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Developing and Validating a Tool to Assess the Musculoskeletal and Psychological Health in Industrial Workers

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Abstract

Background: Industrial workers may be exposed to repetitive tasks, prolonged or awkward postures, physical workload, and psychosocial stressors that can adversely affect musculoskeletal and psychological health. Musculoskeletal conditions affect approximately 1.71 billion people worldwide and are a major contributor to disability, while the World Health Organization estimates that 15% of working-age adults live with a mental disorder at any point in time. **Objectives:** To develop and assess the content validity of the Integrated Musculoskeletal and Psychological Health Questionnaire for Industrial Workers (IMPH-IW), a screening tool designed to consider musculoskeletal and psychological health within a single instrument. **Methods:** The questionnaire was developed from a literature-informed identification of relevant musculoskeletal and psychological health constructs. It comprised two domains, each containing 10 closed-ended items. Content validity was evaluated by four experts using 4-point ratings for relevance, clarity, and simplicity. Item-level Content Validity Indices (I-CVI) and scale-level content validity indices based on the average I-CVI (S-CVI/Ave) were calculated. Expert comments were used to revise wording and organization. Results: For the musculoskeletal domain, the S-CVI/Ave was 0.975 for relevance, clarity, and simplicity. For the psychological domain, the S-CVI/Ave values were 0.925 for relevance, 0.950 for clarity, and 0.925 for simplicity. The psychological domain had I-CVI values of 0.75 for relevance on items 13, 18 and 20, and 0.75 for clarity on items 11 and 15; simplicity was 0.75 for items 11, 13 and 15. All other corresponding items had I-CVI values of 1.00. The results support strong expert agreement regarding the content of the proposed tool, while further validation in the target worker population remains necessary. **Conclusion:** The IMPH-IW shows strong content-validity evidence based on expert ratings and provides an integrated framework for screening musculoskeletal and psychological health. Its criterion validity, reliability, and performance in industrial-worker populations require evaluation in future studies.

Major Findings: The IMPH-IW integrates 10 musculoskeletal and 10 psychological items in one screening tool. Expert review showed high content-validity indices across the two domains. Further psychometric testing in industrial workers is required before clinical or occupational risk classification is recommended.

Keywords: Content Validity, Industrial Workers, Musculoskeletal Disorders, Occupational Health, Psychological Health, Questionnaire

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1. Introduction

Industrial workers in manufacturing and production environments may be exposed to physical, biomechanical, organizational, and psychological hazards. Musculoskeletal conditions are a major global health burden: approximately 1.71 billion people worldwide live with a musculoskeletal condition, and low back pain is

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the leading contributor to disability in many settings[1]. Occupational exposures such as repetitive movements, forceful exertion, prolonged postures, and high physical workload can contribute to work-related musculoskeletal symptoms[2-4].

Psychological health is also relevant to occupational health. The World Health Organization estimates that 15% of working-age adults have a mental disorder at any point in time, and poor working environments—including excessive workloads, low job control, and job insecurity—can pose risks to mental health[5,6]. Psychosocial work factors may also interact with musculoskeletal symptoms, supporting a biopsychosocial approach to worker health[7–10].

Existing occupational assessment instruments frequently focus on either physical/ergonomic exposure or psychological health[11-16]. Ergonomic tools are useful for identifying physical work demands, while psychological screening instruments address constructs such as stress, anxiety, mood, or work-related distress[16-21]. However, these approaches may require separate assessments when both domains are of interest.

The need for an integrated screening approach is particularly relevant in occupational settings where a brief instrument may facilitate early identification of workers who warrant more detailed assessment[22-26]. The present study therefore aimed to develop the Integrated Musculoskeletal and Psychological Health Questionnaire for Industrial Workers (IMPH-IW) and assess its content validity through expert evaluation.

2. Materials and Methodology

2.1 Study Design

This was a questionnaire-development and content-validation study. The validation phase evaluated the relevance, clarity, and simplicity of the proposed items through expert review. No criterion-validation or reliability testing in industrial workers was undertaken in the present phase.

2.2 Questionnaire Development

The questionnaire was developed through a literature-informed identification of musculoskeletal and psychological health constructs relevant to industrial workers (Figure 1). The original study record describes a literature review as the basis for selecting assessment modules; however, a prospective search log specifying the number of records screened, databases, and complete search strings was not retained. Accordingly, these details are not retrospectively reported as if they had been prospectively documented.

