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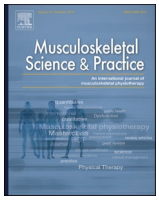

Identifying red flags for serious neck pathology: A UK nominal group study

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ABSTRACT

Background: Red flags are clinical indicators that may signal serious underlying spinal conditions, yet there is no consistently applied guidance for identifying red flags specific to serious neck pathologies. While previous studies have outlined red flags for cervical spine pain more broadly (e.g., Feller et al., 2024), there is limited empirical evidence detailing early presenting features that differentiate serious pathology from common musculoskeletal presentations, particularly in non-traumatic contexts. This gap increases the risk of missed or delayed diagnosis.
Objective: To empirically identify and prioritise red flags for serious neck pathologies to support earlier detection and appropriate management.
Methods: A qualitative study using the Nominal Group Technique was conducted with ten UK-based clinicians experienced in diagnosing and managing serious neck pathologies. Participants independently generated potential red flags, refined them through structured group discussion, and voted on their inclusion using a predefined consensus threshold. Agreed-upon indicators were then organised into thematic categories.
Results: Consensus was achieved on eight categories of red flags across three domains: risk factors, symptoms, and signs. Early indicators prioritised by participants included pain characteristics, functional decline, subtle neurological changes, and patient-reported difficulty supporting the head or neck. Clinicians emphasised that red flags are most informative when interpreted as clusters of evolving features rather than isolated findings.
Conclusion: Unlike prior systematic reviews, this study empirically identifies early, clinician-prioritised red flags specific to serious neck pathologies, providing practical guidance for differentiating serious conditions from benign musculoskeletal neck pain. Recognising these early features may support timely detection and improved patient outcomes.

1. Introduction

Identifying serious pathology as the cause of a person's musculoskeletal presentation is challenging. Red flags are clinical signs or symptoms that suggest a serious underlying spinal condition (Lewis, 2026; Finucane et al., 2020) and are used in patient evaluation and management. Current guidelines recommend their use (Finucane et al., 2020; Greene, 2001), as they help clinicians assess whether a patient may be at risk of serious pathology, even in the absence of objective symptoms (Finucane et al., 2018; Greenhalgh and Selfe, 2009).

For this study, serious neck pathology refers to conditions requiring urgent or specialist medical intervention. These include cervical spine fractures, primary or metastatic malignancy, spinal infection (e.g., discitis, osteomyelitis), conditions causing structural compromise, and spinal cord compression (Bussieres et al., 2016; Finucane et al., 2020). Conditions such as non-specific neck pain, radiculopathy without evidence of serious underlying disease, whiplash-associated disorders, and age-related degenerative changes were not considered serious pathology (Bussieres et al., 2016; Finucane et al., 2020; Patnaik et al., 2020).

Serious cervical presentations, such as vascular-mediated neck pain, are recognised in the broader literature. Vascular causes, including cervical arterial dysfunction, may initially mimic non-specific musculoskeletal neck pain and can present with early neurological features, as outlined in the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) Framework (Rushton et al., 2014) and elsewhere (Hutting et al., 2020). These presentations highlight the diagnostic complexity of neck pain, where serious pathology may initially resemble more common musculoskeletal conditions. Although

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vascular conditions have been extensively addressed in existing frameworks and require specific clinical assessment approaches, their potential overlap with early musculoskeletal presentations reinforces the importance of careful clinical reasoning when evaluating patients with neck pain (Hutting et al., 2020).

Neck pain is a common condition, affecting approximately 203 million people worldwide in 2020 (Wu et al., 2024). Although serious pathologies such as tumours, fractures, infection, and spinal cord compression are much less common in the cervical spine than in the thoracic or lumbar regions, delays in diagnosis can have significant negative consequences for patient outcomes (Henschke et al., 2009; Finucane et al., 2020). Studies estimate that only about 1% of neck pain cases are attributed to serious underlying pathology (Mourad et al., 2023; Faletra et al., 2022), yet research suggests that between 5% and 20% of cases of serious cervical spine pathology are delayed in diagnosis when patients present to the emergency department (Storari et al., 2025; Sizer et al., 2007). This is particularly challenging in non-specialist settings, where early features of serious cervical conditions often overlap with benign musculoskeletal presentations (Greenhalgh and Selfe, 2009; Finucane et al., 2018). A recent systematic review found significant variation in red flags recommended across clinical guidelines, with many not supported by the evidence (Feller et al., 2024).

