METHOD ARTICLE

REVISED Methodology used to develop the minimum common data elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement

[version 2; peer review: 2 approved, 1 approved with reservations]

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Abstract

Background

The objective was to summarize the methodology used to develop the international minimum data elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement. This is a recommended list of elements to be collected and reported when conducting injury surveillance research in military settings.

Methods

A Delphi methodology was employed to reach consensus. Preliminary steps included conducting a literature review and surveying a convenience sample of military stakeholders to 1) identify barriers and facilitators of military musculoskeletal injury (MSKI) prevention programs, 2) identify relevant knowledge gaps, and 3) establish future research priorities. A sequential three-round Delphi consensus survey followed, including relevant stakeholders from militaries around the world, using results to conduct an asynchronous knowledge user meeting (mixture of in-person and live video conference and recording) to explore the level of agreement among subject matter experts. Knowledge users, including former and current military service members, civilian practitioners working in military health networks, and international subject matter experts having experience with policy, execution, or clinical investigation of MSKI mitigation programs, MSKI diagnoses, and MSKI risk factors in military settings. For each round, participants scored questions on a Likert scale of 1-5. Scores ranged from No Importance (1) to Strong Importance (5).

Results

Literature review and surveys helped inform the scope of potential variables. Three rounds were necessary to reach minimum consensus. Ninety-five, 65, and 42 respondents participated in the first, second and third rounds, respectively.

Conclusions

Achieving consensus across relevant knowledge users representing military organizations globally can be challenging. This paper details the methodology employed to reach consensus for a core minimum

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data elements checklist for conducting MSKI research in military settings and improve data harmonization and scalability efforts. These methods can be used as a resource to assist in future consensus endeavors of similar nature.

Keywords
Implementation Science, Consensus, Delphi, Military, Sports Medicine, Military Medicine, Wounds and Injuries, Investigative Techniques

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REVISED **Amendments from Version 1**

This revision includes minor issues recommended by the reviewers, to include some minor grammatical issues and then primarily related to further clarification of certain aspects of the approach, which included:
- Clarifying who the civilian practitioners were
- Explaining what a knowledge user consisted of
- Description of asynchronous meetings

Any further responses from the reviewers can be found at the end of the article

Introduction

Collection, surveillance, and reporting of injury data is an important and ubiquitous aspect of musculoskeletal (MSK) care within systems seeking to evaluate and improve injury prevention and care models. This is particularly true across military performance and medical settings.[1–3] Often the data are inadequately powered (individual clinics or small sample sizes), requiring merging of data to properly compare patient subgroups, generalize results across different populations, and potentially answer clinically important questions.[4,5] However, merging of these data is often hampered by high heterogeneity in data elements, outcomes, and definitions.[1] Thus, there have been many recommendations to standardize data collection elements and practices to improve harmonization of data within a specific discipline or setting.[5–7]

Data collection procedures are highly variable across and even within military organizations world-wide, without a universal standard operating procedure.[1] For example, in a systematic review assessing musculoskeletal injury (MSKI) risk factors in military populations, high variability in exposure, outcome, and predictor collection and reporting from 170 studies limited the ability to effectively compare risk factors and injury risk across service member groups.[1] In a scoping review of 132 articles investigating military MSKI mitigation programs, heterogeneity in data and outcomes hindered the ability to calculate service member injury burden.[8] This variability in the collection and reporting of data elements may prevent clinicians, military leaders, and researchers from answering pertinent operational and clinical questions.

One method to improve consistency of standardized data collection and reporting across studies is through the development of a recommended list of core minimum data elements that everyone should collect and report.[5,7] Consensus for core minimum data elements has occurred across biomedicine fields (e.g. geriatrics,[7] pediatrics[5]) and for specific conditions (e.g. traumatic injuries,[9] osteoarthritis,[10] pain[6]). A common list of standardized data elements enables a systematic approach to data collection and focused analysis, allowing the specific study question to be addressed, but also facilitating aggregation and meta-analysis across studies.[4] This standardized practice ultimately leads to greater potential for increased cohort size and ultimately inference power.[4]

Recently a group of knowledge users (person who contributed to knowledge creation and have input equal to the scientific community) consisting of clinicians, researchers, policymakers and leaders in military settings world-wide collaborated to identify/recommend the minimum elements for collection and reporting in any study assessing MSKI in military populations. The project followed a Delphi consensus methodology to engage many relevant stakeholders world-wide. This paper summarizes the details and methodology used to develop the Minimum Data Elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement.

Methods

Process

The ROMMIL project was informed by the guidance for developers of health research guidelines.[11] Consensus reporting was informed by the ACcurate COnsensus Reporting Document (ACCORD) reporting guidelines.[12] Further methods and details, and respective protocols are available on Open Science Framework (https://osf.io/2wqbr/). Figure 1 displays the consensus process. This project adhered to all ethical principles of the Declaration of Helsinki. It was determined to not be human subjects research by the Institutional Review Board at Wake Forest University, School of Medicine (# IRB00115873), and therefore formal consent was not necessary. All participants were made aware that the data and collected information would be used to formulate a consensus statement, with the intent to publish the results, and all participants were invited to participate in the full process as authors.

Strategy

A core group of six members (GB, NA, JF, SdlM, BF, DR) identified the need for a standardized list of minimum core data elements for collection and reporting when conducting MSKI research. They pursued a balance in expertise across clinical and research disciplines, countries, and military branches while conducting a literature synthesis via scoping review, knowledge user survey, Delphi study and consensus meeting to achieve the ROMMIL consensus statement.

