Guidelines

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The STROCSS 2024 guideline: strengthening the reporting of cohort, cross-sectional, and case–control studies in surgery

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Introduction: First released in 2017, the STROCSS guidelines have become integral for promoting high-quality reporting of observational research in surgery. However, regular updates are essential to ensure they remain relevant and of value to surgeons. Building on the 2021 updates, the authors have developed the STROCSS 2024 guidelines. This timely revision aims to address residual reporting gaps, assimilate recent advances, and further strengthen observational study quality across all surgical disciplines.
Methods: A core steering committee compiled proposed changes to update the STROCSS 2021 guidelines based on identified gaps in prior iterations. An expert panel of surgical research leaders then evaluated the proposed changes for inclusion. A Delphi consensus exercise was used. Proposals that scored between 7-9 on a nine-point Likert agreement scale, by ≥70% of Delphi participants, were integrated into the STROCSS 2024 checklist.
Results: In total, 46 of 56 invited participants (82%) completed the Delphi survey and hence participated in the development of STROCSS 2024. All suggested amendments met the criteria for inclusion, indicating a high level of agreement among the Delphi group. All proposed items were therefore integrated into the final revised checklist.
Conclusion: The authors present the updated STROCSS 2024 guidelines, which have been developed through expert consensus to further enhance the transparency and reporting quality of observational research in surgery.

Keywords: case–control studies, cohort studies, cross-sectional studies, reporting guidelines, STROCSS

Introduction

Observational studies, encompassing cohort, case–control, and cross-sectional studies, are widely used within surgical research to investigate associations and risk factors[1]. However, poor reporting quality has been a persistent issue[2,3]. Consequently, readers critically appraise research less effectively, propagating flawed findings, and ultimately leading to research waste[4]. The systematic implementation of reporting guidelines by journals improves the quality of published research[5–7].

HIGHLIGHTS

- The STROCSS 2021 guidelines were updated through a Delphi consensus exercise.
- Among the 46 participants, a high level of agreement was noted with all proposed amendments and hence were integrated into the final, revised STROCSS checklist.
- The updated STROCSS 2024 guidelines are presented.

Thus, the Strengthening The Report Of Cohort Studies in Surgery (STROCSS) guidelines were introduced in 2017 and have since been updated in 2019 and 2021[8–10]. Despite the original focus on cohort studies, the STROCSS guidelines have been designed to additionally enhance the reporting of case–control and cross-sectional studies, due to similarities in their methodologies. Over the past 6 years, the STROCSS guidelines have been widely adopted with over 3200 citations, illustrating their broad acceptance as the standard for reporting observational research in surgery. However, regular revision is vital. To remain aligned with evolving standards and reflect current best practices, we aimed to update the STROCSS 2021 guidelines. Our objectives were threefold: to elevate reporting quality, address any limitations raised since the preceding update, and incorporate recent advances in reporting standards. The updated STROCSS 2024 guidelines look to optimise the quality and translational impact of observational studies across all surgical disciplines.

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Table 1

The STROCSS 2021 guidelines and the proposed version of the STROCSS 2024 guidelines.

Comparison of STROCSS 2021 and proposed STROCSS 2024

STROCSS 2021			Proposed STROCSS 2024		
Topic	**Item**	**Guideline**	**Topic**	**Item**	**Guideline**
Title	1	Title The word cohort or cross-sectional or case–control is included* Temporal design of study is stated (e.g. retrospective or prospective) The focus of the research study is mentioned (e.g. population, setting, disease, exposure/intervention, outcome etc.) *STROCSS 2021 guidelines apply to cohort studies as well as other observational studies (e.g. cross-sectional, case–control etc.)	Title	1	*Title* The word 'cohort' or 'cross-sectional' or 'case–control' is included* Temporal design of the study is stated (e.g. retrospective or prospective) The focus of the study is clearly stated (e.g. population, setting, disease, exposure/intervention, outcome, etc.) **STROCSS 2024 guidelines apply to all observational studies (e.g. cohort, cross-sectional, case–control, etc.)*
				2	*Highlights* Include three to five bullet points that summarise the key findings of the study Provide a brief background to the study, the key results and clinical relevance
			Abstract	3a	*Structure* Provide a structured abstract that includes the following headings: 1. Background 2. Methods 3. Results 4. Conclusions
Abstract	2a	Introduction - briefly describe: Background Scientific rationale for this study Aims and objectives		3b	*Background* *Briefly describe*: Relevant context Scientific rationale for this study Aims and objectives
	2b	Methods - briefly describe: Type of study design (e.g. cohort, case–control, cross-sectional etc.) Other key elements of study design (e.g. retro-/prospective, single/multicentred etc.) Patient populations and/or groups, including control group, if applicable Exposure/interventions (e.g. type, operators, recipients, timeframes etc.) Outcome measures - state primary and secondary outcome(s)		3c	*Methods* *Briefly describe*: Type of study design (e.g. cohort, case–control, cross-sectional etc.) Specification of study design (e.g. retro-/prospective, single/multicentred etc.) All patient groups involved, including control group, if applicable Exposure/interventions (e.g. type, operators, recipients, dates and time frames etc.) Outcome measures - explicitly state primary and secondary outcome(s), where appropriate Statistical methods of assessment used, where applicable
	2c	Results - briefly describe: Summary data with qualitative descriptions and statistical relevance, where appropriate		3d	*Results* *Briefly describe*: Summary data Principal findings with qualitative descriptions Statistical findings and their significance, where appropriate
	2d	Conclusion - briefly describe: Key conclusions Implications for clinical practice Need for and direction of future research		3e	*Conclusion* Describe key conclusions briefly Refer to implications for clinical practice and public health Describe the need for and direction of future research

