

**Standards for reporting research methods, interventions,
and Outcomes in Surgical Prehabilitation studies (SOS-
Prehab)**

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Title: Standards for reporting research methods, interventions and Outcomes in Surgical Prehabilitation (SOS-Prehab): An Expert Delphi Consensus

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Abstract

Background: Prehabilitation, a process of building physiological reserve before surgery to improve postoperative outcomes, is a complex, multimodal intervention that requires rigorous evaluation in clinical trials. Incomplete reporting of such trials obscures essential intervention components and delivery contexts, hindering comparability and interpretability. This, in turn, limits clinical implementation and the replication or refinement of interventions by researchers. We developed the first reporting checklist for randomized controlled trials of prehabilitation to address this gap: Standards for reporting research methods, interventions and Outcomes in Surgical Prehabilitation (SOS-Prehab).

Methods: We conducted a modified two-round Delphi process using the EQUATOR framework with 53 international experts across exercise, nutrition, psychological, and perioperative care disciplines. An initial checklist of candidate items was adapted from existing reporting standards, contextualized for prehabilitation, and iteratively refined through expert voting. Items rated ≥ 8 on a 9-point scale by at least 70% of participants in Round 2 were classified as *essential*; those rated 7 were considered *important*.

Results: The final SOS-Prehab checklist comprises 40 items—16 classified as *essential* and 24 as *important* items—designed to guide comprehensive reporting of prehabilitation interventions. These items span key domains including intervention components, delivery methods, adherence, participant characteristics, and outcome measures. High agreement among experts underscores the checklist's relevance and usability.

Conclusion: Adoption of SOS-Prehab, alongside methodological and outcome-reporting items of CONSORT-2025, could improve transparency, completeness, and interpretability of prehabilitation trials. This could enable better reproducibility, robust evidence synthesis, and accelerate translation into clinical practice and policy.

Keywords: Pre-rehab, prehabilitation, surgical outcomes, reporting guidelines, checklist, pre-operative, preoperative, pre-surgery

Introduction

Surgery represents a controlled form of physiological trauma performed for a therapeutic purpose; yet, it is rarely preceded by systematic preoperative preparation of the patient, despite evidence that modifiable patient factors (e.g., nutrition status, functional capacity, anxiety) strongly influence outcomes¹. Prehabilitation was developed to address this gap by reframing the surgery waiting period as an opportunity to enhance functional capacity and physiological reserve, so that patients are better prepared to tolerate surgical stress and achieve more effective recovery². While prehabilitation programs vary, they generally involve exercise, nutrition, psychological support, or a combination thereof, to address the impending metabolic, functional, and emotional demands of surgery^{3,4}. The concept is compelling and grounded in physiological rationale; however, its implementation and the supporting evidence remain variable^{2,5-9}.

Existing reviews of prehabilitation suggest potential benefits: a network meta-analysis of over 100 randomised trials found that uni- or multimodal exercise and nutrition interventions may reduce postoperative complications by 30–40% and shorten hospital length of stay by approximately 1 day (low to very low certainty evidence)⁵. Moreover, an umbrella review of 55 systematic reviews reported moderate-certainty evidence for improved functional recovery after cancer surgery¹⁰. Despite these encouraging findings, poor research reporting undermines the strength of the evidence, limits clinical adoption, and restricts opportunities to refine interventions for further research. In this regard, prehabilitation trials on average report about half of the checklist items from the existing general trial- and intervention-reporting frameworks¹¹. Moreover, in a scoping review of 110 oncology prehabilitation studies, one-quarter of the nutrition components were indiscernible, and two-thirds did not report on adherence monitoring¹². Such inconsistent and incomplete reporting limits our ability to identify the active components of prehabilitation, evaluate their effectiveness across different patient populations, and conduct rigorous knowledge synthesis to inform implementation guidelines.

As a complex intervention¹³, prehabilitation therefore requires detailed reporting of its components, delivery, and context to ensure reproducibility and facilitate knowledge translation. Currently, there is no internationally accepted reporting guideline for prehabilitation trials. We aimed to develop a tailored, consensus-based checklist to address this gap and improve the quality, completeness, and consistency of prehabilitation trial reporting.

Methods

The Standards for reporting research methods, interventions and Outcomes in Surgical Prehabilitation (SOS-Prehab) were developed and registered in accordance with the *Enhancing the Quality and Transparency of Health Research* (EQUATOR) framework¹⁴. Consistent with its scope, SOS-Prehab focuses on intervention reporting, while methodological and outcome reporting align with CONSORT 2025¹⁵. Our Delphi methodology was reported in accordance with the DELPHISTAR checklist¹⁶. Ethics approval was obtained from the McGill University Institutional Review Board (A02-E19-24A) prior to study initiation.