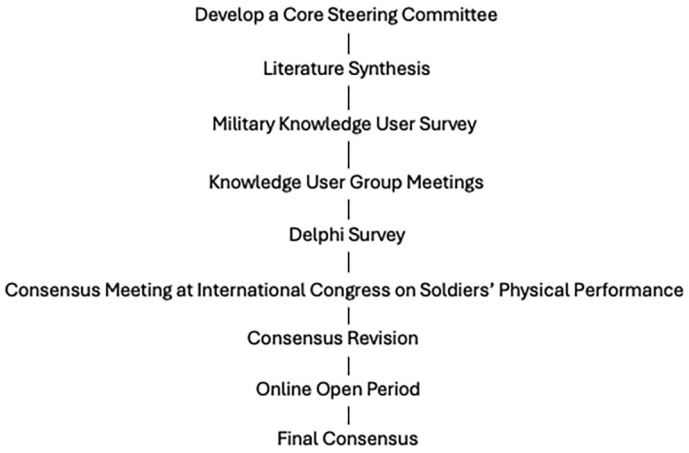

Figure 1. Consensus process.

Bias Reduction

Measures to reduce bias included having steering group members not being able participate in the small group conversations and only contribute to the full group discussions during the consensus meetings when invited. Steering group members were not allowed to initiate remarks. If invited to speak, steering group members were only allowed to provide clarification or guidance when appropriate. An independent experienced external moderator lead all group discussions to reduce the risk of dominant personalities and also reduce steering group bias. Finally, all meetings were open for in person, video, and viewing at a later date, with an open period to comment, to allow for inclusion of voices that could not make the meetings.

Stage 1: Literature synthesis

A scoping review was performed to (1) identify barriers to and facilitators of military MSKI prevention programs, (2) identify relevant knowledge/information gaps and (3) establish future research priorities. This scoping review has been published separately.[8] Databases included MEDLINE and the Defense Technical Information Center (DTIC). The results from the scoping review were merged with recommendations provided by the entire author group. The group created a preliminary list of all possible data elements and principles, based on the results of the scoping review. A knowledge user meeting, consisting of 45 participants, was then convened to further evaluate the list, which then received final approval by the steering committee (GB, NA, JF, SdlM, BF, DR).

Stage 2: Survey

The authors recruited a cross-sectional convenience sample the Total Force Fitness MSK Health conference attendees, then used a snowball recruitment method to gather knowledge user feedback concerning military MSKI mitigation program barriers and facilitators. The detailed results from this survey were reported elsewhere.[13] The reported barriers and facilitators were used to help guide the framework questions for the consensus exercise.

Knowledge user involvement (Patient and public involvement)

Knowledge users (including former and current military service members, civil practitioners that work in military health networks, and international subject matter experts having experience with policy, execution, or clinical investigation of MSKI mitigation programs, MSKI diagnoses, and military MSKI risk factors) were included in the development of the research question. A working group evolved from a sample of the knowledge users after the initial meetings. Knowledge users sought to improve the overarching question while accounting for research implications and facilitate knowledge translations. The knowledge user group included active-duty service members, veterans, military leaders, medical professionals that work in military settings (both military and civilian, that include athletic trainers, physical therapists, and physicians), scientists that work in military settings, and exercise physiologists from the United Kingdom and United States.

Delphi study

Study design

A sequential three round Delphi survey was performed. An asynchronous knowledge user meeting was performed to explore level of agreement among subject matter experts.

Recruitment

Experts were identified through the closeness continuum.[13] The closeness continuum identifies inclusive experts with subjective, mandated, and objective closeness to the topic of interest.[13,14] Military service members having sustained MSKI across their careers had subjective closeness. Clinicians treating service members for MSKI had mandated closeness. Researchers and scientific experts investigating military MSKI had objective closeness.

Recruitment entailed an email identifying an individual as a military MSKI expert and requesting that they participate in a Delphi consensus project, via a series of planned meetings. A follow-up email with an encrypted link was sent to those who wanted to participate, in order to answer a series of questions concerning injury surveillance and reporting in military settings (see extended data).[15] Participants were told that their answers would help inform the consensus project, and that all responses would remain anonymous.

Delphi rounds and scoring

Participants scored each question on a Likert scale of 1-5 for each round. Each question followed one of two formats shown in Table 1.

Following round 1, a synchronous knowledge user virtual meeting was held to discuss outlying scores, express and document disagreement or dissent concerning any statement, and propose alterations to variables and/or verbiage.

In round 2, participants had access to their previous scoring for each question. Changes in scoring were documented. A third round of scoring was unnecessary if the knowledge user group reached consensus on a given question during the second round.

Consensus criteria are defined *a priori* (Table 2).

Statistical analyses

Missing data were assessed prior to analyses. A complete case analysis was performed for the Delphi study. Participant data were reported as mean (standard deviation) for continuous data and count (%) for nominal and ordinal data. All analyses were performed in R 4.2.1 (R Core Team (2023). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/). The *dplyr* package was used for cleaning and analyses, and the *ggplot2* package was used for data visualization. The raw data available from each round are available in an open-source repository.[16]

Table 1. Likert survey question format.

Please refer to the scale below to rate how important you think each data point is to include in military musculoskeletal injury research:
No importance
Minimal importance
Some importance
Strong importance
Extreme importance
Please refer to the scale below to rate how important you think each injury classification system or metric is to define military musculoskeletal injury:
Extremely inappropriate
Somewhat inappropriate
Neither appropriate nor inappropriate
Somewhat appropriate
Extremely appropriate

Table 2. Criteria for consensus for inclusion, consensus for exclusion, and non-consensus.

Criteria	Definition	Implication
Threshold for consensus that variable should be included in a minimum data set for musculoskeletal injury in military populations (Consensus for inclusion).	≥ 80% of participants assign a score of ≥ 4 OR Median score of ≥4 in two consecutive rounds.	Variable does not proceed to the next round.
Threshold for consensus that variable should not be included in a minimum data set for musculoskeletal injury in military populations (Consensus for exclusion).	≥ 50% of participants assign a score of ≤ 2 OR Median score of ≤2 in two consecutive rounds.	Variable does not proceed to the next round.
Threshold for non-consensus.	Median score of 3 in two consecutive rounds OR Median score decreases by ≥ 1 point in a round compared to the previous round.	Variable does not proceed to the next round, consensus for exclusion.
	Median score increases by ≥ 1 point in a round compared to the previous round.	Variable proceeds to the next round.