While the Canadian C-Spine Rule offers high sensitivity for detecting post-traumatic cervical fractures, there remains no standardised or consistently applied guidance for identifying red flags associated with non-traumatic serious neck pathologies that can mimic common musculoskeletal presentations (Stiell et al., 2001; Michaleff et al., 2012). This gap limits clinicians' ability to apply a pragmatic, reliable screening approach to potentially serious spinal conditions. Such uncertainty increases the likelihood that serious neck pathologies may be missed, contributing to delayed or inappropriate management and higher healthcare costs due to delayed diagnosis and treatment (Platzer et al., 2006; Sizer et al., 2007; Versus, 2024).

To address this gap, this study aimed to identify red flags associated with serious neck pathology to support earlier recognition and more appropriate clinical decision-making.

2. Methods

2.1. Study design and ethical approval

This study employed the Nominal Group Technique (NGT), a structured qualitative method for eliciting and prioritising ideas through group discussion, valuing experiential knowledge and shared understanding (Graham et al., 2023; McMillan et al., 2016). A multidisciplinary panel of United Kingdom (UK) clinicians with expertise in identifying and managing serious neck pathologies, including infection, fracture, spinal cord compression, and malignancy, ensured broad representation and reduced the likelihood that any single pathology would dominate the identification of red flags.

The research team comprised clinicians and academics experienced in qualitative research, advanced clinical practice, and education, which informed both the study design and NGT facilitation, ensuring the clinical relevance of the identified red flags (Braun and Clarke, 2022). Reflexive team discussions addressed potential biases and interpretive influences. The study received ethical approval from a UK University Research Ethics Committee (Reference Number: 80,067) and adhered to the Standards for Reporting Qualitative Research (SRQR), with the completed checklist included in Supplementary File One (BMJ Quality & Safety, 2025).

2.2. Researcher reflexivity

Reflexive discussions were conducted before and after each NGT session to identify assumptions, disciplinary biases, and interpretive influences. These reflections guided facilitation, item grouping, and interpretation, enhancing methodological transparency and rigour.

2.3. Patient, public, and stakeholder involvement

Patient and public involvement was incorporated during the preparatory phase of this study through consultation with three patients who had experienced serious neck pathology. They shared their experiences of delayed diagnosis and identified perceived gaps in clinician awareness, emphasising the importance of improving early recognition. One patient noted that "clinicians do not have it [serious pathologies of the neck] on their radar," underscoring the perceived need for greater awareness amongst healthcare professionals. Additional consultation with a stakeholder group, including physiotherapists and spinal surgeons, further supported the need for this research. This combined patient and stakeholder input informed the rationale for the study and helped shape the research question underpinning the work, ensuring that the study addressed issues grounded in lived experience while remaining aligned with clinical practice priorities.

3. Sampling strategy

Clinicians were eligible if they had experience identifying and managing serious neck pathologies, could participate in all study phases, and provided informed consent. Exclusion criteria included lack of relevant clinical experience, inability to attend study sessions, or lack of active involvement in clinical care.

A purposive sample of ten United Kingdom clinicians was recruited to capture perspectives across the care pathway for serious neck pathology. The panel included musculoskeletal clinicians, advanced practice physiotherapists, consultant physiotherapists, and medical specialists involved in diagnosis, acute management, and complex care, including spinal surgery and oncology services. Recruitment occurred through professional networks, professional associations such as the Chartered Society of Physiotherapy (iCSP), specialist clinical services, and social media platforms (WhatsApp groups and X, formerly Twitter). Twelve clinicians were approached, and ten consented to participate, consistent with Nominal Group Technique recommendations that prioritise depth of expertise over participant numbers.

All participants provided written informed consent before participation. Data were anonymised using alphanumeric identifiers (for example, P1 and P2) to maintain confidentiality.

3.1. Pre-elicitation preparation

Before the first NGT session, participants received a preparatory email outlining the study objective, session structure, and a summary of evidence from a recent systematic review highlighting gaps in early identification of red flags (Feller et al., 2024). Red flags for vascular pathologies were excluded as these are comprehensively documented elsewhere (Rushton et al., 2023).