Development Phases

The multidisciplinary and multiprofessional SOS-Prehab Steering committee comprised prehabilitation experts specializing in nutrition (CG, SC), exercise and physiotherapy (DSM, SCB, JFF), psychology (LE), and perioperative medicine (DM, GB, FC). The process began with a scoping review of prehabilitation trials to assess reporting quality against several established guidelines (CERT¹⁷, TIDieR¹⁸, PRESENT¹⁹, CONSORT-SPI²⁰) and to identify candidate checklist items. This review confirmed that reporting quality was suboptimal¹¹. A preliminary 54-item checklist was created by adapting elements from existing guidelines, which were then reviewed for completeness by the international SOS-Prehab Advisory Committee (23 additional experts and co-authors).

Recruitment

Experts were defined as individuals who had previously published randomized trials of prehabilitation. For the purposes of SOS-Prehab, prehabilitation was defined as, “a process from diagnosis to surgery, consisting of one or more preoperative interventions of exercise, nutrition, psychological strategies and respiratory training, that aims to enhance functional capacity and physiological reserve to allow patients to withstand surgical stressors, improve postoperative outcomes, and facilitate recovery.”³ We identified experts by contacting the first and last authors of the trials included in our scoping review¹¹, aiming for a target sample of 50 participants, including approximately 10 from each stakeholder group (perioperative medicine, nutrition, exercise, and psychology). Where gaps in disciplinary representation were identified, additional eligible experts were invited. This target aligns with a meta-analysis of 31 Delphi studies, which reported a median panel size of 50 and noted that larger panels often have lower response rates²¹. Only participants who completed Round 1 were invited to participate in Round 2.

Modified delphi process

We conducted a two-round, international, web-based Delphi survey via REDCap between July and August 2024 to determine the essential reporting items for prehabilitation trials. This approach was chosen because Delphi methods enable structured, iterative input from geographically dispersed experts to achieve consensus on complex issues²². The Delphi was considered ‘modified’ because candidate items were pre-specified based on a scoping review and existing reporting frameworks, rather than generated inductively; structured, anonymized feedback was provided between rounds; and the process incorporated formal clinical sensibility testing in Round 2.

In Round 1, participants rated each pre-specified candidate item on a 9-point scale (1–3 = non-essential, 4–6 = somewhat essential, 7–9 = essential; 0 = unable to respond) and could suggest refinements to item wording through free-text comments. Items rated non-essential by more than 50% of participants were removed from subsequent rounds.

In Round 2, participants were presented with the Round 1 results (agreement rate, median, and range), their own previous scores, and scores stratified by group expertise (perioperative medicine, exercise, nutrition, psychology). Participants were then invited to re-score each item and provide justification for any changes. Free-text comments were used to refine item wording but did not supersede consensus criteria. All responses were anonymized, and participants were blinded to the identities of other respondents throughout the Delphi process. Disagreements were handled quantitatively using pre-

specified consensus thresholds (see analysis section). Additionally, participants completed an adapted version of the clinical sensibility testing tool²³, tailored to the Delphi context and checklist objectives, to appraise the clarity, relevance, and comprehensiveness of the proposed items.

Data analysis

Continuous data were summarized using means and standard deviations or medians and interquartile ranges, as appropriate. Categorical (dichotomous) data were reported as frequencies and percentages. Because no standard cut-offs exist for Delphi consensus²² (reported thresholds vary by as much as 55-100% agreement²⁴), we defined consensus *a priori* as $\geq 70\%$ of respondents rating an item “essential” (scores 7–9) and $< 15\%$ rating it as “non-essential” (scores 1–3). To enhance feasibility and uptake, we further refined the item list into a concise set of *minimum* reporting requirements, the Steering Committee established *post hoc* that items rated 8-9 by $\geq 70\%$ of experts would be classified as “essential”, with the remaining consensus items (rated 7 by $\geq 70\%$) classified as “important.”

Results

The response rate was 46% (n=63/137) in round 1 and 84% (53/63) in round 2 (Figure 1). Table 1 presents the characteristics of the 53 participants. Participants represented perioperative medicine (25 [47%]), exercise science (10 [19%]), nutrition (9 [17%]), psychology (6 [11%]), and other fields (3 [6%]). Most were based in Europe (27 [51%]) and in North America (20 [38%]), with an equal distribution of sex and self-identified gender.

Using the pre-specified threshold ($\geq 70\%$ rating 7-9 = “essential”), 40 items met consensus criteria. After threshold refinement ($\geq 70\%$ rating 8-9 = “essential”; $\geq 70\%$ rating 7 = “important”), the process resulted in a final SOS-Prehab checklist comprising 16 “essential” items and 24 “important” items. The modified Delphi was limited to two rounds because the preparatory scoping review effectively replaced the initial open-ended item-generation round of a traditional Delphi. Moreover, high levels of agreement and rating stability were achieved early in the process, with only a small number of items removed after Rounds 1 & 2. Given the study objective of identifying a concise set of minimum reporting requirements, additional rounds were judged unlikely to meaningfully alter item prioritization while increasing respondent burden and risk of attrition.