Stage 3: Consensus meeting

After completing the Delphi rounds, a final consensus meeting was held on 13 September 2023 at the International Congress on Soldier's Physical Performance, in London, United Kingdom. All participants were invited to attend. The meeting was recorded for people who could not join the meeting in person to view at a later date. The purpose of the meeting was to (1) discuss the literature synthesis, survey, and Delphi survey results and (2) obtain advisory input on the final set of recommended minimum data elements for MSKI research in military settings. Fifty international participants (including military MSKI knowledge users, clinicians, and research experts) were present. The meeting was facilitated by the ROMMIL steering committee (GB, NA, JF, SdlM, BF, DR). Participants discussed and sought to achieve consensus on each data element during the meeting.

Stage 4: Consensus revision

After the consensus meeting, the steering committee (GB, NA, JF, SdlM, BF, DR) reviewed the results and revised the consensus statement based on pertinent feedback. The format and wording of each data element were reviewed and agreed upon, taking into consideration the survey, Delphi study, and consensus meeting results and discussions.

A 6-week open comment period was held for anyone to comment on the document. The electronic link was made available through the Musculoskeletal Injury Rehabilitation Research for Operational Readiness (MIRROR) website (https://mirrorusuhs.org/) and emailed to individuals who had participated in preliminary meetings and activities.

The draft consensus was then circulated again among consensus participants to (1) confirm accurate representation of the group consensus or (2) determine if further clarification was needed.

Results

Ninety-five, 65 and 42 respondents participated in the first, second and third rounds of the Delphi, respectively (Table 3). The process used a Delphi methodology, which is an acceptable and preferred method for validating consensus experiments.[16,17]

Round one

Eleven data elements reached consensus after round one (Table 4). Twenty-six data elements did not reach consensus after round one (Table 5); 66 data elements were excluded after round one (Table 6).

Round two

In round two, 16 more data elements reached consensus (Table 7); four data elements were combined with data elements that had already reached consensus (Table 8). Six data elements did not reach consensus after round two (Table 9).

Round three

Two more data elements reached consensus in round three. The other three data elements did not reach consensus (Table 10).

Table 3. **Delphi participant descriptive statistics.**

Variable	Round one participants (n = 95)	Round two participants (n = 65)	Round three participants (n = 45)
Primary Role			
Administrative Leadership	10 (11%)	4 (6%)	4 (9%)
Clinician/Practitioner	25 (26%)	23 (35%)	11 (24%)
Command/Leadership	5 (5%)	1 (2%)	3 (7%)
Implementing Human Performance Programs	4 (4%)	3 (5%)	4 (9%)
Implementing Injury Prevention Programs	9 (9%)	8 (12%)	3 (7%)
Researcher	41 (43%)	24 (37%)	20 (44%)
Secondary Role			
Administrative Leadership	11 (12%)	6 (9%)	3 (7%)
Clinician/Practitioner	23 (24%)	13 (20%)	12 (28%)
Command/Leadership	3 (3%)	2 (3%)	2 (4%)
Implementing Human Performance Programs	10 (11%)	9 (14%)	7 (16%)
Implementing Injury Prevention Programs	20 (21%)	18 (28%)	7 (16%)
Physical Training Instructor	3 (3%)	1 (2%)	0 (0%)
Researcher	13 (14%)	8 (12%)	7 (16%)
Country			
Australia	14 (15%)		
Belgium	2 (2%)		
Canada	7 (7%)		
New Zealand	2 (2%)		
United Kingdom	23 (24%)		
United States	47 (49%)		

*Blank cells denote information was not disclosed

Table 4. **Data elements with consensus after round one.**

Data element	Median score (IQR)	Agree percent
Unique Individual Identifier (i.e., ID)	5 (1)	81%
Age	5 (1)	92%
Sex	5 (1)	96%
Service Member is in Initial Military Training	5 (1)	96%
Body Part/Region	5 (1)	97%
Mechanism of Injury	5 (1)	90%
Presentation (i.e., sudden or gradual)	5 (1)	94%
Activity during injury	5 (1)	90%
Overuse Injuries	5 (1)	99%
Acute Injuries	5 (1)	99%
Traumatic Injuries	5 (1)	99%

IQR = Interquartile range.
Agree percent equates to a score of 4 or 5.

Table 5. **Data elements with no consensus after round one.**

Data element	Median score (IQR)	Percent agree
Height	4	67%
Weight	4	79%
Military Branch (e.g., Army, Navy, Air Force)	4	64%
Position, Duty or Occupational Specialty	4	76%
Years Working in the Military	4	64%
Terms of Service	4	58%
Previous Orthopaedic Surgery	4	73%
Body Part and/or Joint of Previous Orthopaedic Surgery	4	74%
How Long Ago Was Previous Orthopaedic Surgery	4	73%
What Type of Injury Was Past Injury (location, etc.)	4	78%
How Long Ago Was Previous Musculoskeletal Injury	4	72%
Percent Perceived Return to Function Following Previous Musculoskeletal Injury	4	69%
Tobacco Products Consumption	4	73%
Service Member is Attending Formal Military Training Course	4	69%
Service Member is in Special Operations	4	79%
Individual Exposure	4	76%
Exposure in Hours	4	52%
Exposure in Days	4	66%
Clinical Diagnosis of the Injury	4	71%
Days from Injury to Seeking Medical Care	4	64%
Days from Injury to Physical Therapy for Injury	4	59%
Duty Time Lost in Days from Injury	4.5	78%

