

Development and Internal Validation of a Lifestyle-Based Risk Screening Tool for Iliopsoas Dysfunction and Low Back Pain in Women: An Analytical Cross-Sectional Study

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Abstract:

➤ *Background:*

Low back pain (LBP) is a major musculoskeletal health problem, while sedentary behaviour, reduced physical activity, elevated body mass index and psychosocial stress may contribute to musculoskeletal symptoms. Hip-flexor and iliopsoas dysfunction may represent an additional clinically relevant factor, particularly in individuals exposed to prolonged sitting and sustained hip-flexion postures. However, an integrated lifestyle-based screening approach specifically addressing iliopsoas dysfunction and LBP in women remains limited.

➤ *Objective:*

To identify lifestyle and clinical factors associated with LBP in women and to develop and internally validate a preliminary risk-screening tool incorporating iliopsoas dysfunction and modifiable lifestyle characteristics.

➤ *Methods:*

An analytical cross-sectional study was conducted among 410 women aged 18–50 years. Participants were assessed for demographic characteristics, body mass index, sedentary behaviour, screen exposure, physical activity, perceived stress and occupational/lifestyle factors. LBP was assessed using a standardized symptom history, numerical pain rating scale and Oswestry Disability Index. Iliopsoas/hip-flexor dysfunction was assessed bilaterally using the Modified Thomas Test. Associations with LBP were initially examined using univariable analyses, followed by multivariable logistic regression. A preliminary weighted screening score was developed from independently associated variables. Discrimination was evaluated using receiver operating characteristic analysis, and internal validation was performed using 1,000 bootstrap resamples.

➤ *Results:*

LBP was present in 172 of 410 participants (42.0%), while iliopsoas dysfunction was identified in 158 participants (38.5%). Iliopsoas dysfunction was present in 54.7% of women with LBP compared with 26.9% of women without LBP ($p < 0.001$). In multivariable analysis, sitting for >8 h/day (adjusted OR 2.21, 95% CI 1.38–3.55), iliopsoas dysfunction (adjusted OR 2.16, 95% CI 1.35–3.45), low physical activity (adjusted OR 1.84, 95% CI 1.16–2.91), BMI ≥ 25 kg/m² (adjusted OR 1.74, 95% CI 1.10–2.75) and high perceived stress (adjusted OR 1.71, 95% CI 1.06–2.76) were independently associated with LBP. A seven-point screening score demonstrated an AUC of 0.81 (95% CI 0.77–0.85), with an internally bootstrap-corrected AUC of approximately 0.79.

➤ *Conclusion:*

A combination of prolonged sitting, iliopsoas/hip-flexor dysfunction, low physical activity, elevated BMI and perceived stress was associated with LBP in this sample of women. The preliminary screening tool demonstrated promising internal

discrimination. External and prospective validation are required before the tool can be recommended for routine clinical prediction.

Keywords: Low Back Pain; Iliopsoas; Hip Flexor; Women; Sedentary Behaviour; Physical Activity; Physiotherapy; Screening Tool; Risk Prediction; Musculoskeletal Physiotherapy.

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I. INTRODUCTION

Low back pain is one of the most common musculoskeletal conditions worldwide and represents an important cause of activity limitation and disability. Its development and persistence are influenced by multiple interacting biological, mechanical, behavioural and psychosocial factors.

Women may experience particular combinations of occupational, domestic, caregiving and lifestyle exposures that influence musculoskeletal health.

Prolonged sitting, reduced physical activity, increased screen exposure, elevated body mass index and psychological stress have all been investigated in relation to low back and lumbopelvic symptoms.

The iliopsoas complex is an important contributor to hip flexion and lumbopelvic movement. Prolonged periods of hip flexion, particularly during sitting, may influence hip-flexor length, pelvic positioning and lumbopelvic movement strategies. Recent research has investigated the relationship between hip-flexor tightness and LBP, supporting the need for further clinical investigation of this relationship.

However, LBP is multifactorial and cannot be adequately represented by a single anatomical finding. A clinically useful screening approach may therefore benefit from integrating an objective musculoskeletal assessment with modifiable lifestyle and psychosocial characteristics.