To facilitate integration with existing trial reporting standards, SOS-Prehab items are presented alongside CONSORT-2025 sections and items in Table 2. Below, we provide detailed explanations for each SOS-Prehab essential item categorized by publication section. Further justification for the inclusion of each item, proportion of agreement, application guidance, and examples of reporting are provided in Supplementary Material 1. Excluded items are listed in Supplementary Material 2. A fillable Microsoft Word version of the checklist for authors, readers, and reviewers is available on the EQUATOR Network website.

The following essential items are recommended for each section of manuscripts that report on prehabilitation studies:

Title / Abstract

Specify the target population (i.e., type of surgery, diagnosis, clinical risk)

Intervention feasibility, design, and effectiveness can vary according to patient characteristics, such as the type of surgery (e.g., esophagectomy vs. arthroplasty), diagnosis (e.g., cancer), and baseline clinical risk (e.g., nutritional or frailty status). Reporting this information helps readers judge the applicability of the findings to their own patients or settings, minimizes misinterpretation, improves indexing, and helps ensure that conclusions are not inappropriately generalized beyond the studied population.

Add “prehabilitation” as a keyword for indexing purposes

Including “prehabilitation” as a keyword improves accessibility and prevents incomplete retrieval of relevant trials, which could otherwise lead to biased or misleading conclusions. Because prehabilitation research spans multiple disciplines (i.e., surgery, anesthesia, rehabilitation, nutrition, and psychology) studies may be indexed under broader, less specific terms. Consistent use of “prehabilitation” (rather than variants such as “pre-operative rehabilitation” or “pre-rehabilitation”) facilitates systematic reviews by ensuring that all relevant studies are captured.

Specify prehabilitation components (e.g., exercise, nutrition, psychological support)

Prehabilitation interventions are often multimodal with variability between studies and within components (i.e., modalities). Clear identification of each component enables readers to interpret results within the correct program context, avoiding overgeneralized conclusions about “prehabilitation.” It also allows rapid assessment of applicability, supports accurate indexing, and facilitates evidence synthesis.

Introduction

Specify the prehabilitation components and anticipated benefit(s)

Explicitly detailing each component (e.g., exercise, nutrition, psychological support) and its intended benefit clarifies the component’s purpose and mechanism of action. Because program theory (i.e., how an intervention is expected to produce its effects and under what conditions) may vary, linking each component to the targeted effect prevents assumptions and supports hypothesis-driven interpretation. For example, psychological support could be used to reduce perioperative anxiety or enhance adherence to the other components. This transparency enables readers to assess the plausibility of observed effects, facilitate replication, and, in context-specific results, identify which components may be essential for achieving the desired outcomes.

Methods: Intervention and comparator

Describe the specific behavioural changes targeted by prehabilitation

Health behaviours (e.g., increasing physical activity to 150 minutes/week or consuming 5–10 servings of fruits and vegetables/day) are the patient-oriented mechanisms through which prehabilitation exerts its effects and may be reinforced by behaviour change techniques. Clearly defining behavioural targets provides measurable criteria for evaluating intervention fidelity and patient adherence, helps determine whether desired changes were achieved, and enables identification of specific behaviours that drive

improvements in clinical outcomes. Moreover, explicitly defining target behaviours prevents misclassification of interventions with distinct goals and mechanisms of action.

Describe the mode(s) of delivery (e.g., face-to-face, hybrid, internet, telephone), level of supervision, planned follow-up schedule (number and frequency of visits), and whether the intervention was delivered individually or in groups

Mode of delivery, supervision level, and follow-up schedule can influence accessibility, engagement, adherence, resource needs, scalability, and outcomes. As a complex intervention, prehabilitation's success or failure may depend on these core elements. For example, group-based exercise can foster peer support and reduce costs, whereas individual sessions could allow greater personalization for high-risk patients. The number of planned follow-ups affects program intensity and opportunities for adjustment. Reporting these factors enables accurate interpretation, supports replication and cross-study comparisons, and informs implementation planning across diverse healthcare settings. It also facilitates secondary analyses, such as evaluating dose-response relationships and conducting subgroup analyses based on mode of delivery.

If exercise is part of the intervention:

Specify whether and how baseline assessment informed the therapeutic plan (e.g., personalized vs. generic one-size-fits-all intervention) and provide a rationale for the chosen approach

Personalized interventions, such as tailoring exercise intensity (e.g., based on cardiopulmonary exercise test-derived parameters, heart rate, or the Borg scale), can optimize program design but may require greater resources. Generic programs may enhance scalability, but risk under-addressing individual needs. Stating the baseline assessment approach and its rationale enables meaningful comparison between studies, clarifies the resource demands relative to expected benefits (informing cost-effectiveness analyses), and supports implementation planning. It also allows interpretation of outcomes within the context of the intervention's adaptability and alignment with the program theory.

Describe the cardiovascular exercise, resistance/strength training, and/or respiratory muscle training included in the program, specifying each exercise type separately

Each exercise modality targets distinct physiological systems. Clear differentiation is essential because combining modalities can obscure mechanisms of effect and lead to misinterpretation (e.g., attributing benefits to aerobic training when resistance or respiratory training also contributed). Specific patient groups might respond differently to different types of exercise. Reporting modalities separately enables mechanism-based interpretation, supports mediation analyses to explore causal pathways, and effect modification analyses to assess whether specific subgroups respond differently, while facilitating replication and comparison across studies.

