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Postpartum Perceptions of First-Trimester Information on Physical Exercise and Low Back Pain, Pain Incidence, and Healthcare-Seeking Among Physically Active Pregnant Women

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Abstract

Although educational interventions for pregnancy-related low back pain (PLBP) have previously been investigated, little is known about physically active women's postpartum perceptions of written information or whether these perceptions align with physical activity (PA), PLBP, and healthcare-seeking. This prospective cohort study assessed postpartum perceptions of information provided during the first trimester and their associations with PA, PLBP, and primary care consultation. The cohort included 147 pregnant women who met a prespecified operational PA criterion of ≥600 MET·min/week both before and during pregnancy, with PA assessed using the short form of the International Physical Activity Questionnaire (IPAQ). This threshold was operationally derived from World Health Organization recommendations on PA during pregnancy. At first-trimester recruitment, all participants received comprehensive written information on PA during pregnancy and strategies to prevent or alleviate PLBP. Perceptions were assessed within the first month postpartum. Overall, 97.3% perceived the information as useful, and 90.5% reported a positive influence on their motivation to remain active. PLBP developed in 64.6% of participants, with no significant differences in perceived usefulness or motivational influence between women with and without PLBP. Motivational influence was not associated with PA levels or changes during pregnancy. Among participants who developed PLBP, 44.2% consulted primary care; consultation was not associated with perceived usefulness, motivational influence, or PA. Maximum pain intensity was not associated with motivational influence, whereas PLBP affecting more than one trimester was associated with the absence of a perceived positive motivational influence after adjustment (adjusted OR 6.02; 95% CI 1.66–24.99). Thus, favorable perceptions of the information coexisted with a high incidence of PLBP and a low primary care consultation rate, indicating that perceived usefulness and motivation were not necessarily reflected in PA levels or changes, pain experience, or healthcare-seeking.

Keywords: pregnancy-related low back pain; physical activity; physical exercise during pregnancy; written health information; healthcare-seeking behavior; primary care

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1. Introduction

Pregnancy-related low back pain (PLBP) is one of the most common musculoskeletal complaints during pregnancy and can affect women with no previous history of low back pain [1,2]. PLBP affects a substantial proportion of pregnant women. Although its pooled global prevalence has been estimated at 40.5%, rates exceeding 80% have been reported in certain populations and at specific stages of pregnancy. This wide variation may reflect differences in gestational age, the characteristics of the populations examined, the definition of pain, and the methods used to identify it [3,4]. The distribution of PLBP is not uniform throughout pregnancy: pooled estimates increase progressively from the first trimester and reach their highest level during the third trimester [3–5]. Beyond its frequency, pain intensity and the associated functional limitations may vary across gestational periods and become more clinically relevant as pregnancy progresses [6]. The development of PLBP has been associated with a history of low back pain, obstetric factors, and certain postural, occupational, and lifestyle-related conditions, reflecting the multifactorial nature of this condition [7,8].

The clinical importance of PLBP extends beyond its frequency and intensity, as it can interfere with sleep, mobility, daily activities, and women's overall functioning during pregnancy [1,4]. Its consequences may affect functional independence, emotional well-being, and quality of life, although their magnitude varies considerably among women and across different social and healthcare settings [7,9]. Functional limitations and the need to interrupt or modify occupational activity tend to increase with pain intensity, particularly when PLBP has a greater effect on daily functioning [10,11]. The high frequency of sick leave during pregnancy and the contribution of musculoskeletal disorders to prolonged work absence further emphasize the occupational and socioeconomic burden of PLBP [12].

Despite these consequences, a substantial proportion of women with PLBP do not report their symptoms or receive specific clinical assessment or treatment [1,13]. Perceiving pain as a normal or inevitable consequence of pregnancy may lower expectations of improvement and constitute a barrier to seeking professional care [14]. Underreporting has also been documented among physically active pregnant women. In this population, fewer than half of those who developed PLBP sought professional care for their symptoms, despite some experiencing functional, emotional, or occupational consequences [5]. For some women, symptoms persist after delivery and continue to affect their health and daily functioning [15].

PLBP may also make it more difficult for women to maintain physical activity (PA) during pregnancy, particularly when they have concerns about physical exercise (PE) safety or fear that activity could exacerbate their symptoms [13,14]. A potential reduction in PA is clinically relevant because insufficient activity during pregnancy has been associated with an increased risk of hypertensive disorders, including gestational hypertension and preeclampsia, as well as a higher likelihood of cesarean delivery [16–18]. Regular PA is therefore an essential component of care during pregnancy. In the absence of contraindications, international recommendations advise pregnant women to undertake at least 150 min of moderate-intensity aerobic PA per week and to incorporate muscle-strengthening activities [19–21]. In addition to its broader maternal health benefits, PE is considered an important nonpharmacological strategy for managing PLBP and reducing its intensity, particularly given the limitations of pharmacological treatment during pregnancy [13].

Pooled evidence indicates that PE performed during pregnancy may reduce the intensity of low back, pelvic girdle, or lumbopelvic pain; however, its effects on the occurrence of new episodes are less consistent [22]. More specifically, PE during pregnancy has been associated with a modest reduction in the risk of developing low back pain and in related sick leave, although a comparable preventive effect has not been demonstrated for pelvic girdle pain [23]. The observed effects may also depend on intervention characteristics, including PE modality and frequency, the degree of supervision, and adherence. Some low-impact

modalities, such as aquatic PE, have been associated with reductions in pain intensity and sick leave, although they do not completely prevent the occurrence of PLBP [24]. These recommendations and findings support the incorporation of PE into care during pregnancy. Nevertheless, the variability in its observed effects highlights the need to consider not only the content of PE recommendations but also how the information is communicated, how pregnant women interpret it, and the extent to which they apply it in practice. These aspects have received comparatively limited attention.

Although educational interventions for PLBP have previously been investigated, their content, delivery, and reported effects have varied considerably. An educational approach incorporating anatomical and postural information, ergonomic advice, and PE did not reduce pain occurrence, although improvements were reported in selected pain-related outcomes [25]. Written and illustrated information combined with personal advice has been associated with a lower incidence of PLBP, although methodological limitations preclude firm conclusions regarding its preventive effectiveness [26]. Educational content has also been incorporated into a multicomponent program involving home PE, activity monitoring, and regular telephone support; however, the design did not allow the independent effect of education to be determined [27].

