Development and Psychometric Evaluation of the Pregnancy Low Back Pain Prevention Questionnaire (PLBP-Q) Based on the Health Belief Model

Abstract

Aims: Pregnancy-related low back pain is common, yet often exacerbated by inadequate preventive behaviors. Although HBM-based questionnaires have been developed for other pregnancy-related health behaviors, a questionnaire specifically assessing beliefs about pregnancy-related LBP prevention was needed. This study aimed to develop and psychometrically evaluate a specialized questionnaire to enable targeted, evidence-based preventive interventions.

Instrument & Methods: This two-phase methodological study in 2025-2026 combined qualitative instrument development and cross-sectional validation. Phase one generated an HBM-based item pool through a literature review and 10 qualitative interviews, followed by face and content validation (CVR, CVI, Impact Scores). Phase two evaluated psychometric properties among 282 pregnant women; construct validity was assessed via exploratory factor analysis after KMO and Bartlett's tests. Reliability and stability were examined using Cronbach's alpha, McDonald's omega, and intraclass correlation coefficients (two-week interval).

Findings: Content validity refined the scale from 37 to 34 items. Exploratory factor analysis (KMO=0.863, $p<0.001$) extracted six HBM factors explaining 52.65% of the variance, resulting in a final 29-item scale (loadings: 0.338–0.898) with floor and ceiling effects below 10% for all subscales. Subscales showed high internal consistency (alpha: 0.736–0.906; omega: 0.740–0.906) and moderate to excellent stability (ICC: 0.83–0.91). Inter-construct correlations ($r=-0.136$ to 0.504) suggested distinct subscales.

Conclusion: The PLBP-Q demonstrates satisfactory psychometric properties for assessing health beliefs related to pregnancy-associated low back pain. Its six-factor structure aligns with the HBM, offering a theoretical framework to guide future maternal health research and targeted interventions. However, longitudinal studies are warranted to establish its predictive validity for long-term behavior change.

Keywords: Low Back Pain, Pregnant Women, Psychometrics, Health Belief Model, Surveys and Questionnaires, Musculoskeletal Diseases.

Introduction

Pregnancy-related low back pain (LBP) is a lumbar or pelvic discomfort driven by hormonal shifts, weight gain, and ligamentous laxity, affecting 40% to 80% of pregnant women globally and 57.3% in Iran (1–4). This condition impairs daily activities like walking, sitting, and sleeping, while provoking anxiety and depression (5). Although ergonomic adjustments, safe prenatal exercises, and proper lifting can mitigate disability, fear-avoidant beliefs often hinder compliance(6). Conversely, many women accept LBP as an inevitable part of pregnancy and do not seek care (7). Thus, systematically assessing the cognitive factors and health beliefs driving maternal behaviors remains essential.

The Health Belief Model (HBM) offers a widely used framework for understanding preventive behaviors by analyzing perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy (8). In pregnancy-related LBP, women's adherence to ergonomic modifications is heavily shaped by their perceived risk, potential impact on daily functioning (9), and specific barriers such as the fear of harming the fetus (10). By addressing these cognitive and motivational predictors of behavior change rather than just knowledge (11), HBM constructs—particularly self-efficacy—serve as key determinants for predicting and improving pain management strategies during pregnancy (12).

Despite the high burden of pregnancy-related LBP, existing instruments measure symptoms or physical disability rather than the cognitive determinants of preventive behavior (13,14). Additionally, translating Western tools often fails to capture local sociocultural and religious nuances—such as misconceptions favoring physical inactivity—risking construct inequivalence and compromised reliability (15,16). Therefore, developing a culturally grounded, psychometrically sound HBM instrument specifically for pregnancy-related LBP is essential to provide a useful and conceptually equivalent tool for this population (17).

This study aimed to develop and psychometrically validate the Pregnancy Low Back Pain Prevention Questionnaire (PLBP-Q) as a novel, HBM-based instrument. We hypothesized that this questionnaire would demonstrate a stable, theoretically sound factor structure aligned with HBM constructs, alongside robust validity and reliability. Ultimately, this research provides maternal healthcare systems with a culturally tailored, validated tool to assess pregnant women's preventive health beliefs, establishing a practical foundation for designing targeted educational interventions.

Instrument and Methods

Study Design

This two-phase methodological study was conducted in Galikesh, Iran, from 22 December 2025 to 20 March 2026. The first phase involved developing the PLBP-Q based on the HBM, and the second used a cross-sectional design to evaluate its psychometric properties in the target population.

Participants and Sampling

Participants included 282 pregnant women from comprehensive health centers in Galikesh, Iran, recruited via convenience sampling (Figure 1). Following ethical approval, eligible women attending routine prenatal care were invited to participate. They were provided with explanations regarding the study objectives, and the confidentiality of their information was assured prior to obtaining written informed consent. In accordance with the recommendation of 5 to 10 participants per item for Exploratory Factor Analysis (EFA), a minimum of 200 was targeted; however, additional participants were enrolled to enhance statistical power (18). All 282 participants were included in the EFA, and no independent sample was recruited for CFA. The resulting factor structure therefore requires confirmation in a separate sample.