Provide complete exercise prescription details, including type of exercise, number of sessions, timing, frequency, intensity, and/or dose (sets, repetitions, duration)

Training parameters (e.g., 3 sets of 10 repetitions at 60% one-repetition maximum performed twice weekly) determine the magnitude of physiological adaptations, influence safety, and affect feasibility in different patient populations. Generic descriptions, such as "strength training twice per week", are insufficient for reproducibility, hinder mechanism-based interpretation, and obscure potential dose–

response relationships. Using the FITT principle (frequency, intensity, timing, type) to describe interventions ensures comprehensive reporting, facilitates replication and knowledge mobilization, enables accurate comparison across studies, and supports inclusion in meta-analyses.

If nutrition is part of the intervention:

Describe how nutritional status was evaluated

Baseline nutritional status influences surgical risk, recovery, and functional outcomes. At a minimum, malnutrition should be evaluated using a validated screening or diagnostic tool. Different tools can yield different classifications of malnutrition; as such, transparent reporting is essential for accurate comparison across studies. Clear reporting of assessment methods (e.g., the tool used, timing, cut-offs, and assessor) enables appropriate interpretation of study findings, supports reproducibility, and could facilitate meta-analyses stratified by nutritional status.

Methods: Outcomes

For each target behaviour, describe how engagement, adherence and/or behaviour change were measured (e.g., logbooks, activity monitors, dietary tracking apps, questionnaires) and state the predefined engagement, adherence and/or behavioural outcome targets

For each intervention component, describe how adherence and/or behaviour change were measured (e.g., logbooks, activity monitors, dietary tracking apps, questionnaires) and state the predefined engagement, adherence and/or behavioural outcome targets. Report both the quantitative level of engagement and adherence (e.g., mean, median) and the proportion of participants meeting the prespecified behavioural outcome targets, as these provide complementary insights into intervention fidelity. The choice of measurement method directly affects data accuracy, comparability, and interpretation of effectiveness, as some assessment tools may influence behaviour (e.g., self-monitoring may increase engagement or adherence). Predefined engagement, adherence and behavioural outcome targets enable assessment of whether the intervention was delivered/received as intended, which is essential for interpreting whether observed effects are attributable to the intervention itself or reflect suboptimal implementation. For example, a program targeting a total dietary protein intake of 1.2 g/kg/d may appear ineffective if participants achieve only 0.8 g/kg/d. Transparent reporting of such targets enables dose-response evaluation, facilitates comparison across studies, and informs strategies to improve intervention uptake, engagement, and adherence.

Define and justify postoperative outcomes (e.g., 30-day complication rate), explaining clinical relevance and describing key measurement properties such as validity, reliability, and the minimally important clinical difference

Outcome selection directly affects trial interpretability and comparability, and without a clear justification may be poorly aligned with the intervention's intended effects (e.g., using the six-minute walk test when the intervention does not include walking or any cardiopulmonary/aerobic training that could plausibly improve walking capacity). Reporting key measurement properties (e.g., validity, reliability, and clinically important differences) is essential to ensure that selected outcomes accurately capture the intended construct. When outcomes are measured both at baseline and follow-up, report values at both time points and specify the analytical approach used to assess change. Analyses should emphasize between-group differences in change (the true intervention effect) rather than within-group

improvements alone, which can overestimate benefit and hinder interpretation as well as meta-analytic synthesis. For tools that involve some subjectivity, such as clinician-oriented classifications like the Clavien–Dindo system for complications, detailed supplementary tables that describe how outcomes were identified and classified increase transparency, enable independent verification, strengthen confidence, and facilitate comparison across studies.

Define and justify the timing of assessments

Recovery trajectories vary over time, by type of surgery, and across patient subgroups. Clearly defining and justifying the timing of postoperative assessments (e.g., complications recorded during the index hospitalisation vs. within 30 days) ensures that outcomes are measured at clinically relevant points, align with intervention goals, and are comparable across studies. Explicitly reporting timing also facilitates meta-analyses and supports interpretation of whether observed effects might reflect short-term recovery, longer-term adaptation, or development of complications.

Results: Intervention and comparator delivery

Specify the actual duration of prehabilitation and report appropriate measures of dispersion

Planned and actual prehabilitation durations often differ due to factors such as surgical scheduling, patient readiness, and logistical constraints. Variation in duration (e.g., 2 vs. 6 weeks) can substantially influence physiological adaptations, intervention effectiveness, and the interpretation of findings. Reporting both the mean or median duration and measures of variability (e.g., standard deviation, interquartile range) enables dose-response analyses, supports evidence synthesis, and informs realistic implementation planning in clinical settings.

If applicable, describe any additional testing performed outside both the prehabilitation program and standard care and explain how results influenced prehabilitation delivery

Prehabilitation assessments may prompt further investigations or treatments that fall outside both the prehabilitation program and usual care, such as cardiopulmonary exercise testing, echocardiography, or specialist referrals. These can independently influence outcomes, and if unreported, their effects may be misattributed to the prehabilitation program alone (i.e., attribution bias).