					Include a concise statement that encapsulates the significance of the research and its contribution to the field
			Keywords	4	*Keywords* Include three to six keywords that identify what is covered in the study (e.g. patient population, diagnosis, or surgical intervention) Include study type as a keyword (e.g. cohort study, cross-sectional study, case–control study etc.) Include surgical speciality as one of the keywords Include study location as one of the keywords
Introduction	3	Introduction - comprehensively describe: Relevant background and scientific rationale for study, with reference to key literature Research question and hypotheses, where appropriate Aims and objectives	Introduction	5a	*Introduction* *By referencing key literature throughout, comprehensively describe*: Relevant background and scientific rationale for study Aims and objectives Research question and hypotheses, where appropriate Potential impact of research on future clinical practice Economic relevance of study to society
				5b	*Guideline citation* At the end of the introduction, refer to the STROCSS 2024 publication by stating: 'This cohort/cross-sectional/case–control study has been reported in line with the STROCSS guidelines [*include citation*]'
Methods	4a	Registration In accordance with the Declaration of Helsinki*, state the research registration number and where it was registered, with a hyperlink to the registry entry (this can be obtained from ResearchRegistry.com, ClinicaTrials.goc, ISRCTN etc.) All retrospective studies should be registered before submission; it should be stated that the research was retrospectively registered * *'Every research study involving human subjects must be registered in a publicly accessible database before recruitment of the first subject'*	Additional information	12a	*Registration* In accordance with the Declaration of Helsinki*, state the unique research registration number and where it was registered, with a hyperlink to the registry entry *(this can be obtained from ResearchRegistry.com, ClinicalTrials.gov, ISRCTN etc.)* *N.B. All retrospective studies should be registered before submission; it should be stated that the research was retrospectively registered.* * *'Every research study involving human subjects must be registered in a publicly accessible database before recruitment of the first subject'*
	4b	Ethical approval Reason(s) why ethical approval was needed Name of the body giving ethical approval and approval number Where ethical approval was not necessary, reason(s) are provided		12b	*Ethical approval* Whether ethical approval was needed or not, stated explicitly Reason(s) why ethical approval was/was not needed Name of the body giving ethical approval and approval number
				12c	*Informed consent* State explicitly whether informed consent was obtained, or not. State reason(s) why informed consent was/was not obtained State the nature of consent (e.g. verbal, written, digital/virtual)* The authors must provide evidence of consent, where applicable, and if requested by the journal Consent should be provided for both the original intervention/procedure and publication of the study *If consent was not provided by the patient, explain why (e.g. death of the patient and consent provided by next of kin). If the patient or family members were untraceable, then document the tracing efforts undertaken
	4c	Protocol Give details of protocol (a *priori* or otherwise) including how to access it (e.g. web address, protocol registration number etc.) If published in a journal, cite and provide full reference		12d	*Protocol* Give details of protocol (a *priori* or otherwise) including how to access it (e.g. web address, DOI etc.) Give details of protocol registration (e.g. protocol registration number, protocol registry's name etc.) If published in a journal, cite and provide a full reference

Table 1

(*Continued*)

Comparison of STROCSS 2021 and proposed STROCSS 2024

STROCSS 2021			Proposed STROCSS 2024		
Topic	**Item**	**Guideline**	**Topic**	**Item**	**Guideline**
					If applicable, detail any amendments made to the original protocol, giving reasons why the changes were made
	4d	Patient and public involvement in research Declare any patient and public involvement in research State the stages of the research process where patients and the public were involved (e.g. patient recruitment, defining research outcomes, dissemination of results etc.) and describe the extent to which they were involved.			
	5a	Study design State the type of study design used (e.g. cohort, cross-sectional, case–control etc.) Describe other key elements of study design (e.g. retro-/prospective, single/multicentred etc.)	Methods: Study Design	6a	*Study design* State the type of study design (e.g. cohort, cross-sectional, case–control etc.) Describe other key elements of study design (e.g. retro-/prospective, single/multi-centred etc.) Specify the duration of the study, including start and end dates
	5b	Setting and timeframe of research - comprehensively describe Geographical location Nature of institution (e.g. primary/secondary/tertiary care setting, district general hospital/teaching hospital, public/private, low-resource setting etc.) Dates (e.g. recruitment, exposure, follow-up, data collection etc.)		6b	*Setting and timeframe of research* *Comprehensively describe*: Specific geographical location Nature of institution (e.g. primary/secondary/tertiary care setting, district general hospital/teaching hospital, public/private, l- ow-resource setting etc.) Timeline for study, including dates for recruitment, exposure, follow-up, data collection etc. Any deviations from the initial study design plan or changes to the timeline during the research, with reasons and implications stated
	5c	Study groups Total number of participants Number of groups Detail exposure/intervention allocated to each group Number of participants in each group		6c	*Study groups* Total number of participants Number of groups Number of participants in each group Detail exposure/intervention allocated to each group Inclusion and exclusion criteria with clear definitions
	5d	Subgroup analysis - comprehensively describe Planned subgroup analyses Methods used to examine subgroups and their interactions		6d	*Subgroup analysis* *Comprehensively describe*: How subgroups were defined Planned subgroup analyses Methods used to examine subgroups and their interactions
	6a	Participants - comprehensively describe Inclusion and exclusion criteria with clear definitions Sources of recruitment (e.g. physician referral, study website, social media, posters etc.) Length, frequency and methods of follow-up (e.g. mail, telephone etc.)		6e	*Follow-up* *If applicable, comprehensively describe*: Time, length, frequency, location and methods of follow-up (e.g. mail, telephone, with whom etc.) Any specific long-term surveillance requirements (e.g. imaging surveillance of endovascular aneurysm repair) Any specific postoperative instructions (e.g. postoperative medications, targeted physiotherapy etc.)
	6b	Recruitment - comprehensively describe Methods of recruitment to each patient group (e.g. all at once, in	Methods: Participant Recruitment	7a	*Recruitment* *Comprehensively describe*:

		batches, continuously till desired sample size is reached etc.) Any monetary incentivisation of patients for recruitment and retention should be declared; - clarify the nature of any incentives provided Nature of informed consent (e.g. written, verbal etc.) Period of recruitment			Period of recruitment Methods of recruitment to each patient group (e.g. all at once, in batches, continuously till desired sample size is reached etc.) Sources of recruitment (e.g. physician referral, study website, social media, posters etc.) Any monetary/non-monetary incentivisation of participants to encourage involvement should be declared *(the nature of any incentives provided must be clarified)* Any challenges encountered during the recruitment processes, including how they were addressed
	6c	Sample size - comprehensively describe Analysis to determine optimal sample size for study accounting for population/effect size Power calculations, where appropriate Margin of error calculation		7b	*Sample size* *Comprehensively describe*: Analysis to determine optimal sample size for study accounting for population/effect size Power calculations with justifications for chosen statistical power, where appropriate Margin of error calculation Any associated ethical considerations
Methods - Intervention and Considerations	7a	Preintervention considerations - comprehensively describe Preoperative patient optimisation (e.g. weight loss, smoking cessation, glycaemic control etc.) Preintervention treatment (e.g. medication review, bowel preparation, corrective hypothermia/-volemia/-tension, mitigating bleeding risk, ICU care etc.)	Methods: Intervention and Outcomes	8a	*Preintervention considerations* *Comprehensively describe any preoperative patient optimisation*: Lifestyle optimisation (e.g. weight loss, smoking cessation, glycaemic control etc.) Medical optimisation (e.g. medication review, treating hypothermia/-volemia/-tension, ICU care etc.) Procedural optimisation (e.g. nil by mouth, enema etc.) Other (e.g. psychological support, physiotherapy etc.)
	7b	Intervention - comprehensively describe Type of intervention and reasoning (e.g. pharmacological, surgical, physiotherapy, psychological etc.) Aim of intervention (preventative/therapeutic) Concurrent treatments (e.g. antibiotics, analgesia, antiemetics, VTE prophylaxis etc.) Manufacturer and model details, where appropriate		8b	*Intervention* *Comprehensively describe*: Type of intervention and reasoning (e.g. pharmacological, surgical, physiotherapy, psychological etc.) Aim of intervention (e.g. preventative/therapeutic) Total cost of performing the intervention Degree of novelty of intervention Any learning required for intervention Prevalence or frequency at which the intervention is performed Concurrent treatments (e.g. antibiotics, analgesia, antiemetics, VTE prophylaxis etc.) Manufacturer and model details, where appropriate
	7c	Intraintervention considerations - comprehensively describe Details pertaining to administration of intervention (e.g. anaesthetic, positioning, location, preparation, equipment needed, devices, sutures, operative techniques, operative time etc.) Details of pharmacological therapies used, including formulation, dosages, routes and durations Figures and other media are used to illustrate		8c	*Intraintervention considerations* *Using figures and other media to illustrate wherever appropriate, comprehensively describe*: Details pertaining to administration of intervention (e.g. anaesthetic, positioning, location, preparation, equipment needed, devices, sutures, operative techniques, operative time etc.) For pharmacological therapies, the formulation, dosages, routes, strength and durations For surgery, any postoperative instruction (e.g. when to remove staples or sutures) The degree of novelty for a surgical technique/device (e.g. 'first in human')
	7d	Operator details - comprehensively describe Requirement for additional training Learning curve for technique Relevant training, specialisation and operator's experience (e.g. average number of the relevant procedures performed annually)		8d	*Operator details* *Comprehensively describe*: Requirement for additional training Learning curve for technique, including how it was evaluated (e.g. number of cases required to reach a defined level of proficiency) Relevant training, specialisation, and operator's experience (e.g. average number of the relevant procedures performed annually) Any institutional support that was provided to operators to facilitate their training
				8e	*Setting of intervention* *Comprehensively describe*:

Table 1

(*Continued*)

Comparison of STROCSS 2021 and proposed STROCSS 2024

STROCSS 2021			Proposed STROCSS 2024		
Topic	**Item**	**Guideline**	**Topic**	**Item**	**Guideline**
					Setting in which the intervention was performed Level of experience the centre has in performing the intervention
	7e	Quality control - comprehensively describe Measures taken to reduce interoperator variability Measures taken to ensure consistency in other aspects of intervention delivery Measures taken to ensure quality in intervention delivery		8f	*Quality control* *Comprehensively describe*: Measures taken to reduce interoperator variability (e.g. regular team meetings, calibration exercises) Measures taken to ensure consistency in other aspects of intervention delivery (e.g. data collection) Measures taken to ensure quality in intervention delivery
	7f	Postintervention considerations - comprehensively describe Postoperative instructions (e.g. avoid heavy lifting) and care Follow-up measures Future surveillance requirements (e.g. blood tests, imaging etc.)		8g	*Postintervention considerations* *Comprehensively describe*: Postoperative instructions and care (e.g. avoid heavy lifting, dietary restrictions etc.) Follow-up measures Future surveillance requirements (e.g. blood tests, imaging etc.) How patient engagement with postintervention instructions will be encouraged and monitored If applicable, the criteria for patient discharge from the medical facility
	8	Outcomes - comprehensively describe Primary outcomes, including validation, where applicable Secondary outcomes, where appropriate Definition of outcomes If any validated outcome measurement tools are used, give full reference Follow-up period for outcome assessment, divided by group		8h	Definition of outcomes Define primary outcomes, including validation with full reference to relevant studies, where applicable Define secondary outcomes, where appropriate Describe methods or instruments used to measure each outcome, with full reference given if validated Describe follow-up period for outcome assessment, divided by group
	9	Statistics - comprehensively describe Statistical tests and statistical package(s)/software used Confounders and their control, if known Analysis approach (e.g. intention to treat/per protocol) Any subgroup analyses Level of statistical significance		8i	*Statistics* *Comprehensively describe*: Statistical tests and statistical package(s)/software used Rationale behind the statistical tests/software of choice Confounders and their control, if known Analysis approach (e.g. intention to treat/per protocol) Any subgroup analyses Level of statistical significance How the results of the statistical analyses are presented (e.g. *P* values, confidence intervals, point estimates etc.)
Results	10a	Participants - comprehensively describe Flow of participants (recruitment, nonparticipation, cross-over and withdrawal, with reasons). Use figure to illustrate. Population demographics (e.g. age, sex, relevant socioeconomic features, prognostic features etc.) Any significant numerical differences should be highlighted	Results	9a	*Participants* *Comprehensively describe*: With reasons, the flow of participants (recruitment, nonparticipation, cross-over and withdrawal), using a figure to illustrate where appropriate Population demographics (e.g. age, sex, relevant socioeconomic features, prognostic features etc.) Any significant numerical differences across groups If applicable, the longitudinal changes in participant flow/demographics over time