The resulting IMPH-IW contains two domains: Section A, Musculoskeletal Health, with 10 items addressing pain or discomfort in commonly affected body regions; and Section B, Psychological Health, with 10 items addressing work-related psychological symptoms and stressors. Items use simple closed-ended responses intended for quick screening.

2.3 Scoring

Each item is scored as Yes = 1 and No = 0, giving a possible score of 0–10 within each domain. Because the present study did not establish criterion validity or clinical cut-offs against an external reference standard, the previously proposed categories of 0–3, 4–7, and 8–10 as low, moderate, and high risk are not interpreted as validated risk categories in this manuscript. These score ranges should be considered provisional until tested in a sufficiently large target-worker sample.

2.4 Expert Validation

Four experts reviewed the 20 items using a 4-point scale for relevance, clarity, and simplicity. The validation process was conducted in two rounds. The panel comprised Dr. Srihari Sharma (PhD; Cardiorespiratory; 25 years of experience), Dr. Seema (MPT; CBR; 3 years of experience), Dr. Vijayalakshmi (CBR; 3 years of experience), and Dr. Pradeep Ready (CBR; 20 years of experience). The available expert comments from both rounds were used to guide wording, clarity, and presentation changes.

The four experts had 3–25 years of professional experience and represented cardiorespiratory and CBR practice. A formal statistical calculation for the panel size was not performed; therefore, the four-member panel is interpreted as a content-validation panel rather than as a basis for statistical validation of the instrument. No dedicated psychology qualification was documented among the four experts in the information supplied by the authors, which is acknowledged as a limitation.

2.5 Content Validity Analysis

For each item, the I-CVI was calculated as the proportion of experts rating the item 3 or 4 for the relevant criterion.

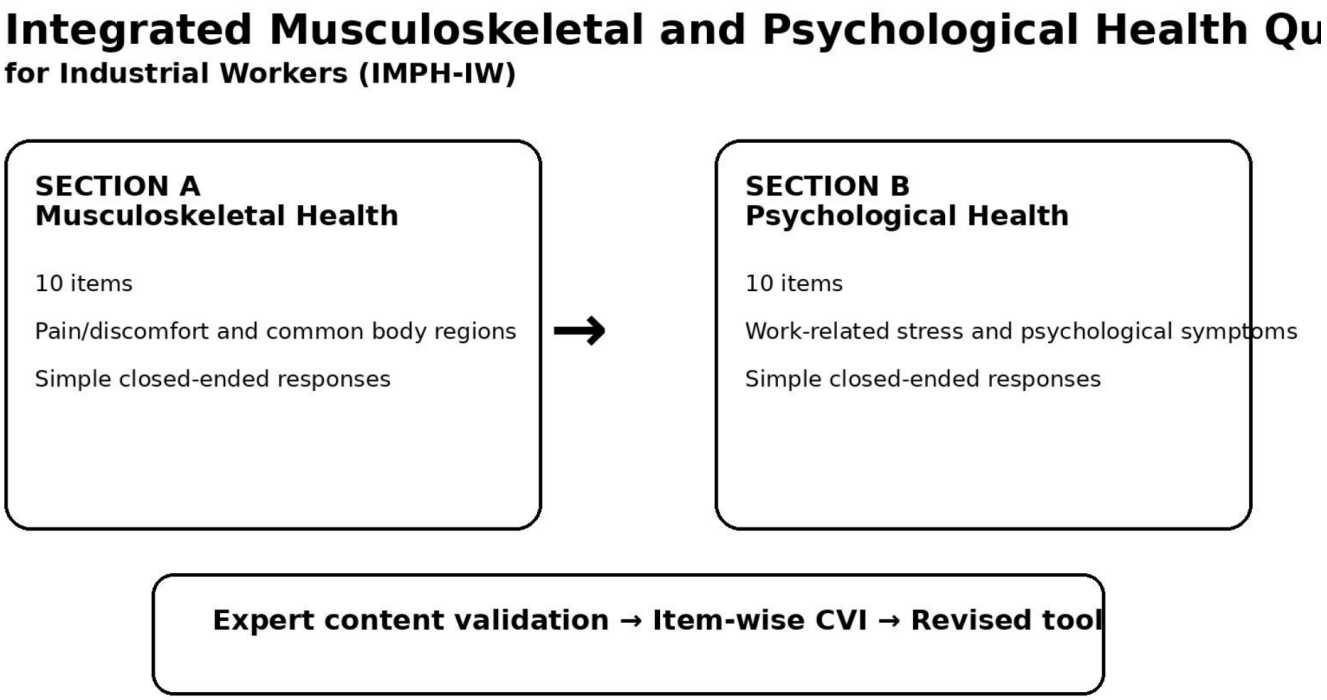


Figure 1. Graphical abstract of the IMPH-IW development and content-validation process.