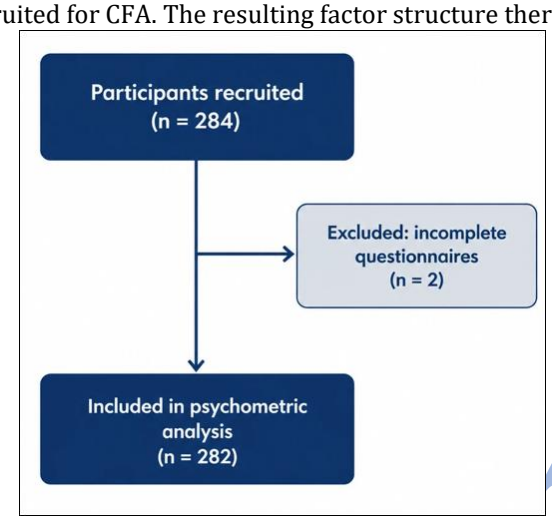


Figure 1. Participant flow through the study

Eligibility Criteria

The inclusion criteria were: (1) being pregnant (at any gestational age), (2) possessing a health record at the selected comprehensive health centers, and (3) providing written informed consent to participate in the study. The exclusion criteria included: (1) cognitive impairment or inability to comprehend and complete the questionnaire, and (2) severe physical or medical complications that prevented participation.

Theoretical Framework

The PLBP-Q was theoretically grounded in the HBM to systematically capture the cognitive determinants driving preventive behaviors for pregnancy-related low back pain. The questionnaire was structured around the six primary HBM constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. Utilizing this framework ensured that the instrument comprehensively measures how pregnant women perceive back pain risks and evaluate the practical motivators and obstacles influencing their adoption of preventive ergonomics and exercises.

Item Generation

The PLBP-Q was developed using a systematic, two-phase instrument design that integrated deductive (literature-driven) and inductive (qualitative-driven) approaches to align theoretical precision with the lived experiences of the target population.

In the deductive phase, a comprehensive literature search was conducted across international and national databases, including PubMed/MEDLINE, Scopus, Web of Science, and SID, covering publications up to December 2025. Search strings combined MeSH terms and text words using Boolean operators: (pregnancy OR pregnant women) AND (low back pain OR lumbopelvic pain) AND (ergonomics OR preventive behavior OR exercise) AND (Health Belief Model OR HBM). This search established an initial conceptual matrix of risk perceptions and preventive practices.

In the inductive phase, individual semi-structured, face-to-face interviews were conducted with a purposive sample of 10 pregnant women recruited from comprehensive health centers. Sampling continued until theoretical data saturation was achieved, defined as the point at which no new codes, categories, or conceptual properties emerged during the final two consecutive interviews. Interviews were audio-recorded with permission, transcribed verbatim, and analyzed using conventional qualitative content analysis following the approach of Elo and Kyngäs (19). Interviews lasted 30–60 minutes. Transcripts were independently coded by members of the research team, and disagreements were resolved through discussion.

By synthesizing the theoretical insights from the literature with the qualitative findings, we drafted and refined the questionnaire items. This integration ensured the instrument was both theoretically robust and culturally resonant. This phase culminated in a 37-item initial pool. A comprehensive matrix detailing the

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HBM constructs, their operational definitions, illustrative qualitative quotes, and sample items is provided in Table 1.

Table 1. Description of the constructs, related citations, and examples from interviews

Constructs & Dimensions	***Literature Review***	***Quotes from the Interviews***	***Sample Items***
Perceived Susceptibility *- Perceived risk of developing pregnancy-related LBP - Role of weight gain and postural changes in LBP risk*	Epidemiological evidence on the high prevalence of pregnancy-related LBP, and the biomechanical impact of rapid maternal weight gain and postural shifts on spinal load(1,3,20).	"I didn't expect pregnancy to put this much pressure on my lower back; I thought back pain only happens in the very last month." "With my belly growing so fast, I feel my spine is under constant strain."	I feel there is a high chance that I will develop LBP during my pregnancy. Due to weight gain and postural changes in pregnancy, I might experience LBP.
Perceived Severity *Impact of LBP on daily routine and sleep - Dependency on others due to severe pain*	Documentation of how pregnancy-related LBP disrupts maternal daily functioning (disability in household tasks), sleep quality (sleep deprivation), and overall psychological well-being (8,21,22).	"When my back pain starts, I cannot even do simple house chores or stand long enough to cook." "The pain gets so sharp at night that I cannot find any comfortable position to sleep."	If I develop LBP, my daily comfort and peace of mind will be disrupted. LBP during pregnancy can deprive me of comfortable and restful sleep.
Perceived Benefits *Preventive role of light physical activity - Benefits of proper ergonomics and lifting postures*	Clinical efficacy of ergonomic interventions, including pelvic support during sitting and kinetic-chain adjustments (bending knees) for safe lifting postures in pregnant women (6,9,13,23).	"When I pay attention to how I sit and support my back with a pillow, the aching decreases significantly." "Bending my knees instead of my back to pick up things makes me feel much more stable."	Maintaining proper posture helps reduce LBP. Proper lifting techniques (bending knees and keeping the back straight) can prevent LBP.
Perceived Barriers *Pregnancy-related fatigue and lack of support - Fear of fetal harm during physical activities*	Identification of maternal barriers to preventive exercises, specifically pregnancy-related fatigue from household chores, perceived lack of time, and safety anxiety regarding fetal harm(10,24,25).	"I want to do the pelvic stretching exercises, but I am honestly terrified that any sudden movement might harm my baby." "By the time I finish my daily housework, I am simply too exhausted to think about any back exercises."	I am worried that performing physical activity might harm the fetus. Daily busy schedules make it difficult for me to perform back-care practices.
Perceived Self-Efficacy *Confidence in maintaining correct postures - Ability to perform safe back care despite fatigue*	Frameworks on maternal self-efficacy, highlighting a woman's confidence to actively maintain correct postures and execute safe lifting techniques despite physical exhaustion(11,22,26,27).	"Even when I am feeling tired, I can still make an effort to sit up straight and avoid slouching." "I am confident that I can remember the proper way to lift my toddler without straining my back."	I can perform light physical activity even when I am tired. I can follow proper principles when lifting objects.
Cues to Action *Influence of healthcare providers (midwives/doctors) - Social support and family advice*	The role of external cues, focusing on professional reminders from midwives during prenatal visits and observational learning	"Whenever my midwife reminds me about pelvic tilts during my routine checkups, I immediately start doing them at home." "Seeing other pregnant women in the clinic	Education from a midwife or health worker prompts me to practice LBP prevention behaviors. Observing other