	10b	Participant comparison Include table comparing baseline characteristics of cohort groups Give differences, with statistical relevance Describe any group matching, with methods		9b	Participant comparison Include table comparing baseline characteristics of cohort groups, with statistical data included Concisely, highlight the principal, significant findings Describe any group matching, with methods
	10c	Intervention - comprehensively describe Degree of novelty of intervention Learning required for interventions Any changes to interventions, with rationale and diagram, if appropriate			
	11a	Outcomes - comprehensively describe Clinician-assessed and patient-reported outcomes for each group Relevant photographs and imaging are desirable Any confounding factors and state which ones are adjusted		9c	*Outcomes* *Comprehensively describe*: Clinician-assessed and patient-reported outcomes (e.g. questionnaires with quality-of-life scales) for each group Expected versus attained outcomes, as assessed by the clinician* Primary and secondary outcomes, as previously defined *(Item 8h)* Details of when the outcomes were recorded (e.g. at how many months/years postoperatively) Relevant photographs and imaging are desirable Any confounding factors and state which ones are adjusted and how Any changes to interventions, with rationale and diagram, if appropriate **NB: reference relevant literature to inform expected outcomes*
	11b	Tolerance - comprehensively describe Assessment of tolerability of exposure/intervention Cross-over with explanation Loss to follow-up (fraction and percentage), with reasons		9d	*Tolerance* *Comprehensively describe*: Assessment of tolerability of exposure/intervention within patient groups Methods of measuring tolerance/adherence If applicable, specific patient perspectives Whether these results will have an impact on the long-term applicability of the findings in clinical practice Loss to follow-up (fraction and percentage), with reasons
	11c	Complications - comprehensively describe Adverse events and classify according to Clavien–Dindo classification* Timing of adverse events Mitigation for adverse events (e.g. blood transfusion, wound care, revision surgery etc.) * Dindo D, Demartines N, Clavien P-A. Classification of Surgical Complications. A New Proposal with Evaluation in a Cohort of 6336 Patients and Results of a Survey. Ann Surg. 2002; 240(2): 205-213		9e	*Complications* *Comprehensively describe*: Adverse events, classified according to the Clavien–Dindo classification* Timing of adverse events Precautionary measures taken to prevent complications (e.g. antibiotic or venous thromboembolism prophylaxis) Management of adverse events (e.g. blood transfusion, wound care, revision surgery etc.) If applicable, whether the complication was reported to the national agency/pharmaceutical company If applicable, specify whether any complications were discussed locally and the impact of such discussions (e.g. during team morbidity & mortality meetings) State explicitly if there were no complications/adverse outcomes **Dindo D, Demartines N, Clavien P-A. Classification of Surgical Complications. A New Proposal with Evaluation in a Cohort of 6336 Patients and Results of a Survey. Ann Surg. 2002; 240(2): 205-213*
	12	Key results - comprehensively describe Key results with relevant raw data Statistical analyses with significance Include table showing research findings and statistical analyses with significance		9f	*Key results* *Describe*: Key findings, supported by relevant raw data and corresponding statistical analyses with significance
Discussion	13	Discussion - comprehensively describe Conclusions and rationale Reference to relevant literature Implications for clinical practice	Discussion	10a	*Principal findings* By referencing key, relevant literature throughout, comprehensively describe: Summary of key findings and conclusions Rationale behind conclusions drawn

Table 1

(*Continued*)