3.2. Consensus process

Participants independently generated potential red flags for serious neck pathology and recorded their ideas on individual cards. Cards were shared sequentially in a round-robin format to ensure equitable contribution and minimise dominance effects (Graham et al., 2023; Jones and Hunter, 1995). All items were documented on a visible flipchart by the facilitator to promote transparency and collective validation. Duplicate or overlapping suggestions were merged, and frequency of mention was recorded (McMillan et al., 2016).

Following the initial generation, items were discussed to clarify and refine their meaning. A predefined consensus threshold of $\geq$70% ($\geq$7 of 10 participants) was applied (List, 2001; Williamson et al., 2012; Graham et al., 2023). Items meeting this threshold were provisionally retained, while those falling below it were revisited in subsequent

discussion rounds to avoid premature exclusion of potentially important indicators.

A second NGT session allowed participants to review the provisional list, refine item wording, and resolve remaining ambiguities. Items that lacked consensus were adjudicated by forced choice using the same ≥70% threshold. Finally, the refined list was circulated electronically to participants for confirmation, allowing for minor clarifications. Fig. 1 illustrates the NGT stages.

3.3. Data analysis

Data analysis was conducted independently of the consensus-building stage. All items generated during NGT sessions were transcribed verbatim from flipcharts and field notes. Participants also ranked items during the sessions, with frequency counts and ranking scores calculated to indicate endorsement and prioritisation (Van Breda, 2005). A modified thematic analysis, adapted from Braun and Clarke (2020), was then applied: two team members independently grouped items into preliminary categories based on semantic similarity and clinical relevance. Patterns were identified, overlapping concepts consolidated, and categories refined collaboratively. Disagreements were resolved through discussion until a consensus was reached. The final list of red flags reflects both quantitative endorsement and qualitative deliberation.

4. Results

4.1. Study participants

Ten healthcare professionals were recruited from multiple National Health Service (NHS) Trusts and specialist centres across the United Kingdom. Participants represented a broad range of disciplines involved in the diagnosis and management of serious neck pathologies. They included physiotherapists working in advanced musculoskeletal and consultant roles, surgeons specialising in complex spinal pathology, and medics and physiotherapists with oncology expertise. Clinical experience ranged from 7 to 25 years post-qualification, with substantial expertise in the diagnosis and management of a wide range of spinal conditions, including fractures, malignancy, inflammatory disorders, and spinal cord compression.

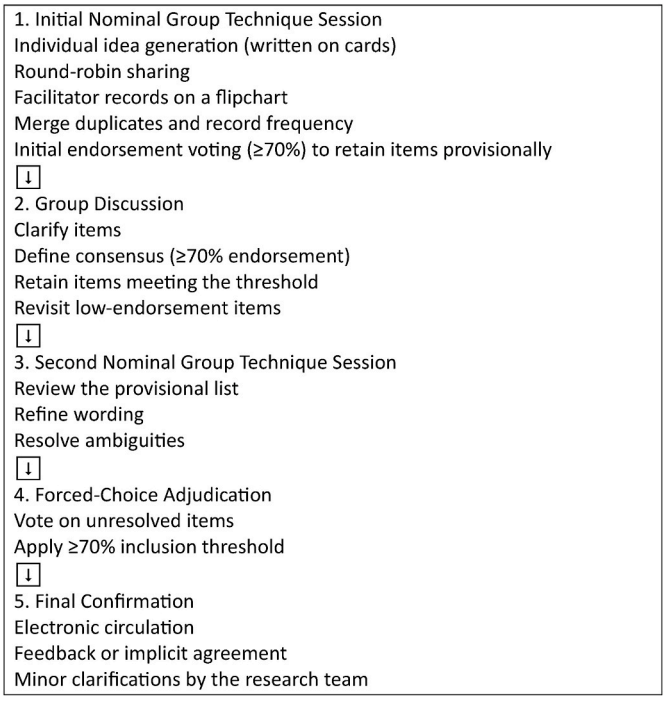

Fig. 1. Outline of stages of nominal group technique groups.