Table 6. **Data elements excluded after round 1.**

Data element	Median score (IQR)	Percent agree
Waist Circumference	2 (1)	13%
Hip to Waist Ratio	2 (1)	6%
Body Fat Percentage	2.5 (1)	16%
Body Mass Index	2 (1)	7%
Race/Ethnicity	2 (1)	10%
Marital Status	1 (1)	6%
Physical Fitness Test Exemptions (e.g., “can do everything except running”)	2.5 (1)	24%
Previous Sport/Exercise Experience	2.5 (1)	18%
Historical Physical Fitness Test Scores	2.5 (1)	14%
Aerobic Fitness	2.5 (1)	27%
Rank	2 (1)	10%
Officer versus Ordinary Rank (i.e., Enlisted)	2 (1)	17%
Highest Level of Education Achieved	2 (1)	2%
Base or Post (i.e., where currently stationed)	2 (1)	9%

Table 6. *Continued*

Data element	Median score (IQR)	Percent agree
Unit	2 (1)	14%
Deployment History	2 (1)	15%
Number of Deployments	2 (1)	6%
Length of Most Recent Redeployment (months)	2 (1)	5%
Time Since Last Deployment (months/years)	2 (2)	6%
Menstrual Cycle/Amenorrhea	2.5 (1)	16%
Use of Oral Contraceptives	2.5 (1)	8%
Number of Pregnancies	2 (1)	8%
Number of Live Births	2 (2)	7%
Live Birth Complications History	2 (2)	5%
Time Since Last Live Birth	2 (1)	10%
Previous Time Loss from Injury (i.e., on profile, limited duty, light duty) Occurrences	2.5 (1)	32%
Previous Number of Days of Time Loss from Injury (i.e., on profile, limited duty, light duty)	2.5 (1)	33%
Treatment Interventions Used for Past Injury	2.5 (1)	17%
How Many Months Since Individual Passed Service Required Physical Fitness Test	2.5 (1)	16%
Joint Hypermobility	2 (1)	3%
Previously Seen a Mental Health Provider for a Mental Health/Behavioral Health Condition (and how long ago)	2.5 (1)	13%
Diagnosed Previous Sleep Disorders	2 (1)	9%
Previous History of Relative Energy Deficiency (RED-S)	2.5 (1)	15%
Previous History of Female Athlete Triad	2.5 (1)	19%
Self-Perceived Health	2 (1)	16%
Self-Perceived Fitness	2 (1)	16%
Recreational Physical Activity (e.g., per day, per week)	2.5 (1)	23%
Nutrition Habits	2.5 (1)	21%
Alcohol Consumption	2.5 (1)	16%
Contact and Collision Sport Involvement (and how long ago)?	2 (1)	13%
Childcare Responsibilities	2 (1)	6%
Social Support	2 (1)	13%
Emotional Stress	2.5 (1)	19%
Hours of Sleep	2.5 (2)	31%
Quality of Sleep	2.5 (1)	22%
Unit/Platoon Exposure	2.5 (1)	19%
Exposure in Minutes	2 (2)	6%
Number of Times/Activities Occurrences	2.5 (1)	22%
Work (exercise) Intensity	2.5 (1)	25%
Time Spent in Specific Activities of Varied Intensity	2.5 (1)	16%
Cumulative Loading Over Military Career	2.5 (1)	23%
Cumulative Loading Over Specified Period of Time (e.g., training exercise; deployment period)	2.5 (1)	31%
Laterality of Injury	2.5 (1)	20%
Amount of Pain from Injury	2 (1)	11%

Table 6. *Continued*

Data element	Median score (IQR)	Percent agree
Days from Initial Complaint Until Injury Became Time-Loss	2.5 (1)	13%
Time of Injury	2 (1)	11%
SNOMED CT Coding System	2 (1)	5%
Tissue	2.5 (2)	32%
Care-Seeking Injury	2.5 (2)	31%
Time Since They Previously Had That Injury If Prior History (months/years)	2.5 (1)	28%

IQR = Interquartile range.
Agree percent equates to a score of 4 or 5.

Table 7. Included data elements after round two.

Data element	Median score (IQR)	Percent agree
Height	4 (1)	66%
Weight	4 (2)	74%
Military Branch	4 (1)	57%
Position Duty or Occupational Specialty	4 (2)	72%
Previous Orthopaedic Surgery	4 (2)	66%
Previous Musculoskeletal Injury	4 (2)	82%
Time Since Previous Musculoskeletal Injury	4 (2)	57%
Military Role (Combat, Support, Special Operations)	4 (1)	69%
Exposure in Days	4 (1)	60%
Clinical Diagnosis of Injury	4 (1)	77%
Days from Injury to Seeking Medical Care	4 (1)	52%
Duty Time Lost in Days from Injury	4 (1)	75%
Type of Injury (Primary, Subsequent, Recurrent, or Exacerbation Injury)	4 (1)	79%
Time Loss of Injury in Days	4 (1)	75%
Prior History of that Specific Injury	4 (1)	71%
Date of Injury	4 (1)	54%

IQR = Interquartile range.
Agree percent equates to a score of 4 or 5.

Table 8. Data elements combined with other elements (already with consensus) after round two.

Data element	Median score (IQR)	Percent agree	Combined with
Terms of Service	3 (2)	43%	Military Role
Exposure in Hours	3 (2)	48%	Exposure in Days
Days from Injury to Physical Therapy	3 (1)	42%	Days to Seeking Medical Attention
Surveillance Days Until Injury	3 (2)	45%	Days Until Injury

IQR = Interquartile range.

Table 9. **No consensus after round two.**

Data element	Median score (IQR)	Percent agree
Tobacco or Nicotine Use	3 (1)	45%
Terrain Where Injury Occurred	3 (1)	39%
Equipment Worn at the Time of Injury	3 (1)	40%
Years Working in Military	3 (2)	45%
Setting of training	3 (1)	46%
Formal Military Course	3 (1)	46%

IQR = Interquartile range.
Agree percent equates to a score of 4 or 5.