	(social modeling) from peer pregnant women (11,23,24,28).	exercising motivated me to take my back care seriously."	pregnant women practicing correct behaviors reminds me to take care of my back.

Psychometric Evaluation

The psychometric properties of the PLBP-Q were evaluated through face, content, and construct validity, alongside reliability testing.

Face Validity

To evaluate face validity, we combined qualitative and quantitative methods. Qualitatively, a purposive expert panel of 10 specialists (comprising 4 in reproductive health, 3 in health promotion/education, and 3 in physical therapy, each with a minimum of 8 years of academic/clinical experience; response rate of 100%), along with a pilot group of 15 pregnant women, reviewed the draft for clarity, simplicity, and relevance. Based on their feedback, we refined item phrasing and operationalized technical terms (e.g., changing "principles of lifting" to "bending the knees and keeping the back straight while lifting"). Quantitatively, a separate sample of 30 pregnant women rated item importance on a 5-point Likert scale. We calculated the Item Impact Score as:

$$\boldsymbol{Impact\ Score} = \boldsymbol{Frequency}(\%) \times \boldsymbol{Importance}$$

where Frequency is the percentage of participants rating the item as 4 or 5, and Importance is the mean score. Items with an impact score of 1.5 or higher were retained.

Content Validity

The same 10-member expert panel evaluated quantitative content validity.

Content Validity Ratio (CVR): To assess item essentiality, experts rated each item as "essential," "useful but not essential," or "not essential." CVR was calculated using Lawshe's formula, with items achieving a score of 0.62 or higher retained.

Content Validity Index (CVI): Experts rated item simplicity, relevance, and clarity on a 4-point scale. The Item-level CVI (I-CVI) was calculated as the proportion of ratings of 3 or 4, which were then averaged to obtain the overall Scale-level CVI (S-CVI/Ave). The minimum acceptable thresholds were 0.78 for I-CVI and 0.90 for S-CVI/Ave.

Construct Validity and Factor Analysis

To verify data suitability for factor analysis, we used the Kaiser-Meyer-Olkin (KMO) measure (threshold of 0.70 or higher) and Bartlett's Test of Sphericity ($p < 0.05$). We performed factor extraction using Principal Axis Factoring with Promax oblique rotation to accommodate the expected correlations among HBM constructs. Factors were retained based on a combination of eigenvalues above 1.0, visual inspection of Cattell's scree plot, and substantive theoretical cohesion with HBM constructs. Items were kept if they met three conditions: a primary factor loading of 0.40 or higher, though values between 0.30 and 0.40 were exceptionally accepted for items with strong theoretical relevance (29); a communality value (h2) of 0.30 or higher; and a minimum loading-difference margin of 0.15 or higher to resolve any cross-loadings. Given the exploratory nature of EFA, this derived factor structure was considered preliminary and hypothesis-generating, warranting future verification through Confirmatory Factor Analysis (CFA) in an independent sample.

Discriminant Validity and Score Distribution

Discriminant validity was evaluated using Pearson correlation analysis, with inter-construct correlations below 0.70 indicating adequate distinctiveness. Additionally, floor and ceiling effects were considered present if more than 15% of respondents scored at the minimum or maximum possible score.

Reliability Assessment

Internal consistency of the PLBP-Q and its subscales was assessed using Cronbach's alpha and McDonald's omega, with values of 0.70 or above indicating acceptable reliability. Temporal stability was evaluated via test–retest reliability; 30 participants completed the questionnaire twice over a two-week interval, and intraclass correlation coefficients (ICC) based on a two-way random-effects model with absolute agreement, along with their 95% confidence intervals (CI), were calculated for each construct.

Instrument

The questionnaire consists of two primary sections:

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(a) Demographic and Obstetric Characteristics: This section gathers background information, including maternal age, pregnancy-related trimester, number of pregnancies, current back pain status , educational level, employment status, financial status, exercise level, and dietary supplement intake.
(b) PLBP-Q: The primary objective of this section is to assess health beliefs related to LBP prevention among pregnant women based on the theoretical constructs of the HBM. The final version of the questionnaire consists of 29 items across six subscales: Perceived Susceptibility (4 items), Perceived Severity (5 items), Perceived Benefits (5 items), Perceived Barriers (4 items), self-efficacy (5 items), and Cues to Action (6 items). Responses to the PLBP-Q items are measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each item is scored numerically, and subscale aggregate scores are calculated by summing the item values—yielding possible score ranges of 4–20 for perceived susceptibility and perceived barriers, 5–25 for perceived severity, perceived benefits, and self-efficacy, and 6–30 for cues to action, with a total scale score ranging from 29 to 145. Higher scores indicate greater levels of the respective HBM construct.