The present study was designed to investigate the relationship between lifestyle factors, iliopsoas/hip-flexor dysfunction and LBP in women and to develop a preliminary lifestyle-based risk-screening tool.

➤ Aim

To develop and internally validate a lifestyle-based risk-screening tool for iliopsoas dysfunction and low back pain in women.

• Objectives

- ✓ To determine the prevalence of LBP among women aged 18–50 years.
- ✓ To determine the prevalence of iliopsoas/hip-flexor dysfunction.
- ✓ To examine the association between iliopsoas dysfunction and LBP.

- ✓ To identify lifestyle, anthropometric and psychosocial factors associated with LBP.
- ✓ To develop a preliminary weighted screening score.
- ✓ To evaluate the discrimination and internal validity of the screening model.

II. METHODS

➤ Study Design and Participants

An analytical cross-sectional study was conducted among 410 women aged 18–50 years.

The sample size was initially estimated using $n = Z^2p(1-p)/d^2$, where $Z = 1.96$, anticipated prevalence (p) = 0.40 and absolute precision (d) = 0.05, producing an estimated minimum sample size of approximately 369 participants. Allowing for incomplete data, the final study sample comprised 410 women.

➤ Eligibility Criteria

- Women aged 18–50 years were eligible for participation.
- Participants were excluded if they had current pregnancy;
- Participants were excluded if they had major lumbar, pelvic or hip surgery;
- Participants were excluded if they had recent fracture;
- Participants were excluded if they had inflammatory spinal disease;
- Participants were excluded if they had malignancy or active infection;
- Participants were excluded if they had neurological disease likely to influence the assessment; or
- Participants were excluded if they had severe hip pathology affecting the Modified Thomas Test.

➤ Study Variables

- Age; height and weight; body mass index; waist-related anthropometric measures;
- Daily sitting duration; uninterrupted sitting duration; frequency of sitting breaks; daily screen exposure; driving; walking;
- Weekly physical activity; exercise frequency and duration; stretching habits;
- Occupational and desk-based work; working hours; bending and lifting exposure;
- Sleep duration and quality; household/caregiving demands; relevant reproductive characteristics;

- Perceived stress; LBP history; pain intensity; disability; and iliopsoas/hip-flexor mobility.

➤ *Assessment of Low Back Pain*

- LBP was identified using a standardized symptom history and assessment of pain characteristics.
- Pain intensity was assessed using the Numerical Pain Rating Scale (NPRS), with scores ranging from 0 to 10.
- Functional disability associated with LBP was assessed using the Oswestry Disability Index (ODI).

➤ *Assessment of Physical Activity*

Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). Participants were categorized according to their physical activity level.

➤ *Assessment of Perceived Stress*

Perceived stress was assessed using the Perceived Stress Scale-10 (PSS-10).

➤ *Assessment of Iliopsoas/Hip-Flexor Dysfunction*

Hip-flexor mobility was assessed bilaterally using the Modified Thomas Test. The test was performed using standardized positioning, with attention to lumbo-pelvic stabilization. The right and left sides were assessed separately.

For the screening model, a positive clinical assessment indicating iliopsoas/hip-flexor dysfunction was treated as the clinical predictor.

➤ *Data Collection*

Participants underwent assessment in the following sequence:

- Eligibility and demographic assessment
- Lifestyle and occupational history
- Physical activity assessment
- Sleep and psychosocial assessment
- Anthropometric measurements
- LBP assessment
- NPRS and ODI assessment
- Bilateral Modified Thomas Test

Where feasible, the assessor conducting the physical examination was blinded to the participant's lifestyle profile.

III. STATISTICAL ANALYSIS

Descriptive statistics were used to summarize participant characteristics.

Continuous variables were expressed using means and standard deviations where appropriate. Categorical variables were expressed as frequencies and percentages.

Comparisons between women with and without LBP were performed using appropriate parametric or non-parametric tests for continuous variables and chi-square or Fisher's exact tests for categorical variables.

Univariable logistic regression was initially performed to identify candidate predictors. Variables considered clinically relevant and/or demonstrating meaningful associations were entered into a multivariable logistic regression model.

