more than 3 times the minimum wage, 16.3% had an income below the minimum wage, and 9.0% had an income between 2 and 3 times the minimum wage. When examining the type of financing, it was determined that the vast majority of individuals are covered by the Social Security Institution (SGK) (98.2%), while only 1.8% pay for services out-of-pocket. The average gestational age was calculated as 33.49 ± 1.11 weeks.

When comparing sociodemographic and clinical variables by mode of delivery, a statistically significant difference was observed between groups in terms of age groups (p = 0.032); the proportion of women

aged 18–25 (46.7%) was found to be higher in the undetermined group compared to the other groups. No significant differences were found between the groups in terms of education level, BMI, place of residence, type of financing, and gestational age ($p = 0.121$; $p = 0.401$; $p = 0.387$; $p = 0.180$; $p = 0.501$, respectively). In contrast, a significant association was found between household income and mode of delivery ($p = 0.009$); specifically, the undecided group had a significantly higher proportion of higher income levels (72.2%). Significant differences were also found between the groups regarding the primary factors influencing birth preference ($p < 0.001$); while the most common reason for preferring vaginal birth was method safety (54.7%), fear of childbirth (60.1%) was the primary factor among those preferring cesarean section. In the undecided group, fear of childbirth (48.9%) and other factors (20%) were observed (Table 1).

Table 1
Comparison of sociodemographic and clinical variables with mode of delivery

Variables	Mode of Delivery			
	Vaginal N = 247	Cesarean N = 173	Undecided N = 90	
Age				
18–25	89 (36)	61 (35.3)	42 (46.7)	0.032[b]
26–30	84 (34)	56 (32.4)	35 (38.9)	
31–35	51 (20.6)	41 (23.7)	13 (14.4)	
36–40	23 (9.3)	15 (8.7)	0 (0)	
Educational level				
Elementary school	58 (23.5)	27 (15.6)	10 (11.1)	0.121[b]
Middle School	78 (31.6)	52 (30.1)	29 (32.2)	
High School	83 (33.6)	67 (38.7)	41 (45.6)	
College	25 (10.1)	23 (13.3)	10 (11.1)	
Graduate	3 (1.2)	4 (2.3)	0 (0)	
BMI	26.87 ± 3.96	26.88 ± 3.98	26.24 ± 4.20	0.401[a]
Residence type				
District	217 (87.9)	151 (87.3)	74 (82.2)	0.387[b]
Village	30 (12.1)	22 (12.7)	16 (17.8)	
Household income				
Below minimum wage	49 (19.8)	28 (16.2)	6 (6.7)	0.009[b]
1–2x	141 (57.1)	91 (52.6)	65 (72.2)	
2–3x	17 (6.9)	23 (13.3)	6 (6.7)	
> 3x	40 (16.2)	31 (17.9)	13 (14.4)	
Financing type				
Social Security	245 (99.2)	168 (97.1)	88 (97.8)	0.180[c]
Paid	2 (0.8)	5 (2.9)	2 (2.2)	

a:ANOVA test, Post-hoc:Bonferroni test, b:Pearson Chi-Square test, c:Fisher's Exact test, $p < 0.05$ statistically significant

Variables	Mode of Delivery			
	Vaginal N = 247	Cesarean N = 173	Undecided N = 90	
Gestational week	33.50 ± 1.16	33.53 ± 1.05	33.36 ± 1.10	0.501[a]
Primary influencing factor				
Doctor's recommendation	63 (25.5)	29 (16.8)	20 (22.2)	< 0.001[c]
Method safety	135 (54.7)	33 (19.1)	3 (3.3)	
Fear of childbirth	24 (9.7)	104 (60.1)	44 (48.9)	
Social/cultural factors	2 (0.8)	0 (0)	3 (3.3)	
Other	20 (8.1)	7 (4)	18 (20)	
Undecided	3 (1.2)	0 (0)	2 (2.2)	

a:ANOVA test, Post-hoc:Bonferroni test, b:Pearson Chi-Square test, c:Fisher's Exact test, p < 0.05 statistically significant

Fear Scores and Birth Preference

When examining the general statistics for the scale and subscales, it was observed that the mean total fear score was 23.79 ± 8.98 and the median value was 25.00 (min–max: 0.00–40.00). When the subscales were evaluated, the fear of pelvic prolapse/vaginal laxity had a mean of 5.62 ± 2.99 (median: 6.00; min–max: 0.00–10.00), fear of sexual dysfunction at 4.80 ± 2.98 (median: 5.00; min–max: 0.00–10.00), and fear of urinary incontinence at 6.83 ± 2.99 (median: 7.00; min-max: 0.00–10.00), and fear of perineal deformity was 6.54 ± 3.13 (median: 7.00; min-max: 0.00–10.00).