Statistical Analysis

Statistical analyses were conducted using SPSS version 23.0 and JASP. Prior to analysis, data were screened for completeness. Questionnaires with missing data were evaluated, and only cases with complete responses across all subscales were retained for the final psychometric evaluation. Descriptive statistics, including frequencies and percentages for categorical variables, as well as means and standard deviations for continuous variables, were calculated to summarize the demographic and clinical characteristics of the participants. The level of statistical significance for all inferential tests was set at $p < 0.05$.

Use of AI: Google's Gemini 3.5 Flash was used solely to improve the language, readability, and grammatical structure of specific sections. The authors reviewed and edited all outputs and take full responsibility for the manuscript's content.

Findings

Demographic Characteristics of the Participants

Table 2 outlines the participants' profiles (mean age: 35 ± 3.8 years). The cohort was mostly comprised of homemakers (83.0%) in their second trimester (47.2%), with a high prevalence of active low back pain (55.3%), low physical activity (83.3%), and supplement intake (96.5%).

Subscale scores are presented as raw sums, together with item-level means to allow comparison across subscales of different lengths. Cues to Action had the highest item-level mean (3.92; raw score 23.54 ± 3.30; theoretical range 6–30; observed 12–30), followed by Perceived Benefits (3.86; 19.31 ± 2.58; theoretical 5–25; observed 11–25), Perceived Severity (3.59; 17.93 ± 3.54; theoretical 5–25; observed 5–25), Perceived Susceptibility (3.56; 14.25 ± 2.50; theoretical 4–20; observed 4–20), and self-efficacy (3.51; 17.57 ± 2.79; theoretical 5–25; observed 9–25). Perceived Barriers had the lowest item-level mean (3.12; 12.48 ± 2.59; theoretical 4–20; observed 4–20). These scores reflect participants' health beliefs about low back pain prevention within the HBM framework and do not measure actual preventive behavior.

Table 2. Demographic Characteristics of the Participants (N=282)

Demographic Characteristics	*Category*	*Frequency (n)*	*Percentage (%)*
Trimester	First Trimester	42	14.9
	Second Trimester	133	47.2
	Third Trimester	107	37.9
Education Level	Primary/Middle School	137	48.6
	High School/Diploma	80	28.4
	University Degree	65	23
Employment Status	Employed	48	17
	Homemaker/Unemployed	234	83
Financial Status	Poor	102	36.2
	Moderate	141	50
	Good	39	13.8
Number of Pregnancies	1 (First pregnancy)	89	31.6
	2	90	31.9
	3 or more	103	36.5
Current Back Pain	Yes	156	55.3
	No	126	44.7
Exercise Level	Low/No Exercise	235	83.3
	Moderate	41	14.5
	High/Regular	6	2.1

Supplement Intake	Yes	272	96.5
	No	10	3.5
		Mean	SD
	Age (Years)	35	3.8

Face Validity

During qualitative face validity, we refined the items based on feedback from experts and pilot-test participants to enhance clarity. Key modifications included making the Perceived Barriers subscale more objective by removing subjective phrasing (e.g., "I feel that…") and replacing abstract terms with specific behaviors (e.g., changing "principles of lifting" to "bending the knees and keeping the back straight"). Additionally, information sources were specified as "midwives or community health workers (Behvarz)" in the Cues to Action subscale, and the item regarding personal experience of back pain was relocated from Perceived Severity to Cues to Action based on expert consensus. Quantitatively, all 37 initial items achieved an impact score above 1.5 and were retained, as illustrated in Figure 2.