4.2. Item generation (NGT stage 1: initial session)

Across the two NGT sessions, participants independently generated 36 potential red flag items through structured idea generation and round-robin sharing. Duplicate items were merged, and the frequency of mention was recorded. Items mentioned only once were retained to avoid prematurely excluding potentially important indicators that are less commonly articulated.

4.3. Clarification, refinement, and initial endorsement (NGT stage 2: group discussion)

During the facilitated discussion, participants clarified the meaning of the items, explored their clinical relevance, and identified any missing indicators. Particular attention was paid to applicability in generalist settings, early features suitable for safety-netting, and distinguishing benign from serious presentations. An a priori consensus threshold of ≥70% endorsement (≥7 of 10 participants) was applied. Of the 36 items generated, 18 items (50%) reached this threshold in the initial round and were provisionally retained. The remaining 18 items were revisited in subsequent discussion rounds to avoid prematurely excluding items that may be clinically relevant.

4.4. Second NGT session and forced-choice adjudication (NGT stages 3 & 4)

During the second session, participants reviewed the provisional list of 18 items, refined item wording, and resolved remaining ambiguities. Nine additional items reached consensus during this round, bringing the total to 27 that met the predefined ≥70% endorsement threshold. For items where agreement remained unclear, a forced-choice adjudication was applied, again using the ≥70% inclusion threshold, ensuring that all retained items had demonstrable group support.

4.5. Clarifying symptom versus sign categories

Some indicators, such as Activities of Daily Living (ADLs) and Escalating Health-Seeking Behaviour, appear in both the symptom and sign domains. This reflects their dual operational nature. As a symptom, these items represent patient-reported experiences. For example, a patient may report difficulty getting out of bed or using cutlery or may describe increasing frequency of visits to their GP. As a sign, these same items represent clinician-observed or documented evidence of functional change, such as observed difficulty with transfers, reliance on aids, or an increase in healthcare utilisation noted in medical records.

4.6. Final agreed-upon red flags

The final consensus-based red flags for serious neck pathology are presented in Table 1, organised into three domains: risk factors, symptoms, and signs. Early presenting features, such as escalating pain and subtle functional deficits, were prioritised for timely recognition and referral. In Table 1, indicators most frequently observed at early clinical presentation are highlighted in green with an asterisk (*), helping clinicians quickly identify which red flags are likely to appear first. Participants emphasised that red flags are most informative when interpreted collectively rather than in isolation. As one clinician explained,

> "These [red flags] are not going to tell us everything … but if you have a collection of symptoms, that is when it becomes concerning" (P2).

Table 1
Final consensus on red flag categories for serious neck pathologies.

Red Flag Category	Indicators	Supporting Quotes
Risk Factors		
Past Medical History	Current or past history of cancer	"Do not rule out any solid tumour … myeloma is another one we really watch for because of its destructive effect on bone." (P4) "Past medical history of cancer or current cancer." (P5)
Infection Risk	Current intravenous drug use; immunocompromised state (e.g., recurrent infections, chronic illness); recent invasive procedure	"IV drug use and immunocompromised states are relevant risk factors." (P6) "He looked fine, no fever, but he had had a recent procedure and was immunosuppressed. Turned out to be a spinal abscess." (P7)
Symptoms (Subjective)		
Pain (Night Pain) [a]	Escalating neck pain; unresponsive to analgesics; increased pain when lying down; sleep disturbance	"Pain tends to be the first symptom." (P3) "Escalating, unresponsive to analgesia." (P7) "Unbearable pain, unable to sleep lying down at night." (P2)
Neurological[a]	Limb heaviness; weakness; swallowing difficulties; dizziness; loss of dexterity	"Difficulty using a knife and fork makes it more obvious." (P8) "Clumsiness or loss of dexterity leading to functional task issues." (P4)
Head/Neck Support Difficulty[a]	Head feels heavy or unstable; requires support; pain worsens when sitting unsupported.	"They say, 'my head … it just feels heavy'." (P6) "People want to hold their heads a particular way." (P9)
Activities of Daily Living (ADLs)[a]	New or rapidly worsening difficulty performing daily activities (e.g., getting out of bed, using cutlery, increased falls)	"It should perhaps be a new difficulty … quite a few older patients have difficulty getting out of bed, but this is different." (P1) "Difficulty using a knife and fork makes it more obvious." (P8)
Escalating Health-Seeking Behaviour	Patient reports increasing frequency of healthcare visits as symptoms worsen.	"From a GP's perspective, they might see that the patient has suddenly started increasing visits … that is a red flag." (P2)
Systemic Illness	Fatigue; feeling generally unwell	"Replace malaise with fatigue and generally unwell." (P5)
Unexplained Weight Loss	>5% body weight over six months	"Fatigue, weight loss, and generally feeling unwell." (P9)
Signs (Objective)		
Neurological[a]	Impaired dexterity or coordination; brisk reflexes; gait disturbance	"Fine motor movements are not what a patient would describe … difficulty using a knife and fork makes it more obvious." (P8)
Head/Neck Support Difficulty[a]	Observed dropped head; altered posture or positioning	"I cannot see where I am going because I cannot lift my head." (P3) "Subtle deformities and gradual onset changes, for example, something like a 'drop head.'" (P1)
Escalating Health-Seeking Behaviour[a]	Documented increase in healthcare utilisation	"From a GP's perspective, they might see that the patient has suddenly started increasing visits … that is a red flag." (P2)