Continued professional support and the inclusion of active strategies may influence the effects of educational interventions. Telephone-supported ergonomic education has been associated with greater reductions in pain and functional limitations than a single educational session [28], while PE combined with education may reduce pain and related functional limitations more effectively than education alone [29]. Nevertheless, the available evidence predominantly concerns women with established low back, pelvic girdle, or lumbopelvic pain, thereby limiting conclusions regarding the prevention of PLBP specifically.

Beyond their heterogeneous clinical effects, educational interventions have predominantly focused on anatomy, biomechanics, posture, and ergonomics, with less attention given to psychological and social factors that may shape pain beliefs, confidence in movement, and responses to education. Previous studies have also rarely examined how pregnant women perceive the information provided, which elements they consider helpful, or how they subsequently apply the recommendations [30]. The relevance of information may extend beyond pain reduction to motivation, self-management, engagement in PA, and healthcare-seeking. However, perceiving information as useful or motivating does not necessarily mean that women will change their behavior. This distinction may be particularly relevant when PLBP is perceived as an expected consequence of pregnancy, potentially discouraging women from seeking professional care [14].

The applicability of the available evidence to physically active pregnant women remains uncertain. Women who accumulated at least 600 metabolic equivalent of task minutes per week (MET·min/week) both before and during pregnancy, thereby meeting the prespecified operational PA criterion used in this study, form a distinct population, and findings from more heterogeneous obstetric samples may not be directly applicable to them. The available review identified no studies specifically examining how women meeting this criterion perceived educational information or whether their perceptions were associated with PA during pregnancy, PLBP, or healthcare-seeking [30].

To the best of our knowledge, no previous study has jointly examined postpartum perceptions of first-trimester information on PE and PLBP, the incidence of PLBP, and primary care consultation in a cohort composed exclusively of physically active pregnant women. Therefore, this study aimed to assess women's retrospective perceptions of the usefulness and motivational influence of information provided during the first trimester on PE during pregnancy and strategies to prevent or alleviate PLBP. It also examined whether these perceptions were associated with PA during pregnancy, the occurrence of PLBP, and primary care consultation.

2. Results

2.1. Study Population Characteristics

A total of 147 physically active pregnant women were included in the study. Their mean maternal age was 34.1 ± 4.0 years, most had a university education, and approximately two-thirds were primiparous. Mean physical activity was 2101.29 ± 1468.98 MET·min/week before pregnancy and 1896.71 ± 1012.05 MET·min/week during pregnancy. PE was maintained, on average, until gestational week 37.12 ± 4.33 (Table 1).

Table 1. Characteristics of the Study Participants.

Variable	Total (n = 147)
Maternal age (years)	34.1 ± 4.0
University education	136 (92.5)
Primiparous	98 (66.7)
Prepregnancy BMI (kg/m^2)	23.3 ± 3.4
Prepregnancy physical activity (MET·min/week)	2101.29 ± 1468.98
Physical activity during pregnancy (MET·min/week)	1896.71 ± 1012.05
Gestational week until which physical exercise was maintained	37.12 ± 4.33

Data are presented as mean ± standard deviation or n (%). BMI: body mass index; MET: metabolic equivalent of task.

2.2. Postpartum Perceptions of First-Trimester Information According to PLBP Occurrence

During pregnancy, 95 of the 147 participants (64.6%) developed PLBP, whereas 52 (35.4%) did not. At the postpartum assessment, 97.3% of participants perceived the information provided during the first trimester as useful, and 90.5% reported that it had positively influenced their motivation to engage in PE during pregnancy to prevent or alleviate PLBP. The perceived usefulness of the information was similarly high among women with and without PLBP (96.8% vs. 98.1%, respectively; $p = 1.000$). Although a positive motivational influence was reported less frequently among women who developed PLBP than among those who did not (87.4% vs. 96.2%), this difference was not statistically significant ($p = 0.139$) (Table 2).

Table 2. Postpartum Perceptions of Information on Physical Exercise and Low Back Pain Provided during the First Trimester, According to the Occurrence of Low Back Pain During Pregnancy.

Postpartum Perception of First-Trimester Information	With PLBP (n = 95)	Without PLBP (n = 52)	Total (n = 147)	*p* Value
Information perceived as useful				1.000
Yes	92 (96.8)	51 (98.1)	143 (97.3)	
No	3 (3.2)	1 (1.9)	4 (2.7)	
Perceived positive influence on motivation to physical exercise during pregnancy to prevent or alleviate PLBP				0.139
Yes	83 (87.4)	50 (96.2)	133 (90.5)	
No	12 (12.6)	2 (3.8)	14 (9.5)	

Data are presented as n (%). PLBP: pregnancy-related low back pain.

A sensitivity analysis including the 10 women excluded for not meeting the PA criterion during pregnancy yielded similar findings. Perceived usefulness was reported by 153 of

157 women (97.5%), compared with 143 of 147 (97.3%) in the main analytical sample. A positive motivational influence was reported by 142 of 157 women (90.4%), compared with 133 of 147 (90.5%) in the main analytical sample.

2.3. Physical Activity According to Perceived Motivational Influence

PA levels before and during pregnancy did not differ significantly according to the perceived motivational influence of the information ($p = 0.231$ and $p = 0.325$, respectively). Similarly, no between-group difference was observed in the absolute change in physical activity between the two periods ($p = 0.913$). PA was maintained or increased by 51.9% of women who reported a positive motivational influence and by 50.0% of those who did not ($p = 1.000$) (Table 3).

Table 3. Physical Activity Before and During Pregnancy According to the Postpartum-Reported Motivational Influence of First-Trimester Information on Physical Exercise and Low Back Pain.