When comparing scale and subscale scores by mode of delivery, a statistically significant difference was found between the groups in terms of total fear scores (p = 0.002); post-hoc analysis revealed that this difference was between the vaginal delivery and cesarean section groups, with the cesarean section group having a higher total fear score (25.25 ± 8.97 vs. 22.38 ± 9.43). No significant differences were found between the groups regarding fear of pelvic prolapse/vaginal laxity and fear of sexual dysfunction (p = 0.204 and p = 0.067, respectively). In contrast, a significant difference was found between the groups regarding fear of urinary incontinence (p = 0.001), and this difference was observed between the vaginal delivery and cesarean section groups; the fear level was higher in the cesarean section group(7.42 ± 2.8 vs. 6.33 ± 3.1). A significant difference was also found between the groups regarding fear of perineal deformity (p = 0.015), and this difference was determined to be between the vaginal delivery and the undecided groups; the fear level was higher in the undecided group (7.26 ± 2.69 vs. 6.18 ± 3.26) (Table 2).

Table 2
Comparison of the scale and subscales with mode of delivery

Variables	Mode of delivery				
	a) Vaginal N = 247	b) Cesarean N = 173	c) Undecided N = 90	p	Post-hoc
Total Concern Score	22.38 ± 9.43	25.25 ± 8.97	24.88 ± 7.04	0.002	a-b
Fear of pelvic prolapse/vaginal laxity	5.39 ± 3.18	5.92 ± 2.95	5.7 ± 2.5	0.204	-
Fear of sexual dysfunction	4.53 ± 3.07	5.21 ± 2.97	4.8 ± 2.72	0.067	-
Fear of urinary incontinence	6.33 ± 3.1	7.42 ± 2.8	7.12 ± 2.82	0.001	a-b
Fear of perineal deformity	6.18 ± 3.26	6.7 ± 3.12	7.26 ± 2.69	0.015	a-c
ANOVA test, Post-hoc: Bonferroni test, p < 0.05 statistically significant					

Discriminatory performance analysis

ROC analysis showed limited discriminatory performance of the total concern score for predicting cesarean preference (AUC = 0.586; 95% CI: 0.531–0.641; p = 0.003). At a cutoff value of ≥ 25.5, sensitivity was 54.3% and specificity was 55.9% (Table 3).

Table 3
Analysis of the Predictive Value of the Total Concern Score in Distinguishing Cesarean Delivery Among Patients

Variables	AUC	95% CI	Cut-off	Sensitivity (%)	Specificity (%)	p
Total Concern Score	0.586	0.531–0.641	≥ 25.50	54.3	55.9	**0.003**
AUC, Area under the curve; 95% CI, Confidence interval						

Logistic regression analysis

When factors influencing cesarean delivery were evaluated using univariate and multivariate logistic regression analyses, it was observed that the likelihood of cesarean delivery was significantly increased in individuals with a Total Concern Score ≥ 25.50 (OR = 1.51; 95% CI: 1.03–2.19; p = 0.031); this association persisted in the multivariate analysis (OR = 1.41; 95% CI: 1.01–2.08; p = 0.048) and was identified as an independent risk factor. Regarding maternal age, the 31–35 age group was found to carry a significantly higher risk of cesarean delivery compared to the 18–25 age group in both univariate (OR = 1.72; 95% CI: 1.03–2.87; p = 0.036) and multivariate analyses (OR = 2.03; 95% CI: 1.15–3.59; p = 0.014). Regarding educational level, univariate analysis showed that high school (OR = 1.73; 95% CI:

1.09–3.03; p = 0.046) and college graduates (OR = 1.97; 95% CI: 1.05–4.09; p = 0.049) were associated with cesarean delivery; however, these associations lost statistical significance in the multivariate analysis (p = 0.078 and p = 0.066, respectively). Similarly, although a significant association was observed for the 2–3 income group in univariate analysis (OR = 1.97; 95% CI: 1.08–5.16; p = 0.030), this relationship was not maintained in the multivariate model (p = 0.087). No significant associations were found between BMI, place of residence, or type of financing and cesarean delivery. The regression model showed low explanatory power (R^2=0.056) (Table 4).