Comparison of STROCSS 2021 and proposed STROCSS 2024

STROCSS 2021			Proposed STROCSS 2024		
Topic	**Item**	**Guideline**	**Topic**	**Item**	**Guideline**
		Comparison to current gold standard of care Relevant hypothesis generation			Comparison to current gold standard of care, current guidelines or similar research Implications of findings for future clinical practice and guidelines Relevant hypothesis generation
	14	Strengths and limitations - comprehensively describe Strengths of the study Weaknesses and limitations of the study and potential impact on results and their interpretation Assessment and management of bias Deviations from protocol, with reasons		10b	*Strengths and limitations* Comprehensively describe: Strengths of the study Weaknesses and limitations of the study Measures taken to overcome the limitations, if applicable Potential impact on results and their interpretation Assessment and management of bias Deviations from protocol, with reasons stated
	15	Relevance and implications - comprehensively describe Relevance of findings and potential implications for clinical practice Need for and direction of future research		10c	*Relevance and implications* Comprehensively describe: Relevance of findings Potential implications for future clinical practice and guidelines Measures that can be taken to enhance the quality of research study Need for and direction of future research
Conclusion	16	Conclusions Summarise key conclusions Outline key directions for future research		11	*Conclusions* Summarise key conclusions, in a concise manner Outline scope for and direction of future research
			Additional information	*12a-12d*	*Items 12a-12d of STROCSS 2024 correlate with items 4a-4d of STROCSS 2021.*
Declarations	17a	Conflicts of interest Conflicts of interest, if any, are described	Declarations	13b	*Conflicts of interest* Conflicts of interest, if any, are described
	17b	Funding Sources of funding (e.g. grant details), if any, are clearly stated Role of funder		13c	*Funding* Sources of funding (e.g. grant details), if any, are clearly stated Role of funder stated Guarantor named
	17c	Contributorship Acknowledge patient and public involvement in research; report the extent of involvement of each contributor		13a	*Contributorship* Acknowledge any patient and/or public and/or professional involvement in research Report the extent of involvement of each contributor, specifically stating what they contributed to (e.g. patient recruitment, defining research outcomes, dissemination of results etc.).
				13d	*Data sharing statement* Explicitly state whether or not the datasets generated during study are available on request

Table 2

STROCSS 2024 Delphi scores.

Item	1–3 (*n* (%))	4–6 (*n* (%))	7–9 (*n* (%))
1	1 (2.2)	2 (4.3)	43 (93.5)
2	1 (2.2)	2 (4.3)	43 (93.5)
3a	0 (0.0)	2 (4.3)	44 (95.7)
3b	1 (2.3)	5 (11.4)	38 (86.4)
3c	0 (0.0)	5 (10.9)	41 (89.1)
3d	1 (2.2)	4 (8.7)	41 (89.1)
3e	1 (2.2)	4 (8.7)	41 (89.1)
4	5 (10.9)	4 (8.7)	37 (80.4)
5a	2 (4.3)	3 (6.5)	41 (89.1)
5b	1 (2.2)	0 (0.0)	45 (97.8)
6a	0 (0.0)	3 (6.5)	43 (93.5)
6b	1 (2.2)	6 (13.0)	39 (84.8)
6c	0 (0.0)	1 (2.2)	45 (97.8)
6d	1 (2.2)	3 (6.5)	42 (91.3)
6e	1 (2.2)	3 (6.5)	42 (91.3)
7a	1 (2.2)	3 (6.5)	42 (91.3)
7b	1 (2.2)	2 (4.3)	43 (93.5)
8a	0 (0.0)	9 (19.6)	37 (80.4)
8b	2 (4.3)	3 (6.5)	41 (89.1)
8c	1 (2.2)	4 (8.7)	41 (89.1)
8d	2 (4.3)	5 (10.9)	39 (84.8)
8e	2 (4.3)	1 (2.2)	43 (93.5)
8f	1 (2.2)	7 (15.2)	38 (82.6)
8g	1 (2.2)	3 (6.5)	42 (91.3)
8h	0 (0.0)	1 (2.2)	45 (97.8)
8i	2 (4.3)	2 (4.3)	42 (91.3)
9a	0 (0.0)	6 (13.0)	40 (87.0)
9b	2 (4.3)	5 (10.9)	39 (84.8)
9c	1 (2.2)	4 (8.7)	41 (89.1)
9d	2 (4.3)	3 (6.5)	41 (89.1)
9e	1 (2.2)	2 (4.3)	43 (93.5)
9f	2 (4.3)	3 (6.5)	41 (89.1)
10a	0 (0.0)	2 (4.3)	44 (95.7)
10b	1 (2.2)	4 (8.7)	41 (89.1)
10c	0 (0.0)	3 (6.5)	43 (93.5)
11	2 (4.3)	2 (4.3)	42 (91.3)
12a	2 (4.3)	3 (6.5)	41 (89.1)
12b	2 (4.3)	1 (2.2)	43 (93.5)
12c	1 (2.2)	2 (4.3)	43 (93.5)
12d	1 (2.2)	2 (4.3)	43 (93.5)
13a	1 (2.2)	0 (0.0)	45 (97.8)
13b	1 (2.2)	2 (4.3)	43 (93.5)
13c	1 (2.2)	2 (4.3)	43 (93.5)
13d	0 (0.0)	1 (2.2)	45 (97.8)

Items listed correspond to individual sections of the STROCCS guidelines. The scores given by participants of the Delphi exercise range from 1 (strongly disagree) to 9 (strongly agree).

Methods

The Delphi methodology used in the development of STROCSS 2017 and its subsequent updates in 2019 and 2021 was applied in the development of the STROCSS 2024 guidelines[11].

Generation of proposed revisions

A core steering committee proposed revisions to the STROCSS 2021 checklist. Recommendations were based on newly identified gaps and aimed to enhance specificity, comprehensiveness, and relevance.

Delphi consensus process

The proposed amendments to the STROCSS 2021 guidelines were developed by the steering committee. These changes were integrated into a structured questionnaire that sought to garner consensus from an expert panel, via a Delphi exercise. The panel encompassed research leaders across various surgical specialties.

The Delphi questionnaire was sent to all participants using Google Forms. They were asked to review each of the 45 proposed modifications to STROCSS 2021 and indicate the degree to which they agreed with integrating each amendment into the new guidelines, using a nine-point Likert scale. While a score of 1 on this scale translated to 'strongly disagree' with the suggested changes, a score of 9 meant 'strongly agree'. Consensus for inclusion of an item was predefined as $\geq 70\%$ of participants scoring an item between 7-9. Items meeting this predetermined threshold were updated in the STROCSS 2024 guidelines. If $<70\%$ of participants scored an item between 7-9, the item did not achieve consensus for inclusion and was therefore left unaltered.