S-CVI/Ave was calculated as the mean of the item-level CVIs within each domain and criterion. This approach distinguishes relevance, clarity, and simplicity and allows the reviewer to inspect item-wise agreement. The analysis was based on the four available expert ratings.

2.6 Participant Criteria

The intended target population for the questionnaire comprises industrial workers aged 18–60 years who are currently employed in industrial or manufacturing occupations, have at least six months of industrial work experience, and voluntarily agree to participate. Workers with a fracture within the preceding three months or an acute musculoskeletal injury, severe mental illness, or cognitive impairment were intended to be excluded from future field validation. These criteria describe the intended target population and were not used as an enrollment sample for the present expert-content-validation phase.

2.7 Ethical Considerations

Ethical approval for the research project was obtained from the Institutional Scientific Committee, Dayananda Sagar University, under reference number ISC/Intern/DSU/2026/1353 dated 09 March 2026. The approval document identified Dr. Gayathri Poojary as Principal Investigator and Sawant Nikhil Namdev as Co-Investigator.

3. Results

3.1 Expert Ratings and Content Validity

The two-round validation process demonstrated strong agreement across the musculoskeletal domain. For all 10 musculoskeletal items, the relevance, clarity, and simplicity I-CVI values were 1.00 except for item 10, for which the I-CVI was 0.75 for all three criteria. Consequently, the S-CVI/Ave was 0.975 for relevance, clarity, and simplicity.

In the psychological domain, relevance I-CVI values were 0.75 for items 13, 18, and 20 and 1.00 for the remaining items, producing an S-CVI/Ave of 0.925. Clarity I-CVI was 0.75 for items 11 and 15 and 1.00 for the remaining items, producing an S-CVI/Ave of 0.950. Simplicity I-CVI was 0.75 for items 11, 13, and 15 and 1.00 for the remaining items, producing an S-CVI/Ave of 0.925. These ratings were obtained across the two expert-validation rounds.

Table 1. Item-wise content validity indices for the musculoskeletal domain

Item	Relevance I-CVI	Clarity I-CVI	Simplicity I-CVI	Key Expert Comment
Q1	1.00	1.00	1.00	—
Q2	1.00	1.00	1.00	Phrase should be consistent across all items.
Q3	1.00	1.00	1.00	Consider a previous-three-month timeframe.
Q4	1.00	1.00	1.00	—
Q5	1.00	1.00	1.00	Relevant, but less common than spine/shoulder conditions.
Q6	1.00	1.00	1.00	—
Q7	1.00	1.00	1.00	Hip/thigh pain is relevant in prolonged standing and load-bearing tasks.
Q8	1.00	1.00	1.00	—
Q9	1.00	1.00	1.00	—
Q10	0.75	0.75	0.75	Replace technical wording with a term understandable to the general population.

S-CVI/Ave: 0.975 for relevance, 0.975 for clarity, and 0.975 for simplicity.

Table 2. Item-wise content validity indices for the psychological domain

Item	Relevance I-CVI	Clarity I-CVI	Simplicity I-CVI	Key Expert Comment
Q11	1.00	0.75	0.75	Clarify "mentally exhausted" for workers.
Q12	1.00	1.00	1.00	—
Q13	0.75	1.00	0.75	Clarify "anxious" for workers.
Q14	1.00	1.00	1.00	Clarify "because of work".
Q15	1.00	0.75	0.75	Consider a two-week timeframe; avoid implying diagnosis.
Q16	1.00	1.00	1.00	—
Q17	1.00	1.00	1.00	Add timeframe/frequency and relate pressure to sleep.
Q18	0.75	1.00	1.00	Specify support source, e.g., supervisor/colleagues.
Q19	1.00	1.00	1.00	Add timeframe/frequency.
Q20	0.75	1.00	1.00	Add a specific timeframe.

S-CVI/Ave: 0.925 for relevance, 0.950 for clarity, and 0.925 for simplicity.

3.2 Item Revisions Informed by Expert Comments

Expert comments were used to improve wording and comprehensibility. Examples included adding or considering a defined recall period for symptom questions, clarifying psychological terms such as anxiety and mental exhaustion, specifying sources of workplace support, and avoiding wording that could be interpreted as a diagnostic assessment. These changes are intended to improve respondent understanding rather than to establish diagnostic validity.