Table 4
Univariate and Multivariate Logistic Regression Results for Various Variables on Cesarean Delivery

Variables	Univariate		Multivariate	
	OR (95% CI)	p	OR (95% CI)	p
Total Concern Score				
< 25.50	ref	0.031	ref	0.048
≥ 25.50	1.51 (1.03–2.19)		1.41 (1.01–2.08)	
Maternal Age		0.047		0.102
18–25	Ref		Ref	
26–30	1.21 (0.77–1.89)	0.393	1.28 (0.80–2.02)	0.292
31–35	1.72 (1.03–2.87)	0.036	2.03 (1.15–3.59)	0.014
36–40	1.40 (0.68–2.87)	0.358	1.71 (0.76–3.82)	0.190
Educational level		0.040		0.305
Elementary school	ref		ref	
Middle School	1.43 (0.80–2.54)	0.222	1.44 (0.76–2.75)	0.257
High School	1.73 (1.09–3.03)	0.046	1.76 (0.93–3.30)	0.078
College	1.97 (1.05–4.09)	0.049	2.05 (0.95–4.14)	0.066
Graduate	2.86 (0.59–13.69)	0.188	2.55 (0.51–12.75)	0.254
BMI	1.01 (0.95–1.06)	0.635	-	-
Residence type				
District	ref	0.811	-	-
Village	0.93 (0.53–1.62)		-	
Household income		0.048		0.153
Below minimum wage	ref		ref	
1–2x	1.12 (0.66–1.92)	0.655	0.91 (0.53–1.56)	0.746
2–3x	1.97 (1.08–5.16)	0.030	1.94 (0.91–4.15)	0.087
> 3x	1.35 (0.70–2.62)	0.365	1.12 (0.57–2.17)	0.734
Financing type				
-2 Log-likelihood: 605.047, R^2= 0.056				

Variables	Univariate		Multivariate	
	OR (95% CI)	p	OR (95% CI)	p
SGK	ref	0.138	-	-
Paid	2.98 (0.70–12.65)		-	
-2 Log-likelihood: 605.047, R^2= 0.056				

Discussion

Main findings

This study demonstrated that specific pelvic floor–related fears significantly influence delivery mode preference in primigravid women. The independent association between total concern score and cesarean preference indicates that delivery decisions are shaped not only by obstetric factors but also by concerns regarding postpartum bodily integrity. Subscale analysis showed that fears of urinary incontinence and perineal deformity were significantly associated with delivery preference, whereas fears related to pelvic organ prolapse and sexual dysfunction were not, suggesting a differential impact of pelvic floor components. These findings suggest that integrating targeted antenatal counseling addressing pelvic floor–related concerns may represent a feasible and scalable intervention to reduce non-medically indicated cesarean delivery.

Strengths and Limitations

A major strength of this study is the inclusion of a homogeneous population of primigravid women within a narrow gestational age range, minimizing variability related to prior obstetric experience. The multidimensional assessment of pelvic floor–related fears using a composite scoring approach further strengthens the study. Additionally, multivariate analysis was performed to control for potential confounders. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference. Self-reported data may introduce response bias. The use of a non-validated measurement tool represents a methodological limitation, and the single-center design may limit generalizability.

Interpretation

While the relationship between tokophobia and cesarean section preference is well-established in the literature, current evidence largely focuses on general fear of childbirth, and the impact of specific, multidimensional anxieties regarding pelvic floor function on birth preference has not been sufficiently characterized(13, 14). The present study offers a new perspective on this field by elucidating the role of more specific and somatic anxieties regarding pelvic floor function in birth preference. In particular, the prominence of fears related to urinary incontinence and perineal deformity suggests that women's concerns regarding postpartum quality of life and bodily integrity play a significant role in the decision-

making process. Understanding the psychosocial and perceptual factors influencing birth preference is of critical importance, particularly in countries like Turkey where cesarean section rates are high.