[a] /green shading: represents indicators most frequently observed during early clinical presentation.

5. Discussion

The structured Nominal Group Technique (NGT) process enabled clinicians to systematically progress from individual idea generation to collective prioritisation, moving from an initial broad list of 36 items to a refined set of consensus red flags. Consensus was achieved on eight categories spanning risk factors, symptoms, and signs, with early presenting features prioritised for their relevance to timely recognition and referral (Table 1). Importantly, these categories emerged from both quantitative endorsement thresholds and qualitative deliberation, ensuring that no single pathology type, such as malignancy, dominated the process. Our findings complement and support the Framework for Red Flags for Potential Serious Spinal Pathologies (Finucane et al., 2020) by illustrating how contextual risk factors, subjective symptoms, objective signs, and functional adaptations interact in early clinical presentations of serious neck pathology.

Although malignancy-related red flags appeared frequently in participant examples, this likely reflects the high clinical risk and emphasis on early cancer detection rather than methodological bias. Indicators relevant to infection (e.g., recent invasive procedures or intravenous drug use), fracture (e.g., trauma, osteoporosis), inflammatory conditions (e.g., systemic illness), and spinal cord compression (e.g., neurological decline, functional deterioration) were also discussed during the consensus process. As such, the red flags identified in this study are relevant across cervical pathologies.

Pain was consistently reported as the earliest and most reliable symptom. Participants described escalating neck pain, unresponsive to analgesics, often worse at night and aggravated by movement or axial loading. This aligns with Lewis (2026), who notes that pain is typically the first manifestation of neck malignancy and is frequently misattributed to benign musculoskeletal conditions. Mesfin et al. (2016) similarly identify axial loading and movement-related pain as early indicators of serious cervical pathology. In Metastatic Spinal Cord Compression (MSCC), radicular-type pain occurs in approximately 79% of patients and may be overlooked in early stages (Patnaik et al., 2020). These observations reinforce that pain, while critical, must be interpreted within a broader clinical reasoning framework (Finucane et al., 2020).

Neurological symptoms were also prominent, including limb heaviness, weakness, reduced dexterity, dizziness, and difficulty swallowing. Functional consequences often appeared first, such as difficulty getting out of bed or using cutlery, preceding clear objective neurological signs. This pattern is consistent with early MSCC presentations, where limb weakness is reported in 85% of cases at diagnosis (Levack et al., 2001). Lewis (2026) further describes overlapping radiculopathy and myelopathy, which can produce paraesthesia, burning or aching pain, and weakness. Capturing these functional and behavioural cues, in conjunction with the International Framework (Finucane et al., 2020), supports early recognition and prioritisation of subtle indicators.

Participants highlighted early warning symptoms, including head feels heavy and neck needs support, reduced ability to perform activities of daily living (including bed mobility, transfers, and fine motor tasks), increased falls, and heightened health-seeking behaviour. These indicators were frequently observed before objective neurological signs, such as gait disturbance or brisk reflexes. Spinal tenderness was discussed but did not reach consensus for inclusion; however, its absence does not exclude metastatic disease (Finucane et al., 2020), highlighting the need for a comprehensive, context-based assessment approach.