Adjusted odds ratios (ORs), 95% confidence intervals (CIs) and p-values were reported.

A weighted preliminary screening score was developed using independently associated variables. Model discrimination was assessed using receiver operating characteristic (ROC) analysis and area under the curve (AUC). Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and classification accuracy were calculated for the provisional screening threshold.

Internal validation was performed using 1,000 bootstrap resamples.

IV. RESULTS

➤ *Participant Characteristics*

A total of 410 women were included. The mean age was 34.8 ± 8.1 years. LBP was reported by 172 participants (42.0%), while 238 participants (58.0%) did not report LBP. Iliopsoas/hip-flexor dysfunction was identified in 158 participants (38.5%). Among women with LBP, 94/172 (54.7%) demonstrated iliopsoas dysfunction, compared with 64/238 (26.9%) among women without LBP ($p < 0.001$).

Table 1 Participant Characteristics

Variable	Overall (n=410)	LBP (n=172)	No LBP (n=238)	p-value
Age, years	34.8 ± 8.1	36.3 ± 7.8	33.7 ± 8.2	0.001
BMI, kg/m ²	25.2 ± 4.3	26.5 ± 4.4	24.2 ± 3.9	<0.001
Sitting, h/day	7.1 ± 2.4	8.2 ± 2.2	6.3 ± 2.2	<0.001
Screen time, h/day	4.9 ± 2.0	5.6 ± 2.0	4.4 ± 1.8	<0.001
Low physical activity	56.3%	68.0%	47.9%	<0.001
High perceived stress	29.8%	40.1%	22.3%	<0.001
Iliopsoas dysfunction	38.5%	54.7%	26.9%	<0.001

➤ Lifestyle Characteristics and Iliopsoas Dysfunction

Participants with iliopsoas dysfunction reported greater daily sitting exposure, higher BMI and greater screen exposure. Low physical activity, prolonged uninterrupted

sitting, desk-based occupation and high perceived stress were also more frequent among participants with iliopsoas dysfunction.

Table 2 Lifestyle Characteristics and Iliopsoas Dysfunction

Variable	Iliopsoas dysfunction	No dysfunction
Sitting, h/day	8.2 ± 2.2	6.4 ± 2.3
BMI, kg/m ²	26.4 ± 4.4	24.4 ± 4.0
Screen time, h/day	5.5 ± 2.0	4.5 ± 1.9
Low physical activity	68.4%	48.8%
Prolonged uninterrupted sitting	65.2%	43.3%
Desk-based occupation	56.3%	40.9%
High perceived stress	38.0%	24.6%

➤ Association Between Iliopsoas Dysfunction and LBP

Iliopsoas dysfunction demonstrated an unadjusted OR of 3.36 (95% CI 2.21–5.10; $p < 0.001$) for LBP.

The Modified Thomas Test demonstrated lower hip-flexor mobility among women with LBP. Right-sided mobility was $4.5 \pm 8.7^\circ$ in women with LBP compared with $8.0 \pm 8.8^\circ$ in women without LBP ($p < 0.001$). Left-sided mobility was $4.8 \pm 8.5^\circ$ compared with $8.2 \pm 8.6^\circ$, respectively ($p < 0.001$). Mean bilateral mobility was $4.7 \pm$

8.4° in the LBP group and $8.1 \pm 8.5^\circ$ in the non-LBP group ($p < 0.001$). A positive Modified Thomas Test was observed in 54.7% of participants with LBP compared with 26.9% without LBP.

➤ Multivariable Logistic Regression

Five variables remained independently associated with LBP: sitting > 8 h/day; iliopsoas dysfunction; low physical activity; BMI ≥ 25 kg/m²; and high perceived stress.

Table 3 Multivariable Logistic Regression

Predictor	Adjusted OR	95% CI	p-value
Sitting > 8 h/day	2.21	1.38–3.55	0.001
Iliopsoas dysfunction	2.16	1.35–3.45	0.001
Low physical activity	1.84	1.16–2.91	0.010
BMI ≥ 25 kg/m ²	1.74	1.10–2.75	0.018
High perceived stress	1.71	1.06–2.76	0.028
Screen time > 5 h/day	1.49	0.94–2.37	0.089
Age	1.02	0.99–1.05	0.174

➤ Development of the Preliminary Screening Score

A seven-point screening score was developed from the variables independently associated with LBP.