Results: Baseline data

Characterize the study sample by reporting baseline and surgery details

Surgical indication, surgical approach, and diagnostic information, such as cancer staging and prior treatments (if relevant), should be reported at a minimum, as these factors influence baseline surgical risk, program feasibility, and/or outcomes. For example, patients with cancer who have completed chemoradiation may require different prehabilitation components than non-cancer surgical patients. Without such diagnostic details, applicability and comparability are compromised. Comprehensive baseline reporting enables assessment of heterogeneity in response to the intervention, supports interpretation of subgroup effects, and informs the generalizability of findings.

Item Acceptability

Table 3 summarizes item acceptability among the 53 prehabilitation experts. Most rated the checklist items as addressing important issues in prehabilitation research to a large extent (64%) or a moderate extent (19%), and as being easily understood to a large extent (43%) or a moderate extent (42%). Most felt the items were well-suited to eliciting information needed for peer review, with 68% rating this to a large extent and 19% to a moderate extent. Perceived omissions were minimal—73% identified insignificant gaps, 21% minimal gaps, and only 2% reported important gaps. Most experts considered the number of inappropriate or redundant items to be minimal (68% “hardly any,” 19% “a few”). A majority believed the checklist was very (58%) or quite likely (25%) to improve the quality of surgical prehabilitation reporting.

Discussion

Reporting guidelines play a meaningful role in improving the quality, transparency, and impact of research. For instance, journal endorsement of the CONSORT guideline is associated with more complete and transparent reporting of randomized trials, including more precise descriptions of methodology and outcomes^{25, 26}. Underscoring the importance of reporting standards, meta-epidemiological studies indicate trials with inadequate or unclear allocation concealment and blinding tend to overestimate treatment effects²⁷⁻³⁰. Moreover, publications developed with checklists significantly aid peer reviewers in identifying gaps and inconsistencies, thereby influencing manuscript quality³¹. In short, guidelines can elevate rigor, facilitate replicability, reliability, support evidence synthesis, and accelerate the generation of high-quality evidence available to clinicians and policymakers.

In a rapidly evolving, multidisciplinary, and still maturing field such as prehabilitation, the need for high-quality, standardised reporting is particularly relevant. Prehabilitation is a complex intervention¹³, often integrating exercise, nutrition, and psychological support, and frequently tailored to individual patient needs^{3, 8}. Without clear and comprehensive reporting, the nuance required to interpret findings is lost, making it impossible to determine which components mediate observed effects, how they interact, and in which contexts they are most effective. Early adoption of prehabilitation-specific reporting standards could accelerate the field’s maturation by ensuring that future trials are conducted and reported in ways that yield clear, comparable, reproducible, and clinically relevant evidence—ultimately enabling the right patient to receive the right care at the right time.

Although frameworks such as TIDieR¹⁸ and CERT¹⁷ provide valuable general guidance for intervention reporting, they were not designed to capture core features distinctive to prehabilitation. SOS-Prehab complements these tools by operationalizing prehabilitation-specific elements such as structured reporting of baseline status (Items 25, 13c, 13d); integration with study context, including setting (hospital/community/home/hybrid) and local care standards (e.g., use of enhanced recovery pathways) (Items 11); intervention adaptability and personalization (Item 13a); and how exercise (and other components) were progressed, regressed, or titrated with explicit thresholds (Item 13b). To maintain alignment with established trial reporting standards, SOS-Prehab focuses on the reporting of prehabilitation interventions, while methodological and outcome-reporting elements should remain guided by CONSORT 2025¹⁵

Limitations

This study has limitations. First, despite our intention to recruit balanced representation across disciplines, psychological expertise was under-represented in the Delphi survey (n=6), which may have limited the depth with which behaviour change components were addressed. While exercise and nutrition professionals also receive formal training in behaviour change strategies (including motivational interviewing, adherence support, and lifestyle counselling), greater input from psychology experts may have further strengthened the identification of “essential” or “important” items related to behavioural support, including behaviour change theory or behaviour change techniques, or items related to psychological support and type of support (e.g., motivational support vs. distress counselling). The absence of such items from the final checklist does not imply that they are irrelevant. Although the response rate in Round 1 was 46%, consistent with Delphi studies recruiting large, international expert panels²¹, retention between rounds was high (84%), indicating sustained expert engagement across rounds. Second, participants self-identified their primary discipline (perioperative medicine, nutrition, exercise/physiotherapy, psychology) but detailed information about their specialty (e.g., anaesthesia, surgery, other) were not systematically collected. Third, while the Delphi process captures expert consensus, agreement among panellists does not guarantee correctness. Prehabilitation is multidisciplinary, and there is a risk that experts may undervalue items outside their own area of expertise, potentially omitting critical components. Fourth, Because SOS-Prehab is a research reporting guideline rather than a clinical or patient-facing intervention, patient and public involvement was not incorporated into the Delphi process; however, such engagement will be essential for future implementation-focused or patient-directed guidance. Fifth, our operational definition of prehabilitation did not include other potential intervention domains, such as cognitive training. Finally, the high level of agreement across items prompted a protocol modification to classify them as “essential” or “important” to ensure a concise final checklist. Only the “essential” items are presented in the main manuscript; however, the “important” items, provided in Table 2 and Supplementary Material 1, were also endorsed by experts. Their reporting is highly encouraged to enhance completeness and transparency in prehabilitation trials. Future work will focus on evaluating the usability and clarity of SOS-Prehab through user testing with investigators and applying the checklist to existing and prospective prehabilitation trials to assess reporting completeness and inform iterative refinement.