Physical Activity	Positive Influence (n = 133)	No Positive Influence (n = 14)	Total (n = 147)	*p* Value
Before pregnancy, MET·min/week	1782.0 (1074.0–2598.0)	2049.0 (1506.0–2772.8)	1866.0 (1079.8–2613.0)	0.231
During pregnancy, MET·min/week	1728.0 (1215.0–2310.0)	2016.0 (1424.3–2657.0)	1746.0 (1215.0–2366.0)	0.325
Absolute change *, MET·min/week	0.0 (−643.5 to 573.0)	117.5 (−1387.9 to 483.8)	0.0 (−654.8 to 556.5)	0.913
Change in physical activity				1.000
Maintained or increased	69 (51.9)	7 (50.0)	76 (51.7)	
Decreased	64 (48.1)	7 (50.0)	71 (48.3)	

Data are presented as median (interquartile range) or n (%). MET: metabolic equivalent of task. *Calculated as physical activity during pregnancy minus physical activity before pregnancy; negative values indicate a reduction.

2.4. Primary Care Consultation Among Women with PLBP

Among the 95 women who developed PLBP during pregnancy, 42 (44.2%) consulted a primary care physician, whereas 53 (55.8%) did not. The perceived usefulness of the information did not differ significantly between women who consulted and those who did not (92.9% vs. 100.0%; $p = 0.083$). Likewise, no significant differences were found in its perceived positive influence on motivation to engage in PE (81.0% vs. 92.5%; $p = 0.124$) or in physical activity during pregnancy ($p = 0.621$) (Table 4).

Table 4. Postpartum Perceptions of First-Trimester Information and Primary Care Consultation among Women Who Developed Low Back Pain during Pregnancy.

Variable	Consulted Primary Care (n = 42)	Did Not Consult Primary Care (n = 53)	Total (n = 95)	*p* Value
Information perceived as useful				0.083
Yes	39 (92.9)	53 (100.0)	92 (96.8)	
No	3 (7.1)	0 (0.0)	3 (3.2)	

Table 4. *Cont.*

Variable	Consulted Primary Care (n = 42)	Did Not Consult Primary Care (n = 53)	Total (n = 95)	*p* Value
Perceived positive influence on motivation to physical exercise during pregnancy to prevent or alleviate PLBP				0.124
Yes	34 (81.0)	49 (92.5)	83 (87.4)	
No	8 (19.0)	4 (7.5)	12 (12.6)	
Physical activity during pregnancy, MET·min/week	1752.8 (1363.5–2427.8)	1746.0 (1244.0–2124.0)	1746.0 (1292.3–2348.0)	0.621

Data are presented as n (%). PLBP: pregnancy-related low back pain; MET: metabolic equivalent of task.

2.5. PLBP Intensity and Trimester Pattern According to Perceived Motivational Influence

Maximum pain intensity did not differ significantly according to the postpartum-reported motivational influence of the information. The median maximum visual analogue scale (VAS) score was 6.0 in both groups, and no significant association was found when pain intensity was categorized as mild, moderate, or severe. However, the trimester pattern of PLBP differed significantly between groups. Women who reported no positive motivational influence were proportionally more likely to have experienced PLBP during both the second and third trimesters or throughout all three trimesters, whereas PLBP limited to the third trimester was more frequent among those reporting a positive influence ($p = 0.014$) (Table 5).

Table 5. Postpartum-Reported Motivational Influence of First-Trimester Information According to Pain Intensity and Trimester Pattern among Women with PLBP.

PLBP Characteristic	Positive Influence (n = 83)	No Positive Influence (n = 12)	Total (n = 95)	*p* Value
Maximum VAS score	6.0 (5.0–7.0)	6.0 (5.8–7.3)	6.0 (5.0–7.0)	0.325
Maximum pain intensity				1.000
Mild (VAS 1–3)	8 (9.6)	1 (8.3)	9 (9.5)	
Moderate (VAS 4–6)	44 (53.0)	6 (50.0)	50 (52.6)	
Severe (VAS 7–10)	31 (37.3)	5 (41.7)	36 (37.9)	
Trimester pattern of PLBP				**0.014**
First trimester only	1 (1.2)	0 (0.0)	1 (1.1)	
Second trimester only	10 (12.0)	1 (8.3)	11 (11.6)	
Third trimester only	54 (65.1)	3 (25.0)	57 (60.0)	
First and second trimesters	1 (1.2)	0 (0.0)	1 (1.1)	
Second and third trimesters	15 (18.1)	6 (50.0)	21 (22.1)	
All three trimesters	2 (2.4)	2 (16.7)	4 (4.2)	

Data are presented as median (interquartile range) or n (%). The maximum VAS score was defined as the highest score recorded across the four positions assessed. PLBP: pregnancy-related low back pain; VAS: visual analogue scale.

2.6. Factors Associated with the Absence of a Perceived Positive Motivational Influence

PLBP affecting more than one trimester was associated with higher odds of reporting no positive motivational influence of the information. This association remained statistically significant after adjustment for maximum VAS score, maternal age, and parity (adjusted odds ratio (OR) 6.02; 95% confidence interval (CI) 1.66–24.99; $p = 0.006$). Maximum VAS score, maternal age, and multiparity were not significantly associated with the absence of a perceived positive motivational influence (Table 6).

Table 6. Factors Associated with the Absence of a Postpartum-Reported Positive Motivational Influence of First-Trimester Information among Women Who Developed Low Back Pain during Pregnancy.

Variable	Unadjusted OR (95% CI)	*p* Value	Adjusted OR (95% CI)	*p* Value
Maximum VAS score, per 1-point increase	1.21 (0.86–1.75)	0.268	1.04 (0.70–1.55)	0.852
PLBP during more than one trimester	6.69 (1.98–25.57)	**0.002**	6.02 (1.66–24.99)	**0.006**
Maternal age, per 1-year increase	0.98 (0.84–1.13)	0.738	0.91 (0.76–1.08)	0.305
Multiparity	2.00 (0.58–6.65)	0.265	2.12 (0.51–8.60)	0.293

The absence of a perceived positive motivational influence was modeled as the outcome. The adjusted model included all variables shown. Reference categories were PLBP during one trimester and primiparity. PLBP: pregnancy-related low back pain; OR: odds ratio; CI: confidence interval; VAS: visual analogue scale.