Table 4 Development of the Preliminary Screening Score

Predictor	Points
Sitting > 8 h/day	2
Positive Modified Thomas Test / iliopsoas dysfunction	2
Low physical activity	1
BMI ≥ 25 kg/m ²	1
High perceived stress	1
Maximum score	7

The provisional interpretation was: 0–2 points, lower probability; 3–4 points, moderate probability; 5–7 points, higher probability. These categories should be considered provisional and require external validation before clinical implementation.

Sensitivity = 79.2%
Specificity = 70.7%
PPV = 66.2%
NPV = 82.4%
Accuracy = 74.3%

➤ Screening Performance

The preliminary seven-point score demonstrated an AUC of 0.81 (95% CI 0.77–0.85). The optimal provisional threshold was ≥ 3 points.

Following 1,000 bootstrap resamples, the internally corrected AUC was approximately 0.79.

V. DISCUSSION

This study investigated the relationship between lifestyle characteristics, iliopsoas/hip-flexor dysfunction and LBP in women and developed a preliminary screening tool integrating clinical and lifestyle variables.

LBP was present in 42.0% of the study population, while iliopsoas dysfunction was identified in 38.5%. Iliopsoas dysfunction occurred substantially more frequently among participants with LBP than among those without LBP.

The association remained significant after adjustment for other variables, with iliopsoas dysfunction demonstrating an adjusted OR of 2.16. This finding supports the potential clinical relevance of hip-flexor assessment as one component of a broader musculoskeletal assessment.

The strongest independent association in the model was prolonged sitting of more than eight hours per day. Participants with LBP reported approximately two additional hours of daily sitting compared with those without LBP. Prolonged sitting may be particularly relevant because it combines sustained hip flexion with reduced movement variability.

Low physical activity was also independently associated with LBP. This finding supports the importance of considering physical activity behaviour alongside localized musculoskeletal examination rather than focusing exclusively on structural or symptomatic factors.

BMI and perceived stress remained independently associated with LBP. These findings reinforce the multifactorial nature of LBP and the potential relevance of integrating physical and psychosocial variables into physiotherapy screening.

The Modified Thomas Test demonstrated lower hip-flexor mobility among participants with LBP. The findings are directionally consistent with emerging research examining relationships between hip-flexor tightness and LBP. However, the Modified Thomas Test should not be interpreted as a direct measurement of isolated iliopsoas muscle length, as the observed position is influenced by multiple anatomical and biomechanical factors.

The screening model demonstrated an AUC of 0.81 before internal correction and approximately 0.79 after bootstrap correction. This indicates promising discrimination within the study sample. Nevertheless, discrimination in an internally validated dataset does not establish transportability to other populations. Independent external validation and prospective evaluation are required before the score can be used as a clinical prediction tool.

VI. CLINICAL IMPLICATIONS

- Duration of daily sitting
- Uninterrupted sitting behaviour
- Physical activity level

- BMI
- Perceived stress
- Hip-flexor/iliopsoas mobility

The proposed screening score is intended as a research-stage tool rather than a diagnostic instrument. It should not be used to diagnose iliopsoas pathology or predict future LBP until external and prospective validation have been completed.

➤ Strengths

The study focused specifically on women and incorporated lifestyle exposures that may be modifiable through physiotherapy and health-promotion interventions.

The study combined subjective lifestyle information with an objective clinical musculoskeletal assessment.

The analysis incorporated multivariable modelling rather than relying solely on unadjusted associations.

Internal bootstrap validation was performed to assess potential model optimism.

The proposed tool uses relatively simple clinical and lifestyle variables that could potentially be incorporated into routine physiotherapy screening.

VII. LIMITATIONS

The cross-sectional design prevents determination of temporal relationships or causality.

Lifestyle variables were partly self-reported and may therefore be affected by recall or reporting bias.

The relationship between prolonged sitting, iliopsoas dysfunction and LBP may be bidirectional, and reverse causality cannot be excluded.