4. Discussion

The present study developed the IMPH-IW as an integrated screening instrument containing musculoskeletal and psychological domains. The content-validation findings indicate high agreement among the four experts across the three evaluated criteria. The musculoskeletal domain showed an S-CVI/Ave of 0.975 for relevance, clarity, and simplicity, while the psychological domain showed S-CVI/Ave values of 0.925, 0.950, and 0.925, respectively. The item-wise results also identify specific psychological items

requiring careful wording and one musculoskeletal item requiring improvement in comprehensibility.

The findings support the conceptual rationale for considering physical and psychological health together. Occupational musculoskeletal symptoms may coexist with psychosocial stressors, workload, and other workplace factors. WHO guidance similarly emphasizes that excessive workloads, low job control, job insecurity, and other poor working conditions can affect mental health[2,6]. The integrated structure of IMPH-IW may therefore be useful as an initial screening framework when both domains need to be considered.

Compared with instruments that focus exclusively on ergonomic exposure or psychological symptoms, IMPH-IW is intended to provide a brief combined screen. This does not mean that it replaces established domain-specific instruments or clinical assessment. Rather, its potential value lies in identifying workers who may require more detailed evaluation. Future studies should compare IMPH-IW scores with established musculoskeletal and psychological measures to determine convergent and criterion-related validity.

The expert comments also highlight an important issue in occupational screening: language must be understandable to the target worker population. Terms such as 'anxious' and 'mentally exhausted' may not have uniform meaning across workers with different educational and cultural backgrounds. The proposed wording changes therefore strengthen face-level comprehensibility, but their effect should be examined in cognitive interviews or pilot testing with industrial workers.

The four-expert panel should be interpreted as a content-validation panel rather than as statistical validation of the final instrument. The two-round review provided structured expert feedback and item-level content-validity evidence, but the panel size does not establish reliability, construct validity, criterion validity, sensitivity, specificity, or clinical cut-offs. The panel included cardiorespiratory and CBR expertise; no dedicated psychology qualification was documented in the supplied expert information.

The previously reported negative Cronbach's alpha values are not retained as evidence of expert agreement. Internal consistency statistics are not appropriate to interpret expert agreement across content-validity ratings in the manner previously described. The present revision therefore focuses on I-CVI and S-CVI/Ave, which directly address the content-validity question posed by the reviewer.

5. Limitations

First, the content-validation phase involved only four experts, and no formal statistical calculation was used to determine the panel size. Second, although the panel included cardiorespiratory and CBR expertise, no dedicated psychology qualification was documented in the information supplied for the four experts. Third, no industrial-worker sample was included in this phase; therefore, the questionnaire's reliability, construct validity, criterion validity, diagnostic performance, and clinical/occupational cut-offs remain unestablished. Fourth, the original study documentation does not contain a complete prospective literature-search log, so the number of records screened, databases, and exact search strategy cannot be retrospectively specified. Fifth, the proposed 0–10 domain scores should not yet be interpreted as validated low-, moderate-, or high-risk categories. Finally, although expert comments informed revisions over two rounds, cognitive interviewing and pilot testing with the target population were not performed.

6. Conclusion

The IMPH-IW is a structured 20-item questionnaire designed to screen musculoskeletal and psychological health within a single occupational-health instrument. Expert review showed strong content-validity evidence across relevance, clarity, and simplicity, with domain-level S-CVI/Ave values ranging from 0.925 to 0.975. The findings support continued development of the tool but do not establish clinical or occupational risk thresholds. Field testing in industrial workers, including reliability, construct validity, criterion validity, and determination of appropriate score interpretation, is required before routine implementation.

7. Declarations

7.1 Ethics approval

Ethical approval was obtained from the Institutional Scientific Committee, Dayananda Sagar University (Ref: ISC/Intern/DSU/2026/1353; 09 March 2026).

7.2 Consent

Not applicable to the content-validation phase because no industrial-worker participants were recruited; the questionnaire was evaluated by experts.

7.3 Conflict of Interest

The authors declare no conflict of interest.

7.4 Funding

No external funding was received for this study.

7.5 Data Availability

The expert-rating data used for the content-validity analysis are available from the corresponding author on reasonable request, subject to institutional and participant/privacy requirements.

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Author Contribution

Dr. Gayathri Poojary: Conceptualization, supervision, methodology, expert-validation oversight, manuscript review and editing. Nikhil Sawant: Literature synthesis, questionnaire development, data organization, content-validity analysis, manuscript drafting and revision. Both authors reviewed and approved the final manuscript.

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