Table 10. **Round three.**

Data element	Median score (IQR)	Percent agree
Tobacco or Nicotine Use	4 (3)	26%
Terrain Where Injury Occurred	3 (1)	22%
Equipment Worn at the Time of Injury	3 (1)	24%
Years Working in Military	3 (2)	21%
Setting of training	4 (2)	33%

IQR = Interquartile range.
Agree percent equates to a score of 4 or 5.

Discussion

An integrated and scalable process for collecting and reporting MSKI data is necessary to successfully evaluate MSKI interventions in military populations. The methodology, supporting results, and decisions made during the ROMMIL development are provided in this report. The process included a literature synthesis, knowledge user survey, Delphi study, consensus meeting, and electronic consensus open meeting for further review. This process incorporated a broad range of supporting literature, relevant data, and direct input from knowledge users having wide-ranging MSKI-related experiences and expertise.

The steering committee included members with wide-ranging viewpoints and areas of expertise; military MSKI surveillance and research occur world-wide, encompassing varying levels of institutional support, environments, and cultures. Multiple knowledge user meetings were held across the research process. The closeness continuum,[13] identifying different types of experts, was used to inform and identify knowledge users for inclusion in the consensus process. The ROMMIL consensus statement was presented in person, on an open science platform, and through an open, freely accessible electronic link to mitigate or eliminate travel or institutional support barriers. Feedback was received through multiple interfaces, allowing for comprehensive input. Forms of feedback included verbal, free text, and quantitative scores, increasing the depth and richness of feedback.

Potential limitations

While international input was emphasized, most knowledge user feedback came from participants living in English speaking countries (i.e. North America, Europe, former British Commonwealth countries), with the steering committee living in the United States and the United Kingdom. Military organizations with differing levels of institutional support may have differing (1) MSKI-related needs and (2) abilities to collect and report specific data elements. Further enquiry is needed to evaluate the ROMMIL checklist in these military populations. Only one conference was attended to help inform the original data elements list, as knowledge users from different backgrounds could attend other conferences across the globe, there may be selection bias limitations in the original proposed elements list. There was attrition in the Delphi survey, potentially decreasing the strength of recommendations.

The ROMMIL steering committee screened data elements throughout the process, ensuring a manageable and feasible number of data elements was included for collection and reporting. Continual screening was necessary, given the

wide-ranging (1) body of MSKI-related literature, (2) knowledge user suggestions, and (3) responses from the knowledge user survey and Delphi study. The steering committee might have selected data elements that differed from individual knowledge users' selections. To mitigate this potential bias, the steering committee conducted multiple knowledge user meetings and encouraged maximal input/feedback from all members throughout the process. The primary report summarizing the ROMMIL consensus checklist for minimum data elements to collect and report when conducting injury surveillance research will be published separately.

Conclusions
Achieving consensus with knowledge users representing global-wide military organizations is challenging. This paper details the methodology established to reach consensus, while enabling all participants to provide input (including dissenting opinions). The ROMMIL consensus provides a core minimum data elements checklist for military MSKI scientists to improve data harmonization and scalability efforts. These methods can be used as a resource to assist future consensus endeavors in similar populations.

Ethics and consent
This project was determined to not be human subjects research by the Institutional Review Board at Wake Forest University, School of Medicine (# IRB00115873, determination made 1 July 2024). Individuals consented to be involved by participating in the meetings and voting process, a determination that was approved by the Institutional Review Board. All participants were made aware up front that the results and conclusions would be summarized into a consensus statement that would be published and shared with the greater scientific community. Data were anonymous and not linked to individual participants.

Disclaimer
The view(s) expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Uniformed Services University, the US Defense Health Agency, the US Department of Defense, the U.K. Department of Defense, nor the U.S. or U.K. Governments.

Author information
The following authors are military service members (either past or present): JJF, BRH, JMM, DST, JMT, EW, SW, DVT, JJV, RBW, DIR.

Data availability
Underlying data
OSF: Supplementary Data for Project: Minimum Common Data Elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL); DOI 10.17605/OSF.IO/2WQBR.[15]

URL: https://osf.io/2wqbr/,[15]

This project contains the following underlying data:

This is a description of methodology and not a full report of the actual Delphi study, the results of which will be reported elsewhere.

Delphi data

- DataDictionary.csv
- Round1.csv
- Round2.csv
- Round3.csv

Extended data
OSF: Supplementary Data for Project: Minimum Common Data Elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL); DOI 10.17605/OSF.IO/2WQBR.[15]

URL: https://osf.io/2wqbr/,[15]

This project contains the following extended data:

Initial questions

- Appendix_Delphi_Initial_Tables.docx

Recruitment email

- Delphi_Email.docx

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Open Peer Review

Current Peer Review Status: ✔ ✔ ?

Version 2

Reviewer Report 16 April 2025

https://doi.org/10.5256/f1000research.179630.r375434

✔

Oliver O'Sullivan
University of Nottingham, Nottingham, England, UK

Dear authors, thank you for taking on board all the recommendations from the peer reviewers. I think the manuscript reads well, is clear and has an important message - as far as I am concerned, it is ready. Best wishes and well done.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Sports and exercise medicine, rehabilitation, military medicine

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 05 December 2024

https://doi.org/10.5256/f1000research.167283.r339134

?

Kenton R Kaufman
Mayo Clinic, Rochester, USA

Abstract:

- Please define a “mixed knowledge user”.

- Please describe how the “asynchronous mixed knowledge user meeting” was conducted, or is this a typographical error? Please see comment in Methods section below.
- Recommend describing “civil servant practitioners” as a “civilian practitioner”.

Introduction
- Please define a definition of “knowledge user”.

Methods
- When the core group pursued “a balance in expertise”, what expertise was being balanced? What criteria were used to know when this goal had been achieved?
- Stage 2: What was the military MSKI conference that was used to collect the convenience sample? How was this conference selected? How was the stated goal to sample “global-wide subject matter experts” met?
- The methods state that a “synchronous mixed knowledge user meeting” was performed. The abstract states that an “asynchronous mixed knowledge user meeting” was conducted. Is there a typographic error in the abstract?
- Recommend describing “civil servant practitioners” as a “civilian practitioner”.