Conclusion

SOS-Prehab is the first consensus-based reporting checklist designed to address the complexity of surgical prehabilitation trials. By detailing key aspects of intervention components, context, and outcomes, this checklist aims to enhance the clarity, completeness, and reproducibility of research in this field. Given the multidisciplinary nature of prehabilitation, consistent use of SOS-Prehab could enable more accurate interpretation of findings, facilitate evidence synthesis, and accelerate translation into practice and policy. With widespread adoption and periodic refinement as the field evolves, SOS-Prehab has the potential to standardize the conduct and reporting of prehabilitation research globally, thereby accelerating progress toward more effective, evidence-informed prehabilitation care.

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Figure 1: Flow diagram illustrating expert recruitment and participation across Delphi rounds, and the evolution of checklist items from initial generation to the final SOS-PREHAB reporting guideline

Table 1: Characteristics of 53 prehabilitation experts who completed both rounds of the Delphi

Profession/expertise	n (%)
Perioperative medicine	25 (47)
Exercise	10 (19)
Nutrition	9 (17)
Psychology	6 (11)
Other (nurse, research coordinator)	3 (6)
Sex, n (%)	
Male	27 (51)
Female	26 (49)
Self-identified gender, n (%)	
Man	27 (51)
Woman	26 (49)
Age, years, mean (SD)	51 (8.9)
Years since graduation of primary degree, mean (SD)	26 (10.9)
Continent, n (%)	
Europe	27 (51)
North America	20 (38)
Australia	5 (9)
Asia	1 (2)

Table 2: Integration of essential* and important SOS-Prehab Items with corresponding

CONSORT-2025 checklist items

Section	Consort 2025 Item	SOS-Prehab Item
Title and abstract		
Title and structured abstract	1.a) Identification as a randomised trial	1a (i). Label the intervention as “prehabilitation” (ii). Specify the target population (e.g., type of surgery, diagnosis, clinical risk) (iii). Add “prehabilitation” as a keyword for indexing purposes
	1.b) Structured summary of the trial design, methods, results, and conclusions	1b (i). List all prehabilitation components (e.g., exercise, nutrition, psychological support) (ii). Specify the duration (range) of prehabilitation (iii). State the setting where the prehabilitation intervention took place (e.g., hospital, community, home) and whether the intervention was supervised, unsupervised, or hybrid
Open Science		
Trial registration	2. Name of trial registry, identifying number (with URL) and date of registration	
Protocol and statistical analysis plan	3. Where the trial protocol and statistical analysis plan can be accessed	
Data sharing	4. Where and how the individual de-identified participant data (including data dictionary), statistical code and any other materials can be accessed	
Funding and conflicts of interest	5. a) Sources of funding and other support (eg, supply of drugs), and role of funders in the design, conduct, analysis and reporting of the trial	
	5. b) Financial and other conflicts of interest of the manuscript authors	
Introduction		
Background and rationale	6. Scientific background and rationale	6a (i). Define 'prehabilitation' as applied in this trial (ii). Specify the prehabilitation components (e.g., exercise,

		nutrition, psychological support and anticipated benefit(s)
Objectives	7. Specific objectives related to benefits and harms	
Methods		
Patient and public involvement	8. Details of patient or public involvement in the design, conduct and reporting of the trial	
Trial design	9. Description of trial design including type of trial (eg, parallel group, crossover), allocation ratio, and framework (eg, superiority, equivalence, non-inferiority, exploratory)	
Changes to trial protocol	10. Important changes to the trial after it commenced including any outcomes or analyses that were not prespecified, with reason	
Trial setting	11. Settings (eg, community, hospital) and locations (eg, countries, sites) where the trial was conducted	<p>11 (i). For trials that select participants based on screening, describe screening processes, tools, and personnel</p> <p>11 (ii). Describe the existing standard of care at the <u>surgical site</u>, including:</p> <ul style="list-style-type: none"> • Preoperative medical optimization (e.g., anemia treatment, smoking cessation, alcohol cessation, polypharmacy management, diabetes management) • Use of Enhanced Recovery Pathways • Use of neoadjuvant oncologic treatments, where applicable <p>11 (iii). State the intervention setting (i.e., hospital, outpatient clinic, community, home, hybrid)</p>
Eligibility criteria	12. a) Eligibility criteria for participants	
	12. b) If applicable, eligibility criteria for sites and for individuals delivering the interventions (eg, surgeons, physiotherapists)	12b. Identify providers for each intervention component (e.g., kinesiologist, physiotherapist), describing their qualifications and any study-specific training