Participants

Researchers involved in the development of previous STROCSS updates in 2017, 2019, and 2021 were invited again to participate in the expert panel for STROCSS 2024. Notably, editorial board members from the International Journal of Surgery (IJS) were included. As IJS mandates any observational research submissions to comply with the STROCSS guidelines, involving IJS editors provides key insights. Overall, our panel combined accomplished authors, researchers, journal reviewers, and editorial board members representing a variety of surgical disciplines and countries across Asia, Europe, Australia, Africa, North America, and South America. With multidisciplinary and global insights, we ensured the STROCSS 2024 guidelines remain well-equipped to optimise the reporting quality of observational studies globally.

Results

The Delphi questionnaire was distributed to 56 individuals who agreed to participate in the development of the STROCSS 2024 guidelines. A total of 46 individuals (82%) completed the Delphi survey and therefore contributed to the guideline amendments. Table 1 is a comparison table, between STROCSS 2021 and proposed STROCSS 2024, highlighting the changes suggested. Table 2 summarises the scores given by the survey participants to indicate the extent of their agreement with the proposed modifications to each item of the STROCSS 2021 checklist.

All 45 proposed changes obtained a score of 7-9 by $\geq 70\%$ of the participants, indicating consensus with all suggested changes to each item. The complete, revised STROCSS 2024 guidelines are shown in Table 3.

Discussion

Since the inception of the STROCSS guidelines in 2017, they have amassed over 3200 citations. This is a testament to their great acceptance within the surgical research community. We now present the updated STROCSS 2024 guidelines: a standardised framework for observational research reporting in surgery.

Table 3

The full, revised STROCSS 2024 checklist.

STROCSS 2024 Guidelines

Topic	Item	Item description	Page number
Title	1	*Title* The word 'cohort' or 'cross-sectional' or 'case–control' is included* Temporal design of the study is stated (e.g. retrospective or prospective) The focus of the study is clearly stated (e.g. population, setting, disease, exposure/intervention, outcome, etc.) **STROCSS 2024 guidelines apply to all observational studies (e.g. cohort, cross-sectional, case–control, etc.)*	
Highlights	2	*Highlights* Include three to five bullet points that summarise the key findings of the study Provide a brief background to the study, the key results and clinical relevance	
Abstract	3a	*Structure* Provide a structured abstract that includes the following headings: 1. Background 2. Methods 3. Results 4. Conclusions	
	3b	*Background* Briefly describe: Relevant context Scientific rationale for this study Aims and objectives	
	3c	*Methods* Briefly describe: Type of study design (e.g. cohort, case–control, cross-sectional etc.) Specification of study design (e.g. retro-/prospective, single/multicentred etc.) All patient groups involved, including control group, if applicable Exposure/interventions (e.g. type, operators, recipients, dates and time frames etc.) Outcome measures - explicitly state primary and secondary outcome(s), where appropriate Statistical methods of assessment used, where applicable	
	3d	*Results* Briefly describe: Summary data Principal findings with qualitative descriptions Statistical findings and their significance, where appropriate	
	3e	*Conclusion* Describe key conclusions briefly Refer to implications for clinical practice and public health Describe the need for and direction of future research Include a concise statement that encapsulates the significance of the research and its contribution to the field	
Keywords	4	*Keywords* Include three to six keywords that identify what is covered in the study (e.g. patient population, diagnosis, or surgical intervention) Include study type as a keyword (e.g. cohort study, cross-sectional study, case–control study etc.) Include surgical speciality as one of the keywords Include study location as one of the keywords	
Introduction	5a	*Introduction* By referencing key literature throughout, comprehensively describe: Relevant background and scientific rationale for study Aims and objectives Research question and hypotheses, where appropriate Potential impact of research on future clinical practice Economic relevance of study to society	
	5b	*Guideline citation* At the end of the introduction, refer to the STROCSS 2024 publication by stating: 'This cohort/cross-sectional/case–control study has been reported in line with the STROCSS guidelines [*include citation*]'	
Methods: Study Design	6a	*Study design* State the type of study design (e.g. cohort, cross-sectional, case–control etc.) Describe other key elements of study design (e.g. retro-/prospective, single/multi-centred etc.) Specify the duration of the study, including start and end dates	
	6b	*Setting and timeframe of research* Comprehensively describe: Specific geographical location	

Table 3

(*Continued*)