Results
- There was a >50% decrease in Administrative Leadership, Command Leadership, and Physical Training Instructor between Round 1 and Round 2 of the Delphi Study. Was there any concern about this significant decrease in participation from these groups?

Discussion
- This study provides an important list of data elements to be used for surveillance and reporting of musculoskeletal injuries that occur during military training. A weakness is that no data dictionary was created in this process and there is no indication that plans are in place to accomplish this task soon.

Is the rationale for developing the new method (or application) clearly explained?

Yes

Is the description of the method technically sound?

Yes

Are sufficient details provided to allow replication of the method development and its use by others?

Yes

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Musculoskeletal injury, Orthopedics, Registries, Outcomes Measurement

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 18 Mar 2025

Daniel Rhon

Thank you Dr. Kaufman for your valuable time and interest for reviewing this work and for the detailed feedback and recommendations for improving this manuscript. They are greatly appreciated. For clarity, we have copied your original remarks below and then provided a point-by-point response to each one.

Thank you to the authors for their tremendous effort in addressing MSKI in military populations. The methods described for the development of the Minimum Data Elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement will be an important reference for future publications and work in this field. Overall, the article is clear, concise and well written. A few minor changes

RESPONSE: Thank you for the positive sentiment towards our work.

Introduction:
-Well written, intention and purpose are clearly described.
RESPONSE: Thank you.

Methods:
-(Minor change): " Military service members having sustained MSKI across their careers had subjective closeness. Clinicians treating service members for MSKI had mandated closeness. Researchers and scientific experts investigating military MSKI had objective closeness." For individuals who qualified for more than 1 category, how were they assessed/allocated?
RESPONSE: Thank you for this question. If a knowledge user was allocated to more than one group, they were included in both. We tried to create a balance between all three groups, and also have knowledge users in each group that were only in one group and were in multiple groups.

-(Minor change):Please include a brief discussion on what measures were taken to mitigate biases.
RESPONSE: Measures to reduce bias included having steering group members not being able participate in the small group conversations and only contributed to the full group discussions during the consensus meetings when invited. Steering group members were not allowed to initiate remarks. If invited to speak, steering group members were only allowed to provide clarification or guidance when appropriate. An independent experienced external moderator lead all group discussions to reduce the risk of dominant personalities and also reduce steering group bias. Finally, all meetings were open for in person, video, and viewing at a later date, with an open period to comment, to allow for inclusion of voices that could not make the meetings. This has been clarified within the methods.

-(Minor change):Please describe dataset limitations within this section.
RESPONSE: Data limitations have been added to the manuscript. "Only one conference was attended to help inform the original data elements list, as knowledge users from different backgrounds could attend other conferences across the globe, there may be selection bias limitations in the original proposed elements list. There was attrition in the Delphi survey, potentially decreasing the strength of recommendations."

Results:
-The results are presented clearly. No recommended changes.
RESPONSE: Thank you for this comment.

Discussion/Conclusion:

-(Minor change): Please provide a participant demographic breakdown, including profession. Given the challenges faced in achieving consensus, this information is relevant.
RESPONSE: This is provided in Table 3, and also within the supplement.

-(Minor change): It would also be helpful if other limitations were explored that could have contributed to the consensus challenges.
RESPONSE: Further limitations have been added, as discussed above. "Only one conference was attended to help inform the original data elements list, as knowledge users from different backgrounds could attend other conferences across the globe, there may be selection bias limitations in the original proposed elements list. There was attrition in the Delphi survey, potentially decreasing the strength of recommendations."

-(Minor change): Please reframe the Discussion, or at least identify within the limitations, and amend the Conclusion to reflect this Delphi describes the United States and United Kingdom perspective, as indicated in the Methods section.
RESPONSE: Further detail is included in the limitations.

Supplementary Files:
-Thank you for including the Initial Tables file, it provides contexts and allows transparency around data bias.
RESPONSE: You are welcome.

Competing Interests: No competing interests

Reviewer Report 27 November 2024

https://doi.org/10.5256/f1000research.167283.r339129

Chris M. Edwards
University of Sherbrooke, Sherbrooke, Québec, Canada

Thank you to the authors for their tremendous effort in addressing MSKI in military populations. The methods described for the development of the Minimum Data Elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement will be an important reference for future publications and work in this field.

Overall, the article is clear, concise and well written. A few minor changes

Introduction:
-Well written, intention and purpose are clearly described.

Methods:

-(Minor change): " Military service members having sustained MSKI across their careers had subjective closeness. Clinicians treating service members for MSKI had mandated closeness. Researchers and scientific experts investigating military MSKI had objective closeness." For individuals who qualified for more than 1 category, how were they assessed/allocated?

-(Minor change):Please include a brief discussion on what measures were taken to mitigate biases.

-(Minor change):Please describe dataset limitations within this section.

Results:

-The results are presented clearly. No recommended changes.

Discussion/Conclusion:

-(Minor change): Please provide a participant demographic breakdown, including profession. Given the challenges faced in achieving consensus, this information is relevant.

-(Minor change): It would also be helpful if other limitations were explored that could have contributed to the consensus challenges.

-(Minor change): Please reframe the Discussion, or at least identify within the limitations, and amend the Conclusion to reflect this Delphi describes the United States and United Kingdom perspective, as indicated in the Methods section.

Supplementary Files:

-Thank you for including the Initial Tables file, it provides contexts and allows transparency around data bias.

Is the rationale for developing the new method (or application) clearly explained?

Yes

Is the description of the method technically sound?
Yes

Are sufficient details provided to allow replication of the method development and its use by others?
Yes

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Musculoskeletal injuries in military and emergency response personnel, female health in military and emergency response personnel, physical performance in military and emergency response personnel, mental health in military and emergency response personnel.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Mar 2025

Daniel Rhon

Thank you Dr. Edwards for your valuable time and interest for reviewing this work and for the detailed feedback and recommendations for improving this manuscript. They are greatly appreciated. For clarity, we have copied your original remarks below and then provided a point-by-point response to each one.