<p>Intervention and comparator</p>	<p>13. Intervention and comparator with sufficient details to allow replication. If relevant, where additional materials describing the intervention and comparator (eg, intervention manual) can be accessed</p>	<p>Overall information about the prehabilitation program</p> <p>13.a (i). Describe any physical or information resources used in the intervention (i.e., information booklets, fitness monitors) or to facilitate intervention delivery (e.g., smartphone applications) and the instructions/training provided to participants, and where these materials can be accessed (e.g., online appendix, URL)</p> <p>(ii). Describe the specific behaviour changes targeted by the prehabilitation program (e.g., increasing physical activity to ≥ 150 min/week, consuming 5–10 servings of fruits and vegetables/day)</p> <p>(iii). Describe the mode(s) of delivery (e.g., face-to-face, hybrid, internet, telephone), level of supervision, planned follow-up schedule (number and frequency of visits), and whether the intervention was delivered individually or in groups</p> <p>If exercise is part of the intervention:</p> <p>13b (i). Specify whether and how baseline assessment informed the therapeutic plan (e.g., personalized vs. generic one-size-fits-all intervention) and provide a rationale for the chosen approach</p> <p>(ii). Describe the cardiovascular exercise, resistance/strength training, and/or respiratory muscle training included in the program, specifying each exercise type separately</p> <p>(iii). Provide complete exercise prescription details, including type of exercise, number of sessions, timing, frequency, intensity, and/or dose (sets, repetitions, duration)</p>
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(iv). If the intervention was personalized, titrated, or adapted, describe how progressions and regressions were managed—specifying what changes were made, why, when, how, and the thresholds used. Include how initial exercises were selected and progressed

If nutrition is part of the intervention:

13c. (i). Describe how nutritional status was evaluated, which may include:

- **Malnutrition assessment (e.g., Subjective Global Assessment)**
- Anthropometrics (e.g., weight, height) and/or body composition analysis (e.g., Bioelectrical Impedance Analysis, DXA, CT)
- Dietary intake assessment (e.g., food record or recall, number of days, portion size estimation, food composition tables), including supplemental intake (e.g., oral nutrition supplements, vitamins/minerals)

(ii). For nutrition interventions, describe the intervention targets, such as nutritional requirements (e.g., energy, protein), dietary recommendations, or guidelines used to guide the prescription

(iii). For nutrition interventions that include supplements, specify the type (e.g., plant-based protein, whey protein), prescribed dose, timing (e.g., before or after exercise), and duration of use

If psychological support is part of the intervention:

		<p><i>13d (i).</i> Describe how psychological status was assessed (e.g., Distress Thermometer, GAD-7), including thresholds used, and explain how assessment results informed the prehabilitation program</p> <p><i>(ii)</i> Explain the purpose of the psychological support component (e.g., improving mental health, normalizing preoperative mood disturbances, enhancing intervention adherence) and how it is expected to contribute to overall prehabilitation outcomes</p> <p><i>(iii).</i> Specify the type of psychological support provided (e.g., mindfulness, cognitive behavioural therapy, counselling) and detail the number, frequency, and duration of sessions</p>
<p>Outcomes</p>	<p>14. Prespecified primary and secondary outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome</p>	<p>14a (i). For each target behaviour, describe how engagement, adherence and/or behaviour change were measured (e.g., logbooks, activity monitors, dietary tracking apps, questionnaires) and state the predefined engagement, adherence and/or behavioural outcome targets</p> <p><i>(ii).</i> If explanatory preoperative outcomes were assessed (e.g., changes in physical, nutritional, or psychological status from baseline to immediately before surgery), define and justify each outcome. Specify any thresholds or criteria used to determine post-intervention ‘success’ (e.g., increase of [x] meters in six-minute walking distance)</p> <p><i>(iii).</i> Define and justify postoperative outcomes (e.g., 30-day complication rate), explaining clinical relevance and describing key measurement properties</p>

		such as validity, reliability, and the minimally important clinical difference (iv). Define and justify the timing of assessments
Harms	15. How harms were defined and assessed (eg, systematically, non-systematically)	
Sample size	16. a) How sample size was determined, including all assumptions supporting the sample size calculation	
	16. b) Explanation of any interim analyses and stopping guidelines	
Randomisation: Sequence generation	17. a) Who generated the random allocation sequence and the method used	
	17. b) Type of randomisation and details of any restriction (eg, stratification, blocking and block size)	
Allocation concealment mechanism	19. Mechanism used to implement the random allocation sequence (eg, central computer/telephone; sequentially numbered, opaque, sealed containers), describing any steps to conceal the sequence until interventions were assigned	
Implementation	19. Whether the personnel who enrolled and those who assigned participants to the interventions had access to the random allocation sequence	
Blinding	20. a) Who was blinded after assignment to interventions (eg, participants, care providers, outcome assessors, data analysts)	
	20. b) If blinded, how blinding was achieved and description of the similarity of interventions	
Statistical methods	21. a) Statistical methods used to compare groups for primary and secondary outcomes, including harms	
	21. b) Definition of who is included in each analysis (eg, all randomised participants), and in which group	