3. Discussion

The main findings of this study show that the high acceptance of the information provided during the first trimester was not accompanied by detectable differences in PA, the occurrence of PLBP, or subsequent healthcare-seeking. Although most participants perceived the information as useful and reported that it had strengthened their motivation to remain active, PLBP remained frequent, and more than half of the affected women did not consult a primary care physician for this condition. Furthermore, perceived motivational influence was not associated with the amount of PA performed during pregnancy or with whether PA was maintained or increased versus decreased. Among women who developed PLBP, maximum pain intensity was also unrelated to perceived motivational influence. However, PLBP affecting more than one trimester was associated with a greater likelihood of reporting no positive motivational influence, even after accounting for maximum pain intensity, maternal age, and parity. These findings suggest that perceptions of information, motivation, PA behavior, pain experience, and healthcare-seeking are related but not necessarily concordant dimensions.

A novel contribution of the present study is the joint examination of postpartum perceptions of first-trimester information, quantified PA behavior, the occurrence and trimester pattern of PLBP, and primary care consultation in a cohort composed exclusively of physically active pregnant women.

Perceptions of the information were similarly favorable among women who developed PLBP and those who did not. Thus, neither the usefulness attributed to the information nor its perceived motivational influence was significantly associated with the occurrence of pain during pregnancy. However, this finding cannot establish the preventive effectiveness of the material because all participants received the information and no unexposed comparison group was available.

Pregnant women's perceptions and subsequent use of educational information have received limited attention in the literature. A recent systematized narrative review of educational interventions for the prevention and treatment of low back and pelvic girdle

pain during and after pregnancy found that previous studies had focused predominantly on the effects of education on pain and disability, with insufficient examination of how women perceived the information, which elements they considered helpful, or how they subsequently incorporated the recommendations into their daily lives [30]. Our findings help address one aspect of this evidence gap by examining women's postpartum-reported perceptions of the usefulness and motivational influence of information delivered early in pregnancy.

Perceived motivational influence was not accompanied by significant differences in the amount of PA performed. No differences were observed in prepregnancy PA either; this measure was included as a baseline reference rather than as an outcome that could have been modified by information provided subsequently. This lack of association should be interpreted cautiously. Most participants reported a positive motivational influence, resulting in a small comparison group and limited ability to detect differences. Moreover, perceived motivation and reported PA levels are related but distinct constructs. A woman may perceive that the information reinforced her decision to remain active without demonstrating a quantifiable increase in PA, particularly if she was already highly active before pregnancy. Similarly, pregnancy-related symptoms, physical limitations, and personal circumstances may influence PA independently of any motivation generated by the information. The cohort consisted exclusively of women classified as physically active both before and during pregnancy, who generally continued exercising until advanced stages of gestation. This selection reduced variability in PA, may have introduced selection bias and reduced the ability to detect associations between perceived motivational influence and PA outcomes, limited the ability to determine whether the information prevented discontinuation of PE, and restricted the generalizability of the findings to sedentary women or those with a lower initial predisposition toward PA.

Regarding the ability of educational interventions to prevent PLBP, the available evidence is heterogeneous. A quasi-randomized study compared usual care with programs incorporating education on anatomy, posture, movement and work techniques, PE, and relaxation and found no statistically significant differences in pain incidence. Nevertheless, improvements were observed in selected pain-related outcomes and the frequency of sick leave. Moreover, lumbar and posterior pelvic pain were analyzed together, limiting direct comparison with the present findings [25]. A lower incidence of PLBP has also been reported among pregnant women who received personal advice together with written and illustrated information on back care. However, methodological limitations require these findings to be interpreted cautiously [26]. A reduction in lumbopelvic pain intensity and associated disability has also been reported following a program that included education, daily home PE, an activity diary, and weekly telephone calls intended to reinforce adherence. The multicomponent nature of the intervention prevents its effects from being attributed specifically to the educational component [27]. The heterogeneity of these findings may be explained, at least partly, by differences in intervention content, duration, individualization, supervision, and integration with PE, follow-up, or other therapeutic strategies.

The available evidence suggests that education delivered in isolation may be less effective than education integrated with active strategies such as PE. Traditional educational content has focused predominantly on anatomy, pregnancy-related biomechanical changes, posture, and ergonomics, whereas psychological and social factors related to the pain experience have received comparatively limited attention [30]. A systematic review and meta-analysis found that combining PE with education may produce greater reductions in pain and disability than education alone among pregnant women with low back and/or pelvic pain [29]. However, this evidence relates primarily to the treatment of established symptoms and does not demonstrate that a combined intervention can prevent their occur-

rence. Telephone-supported ergonomic education has also been associated with greater reductions in pain and disability than a single educational session. Regular contact enabled recommendations to be reinforced and facilitated their practical implementation [28]. Nevertheless, this intervention was delivered to women with established PLBP and therefore did not evaluate its potential preventive effect. However, such interventions are not directly comparable with the provision of an information dossier because they include additional components that may facilitate the implementation of recommendations and modify pain or disability. It has been proposed that general recommendations should be adapted to each woman's type of pain, functional limitations, and personal circumstances. This proposal is derived from the synthesis and interpretation of the available evidence and does not constitute conclusive evidence that any specific individualized intervention is superior [30].

In the present study, maximum pain intensity was not associated with perceived motivational influence. The distribution of participants across the mild, moderate, and severe maximum pain categories also did not differ significantly according to this perception. In contrast, women who experienced PLBP during more than one trimester were more likely to report no positive motivational influence, even after accounting for maximum pain intensity, maternal age, and parity. This finding suggests that the temporal extent of the pain experience may be more relevant to the retrospective appraisal of the information than the highest reported pain intensity. However, PLBP affecting more than one trimester does not necessarily indicate continuous pain and should not be interpreted directly as a measure of symptom duration or persistence. A lower perceived motivational influence may have been related to how women responded to pain during pregnancy; conversely, experiencing pain during several trimesters may have led to a less favorable postpartum appraisal of the information received. Because perceptions were assessed after pregnancy, the temporal direction of this association cannot be established. Furthermore, the small number of women who reported no positive motivational influence and the wide confidence interval indicate that this finding should be considered exploratory.