Risk factors, including a history of cancer, immunocompromised states, recent invasive procedures, and intravenous drug use, were described as modifiers of clinical concern rather than standalone triggers. For example, a history of malignancy combined with unexplained weight loss or fatigue substantially elevates clinical suspicion, aligning with the International Framework's (Finucane et al., 2020) emphasis on contextualising red flags within the patient's broader clinical picture.

Although vascular pathologies and craniovertebral instability were

not the primary focus of this study, several early features identified, such as swallowing difficulties, escalating pain, and functional decline, may overlap with presentations described in the IFOMPT Cervical Framework or the craniovertebral instability literature (Rushek et al., 2023). This highlights the importance of considering both vascular and non-vascular causes when evaluating potentially serious neck presentations. In this context, red flags are most informative when interpreted as clusters rather than as isolated findings (Feller et al., 2024). Patients presenting with isolated or mild features may be suitable for monitoring, whereas urgent referral is warranted when high-risk factors, functional decline, or multiple red flags are present. These findings reinforce that serious neck pathology rarely presents with a single indicator; rather, risk factors, symptoms, signs, functional impacts, and behavioural cues should be considered cumulatively to support earlier detection and safe, informed clinical management (Finucane et al., 2020).

6. Limitations and future research

This UK-based study may limit the international generalisability due to differences in healthcare systems and patient populations. Although the multidisciplinary panel was a strength, the small panel size (n = 10), while consistent with the Nominal Group Technique (NGT) methodology, which prioritises depth of expertise, may limit the breadth of perspectives represented.

Whilst some participants were professionally known to the research team, it is recognised that this could introduce familiarity bias. To mitigate this risk, the NGT structure incorporated independent idea generation, round-robin sharing, visible documentation of all contributions, and predefined voting thresholds to minimise dominance effects and encourage equitable participation.

Furthermore, although the study focused on serious neck pathologies such as malignancy, fractures, infection, inflammatory conditions, and spinal cord compression, vascular pathologies and craniovertebral instability were not examined. Some early presenting features identified in this study, such as dizziness, escalating pain, or functional decline, may overlap with these conditions. Future research could examine how these presentations intersect with red flags for vascular or craniovertebral causes and whether additional indicators could improve early recognition.

Finally, although the consensus process identified clusters of risk factors, symptoms, and signs, red flags rarely indicate serious pathology in isolation. The findings should therefore be interpreted as part of cumulative clinical reasoning rather than as a definitive diagnostic checklist. Future studies involving larger and more diverse international panels could further validate these findings and strengthen their applicability across varied clinical contexts.

7. Implications for policy and practice

The study supports integrating red flags within a structured clinical reasoning approach rather than relying on a checklist. Clinician education should emphasise contextual interpretation, considering symptom progression, functional decline, behavioural cues, and risk factors. Healthcare systems should facilitate timely access for patients with evolving or multiple red flags through interprofessional communication, rapid imaging pathways, and telehealth triage where appropriate. Incorporating patient-reported functional challenges and environmental adaptations may enhance early recognition and safety, ultimately improving outcomes for serious neck pathologies.

8. Conclusions

This study is the first to empirically identify red flags specific to serious neck pathologies, thereby supporting early detection, timely management, and improved patient outcomes. Using the NGT, consensus was reached on eight categories encompassing risk factors, symptoms, and signs, mapped to the International Framework for Red Flags. Findings emphasise that red flags should be interpreted dynamically and contextually, with attention to temporal progression, functional impact, and behavioural indicators. Early recognition of indicators such as neck pain characteristics, neurological changes, and functional decline is critical for informed referral. Future research should validate these findings in diverse clinical settings and assess their impact on early management and patient outcomes.

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CRediT authorship contribution statement

Susan Greenhalgh: Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. **Melika Ghorbankhani:** Data curation, Investigation, Writing – original draft. **Laura Finucane:** Conceptualization, Formal analysis, Validation, Writing – review & editing. **Gillian Yeowell:** Conceptualization, Formal analysis, Investigation, Supervision, Writing – review & editing.

Conflict of interest

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2026.103569.

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