Abstract

- Please define a “mixed knowledge user”.

RESPONSE: A mixed knowledge user is denoting multiple groups in one meeting. As discussed in reviewer 1, the authors felt that this term should be deleted to provide clarity.

- Please describe how the “asynchronous mixed knowledge user meeting” was conducted, or is this a typographical error? Please see comment in Methods section below.

RESPONSE: Mixed knowledge user was deleted from the manuscript. However, asynchronous knowledge user meeting is denoting meeting that have a mixture of live video conferencing and the ability of other knowledge users to watch the video later and give comments. This has been further clarified within the methods.

- Recommend describing “civil servant practitioners” as a “civilian practitioner”.

REPSONSE: this has been edited per the reviewer's suggestion.

Introduction

- Please define a definition of "knowledge user".

RESPONSE: A knowledge user is a person who contributes as an active knowledge creator, who construct meaning in their own settings, and have input that is equal to those of the scientific community. Bullock GS, Fallowfield J, Fisher B, Whittaker JL, Gafari O, Bilzon JL. Prioritizing Knowledge User Engagement: Engaging Patients and the Public in Creating Enduring Musculoskeletal Rehabilitation Research. journal of orthopaedic & sports physical therapy. 2024 Dec;54(12):743-7.
This has been further clarified within the introduction.

Methods

- When the core group pursued "a balance in expertise", what expertise was being balanced? What criteria were used to know when this goal had been achieved?

RESPONSE: Expertise balance was focused on subjective, mandated and objective closeness. Subjective is lived experience in MSKI within the military, mandated is practioner/performance/physiology and methods in MSKI, and objective is specific research in military MSKI.

- Stage 2: What was the military MSKI conference that was used to collect the convenience sample? How was this conference selected? How was the stated goal to sample "global-wide subject matter experts" met?

RESPONSE: The conference was Total Force Fitness MSK Health conference addressing human performance optimization and MSKI mitigation and treatment in service members. This was an international conference, across different professions in the military. This has been clarified within the methods.

- The methods state that a "synchronous mixed knowledge user meeting" was performed. The abstract states that an "asynchronous mixed knowledge user meeting" was conducted. Is there a typographic error in the abstract?

RESPONSE: Thank you for bringing this to our attention. This was an asynchronous meeting. This has been edited.

- Recommend describing "civil servant practitioners" as a "civilian practitioner".

RESPONSE: This has been edited per the reviewer's suggestion.

Results

- There was a >50% decrease in Administrative Leadership, Command Leadership, and Physical Training Instructor between Round 1 and Round 2 of the Delphi Study. Was there any concern about this significant decrease in participation from these groups?

RESPONSE: It is true that there was attrition over time. Participants represent busy military leaders and clinicians, who travel often. We attempted to provide as large of a window as possible for responses to be submitted for those who could not attend; however, our hypothesis is that many individuals provided their input on the variables they felt of most importance in the very beginning. Those variables with consensus across the board did pass through to final stages. Individuals were reminded multiple times that this was their

opportunity to provide additional feedback, especially if they felt strongly about any remaining variable inclusion/exclusion. It is possible that attrition was due to more ambivalence by some individuals towards the remaining variables. This has also been highlighted in the limitations section.

Discussion

- This study provides an important list of data elements to be used for surveillance and reporting of musculoskeletal injuries that occur during military training. A weakness is that no data dictionary was created in this process and there is no indication that plans are in place to accomplish this task soon.

RESPONSE: Thank you for this comment. The publication reporting the final publication does indeed provide guidance and examples to guide reporting of the recommended elements.

Competing Interests: No competing interests

Reviewer Report 04 October 2024

https://doi.org/10.5256/f1000research.167283.r323555

?

Oliver O'Sullivan
University of Nottingham, Nottingham, England, UK

Dear Colleagues,

Thank you for asking me to review Methodology used to develop the minimum common data elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement, which is a description of methodological approach taken to develop minimum data elements for Musculoskeletal injuries.

This is an important area of work and much needed - you all should be applauding for grasping the nettle on this.

I felt the manuscript was well written overall, but could be refined by addressing some of the points below. The most pressing is the use (and possible over-use) of the phrase Knowledge User - the definition seemed to shift and it wasn't clear by the end who you were actually talking about.

However, the area of concern I have is with regard to the results of Delphi. They are partly presented in the results and in Table 4-10; however, you report that the full results will be published elsewhere. This seems to me to be a little bit odd - would it not be better to present

them in full in this manuscript, or to remove the partial presentation from this manuscript to avoid double reporting/duplicate publications?

I wish the authors Good luck with the next version

Minor Revisions -

In your abstract, you capitalise Minimum Data Elements in the background, but then don't in the results/conclusions - could I suggest a consistent approach please?

In abstract methods, you use a phrase 'civil servant practitioners' - do you think, given the international authorship and readership, that this term would translate? You could consider 'civilian' as a simpler alternative.

The last sentence in the strategy section is exactly the same at the last sentence in the background section - suggest removing one of those.

The fourth and fifth sentences in the Stage 1 paragraph appear to be saying 95% the same thing, but with a subtle difference. Do you require both? If so, suggest rephrasing for clarity.

Your 'knowledge user' groups appear to change between the 'knowledge user involvement' and 'patient public involvement' sections. Either remove one of the elements in parenthesis if these phrases relate to the same people or please articulate the different knowledge user groups. In fact, you appear to change the knowledge user group composition in the PPI section (which is again different to above!) - please can you review this? If these are all different groups, composed of different individuals for a bespoke reason, please can you give the groups different names?

Also, as an extension to above, please can you explain what you mean by 'mixed knowledge user'? Is that an amalgam of the three groups above, or something else?