The discordance between favorable perceptions of the information and primary care consultation represents another relevant finding. Among women who developed PLBP, neither the perceived usefulness of the dossier nor its perceived influence on motivation to engage in PE was significantly associated with the decision to consult. PA during pregnancy also did not differ between women who consulted and those who did not. Perceiving the information as useful or as strengthening motivation to engage in PE does not necessarily imply recognizing a need to seek professional care after pain develops. Nevertheless, the limited variability in responses concerning usefulness and the small number of women reporting no positive motivational influence reduced the ability to detect associations. During the postpartum interview, participants who had experienced PLBP were asked whether they had sought professional care and could identify a family physician, an obstetrician, or another professional as the healthcare provider consulted. All women who reported seeking care identified a family physician; for this reason, our analyses focused on primary care consultation. However, the findings do not provide a detailed characterization of broader healthcare-seeking patterns or consultations with other professional groups. The normalization of PLBP during pregnancy may partially explain the limited consultation observed. In a study examining women's experiences of PLBP during pregnancy, perceiving pain as a normal consequence of pregnancy was among the reasons reported for not seeking treatment [14]. Pain normalization should therefore be regarded as an interpretative hypothesis rather than as a conclusion derived directly from the present findings. The observed consultation rate should not be interpreted as evidence of unmet healthcare needs or barriers to care, which were not assessed in this study. Future research should investigate women's reasons for seeking or not seeking care, including symptom

interpretation, perceived severity, access to healthcare services, and awareness of available treatment options.

From a biopsychosocial perspective, information provided during pregnancy should extend beyond traditional anatomical, biomechanical, and postural explanations. Although such content may be useful, it does not fully address the beliefs, fears, expectations, and personal and social circumstances that shape the pain experience and women's responses to information. Available educational programs have been reported to give insufficient consideration to the psychosocial dimensions of pain and should help women understand their pain experience, reduce its perceived threat, strengthen confidence in movement, and facilitate continued PA [30]. The potential value of incorporating content targeting pain-related beliefs, personalized recommendations, active strategies, and professional follow-up should be evaluated in controlled studies specifically designed for this purpose.

The strengths of this study include the prospective recruitment of participants during the first trimester, before their subsequent experience of PLBP was known, and the standardized provision of the information dossier at that time. Quantified data were also available on PA before and during pregnancy, the occurrence and characteristics of PLBP, and subsequent primary care consultation. The use of validated instruments, including the International Physical Activity Questionnaire (IPAQ) for PA assessment and the VAS for pain intensity, provided standardized measures of these variables. Conducting the interview within the first month postpartum reduced the interval between pregnancy and the retrospective assessment of these variables. Finally, the inclusion of a clearly defined and relatively homogeneous cohort of physically active pregnant women allowed these relationships to be examined in this specific population.

Several limitations should nevertheless be considered. Perceived usefulness and motivational influence were assessed within the first month postpartum and may therefore have been shaped by the PA performed, the experience of PLBP, and the healthcare received during pregnancy. This retrospective assessment introduces the possibility of recall bias and reverse causality, precludes clear determination of the temporal direction of the associations, and does not permit causal inference. Previous validation studies have shown that maternal recall may have acceptable reproducibility and validity for certain objective events relating to pregnancy, labor, and birth, even when information is collected several months or years later [31,32]. Retrospective assessment of PA during pregnancy among women evaluated postpartum has also demonstrated acceptable validity, although this evidence was obtained using an instrument specifically designed for that purpose [33]. In our study, the adaptation of the IPAQ recall period to a typical week may have introduced additional recall error and may not have adequately captured fluctuations in PA across pregnancy. However, these findings cannot be directly extrapolated to the recall of PLBP characteristics or to retrospective appraisals of the usefulness and motivational influence of the dossier, which are subjective measures that may have been shaped by participants' subsequent experiences. Although a standardized anatomical definition and an illustration were used to facilitate the identification of low back pain, some misclassification between low back pain and pelvic girdle pain cannot be excluded because no clinical examination was performed. Furthermore, the dichotomous response format did not capture differences in the degree of perceived usefulness or motivational influence. The high proportions of positive responses (97.3% and 90.5%, respectively) suggest a ceiling effect that may have limited the ability to detect associations with other variables. Social desirability bias may also have contributed to favorable responses. Therefore, although conducting the interview within the first month postpartum shortened the recall period, differential information bias among women with different PLBP experiences cannot be excluded.

The present study was a secondary analysis of a previously established prospective cohort [5]; therefore, no separate sample size calculation was performed for the research questions addressed in this analysis. Although the cohort included 147 participants, few women perceived the information as not useful or reported no positive motivational influence, limiting the statistical power of the comparisons and the precision of the estimates. This limitation is particularly relevant to the multivariable analysis, which was restricted to women with PLBP and included only 12 participants who reported no positive motivational influence. Firth's penalized logistic regression was used to reduce bias associated with the small number of events; nevertheless, the confidence intervals remained wide. Consequently, the model findings, particularly the association between PLBP affecting more than one trimester and the absence of a positive motivational influence, should be considered exploratory and confirmed in larger studies specifically designed to address this question. Furthermore, the absence of adjustment for multiple comparisons increases the risk of type I errors, reinforcing the need for cautious interpretation of these exploratory findings.

The absence of a comparison group that did not receive the information dossier precluded assessment of its effectiveness in preventing PLBP, maintaining PA, or encouraging primary care consultation. The high perceived usefulness and motivational influence reported by participants should therefore be interpreted as subjective appraisals of the information rather than as indicators of its preventive or behavioral effectiveness. The exclusive inclusion of physically active pregnant women reduced variability in PA levels, potentially making associations with changes in PA more difficult to detect and limiting the generalizability of the findings to less active women. Furthermore, because eligibility was partly determined by PA during pregnancy, assessed after the educational information had been provided, selection bias may have affected the associations estimated within the cohort. Although the sensitivity analysis including the 10 women excluded for insufficient PA did not materially change the descriptive findings on perceived usefulness and motivational influence, it cannot rule out selection bias in the associations examined. The findings should therefore be interpreted as applying to women with uncomplicated pregnancies who met the prespecified PA criterion both before and during pregnancy and completed postpartum follow-up. The relatively high mean maternal age of the participants (34.1 years) may also limit the generalizability of our findings to younger pregnant women, who may differ in their pain experiences and health-related behaviors. Finally, the study assessed neither the specific content that participants remembered or applied nor the reasons underlying their decision to seek or not seek care. Moreover, because all reported consultations involved family physicians, the findings do not characterize healthcare-seeking through other professional groups.