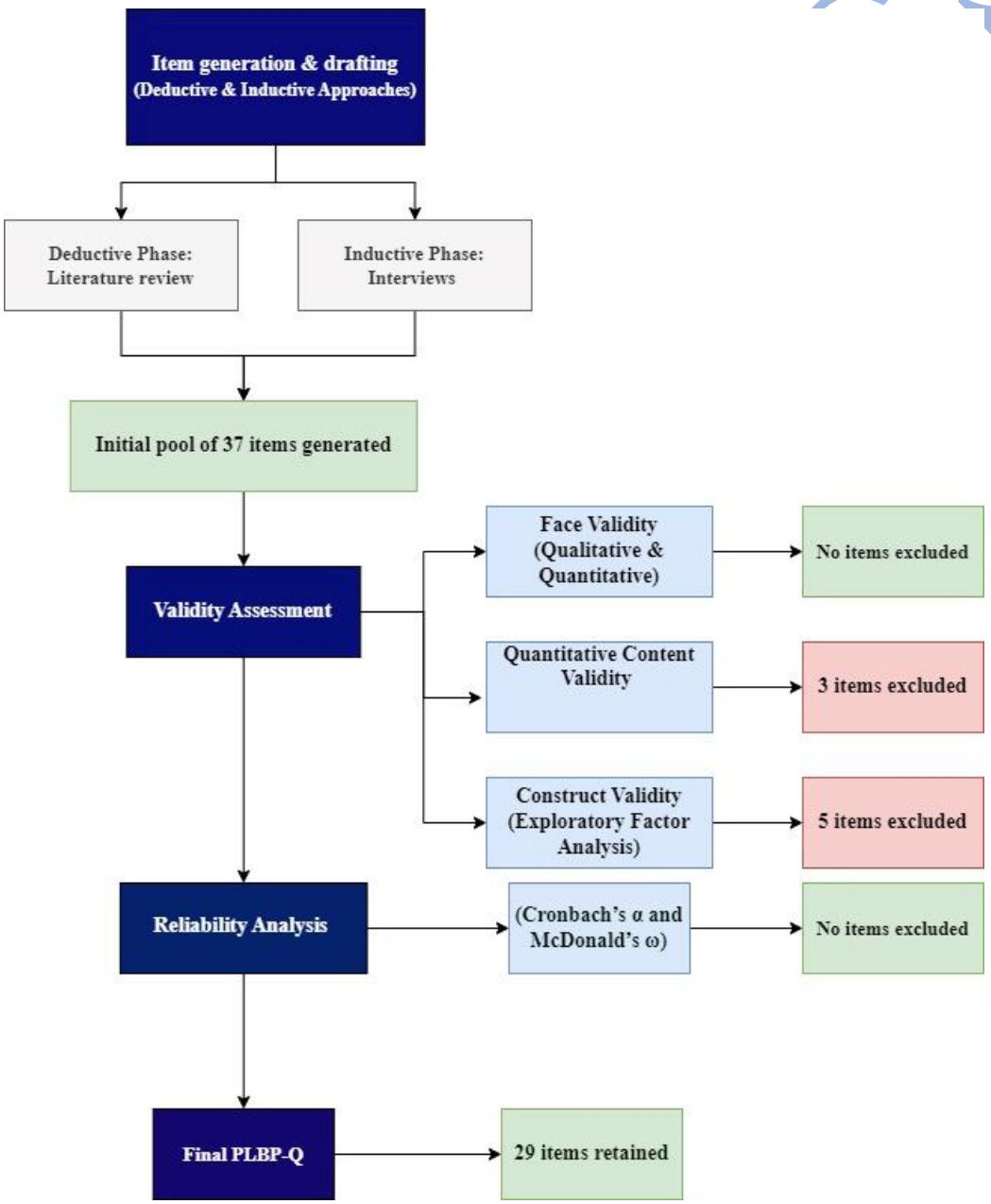


Figure 2. Flowchart of the development and psychometric validation of the PLBP-Q

Content Validity

Out of 37 items, 34 met the minimum CVR threshold of 0.62 and were retained. Three items were excluded: two from Perceived Susceptibility and one from self-efficacy. Across the subscales, the mean CVR values were 0.74 for Perceived Susceptibility, 0.83 for Perceived Severity, 0.88 for Perceived Benefits, 0.85 for Perceived Barriers, 0.86 for self-efficacy, and 0.84 for Cues to Action. Regarding the Content Validity Index, the I-CVI values for the retained items ranged from 0.80 to 1.00, meeting the acceptable threshold of 0.78 for a 10-expert panel. The overall scale-level content validity index (S-CVI/Ave) was 0.94, exceeding the recommended threshold of 0.90, and the S-CVI values across the subscales ranged from 0.88 to 0.96, indicating strong content validity.

Construct Validity: Exploratory Factor Analysis (EFA)

Data suitability was supported by a KMO value of 0.863 and Bartlett's test of sphericity ($\chi^2(561) = 4917.87$, $p < 0.001$). The EFA of the 34 items yielded a six-factor structure explaining 52.65% of the total variance, which aligned with the scree plot (Figure 3). Five items were excluded due to cross-loadings or communalities below 0.30: one item each from perceived susceptibility (item 5), perceived severity (item 1), and self-efficacy (item 6), alongside two items from perceived barriers (items 1 and 2). The final 29-item questionnaire (Table 3) exhibited factor loadings ranging from 0.338 to 0.898, communalities from 0.306 to 0.757, and corrected item-total correlations from 0.418 to 0.814.

Table 3. Factor Loadings (Pattern Matrix) and Communalities (h^2) Organized by HBM Constructs

Factor	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality h^2	CITC
F6	I feel there is a high chance that I will develop low back pain during my pregnancy.	-0.004	0.178	0.015	-0.131	0.014	**0.566**	0.481	0.565
	Due to weight gain and postural changes in pregnancy, I might experience low back pain.	0.021	0.175	-0.077	-0.133	0.041	**0.668**	0.586	0.622
	If I do not maintain proper posture during daily activities, my risk of low back pain increases.	0.091	-0.007	0.089	-0.076	-0.073	**0.775**	0.635	0.647
	If I do not follow the prevention recommendations for back pain during pregnancy, I will likely experience low back pain.	-0.021	0.110	0.113	0.073	-0.125	**0.695**	0.624	0.590
F2	If I develop low back pain, my daily comfort and peace of mind will be disrupted.	-0.050	**0.838**	-0.098	0.074	-0.017	0.030	0.641	0.753
	Low back pain can limit my physical activity.	0.053	**0.835**	-0.050	-0.011	0.012	0.094	0.757	0.814
	Low back pain can make me dependent on others to perform my tasks.	0.112	**0.842**	-0.089	-0.078	0.095	-0.016	0.706	0.786
	Low back pain during pregnancy can be a significant problem for me.	-0.064	**0.675**	0.099	0.021	0.140	0.054	0.661	0.759
	Low back pain during pregnancy can deprive me of comfortable and restful sleep.	-0.066	**0.628**	0.048	0.053	0.049	0.140	0.570	0.714
F3	Performing light physical activity can prevent low back pain during pregnancy.	-0.047	0.170	**0.338**	0.187	-0.175	0.140	0.406	0.552
	Maintaining proper posture helps reduce low back pain.	-0.039	0.111	**0.489**	0.152	-0.193	0.231	0.505	0.653
	Proper lifting techniques (bending knees and keeping the back straight) can prevent low back pain.	0.007	-0.054	**0.843**	0.080	0.033	-0.053	0.692	0.744