In stage 3 & 4, you refer to the steering committee. Are these the six individuals noted in the Strategy section? If so, please can you overtly make that point?

The second sentence of Results sounds decidedly like an intro or methods sentence - please could you consider its inclusion?

The second paragraph in the limitation appears repetitive - please could this be reviewed?

You mention dissenting opinions in the conclusion, but I am struggling to see where these have been described or presented - please can you clarify this?

In Table 3, the nationality for Round 2/3 'not disclosed' might be better in the title line, not in the same line as New Zealand

Table 4 - 10 - please consider the implications of including these data if there is a plan for a further publication presenting said findings

Is the rationale for developing the new method (or application) clearly explained?
Yes

Is the description of the method technically sound?
Yes

Are sufficient details provided to allow replication of the method development and its use by others?
Yes

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Sports and exercise medicine, rehabilitation, military medicine

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 18 Mar 2025

Daniel Rhon

Thank you Dr. O'Sullivan for your valuable time and interest for reviewing this work and for the detailed feedback and recommendations for improving this manuscript. They are greatly appreciated. For clarity, we have copied your original remarks below and then provided a point-by-point response to each one.

Dear Colleagues,
Thank you for asking me to review Methodology used to develop the minimum common data elements for surveillance and Reporting of Musculoskeletal Injuries in the MILitary (ROMMIL) statement, which is a description of methodological approach taken to develop minimum data elements for Musculoskeletal injuries.

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I felt the manuscript was well written overall, but could be refined by addressing some of the points below. The most pressing is the use (and possible over-use) of the phrase Knowledge User - the definition seemed to shift and it wasn't clear by the end who you were

actually talking about.

However, the area of concern I have is with regard to the results of Delphi. They are partly presented in the results and in Table 4-10; however, you report that the full results will be published elsewhere. This seems to me to be a little bit odd - would it not be better to present them in full in this manuscript, or to remove the partial presentation from this manuscript to avoid double reporting/duplicate publications?

I wish the authors good luck with the next version

RESPONSE: Thank you for these additional points. We have reviewed and considered them all carefully, to include addressing the "knowledge user" term. We have also reviewed the tables (4-10) and wish to provide some further context. There is another publication that will report on the final checklist. However, the space constraints prohibit many of the details that expand on how we were able to reach the final consensus. This manuscript in F1000 provides much more granular details about the iterative steps taken to reach the final checklist. Therefore, we focused on methodology in this manuscript. If we provided the final checklist here, then there would also be copyright concerns to address when publishing it again in the final publication. The publication with the completed checklist refers back to this manuscript, to provide readers with further details about the process.

Minor Revisions -
In your abstract, you capitalise Minimum Data Elements in the background, but then don't in the results/conclusions - could I suggest a consistent approach please?
RESPONSE: Thank you for this comment. 'Minimum Data Elements' within the abstract background has been edited to lower case.

In abstract methods, you use a phrase 'civil servant practitioners' - do you think, given the international authorship and readership, that this term would translate? You could consider 'civilian' as a simpler alternative.
RESPONSE: Yes, thank you. That is a great suggestion and we have made that change.

The last sentence in the strategy section is exactly the same at the last sentence in the background section - suggest removing one of those.
RESPONSE: Thank you, we have removed the redundancy from the background section.

The fourth and fifth sentences in the Stage 1 paragraph appear to be saying 95% the same thing, but with a subtle difference. Do you require both? If so, suggest rephrasing for clarity.
RESPONSE: Thank you, this has been consolidated to improve clarity.

Your 'knowledge user' groups appear to change between the 'knowledge user involvement' and 'patient public involvement' sections. Either remove one of the elements in parenthesis if these phrases relate to the same people or please articulate the different knowledge user groups. In fact, you appear to change the knowledge user group composition in the PPI section (which is again different to above!) - please can you review this? If these are all different groups, composed of different individuals for a bespoke reason, please can you give the groups different names?

RESPONSE: Thank you for bringing this to our attention. The patient and public involvement section has been deleted, and the knowledge user group section has been updated for one paragraph.

Also, as an extension to above, please can you explain what you mean by 'mixed knowledge user'? Is that an amalgam of the three groups above, or something else?
RESPONSE: Mixed knowledge user details knowledge users from across different groups. The term 'mixed' has been deleted from the manuscript as the authors felt this decreased the clarity in the methods.

In stage 3 & 4, you refer to the steering committee. Are these the six individuals noted in the Strategy section? If so, please can you overtly make that point?
RESPONSE: Yes, the steering committee are the six individuals in the strategy section. This has been clarified.

The second sentence of Results sounds decidedly like an intro or methods sentence - please could you consider its inclusion?
RESPONSE: This sentence has been moved to the methods section, under the statistical analyses subheading.

The second paragraph in the limitation appears repetitive - please could this be reviewed?
RESPONSE: The second limitations sentence has been edited.

You mention dissenting opinions in the conclusion, but I am struggling to see where these have been described or presented - please can you clarify this?
RESPONSE: The dissenting opinions will be published for full transparency in the supplementary appendix of the manuscript reporting the final checklist.

In Table 3, the nationality for Round 2/3 'not disclosed' might be better in the title line, not in the same line as New Zealand
RESPONSE: This has been edited with a foot note stating that a blank cell denotes that the information was not disclosed.

Table 4 - 10 - please consider the implications of including these data if there is a plan for a further publication presenting said findings
RESPONSE: Thank you for this discussion. As discussed in the first response, there is another publication that will report on the final checklist. However, the space constraints prohibit many of the details that expand on how we were able to reach the final consensus. This manuscript in F1000 provides much more granular details about the iterative steps taken to reach the final checklist. Therefore, we focused on methodology in this manuscript. If we provided the final checklist here, then there would also be copyright concerns to address when publishing it again in the final publication. The publication with the completed checklist will refer back to this manuscript, to provide readers with further details about the process.

Competing Interests: No competing interests