4. Materials and Methods

4.1. Study Design and Setting

This study was a secondary analysis of a prospective cohort of physically active pregnant women whose recruitment procedures and primary clinical findings have been reported elsewhere [5]. The original cohort study was conducted at La Moraleja University Hospital (Madrid, Spain) and was designed to investigate the incidence and clinical characteristics of PLBP during pregnancy. The present secondary analysis addresses distinct research questions concerning postpartum perceptions of written information provided during the first trimester on the benefits of PA during pregnancy and strategies to prevent or alleviate PLBP and examines whether these perceptions were associated with PA during pregnancy, the occurrence of PLBP, and primary care consultation. Participants were recruited between 11^{+0} and 13^{+6} weeks of gestation from a specialized first-trimester clinic for low-risk pregnancies. Recruitment and follow-up were conducted between Oc-

tober 2023 and June 2025. Baseline characteristics and prepregnancy PA were recorded at enrollment. Information on PA performed and PLBP experienced during pregnancy, primary care consultation for PLBP, and participants' perceptions of the written information received during the first trimester was collected through a structured telephone interview conducted within the first month postpartum. Accordingly, although participants were enrolled prospectively, several of the variables examined in the present secondary analysis were assessed retrospectively after delivery.

4.2. Study Population

4.2.1. Eligibility Criteria

Women were eligible for the present analysis if they were aged ≥18 years, had a singleton, low-risk pregnancy with an uncomplicated clinical course, attended the standardized first-trimester assessment, completed the postpartum interview, and provided sufficient data to classify their PA levels. Participants were additionally required to have engaged in regular PA during the six months preceding conception and to meet the prespecified criterion for being physically active both before and during pregnancy. This eligibility criterion was established for the original prospective cohort [5], rather than specifically for the present secondary analysis, to study women who were physically active before pregnancy and maintained a minimum PA level during gestation. For the purposes of this study, women were classified as physically active if their total PA reached ≥600 MET·min/week in each period, as assessed using the short form of the IPAQ. This threshold was adopted as an operational criterion derived from World Health Organization recommendations advising pregnant women without contraindications to perform at least 150 min/week of moderate-intensity aerobic PA [19]. Under the IPAQ scoring protocol, moderate-intensity activity is assigned a value of 4 MET; therefore, 150 min/week corresponds to 600 MET·min/week (4 MET × 150 min) [34]. An equivalent volume of PA may also be accumulated through a combination of moderate and vigorous-intensity activities, as recommended by the World Health Organization [19]. For the operational calculation of total PA, all activity categories recorded by the IPAQ, including walking and moderate and vigorous-intensity activities, were included in accordance with its scoring protocol [34]. Consequently, achieving ≥600 MET·min/week of total IPAQ-assessed PA was a study-specific eligibility criterion and did not necessarily indicate compliance with the WHO recommendation of at least 150 min/week of moderate-intensity aerobic PA.

4.2.2. Exclusion Criteria

Women were excluded if they developed an obstetric complication or had an acute or chronic medical condition that limited or contraindicated safe participation in PA during pregnancy. These conditions included clinically relevant cardiovascular, neurological, or pre-existing musculoskeletal disorders unrelated to PLBP, as well as pregnancy-related complications incompatible with PA participation. Women were also excluded if they did not meet the required PA criterion either before or during pregnancy, did not complete the postpartum assessment, or provided insufficient data for the present analyses. As reported in the original cohort study [5], of the 183 pregnant women initially invited to participate, 15 declined, leaving 168 women who completed the baseline assessment. During follow-up, four women experienced miscarriage and seven did not complete the postpartum interview. A further 10 women were excluded because they did not meet the prespecified PA criterion of ≥600 MET·min/week during pregnancy, resulting in a final analytical sample of 147 participants.

4.3. Study Procedures and Measures

Data were collected at two time points using a structured study protocol that combined standardized assessment instruments with an ad hoc questionnaire developed for the original cohort. The first assessment was conducted face to face at first-trimester recruitment, whereas the second was conducted by telephone within the first month postpartum. At recruitment, participants were informed that they would be contacted by telephone after delivery to assess their pregnancy experience and their perceptions of the written information provided.

When the study protocol was developed, the investigators did not identify a single validated Spanish or international questionnaire covering the full range of clinical, functional, behavioral, and healthcare-related variables required to address the study objectives. Therefore, an ad hoc questionnaire was designed to collect the information not captured by the standardized instruments. Its items were informed by the available literature on PLBP and were reviewed by obstetric clinicians and researchers with experience in questionnaire development to assess their clarity, clinical relevance, and applicability. However, the questionnaire did not undergo formal pilot testing or psychometric validation before its use.

For the present secondary analysis, the ad hoc questionnaire provided information on PLBP characteristics, primary care consultation, and participants' postpartum perceptions of the written information received during the first trimester. In particular, perceived usefulness and perceived motivational influence were assessed using two study-specific items that were not derived from a previously validated instrument. PA and pain intensity were assessed separately using the standardized instruments described below.

4.3.1. Written Information Provided at First-Trimester Recruitment

During the first-trimester recruitment visit, each participant was provided with the same standardized written dossier consisting of two illustrated documents addressing PA, PE, and PLBP during pregnancy. Throughout this manuscript, PA refers to overall physical activity, as assessed using the IPAQ, whereas PE refers to planned and structured exercise, including the exercise recommendations provided in the dossier and the interventions examined in the cited literature. The dossier described the evidence-based benefits of remaining physically active for maternal, fetal, neonatal, and infant health and translated current recommendations into practical guidance on the appropriate frequency, duration, intensity, and modalities of PA during pregnancy. Specifically, it recommended at least 150 min of moderate-intensity PA per week, distributed over at least three days, and included examples of aerobic, resistance, and flexibility exercises.