The Modified Thomas Test assesses hip-flexor mobility but does not directly isolate iliopsoas muscle length or function.

The screening score was internally validated in the same study population and requires external validation in independent populations.

Prospective studies are also required to determine whether the score can predict the future development or persistence of LBP.

VIII. CONCLUSION

In this sample of women aged 18–50 years, LBP was associated with prolonged sitting, iliopsoas/hip-flexor dysfunction, low physical activity, elevated BMI and high perceived stress.

A preliminary seven-point screening tool incorporating these factors demonstrated promising internal discrimination,

with an AUC of 0.81 and bootstrap-corrected AUC of approximately 0.79.

The findings support further investigation of integrated lifestyle and musculoskeletal screening approaches in physiotherapy practice. However, independent external and prospective validation are required before the proposed tool can be considered suitable for routine clinical prediction.

➤ *Ethics Statement*

This study involved human participants and was conducted at First One Rehab Foundation. The Foundation did not have an Institutional Ethics Committee at the time the study was conducted, and no formal Institutional Ethics Committee approval was obtained.

Participant confidentiality and privacy were maintained during data collection, analysis and reporting, and no identifiable participant information is reported in this manuscript.

INFORMED-CONSENT STATEMENT REQUIRES AUTHOR CONFIRMATION BEFORE SUBMISSION: The manuscript should state the exact form of informed consent obtained from participants. If written informed consent was obtained from all participants, the final statement should read: “Written informed consent was obtained from all participants before participation in the study.” If a different form of consent was used, the statement must accurately describe that process.

The authors acknowledge that the absence of prior ethics committee approval may be subject to editorial and journal-level assessment.

➤ *Declaration of Competing Interest*

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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No external funding was received for this study.

➤ *Data Availability*

The data underlying this study are not publicly available because they contain participant-level information. De-identified data may be made available from the corresponding author upon reasonable request, subject to appropriate privacy and ethical considerations.

➤ *Author Contributions*

- Dr. Sushmita Bhati: Conceptualization, methodology, data collection, investigation, analysis, writing – original draft.
- Dr. Mahipal Singh: Conceptualization, methodology, clinical interpretation, supervision, critical revision of the manuscript.
- Dr. Diksha Srivastava: Methodological input, clinical interpretation, supervision, critical revision of the manuscript.

All authors approved the final manuscript and agree to be accountable for all aspects of the work.

➤ *Conference Presentation*

Preliminary findings from this study were presented at a national scientific conference held at Artemis Hospital, where the study received first position.

REFERENCES

- [1]. World Health Organization. Low back pain. Geneva: World Health Organization; 2023.
- [2]. Chawla JK, Sushil P, Kumar P, Singh M, Sharma R, et al. Development of prediction model for risks of musculoskeletal chronic lumbopelvic pain in Indian women. *Scientific Reports*. 2024;14:22566. doi:10.1038/s41598-024-69063-6.
- [3]. Eimiller K, Vraa M, Sigmund K, Zellmer M. Relationship between hip flexor tightness and low back pain in non-care-seeking individuals. *Clinical Biomechanics*. 2026;132:106739. doi:10.1016/j.clinbiomech.2025.106739.
- [4]. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*. 2003;35(8):1381–1395. doi:10.1249/01.MSS.0000078924.61453.FB.
- [5]. Fairbank JCT, Pynsent PB. The Oswestry Disability Index. *Spine*. 2000;25(22):2940–2952. doi:10.1097/00007632-200011150-00017.
- [6]. Ha SM, Kwon OY, Yi CH, Jeon HS, Lee WH. Reliability of the Modified Thomas Test using lumbopelvic stabilization. *Journal of Physical Therapy Science*. 2015;27:365–368.
- [7]. Riley RD, Ensor J, Snell KIE, et al. Calculating the sample size required for developing a clinical prediction model. *BMJ*. 2020;368:m441. doi:10.1136/bmj.m441.
- [8]. Saltychev M, Mattie R, McCormick Z, Bärlund E. Psychometric properties of the Oswestry Disability Index. *International Journal of Rehabilitation Research*. 2017;40(3):202–208. doi:10.1097/MRR.0000000000000226.