Misconceptions, gaps, or exaggerated perceptions regarding pelvic floor function may position cesarean section as a safer or more protective option, particularly among women without prior obstetric experience. The association between vaginal birth and pelvic organ prolapse has long been established, and it has been shown that factors such as multiparity, operative vaginal delivery, and advanced maternal age may contribute to weakened pelvic floor support(15, 16). However, current evidence indicates that pelvic floor dysfunction is a multifactorial process and cannot be explained by mode of delivery alone(17). Nevertheless, it has been reported that there is a widespread perception among women that vaginal delivery causes permanent and inevitable damage to the pelvic floor(18). This perception is shaped primarily by fears related to conditions such as pelvic organ prolapse, urinary incontinence, and loss of perineal integrity, and may influence the choice of delivery method. Similarly, in our study, it was demonstrated that the total level of fear related to the pelvic floor is an independent determinant of cesarean section preference. These findings support the notion that perceptions regarding pelvic floor function are shaped not only by biological risks but also through individual interpretations and expectations, and play a significant role in the childbirth decision-making process.

In particular, the literature has shown that changes in pelvic floor support following vaginal delivery may be associated with an increased risk of urinary incontinence. However, current evidence indicates that cesarean delivery does not completely eliminate this risk and that pelvic floor dysfunction arises from the interaction of numerous factors, including age, genetic predisposition, connective tissue characteristics, and lifestyle(19). Nevertheless, there is a widespread perception among women that vaginal delivery poses a significant and inevitable risk for urinary incontinence, and this perception can be a major determinant in the choice of delivery method. Indeed, some studies have reported that the fear of developing urinary incontinence is one of the primary factors driving the preference for cesarean delivery(20). Similarly, in the present study, it was found that the level of fear regarding urinary incontinence was significantly higher in the group opting for cesarean delivery, and this finding supports the notion that perceptions regarding pelvic floor function play a significant role in the decision-making process regarding delivery.

The relationship between sexual dysfunction and mode of delivery has long been debated in the literature; in particular, it has been suggested that trauma to the pelvic floor muscles, neural structures, and perineal tissues that may occur during vaginal delivery could affect sexual function in the postpartum period(21). However, current evidence indicates that this relationship is inconsistent and that sexual function is shaped not only by mode of delivery but also by the interaction of numerous variables such as hormonal changes, psychosocial factors, partner relationships, and individual perceptions(22). In our study, it was found that fear of sexual dysfunction did not show a significant association with birth preference. This suggests that concerns regarding sexual function are not the sole determining factor, and that somatic and more directly perceivable risks—such as urinary incontinence and perineal integrity—may play a more prominent role in the choice of delivery method.

Perineal integrity is of central importance for women's body image and functional well-being in the postpartum period. Stretching, tearing, or surgical interventions (such as episiotomy) that may occur in the perineal tissues during vaginal delivery can lead to short- and long-term anatomical changes; this is associated in the literature with pelvic floor support and perineal structure(23). However, the occurrence of perineal injury and its clinical manifestations are not limited solely to the mode of delivery; they are determined by the interaction of various factors, including obstetric interventions, fetal characteristics, and individual tissue properties. Nevertheless, there is a significant concern, particularly among women without prior childbirth experience, that permanent deformation may develop in the perineal region, and it is believed that this concern may influence childbirth preferences(24). In the current study, the fact that fear of perineal deformity showed significant differences across childbirth preference groups and was particularly higher in the undecided group suggests that this concern may act as a factor increasing uncertainty in the decision-making process. This finding suggests that perceptions regarding perineal integrity may be related not only to expectations regarding physical outcomes but also to more complex cognitive processes such as concerns about loss of control and permanence.

However, the limited discriminative performance of the ROC analysis (AUC = 0.586) and the low explanatory power of the regression model (R^2=0.056) indicate that factors determining birth preference are not limited to pelvic floor–related fears alone. This finding reflects the complex and multidimensional nature of the processes shaping birth preferences, suggesting that cultural norms, health system dynamics, and individual experiences also play significant roles in this decision-making process. In this context, it is understood that fears related to the pelvic floor are not sufficient predictors on their own but should be evaluated as part of a broader psychosocial framework.

Conclusion

Pelvic floor–related fears are an independent determinant of delivery mode preference in primigravid women, highlighting the role of perception-driven factors beyond obstetric indications. Integrating structured antenatal counseling targeting these concerns may offer a modifiable strategy to reduce non-medically indicated cesarean rates.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the Clinical Research Ethics Committee of Gazi Yaşargil Training and Research Hospital (Approval No: 699; Date: 07 November 2025). All procedures involving human participants were performed in accordance with the ethical standards of the institutional research committee, the Declaration of Helsinki, and relevant guidelines and regulations. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Availability of data and materials

Data are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed to the study design, data acquisition, analysis, and interpretation. All authors critically revised the manuscript and approved the final version.

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