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	Avoiding rapid movements or sudden twisting of the waist reduces pressure on the spine.	-0.072	-0.065	**0.898**	-0.005	-0.014	0.020	0.717	0.736
	Taking care of my back makes me feel more comfortable during pregnancy.	0.020	-0.078	**0.736**	0.029	0.060	0.026	0.534	0.639
F5	Since I have not received adequate education, it is difficult for me to maintain proper body posture.	0.036	-0.102	0.011	-0.037	**0.573**	0.030	0.306	0.418
	I am worried that performing physical activity might harm the fetus.	-0.095	0.070	0.021	0.064	**0.664**	-0.171	0.442	0.539
	Daily busy schedules make it difficult for me to perform back-care practices.	0.004	0.247	-0.008	0.050	**0.606**	-0.029	0.512	0.577
	Due to my physical condition in pregnancy, I cannot perform back-care behaviors.	0.002	0.177	-0.097	0.055	**0.647**	-0.019	0.501	0.598
F4	I can perform light physical activity even when I am tired.	-0.057	0.059	0.055	**0.516**	0.084	-0.071	0.374	0.427
	I can maintain proper posture most of the time.	0.066	-0.004	0.050	**0.684**	0.122	-0.024	0.557	0.663
	I can follow proper principles when lifting objects.	-0.005	-0.002	0.034	**0.788**	-0.036	-0.074	0.632	0.695
	I can avoid movements that cause low back pain.	0.138	0.044	0.045	**0.643**	-0.096	-0.109	0.544	0.670
	I can take care of my back despite the conditions and changes of pregnancy.	0.101	0.054	0.130	**0.629**	-0.018	-0.097	0.537	0.654
F1	Recommendations from a health worker, midwife, or doctor encourage me to take care of my back.	**0.763**	0.137	-0.042	-0.003	-0.044	-0.107	0.581	0.676
	Education from a midwife or health worker prompts me to practice low back pain prevention behaviors.	**0.745**	0.145	-0.003	0.073	-0.112	-0.051	0.641	0.727
	Experiencing back pain encourages me to take better care of my back.	**0.562**	-0.228	-0.071	0.082	0.175	0.139	0.388	0.519
	Seeing educational materials or content related to the back from any source draws my attention to my back health.	**0.827**	-0.089	0.002	0.039	0.023	0.086	0.718	0.772
	Observing other pregnant women practicing correct behaviors reminds me to take care of my back.	**0.872**	-0.037	0.028	-0.087	0.052	0.044	0.719	0.791
	Recommendations from my spouse or family encourage me to maintain proper posture.	**0.771**	0.016	-0.023	0.019	-0.017	0.027	0.599	0.709
Eigenvalue		7.314	4.709	2.062	1.633	1.184	1.002		
% of Var.		21.51 %	13.85 %	6.06%	4.80%	3.48%	2.94%		
Cumul. %		21.51 %	35.36 %	41.43 %	46.23 %	49.71 %	52.65 %		
Note. N = 282. Principal Axis Factoring with Promax rotation (Kaiser normalization). Primary loadings are bolded. h^2 = communality; CITC = corrected item–total correlation. F1 = Cues to Action; F2 = Perceived Severity; F3 = Perceived Benefits; F4 = Self-Efficacy; F5 = Perceived Barriers; F6 = Perceived Susceptibility.									

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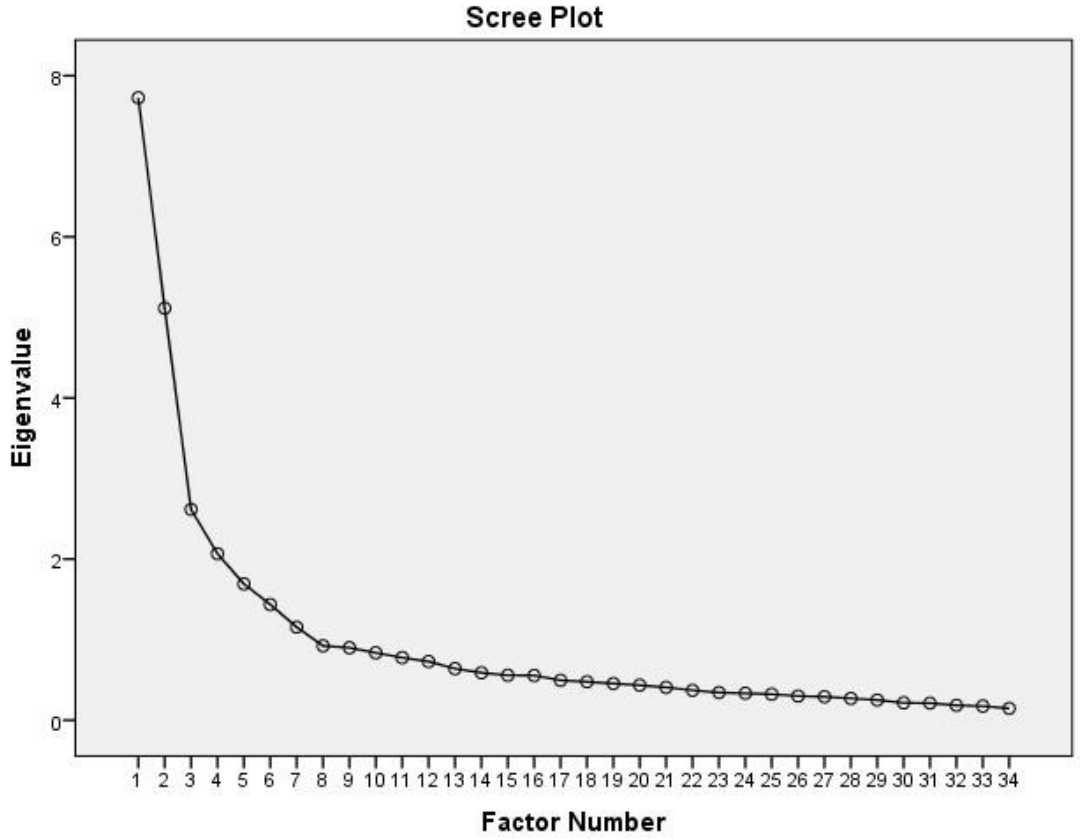