The material also addressed PE safety. It summarized absolute and relative contraindications, symptoms requiring PA to be discontinued and medically assessed, and activities considered unsuitable during pregnancy. A separate component provided general strategies intended to prevent or alleviate PLBP, including guidance on exercising safely and managing lumbar discomfort during gestation. It also described the frequency and possible causes of PLBP and included illustrated exercises with practical instructions for lumbar mobility and stretching. The dossier was delivered before participants' subsequent experience of PLBP and PA during pregnancy were known.

Because every participant received the same dossier, no group unexposed to the written information was available for comparison. Accordingly, the present analysis examined participants' postpartum perceptions of its usefulness and motivational influence and the associations of these perceptions with PA, PLBP, and primary care consultation. It was not designed to establish the preventive or therapeutic efficacy of the dossier.

4.3.2. Postpartum Perceptions of the Information

During the postpartum interview, participants responded to two dichotomous items concerning the written information received at first-trimester recruitment. The first asked whether they considered the information on PE during pregnancy and PLBP to be useful. The second asked whether they perceived that the information had positively influenced their motivation to engage in PE during pregnancy with the aim of preventing or alleviating PLBP. Responses to both items were recorded as "yes" or "no".

The two items were used to define perceived usefulness and perceived motivational influence, respectively. They did not assess knowledge acquisition, understanding or recall of specific content, adherence to individual recommendations, or objectively verified behavioral change. Because both items were administered after delivery, they were interpreted as retrospective, self-reported appraisals rather than prospective measures of motivation. These responses may have been influenced by the PA performed and PLBP experienced during pregnancy.

4.3.3. Physical Activity Assessment

PA was assessed using the short form of the International Physical Activity Questionnaire (IPAQ) [34]. At first-trimester recruitment, participants retrospectively reported their habitual PA during the six months preceding conception. During the postpartum interview, they retrospectively reported the PA performed throughout pregnancy. To characterize habitual PA over each study period rather than activity performed during a single week, participants were instructed to report a typical week. Thus, the conventional IPAQ recall period referring to the previous seven days was adapted for the purposes of this study. The resulting values were therefore considered retrospective estimates of habitual PA rather than measurements obtained using the standard seven-day recall protocol.

The reported frequency, duration, and intensity of PA were used to calculate total PA volume and express it as MET·min/week in accordance with the IPAQ scoring protocol. Walking and moderate- and vigorous-intensity activities were assigned values of 3.3, 4.0, and 8.0 MET, respectively. For each activity category, MET·min/week were calculated by multiplying the assigned MET value by the number of minutes performed per day and the number of days per week. Total PA was calculated as the sum of the MET·min/week accumulated across the three activity categories. The resulting total was used to classify participants as physically active in each study period, with ≥600 MET·min/week representing the prespecified operational threshold. The IPAQ short form has demonstrated acceptable reliability and concurrent validity in pregnant women [35] and has also been validated in a Spanish adult population [36]. Participants additionally reported the gestational week until which they continued to exercise.

Absolute change in PA was calculated as PA during pregnancy minus prepregnancy PA; therefore, negative values represented a reduction. For the categorical analysis, participants with a change of ≥0 MET·min/week were classified as having maintained or increased their PA, whereas those with a change of <0 MET·min/week were classified as having decreased their PA.

4.3.4. Assessment of PLBP

PLBP was defined as pain located between the twelfth rib and the gluteal fold, with or without radiation to the lower extremities. At first-trimester recruitment, participants were shown an anatomical illustration identifying this region, which was also available for reference during the postpartum telephone interview. PLBP was identified through participant self-report, without a specific clinical diagnostic examination. During the postpartum interview, participants reported whether they had experienced PLBP at any

time during pregnancy and identified the trimester or trimesters in which the pain had been present. Thus, the trimester variable represented the gestational periods affected by PLBP and not necessarily the trimester in which the pain first developed.

Pain intensity was assessed using a 0–10 visual analogue scale (VAS), where 0 indicated no pain and 10 the worst imaginable pain [37]. Separate ratings were obtained for four positions: sitting, standing, supine, and lateral decubitus. At first-trimester recruitment, participants were shown the VAS and provided with a printed copy to retain for reference during the postpartum telephone interview. During that interview, participants consulted their printed VAS and retrospectively reported the pain intensity experienced during pregnancy in each of the four positions, verbally communicating the corresponding scores, which were recorded by the interviewer. Pain intensity scores were recorded as integers from 0 to 10; decimal values were not recorded.

For each participant, maximum pain intensity was defined as the highest VAS score reported across the four assessed positions (sitting, standing, supine, and lateral decubitus), rather than the maximum intensity of any individual pain episode during pregnancy. Maximum pain intensity was subsequently categorized as mild (VAS 1–3), moderate (VAS 4–6), or severe (VAS 7–10). The original trimester response categories were retained for the descriptive analysis of PLBP patterns. For the regression analysis, the variable was dichotomized as PLBP present during one trimester versus PLBP present during more than one trimester. Presence during more than one trimester was not interpreted as continuous pain or as a direct measure of symptom duration.

4.3.5. Primary Care Consultation

During the postpartum interview, women who reported PLBP were asked whether they had consulted a healthcare professional because of their pain during pregnancy and to identify the professional consulted as an obstetrician, a family physician, or another healthcare professional. All participants who reported seeking professional care identified a family physician; therefore, consultation was analyzed as a binary primary care variable ("yes" or "no"). The question covered the entire pregnancy, and the number of consultations or repeated visits was not recorded.

Participants were also asked whether any treatment had been recommended, the type of treatment recommended (pharmacological treatment, PE, or another intervention), and their perceived response to that treatment (feeling much better, feeling better, experiencing no improvement, or experiencing greater pain). These treatment-related variables were not included in the present analysis.

4.3.6. Covariates

Maternal age was recorded in years at first-trimester recruitment, and parity was categorized as primiparous or multiparous. Maximum VAS score, defined as described above, was included as an indicator of pain intensity. Maternal age, parity, and maximum VAS score were selected a priori as covariates because of their potential clinical relevance to the experience of PLBP and participants' retrospective appraisal of the information. Covariate selection was based on clinical plausibility rather than on statistical significance in the univariable analyses.