STROCSS 2024 Guidelines

Topic	Item	Item description	Page number
		Nature of institution (e.g. primary/secondary/tertiary care setting, district general hospital/teaching hospital, public/private, low-resource setting etc.)	
		Timeline for study, including dates for recruitment, exposure, follow-up, data collection etc.	
		Any deviations from the initial study design plan or changes to the timeline during the research, with reasons and implications stated	
	6c	*Study groups*	
		Total number of participants	
		Number of groups	
		Number of participants in each group	
		Detail exposure/intervention allocated to each group	
		Inclusion and exclusion criteria with clear definitions	
	6d	*Subgroup analysis*	
		Comprehensively describe:	
		How subgroups were defined	
		Planned subgroup analyses	
		Methods used to examine subgroups and their interactions	
	6e	*Follow-up*	
		If applicable, comprehensively describe:	
		Time, length, frequency, location and methods of follow-up (e.g. mail, telephone, with whom etc.)	
		Any specific long-term surveillance requirements (e.g. imaging surveillance of endovascular aneurysm repair)	
		Any specific postoperative instructions (e.g. postoperative medications, targeted physiotherapy etc.)	
Methods:	7a	*Recruitment*	
Participant Recruitment		Comprehensively describe:	
		Period of recruitment	
		Methods of recruitment to each patient group (e.g. all at once, in batches, continuously till desired sample size is reached etc.)	
		Sources of recruitment (e.g. physician referral, study website, social media, posters etc.)	
		Any monetary/nonmonetary incentivisation of participants to encourage involvement should be declared *(the nature of any incentives provided must be clarified)*	
		Any challenges encountered during the recruitment processes, including how they were addressed	
	7b	*Sample size*	
		Comprehensively describe:	
		Analysis to determine optimal sample size for study accounting for population/effect size	
		Power calculations with justifications for chosen statistical power, where appropriate	
		Margin of error calculation	
		Any associated ethical considerations	
Methods:	8a	*Pre-intervention considerations*	
Intervention and Outcomes		Comprehensively describe any preoperative patient optimisation:	
		Lifestyle optimisation (e.g. weight loss, smoking cessation, glycaemic control etc.)	
		Medical optimisation (e.g. medication review, treating hypothermia/-volemia/-tension, ICU care etc.)	
		Procedural optimisation (e.g. nil by mouth, enema etc.)	
		Other (e.g. psychological support, physiotherapy etc.)	
	8b	*Intervention*	
		Comprehensively describe:	
		Type of intervention and reasoning (e.g. pharmacological, surgical, physiotherapy, psychological etc.)	
		Aim of intervention (e.g. preventative/therapeutic)	
		Total cost of performing the intervention	
		Degree of novelty of intervention	
		Any learning required for intervention	
		Prevalence or frequency at which the intervention is performed	
		Concurrent treatments (e.g. antibiotics, analgesia, antiemetics, VTE prophylaxis etc.)	
		Manufacturer and model details, where appropriate	
	8c	*Intraintervention considerations*	
		Using figures and other media to illustrate wherever appropriate, comprehensively describe:	
		Details pertaining to administration of intervention (e.g. anaesthetic, positioning, location, preparation, equipment needed, devices, sutures, operative techniques, operative time etc.)	
		For pharmacological therapies, the formulation, dosages, routes, strength and durations	
		For surgery, any postoperative instruction (e.g. when to - remove staples or sutures)	
		The degree of novelty for a surgical technique/device (e.g. 'first in human')	
	8d	*Operator details*	
		Comprehensively describe:	

Table 3

(*Continued*)

STROCSS 2024 Guidelines

Topic	Item	Item description	Page number
		Requirement for additional training Learning curve for technique, including how it was evaluated (e.g. number of cases required to reach a defined level of proficiency) Relevant training, specialisation, and operator's experience (e.g. average number of the relevant procedures performed annually) Any institutional support that was provided to operators to facilitate their training	
	8e	*Setting of intervention* Comprehensively describe: Setting in which the intervention was performed Level of experience the centre has in performing the intervention	
	8f	*Quality control* Comprehensively describe: Measures taken to reduce interoperator variability (e.g. regular team meetings, calibration exercises) Measures taken to ensure consistency in other aspects of intervention delivery (e.g. data collection) Measures taken to ensure quality in intervention delivery	
	8g	*Postintervention considerations* Comprehensively describe: Postoperative instructions and care (e.g. avoid heavy lifting, dietary restrictions etc.) Follow-up measures Future surveillance requirements (e.g. blood tests, imaging etc.) How patient engagement with postintervention instructions will be encouraged and monitored If applicable, the criteria for patient discharge from the medical facility	
	8h	*Definition of outcomes* Define primary outcomes, including validation with full reference to relevant studies, where applicable Define secondary outcomes, where appropriate Describe methods or instruments used to measure each outcome, with full reference given if validated Describe follow-up period for outcome assessment, divided by group	
	8i	*Statistics* Comprehensively describe: Statistical tests and statistical package(s)/software used Rationale behind the statistical tests/software of choice Confounders and their control, if known Analysis approach (e.g. intention to treat/per protocol) Any subgroup analyses Level of statistical significance How the results of the statistical analyses are presented (e.g. *P* values, confidence intervals, point estimates etc.)	
Results	9a	*Participants* Comprehensively describe: With reasons, the flow of participants (recruitment, nonparticipation, cross-over and withdrawal), using a figure to illustrate where appropriate Population demographics (e.g. age, gender, relevant socioeconomic features, prognostic features etc.) Any significant numerical differences across groups If applicable, the longitudinal changes in participant flow/demographics over time	
	9b	*Participant comparison* Include table comparing baseline characteristics of cohort groups, with statistical data included Concisely, highlight the principal, significant findings Describe any group matching, with methods	
	9c	*Outcomes* Comprehensively describe: Clinician-assessed and patient-reported outcomes (e.g. questionnaires with quality-of-life scales) for each group Expected versus attained outcomes, as assessed by the clinician* Primary and secondary outcomes, as previously defined *(Item 8h)* Details of when the outcomes were recorded (e.g. at how many months/years postoperatively) Relevant photographs and imaging are desirable Any confounding factors and state which ones are adjusted and how Any changes to interventions, with rationale and diagram, if appropriate **NB: reference relevant literature to inform expected outcomes*	
	9d	*Tolerance* Comprehensively describe:	

Table 3

(*Continued*)