Figure 3. Scree plot of the exploratory factor analysis of PLBP-Q.

Reliability and Inter-Construct Relationships

All subscales demonstrated acceptable internal consistency, with Cronbach's alpha and McDonald's omega ranging from 0.736 to 0.906. Test-retest reliability was assessed among 30 participants. ICC values indicated moderate to excellent temporal stability across all subscales, ranging from 0.83 (self-efficacy; 95% CI: 0.67–0.92) to 0.91 (Cues to Action; 95% CI: 0.82–0.96), with Perceived Susceptibility (ICC = 0.87; 95% CI: 0.75–0.94), Perceived Severity (ICC = 0.88; 95% CI: 0.76–0.94), Perceived Benefits (ICC = 0.90; 95% CI: 0.80–0.95), and Perceived Barriers (ICC = 0.85; 95% CI: 0.71–0.93) falling between these bounds. Based on the 95% confidence intervals and the benchmarks of Koo and Li, reliability ranged from moderate to excellent; the lowest bound was observed for self-efficacy (30). All dimensions met normality criteria (skewness and kurtosis within ±1) with floor and ceiling effects below 10% for all subscales. Inter-construct Pearson correlations were weak-to-moderate (r range: −0.136 to 0.504), all below the 0.70 threshold, suggesting that the subscales capture related but distinct constructs (Table 4).

Table 4. Inter-Construct Correlations and Reliability of the PLBP-Q

Construct	*1*	*2*	*3*	*4*	*5*	*6*	*α*	*ω*	*Skewness*	*Kurtosis*
1. Perceived Susceptibility	1						0.837	0.838	0.03	0.03
2. Perceived Severity	0.504**	1					0.906	0.906	-0.38	0.73
3. Perceived Benefits	0.413**	0.419**	1				0.850	0.853	0.11	0.29
4. Perceived Barriers	0.234**	0.476**	0.206**	1			0.736	0.740	0.28	0.73
5. Self-Efficacy	-0.136*	0.018	0.324**	-0.020	1		0.822	0.827	-0.22	-0.08

6. Cues to Action	0.036	0.045	0.308**	0.055	0.402**	1	0.883	0.884	0.06	0.33

*Note. *p < 0.05; **p < 0.01. α = Cronbach's alpha; ω = McDonald's omega.*

Discussion

This study aimed to design and psychometrically evaluate the PLBP-Q based on the constructs of the HBM among pregnant women. To our knowledge, this is the first instrument based on the HBM to assess health beliefs related to LBP prevention during pregnancy. The findings support a six-factor structure comprising twenty-nine items, demonstrating acceptable face and content validity, with preliminary structural evidence from exploratory factor analysis, alongside satisfactory reliability. Overall, the results suggest that the PLBP-Q has the potential to help address the limited availability of standardized instruments for assessing health beliefs related to LBP prevention in this population.

The subscale pattern suggests that external cues were among the most highly endorsed components, whereas personal risk appraisal was rated at a moderate level. The strong endorsement of Cues to Action may reflect the routine role of midwives and health workers in antenatal care, where advice and reminders are repeated at each visit (23,24). In contrast, perceived susceptibility was rated in a similar range to perceived severity, which suggests that women may recognize the risk of back pain without viewing it as a personal threat. Earlier studies have linked gestational low back pain to sedentary behavior, prolonged standing, and reduced physical activity, and have also emphasized the role of cognitive beliefs and fear-related appraisals (31). Accordingly, antenatal counseling that addresses fear of harming the fetus and gaps in knowledge about posture may be a practical target for intervention (32).

During the initial phase, the item addressing personal experience of back pain was reallocated from Perceived Severity to Cues to Action based on expert feedback, as pain history was considered to serve more as an internal trigger for preventive behavior than an assessment of severity. This qualitative decision was supported by the exploratory factor analysis, in which the item loaded adequately onto the Cues to Action factor and was retained in the final instrument. This corresponds with previous literature suggesting that prior symptom experiences can function as actionable cues in health belief frameworks (33).