	21. c) How missing data were handled in the analysis	
	21. d) Methods for any additional analyses (eg, subgroup and sensitivity analyses), distinguishing prespecified from post hoc	21d. If an adherence or per-protocol analysis is planned, clearly define the criteria (e.g., completion of ≥ 4 of 6 prescribed sessions, achievement of $\geq 80\%$ of the prescribed rating of perceived exertion)
Results		
Participant flow, including flow diagram	22. a) For each group, the numbers of participants who were randomly assigned, received intended intervention, and were analysed for the primary outcome	22a. When feasible, report the characteristics of patients who declined trial participation and their reasons for refusal
	22. b) For each group, losses and exclusions after randomisation, together with reasons	
Recruitment	23. a) Dates defining the periods of recruitment and follow-up for outcomes of benefits and harms	
	23. b) If relevant, why the trial ended or was stopped	
Intervention and comparator delivery	24. a) Intervention and comparator as they were actually administered (eg, where appropriate, who delivered the intervention/comparator, how participants adhered, whether they were delivered as intended (fidelity))	<p>24 (i). Specify the actual duration of prehabilitation and report appropriate measures of dispersion</p> <p>(ii). Specify and describe the number of intervention sessions actually delivered, compared with the number planned, and indicate whether they were delivered as intended</p> <p>(iii). For each intervention, report the proportion of participants who met attendance, adherence, and/or behavioural targets, and, where applicable, describe reasons for poor adherence</p> <p>(iv). Explicitly report any pre-defined components of the intervention that were not delivered, including deviations from the planned protocol</p>
	24. b) Concomitant care received during the trial for each group	24b. If applicable, describe any additional testing performed outside both the prehabilitation

		program and standard care (e.g., CPET, echocardiography) and explain how results influenced the prehabilitation plan
Baseline data	25. A table showing baseline demographic and clinical characteristics for each group	25. Characterize the study sample by reporting baseline and surgery details, including: <ul style="list-style-type: none"> • Diagnostic information (e.g., cancer vs. non-cancer, tumor type, neoadjuvant treatment) • Surgical risk (e.g., ASA status) • Functional capacity/status (e.g., CPET, 6MWT) • Nutritional status (e.g., SGA) • Psychological status (e.g., GAD-7) • Surgical approach
Numbers analysed, outcomes and estimation	26. For each primary and secondary outcome, by group: <ul style="list-style-type: none"> • the number of participants included in the analysis • the number of participants with available data at the outcome time point • result for each group, and the estimated effect size and its precision (such as 95% confidence interval) • for binary outcomes, presentation of both absolute and relative effect size 	
Harms	27. All harms or unintended events in each group	27 (i). Explicitly state whether adverse events occurred. If they did, differentiate between adverse events and serious adverse events (ii). Describe how adverse events, if any, were monitored and managed, and indicate whether affected participants remained in the study
Ancillary analyses	28. Any other analyses performed, including subgroup and sensitivity	

	analyses, distinguishing pre-specified from post hoc	
Discussion		
Interpretation	29. Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	
Limitation	30. Trial limitations, addressing sources of potential bias, imprecision, generalisability, and, if relevant, multiplicity of analyses	30. Discuss the limitations arising from not addressing specific SOS-PREHAB reporting checklist items in the trial design and/or analysis

*Items coloured blue are considered essential, while items coloured in black items are important/recommended

Table 3: Acceptability of the 40 SOS-PREHAB items as rated by 53 prehabilitation experts

Items	n (%)
To what extent are the items directed at important issues pertaining to surgical prehabilitation research	Large extent: 34 (64) Moderate extent: 10 (19) Fair extent: 4 (8) Limited extent: 5 (9)
To what extent are the items provided easily understood?	Large extent: 23 (43) Moderate extent: 22 (42) Fair extent: 5 (9) Limited extent: 3 (6)
To what extent are these items to elicit the information you need to provide a peer review of surgical prehabilitation interventions?	Large extent: 36 (68) Moderate extent: 10 (19) Fair extent: 3 (6) Limited extent: 4 (7)
Are there important items pertaining to the reporting of surgical prehabilitation interventions that should be included in the checklist that have been omitted?	Insignificant gaps: 39 (73) Minimal gaps: 11 (21) Minor gaps: 2 (4) Important gaps: 1 (2)
How many items are inappropriate or redundant?	Hardly any: 36 (68) A few: 10 (19) Some: 3 (6) Many: 4 (7)
How likely is the reporting of these items to influence the quality of reporting for surgical prehabilitation	Very likely: 31 (58) Quite likely: 13 (25) Likely: 3 (6)

	Unlikely: 4 (7) Very unlikely: 2 (4)
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