4.4. Study Outcomes

The two principal outcomes were participants' postpartum-reported perceptions of the usefulness of the information provided during the first trimester and its positive influence on their motivation to engage in PE during pregnancy to prevent or alleviate PLBP. Both perception outcomes were examined according to the occurrence of PLBP during pregnancy.

Among women who developed PLBP, perceived usefulness and perceived motivational influence were also evaluated in relation to primary care consultation. Perceived motivational influence was additionally examined according to:

1. PA before and during pregnancy;
2. Absolute change in PA between the two periods;
3. Maintenance or increase versus decrease in PA;
4. Maximum VAS score and categorized maximum pain intensity; and
5. The trimester pattern of PLBP.

4.5. Sample Size

As this study was a secondary analysis, its sample size was determined by the number of eligible participants available in the original cohort [5]. No a priori sample size calculation was therefore performed specifically for the research questions addressed in the present analysis, and all 147 eligible participants were included. Only 14 women in the complete cohort reported no positive motivational influence, and this number was reduced to 12 in the analysis restricted to women with PLBP. The small number of participants with this outcome limited the precision of the multivariable estimates. Accordingly, the multivariable analysis was considered exploratory, and its findings were interpreted with particular attention to the width of the confidence intervals.

4.6. Statistical Analysis

The distributions of continuous variables were evaluated using histograms, quantile-quantile (Q–Q) plots, and the Shapiro–Wilk test. Continuous variables used to describe the overall cohort are presented as means and standard deviations, whereas variables with asymmetric distributions or those analyzed using nonparametric methods are summarized as medians and interquartile ranges. Categorical variables are presented as frequencies and percentages. Postpartum perceptions of the information were compared between women with and without PLBP using Fisher's exact test. PA before pregnancy, PA during pregnancy, and absolute change in PA were compared according to perceived motivational influence using the Mann–Whitney U test. The proportions of women whose PA was maintained or increased versus decreased were compared using Fisher's exact test.

Among women who developed PLBP, perceived usefulness and perceived motivational influence were compared according to primary care consultation using Fisher's exact test. PA during pregnancy was compared between women who consulted a primary care physician and those who did not using the Mann–Whitney U test. Maximum VAS scores were compared according to perceived motivational influence using the Mann–Whitney U test. Fisher's exact test was used to compare the distribution of mild, moderate, and severe maximum pain intensity. Because the trimester-pattern contingency table contained several cells with small or zero frequencies, its association with perceived motivational influence was examined using the Fisher–Freeman–Halton exact test.

An exploratory regression analysis was conducted among women who developed PLBP. The dependent variable was the absence of a postpartum-reported positive motivational influence. Because only 12 women reported no positive motivational influence, conventional maximum-likelihood logistic regression could have produced small-sample bias or complete or quasi-complete separation. Univariable and multivariable associations were therefore estimated using Firth's penalized likelihood logistic regression. PLBP affecting more than one trimester was entered as the principal explanatory variable in the adjusted model. Maximum VAS score, maternal age, and parity were selected on clinical grounds as covariates. Maximum VAS score and maternal age were entered as continuous variables, and their corresponding ORs were expressed per one-point and one-year increase,

respectively. Parity was entered as a binary variable, with primiparous women as the reference group. PLBP affecting one trimester was the reference category for the trimester variable. Unadjusted and adjusted odds ratios (ORs), 95% confidence intervals (CIs), and two-sided p values were reported.

Given the secondary and exploratory nature of the analysis, no adjustment was made for multiple comparisons. Statistical significance was defined as a two-sided $p < 0.05$. However, findings were interpreted by considering the magnitude and precision of the effect estimates, the sample size, and the exploratory nature of the analyses. All analyses were performed using R software, version 4.3.2.

4.7. Ethical Considerations

The study protocol was approved by the Research Ethics Committee of La Princesa University Hospital, Madrid, Spain (approval No. 5365). Before enrollment, all participants received verbal and written information regarding the study procedures, provided written informed consent, and were informed that participation was voluntary and that consent could be withdrawn at any time.

5. Conclusions

The information provided during the first trimester of pregnancy regarding the benefits of PE and strategies to prevent or alleviate PLBP was perceived as useful by most participants and as having a positive influence on their motivation to remain active. However, perceived motivational influence was not significantly associated with PA levels during pregnancy, changes in PA, or the occurrence of PLBP. Among women who developed PLBP, maximum pain intensity was not significantly associated with perceived motivational influence, whereas perceived usefulness, motivational influence, and PA during pregnancy were not significantly associated with primary care consultation.

In contrast, experiencing PLBP during more than one trimester was associated with the absence of a perceived positive motivational influence, even after adjustment for maximum pain intensity, maternal age, and parity. This finding suggests that the temporal extent of the pain experience, rather than its maximum intensity, may be relevant to women's retrospective appraisal of the information received. Nevertheless, this association should be interpreted cautiously because perceptions were assessed postpartum and may have been influenced by participants' subsequent experience of PLBP.

Overall, favorable perceptions of the information coexisted with a high incidence of PLBP and a low primary care consultation rate among affected women. These findings indicate that perceived usefulness, motivation to engage in PE, PA behavior, pain experience, and healthcare-seeking are distinct but interrelated dimensions that may not necessarily align.

Future studies should assess women's perceptions at different stages of pregnancy and compare written information alone with multicomponent educational interventions using controlled designs. Research should also include women with different baseline PA levels, examine how information is understood and applied in practice, and explore why some women do not seek professional care after developing PLBP. Such studies should determine whether complementing written information with individualized counseling, professional follow-up, active strategies, and content designed to challenge the perception of PLBP as a normal or inevitable consequence of pregnancy could improve prevention, self-management, and timely primary care consultation.

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Abbreviations

The following abbreviations are used in this manuscript:

BMI	Body Mass Index
CI	Confidence Interval
IPAQ	International Physical Activity Questionnaire
MET	Metabolic Equivalent of Task
OR	Odds Ratio
PA	Physical Activity
PE	Physical Exercise
PLBP	Pregnancy-Related Low Back Pain
VAS	Visual Analog Scale
WHO	World Health Organization

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