STROCSS 2024 Guidelines

Topic	Item	Item description	Page number
		Assessment of tolerability of exposure/intervention within patient groups Methods of measuring tolerance/adherence If applicable, specific patient perspectives Whether these results will have an impact on the long-term applicability of the findings in clinical practice Loss to follow-up (fraction and percentage), with reasons	
	9e	*Complications* Comprehensively describe: Adverse events, classified according to the Clavien–Dindo classification* Timing of adverse events Precautionary measures taken to prevent complications (e.g. antibiotic or venous thromboembolism prophylaxis) Management of adverse events (e.g. blood transfusion, - wound care, revision surgery etc.) If applicable, whether the complication was reported to the national agency/pharmaceutical company If applicable, specify whether any complications were discussed locally and the impact of such discussions (e.g. during team morbidity & mortality meetings) State explicitly if there were no complications/adverse outcomes **Dindo D, Demartines N, Clavien P-A. Classification of Surgical Complications. A New Proposal with Evaluation in a Cohort of 6336 Patients and Results of a Survey. Ann Surg. 2002; 240(2): 205-213*	
	9f	*Key results* Describe: Key findings, supported by relevant raw data and corresponding statistical analyses with significance	
Discussion	10a	*Principal findings* By referencing key, relevant literature throughout, comprehensively describe: Summary of key findings and conclusions Rationale behind conclusions drawn Comparison to current gold standard of care, current guidelines or similar research Implications of findings for future clinical practice and guidelines Relevant hypothesis generation	
	10b	Strengths and limitations Comprehensively describe: Strengths of the study Weaknesses and limitations of the study Measures taken to overcome the limitations, if applicable Potential impact on results and their interpretation Assessment and management of bias Deviations from protocol, with reasons stated	
	10c	*Relevance and implications* Comprehensively describe: Relevance of findings Potential implications for future clinical practice and guidelines Measures that can be taken to enhance the quality of research study Need for and direction of future research	
Conclusion	11	*Conclusions* Summarise key conclusions, in a concise manner Outline scope for and direction of future research	
Additional information	12a	*Registration* In accordance with the Declaration of Helsinki*, state the unique research registration number and where it was registered, with a hyperlink to the registry entry *(this can be obtained from ResearchRegistry.com, ClinicalTrials.gov, ISRCTN etc.)* *N.B. All retrospective studies should be registered before submission; it should be stated that the research was retrospectively registered.* * *'Every research study involving human subjects must be registered in a publicly accessible database before recruitment of the first subject'*	
	12b	*Ethical approval* Whether ethical approval was needed or not, stated explicitly Reason(s) why ethical approval was/was not needed Name of the body giving ethical approval and approval number	
	12c	*Informed consent* State explicitly whether informed consent was obtained, or not. State reason(s) why informed consent was/was not obtained State the nature of consent (e.g. verbal, written, digital/virtual)*	

Table 3

(*Continued*)

STROCSS 2024 Guidelines

Topic	Item	Item description	Page number
		The authors must provide evidence of consent, where applicable, and if requested by the journal Consent should be provided for both the original intervention/procedure and publication of the study *If consent was not provided by the patient, explain why (e.g. death of the patient and consent provided by next of kin). If the patient or family members were untraceable, then document the tracing efforts undertaken	
	12d	*Protocol* Give details of protocol (a *priori* or otherwise) including how to access it (e.g. web address, DOI etc.) Give details of protocol registration (e.g. protocol registration number, protocol registry's name etc.) If published in a journal, cite and provide a full reference If applicable, detail any amendments made to the original protocol, giving reasons why the changes were made	
Declarations	13a	*Contributorship* Acknowledge any patient and/or public and/or professional involvement in research Report the extent of involvement of each contributor, specifically stating what they contributed to (e.g. patient recruitment, defining research outcomes, dissemination of results etc.).	
	13b	*Conflicts of interest* Conflicts of interest, if any, are described	
	13c	*Funding* Sources of funding (e.g. grant details), if any, are clearly stated Role of funder stated Guarantor named	
	13d	*Data sharing statement* Explicitly state whether or not the datasets generated during study are available on request	

Past studies have demonstrated that most surgical journals still do not implement rigorous reporting checks or guidelines for authors[2]. However, analysis has indicated that adherence to comprehensive reporting guidelines leads to significant improvements in manuscript quality and reporting completeness[5,6]. As such, we strongly encourage authors, editors, and journals across surgical disciplines to broadly adopt the updated STROCSS 2024 guidelines.

Furthermore, we strongly advise authors to explicitly state their use of and reference the STROCSS 2024 guidelines in their introduction section. They should also submit a completed STROCSS checklist together with their manuscript to assist editors when evaluating alignment with the guidelines during the submission review process. Table 3 constitutes the full and revised STROCSS guidelines, together with a column in which the author can state the page number on which the criterion was met in their submission.

The STROCSS website (https://www.strocssguideline.com/) has made the 2024 checklist available across various formats to promote accessibility and facilitate adoption. We must emphasise that these guidelines represent the minimum detail that should be reported: if something was not done, it should be stated, to aid transparency.

Collective and systematic uptake of STROCSS 2024 by authors, reviewers, editors, and publishers promises to elevate the calibre, translational value, and clinical applicability of observational research in surgery.

Conclusion

We present the updated STROCSS 2024 guidelines. Adoption within the surgical research community of authors, reviewers, editors, and medical journals is strongly encouraged. We urge surgical research stakeholders globally to implement these guidelines when conducting, evaluating, and disseminating observational findings, driving continual improvements in evidence-based patient care.

Through the Delphi consensus exercise and the integration of recent advances in reporting standards, the STROCSS 2024 guidelines were systematically developed to uphold the highest standards for reporting observational research in surgery.

Ethical approval

Not applicable. No patients were involved in the production of these surgical guidelines.

Consent

Not applicable. No patients were involved in the production of these surgical guidelines.

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None.

Author contribution

R.A.A.: concept and design, data interpretation and analysis, drafting, revision and approval of final manuscript; R.R., C.S., A.K., T.F., G.M., and M.N.: design, data collection, data interpretation and analysis, drafting, revision, and approval of final manuscript.

Conflicts of interest disclosure

None declared. The authors have no financial, consultative, institutional, or any other relationships that might lead to bias or conflict of interest.

Research registration unique identifying number (UIN)

1. Name of the registry: not applicable.
2. Unique identifying number or registration ID: not applicable.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): not applicable.

Guarantor

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Data availability statement

The data in this guideline is derived from individual responses to the survey and is therefore confidential and not in the public domain.

Provenance and peer review

Not commissioned, internally reviewed.

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