The exploratory factor analysis supported a six-factor structure for the PLBP-Q, providing preliminary evidence of structural validity and showing clear conceptual alignment with the core dimensions of the HBM. This pattern is consistent with previous HBM-based validation studies, which have similarly shown that theoretically related health beliefs can emerge as distinct but interconnected cognitive domains (28). At the same time, the removal of five items improved the scale's psychometric quality, as items with low communality or weak factor loadings are unlikely to represent a single latent construct with sufficient precision (29). Two items from the Perceived Barriers subscale were excluded because they cross-loaded on the Perceived Benefits factor. In HBM scale development, benefits and barriers are conceptually closely related to the target behavior; items that lack clear behavioral specificity often fail to distinguish between the two and load on both factors (34). Similar removals of non-specific cross-loading items have been reported in HBM-based studies: removing non-specific cross-loading items yielded distinct factor structures in breast cancer screening (27), cervical cancer screening (35), COVID-19 protective practices (36), and disaster preparedness instruments (37). The retained items loaded primarily on their intended factors.

The PLBP-Q demonstrated acceptable to high internal consistency across subscales, with both Cronbach's alpha and McDonald's omega exceeding commonly accepted thresholds and highest reliability observed for perceived Severity. These findings generally align with previous HBM validations and were comparable to or higher than earlier reports in some domains (27). Reporting both alpha and omega strengthens the psychometric evidence because omega yields a more realistic estimate when item loadings vary, whereas alpha can be biased by the tau-equivalence assumption (38). Inter-construct correlations were low to moderate, the largest occurring between perceived susceptibility and perceived severity, and none approached levels typically associated with multicollinearity. By contrast, instruments that show very high inter-dimensional correlations have raised concerns about construct redundancy (39). These findings support the distinctness of the subscales.

Implications

The PLBP-Q is designed to assess beliefs that may hinder effective prevention of pregnancy-related low back pain, which could help clinicians move from generic advice toward more targeted counseling. This may allow antenatal education to focus on the beliefs most relevant to each woman as identified through assessment and to use midwives and other health workers intentionally as cues to action. The instrument also supports development of prevention programs that pair belief-focused education with practical

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measures (for example, safe movement, posture, and daily self-care). By assessing belief-related barriers, the PLBP-Q may support the alignment of counseling strategies with routine maternal care. Further studies are needed to examine whether PLBP-Q scores are related to actual preventive behaviors.

Strengths and limitations

One major strength of this study is the use of a HBM-based item development based on the HBM, which provided a clear conceptual basis for item development and interpretation. Another strength is the systematic evaluation of face and content validity across both qualitative and quantitative phases, which helped ensure that the PLBP-Q was relevant, clear, and contextually appropriate. In addition, reliability was assessed using both Cronbach's alpha and McDonald's omega, allowing a more robust evaluation of internal consistency than reliance on a single coefficient alone. Although the study utilized a cross-sectional design, acceptable temporal stability was demonstrated through test–retest reliability analysis.

The study also has several limitations. Participants were recruited from comprehensive health centers across Galikesh, Iran, using convenience sampling, which introduces the possibility of selection bias. Because recruitment was restricted to a single geographic district, the findings may not be fully generalizable to pregnant women in other provinces, rural areas, or culturally diverse regions of the country. The reliance on self-report data may further have introduced social desirability bias, as participants may have responded in ways they perceived as favorable rather than accurately reflecting their actual beliefs and practices.

Beyond sampling, the PLBP-Q has not yet been evaluated for criterion or convergent validity, as no comparable Persian-language HBM-based instrument was available for this construct. Additionally, measurement invariance across clinically and demographically relevant subgroups — such as women with and without active back pain, across different trimesters, or varying levels of physical activity — was not examined, and it therefore remains unclear whether the factor structure holds equally across these groups.

The main limitation, however, is the absence of confirmatory factor analysis to cross-validate the factor structure identified through exploratory analysis. No independent sample was available for CFA; therefore, the factor structure should be considered preliminary. Although the exploratory factor analysis produced a preliminary, interpretable structure, further studies in larger, multi-regional, and more diverse national samples are needed to confirm the factor structure, assess measurement invariance across subgroups, and establish the external validity of the PLBP-Q beyond the current Iranian sample.

Conclusion

In conclusion, this study provides preliminary psychometric evidence that the PLBP-Q is a reliable instrument for measuring health beliefs regarding LBP prevention in Iranian pregnant women. Building on its exploratory six-factor structure, the study provides a theoretically grounded tool to evaluate the key cognitive dimensions that are theorized to influence preventive behavior during pregnancy. While longitudinal research is warranted to fully assess the scale's predictive capacity on long-term behavioral change, the current version of the PLBP-Q offers a structured and practical framework to support both research and routine maternal care assessment.

List of abbreviations

CVI: Content Validity Index; CVR: Content Validity Ratio; EFA: Exploratory factor analysis; HBM: The Health Belief Model; ICC: Intraclass correlation coefficients; LBP: Low back pain; PLBP-Q: Pregnancy Low Back Pain Prevention Questionnaire.

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Ethical Permissions: This study received ethical clearance from the Human Research Ethics Committee of Golestan University of Medical Sciences (Protocol Code: IR.GOUMS.REC.1404.073). Prior to enrollment, all participants provided written informed consent. To protect respondent privacy, strict confidentiality and anonymity were maintained throughout the study.

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