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Failure-to-Rescue in Surgical Practice: A Systematic Review and Critical Appraisal of Recent Clinical Studies

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Agostino Gemelli IRCCS.**ADMINISTRATIVE INFORMATION****Support** - None.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202630097**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 March 2026 and was last updated on 27 March 2026.**INTRODUCTION**

Review question / Objective • Population: Adult patients (age ≥ 18 years) undergoing any surgical procedure in any surgical subspecialty (general surgery, emergency surgery, cardiovascular surgery, thoracic surgery, hepatobiliary surgery, colorectal surgery, urologic surgery, orthopedic surgery, neurosurgery, gynecologic surgery, or other surgical disciplines).

• Intervention/Exposure: Occurrence of one or more postoperative complications as defined by individual studies. No restrictions were placed on complication types or definitions to capture the full heterogeneity of FTR operationalization.

• Comparator: Studies with or without comparator groups were eligible. Comparators, when present, included different hospital types (teaching vs. non-teaching, high-volume vs. low-volume), different care processes (rapid response teams vs. standard care, different time-to-intervention thresholds), or different patient populations (stratified by age, comorbidity, or complication severity).

- Outcome: Failure to rescue, defined as death following a postoperative complication, reported as either the primary or secondary outcome. FTR could be operationalized as a structural indicator (hospital/system-level characteristics associated with FTR rates), process indicator (care pathways or interventions affecting FTR), or clinical outcome (patient-level mortality stratified by complication type or patient factors).
- Study design: Clinical studies including prospective or retrospective cohort studies, case-control studies, comparative observational studies, clinical trials (randomized or non-randomized), and multicenter registry-based studies. Case reports, editorials, commentaries, letters, conference abstracts, and narrative reviews were excluded.

Rationale This review is focused on failure to rescue (FTR). Despite its conceptual importance, measuring FTR remains challenging. A recent systematic review by Aiken and colleagues identified 131 distinct complications used to define FTR across 295 studies, with a median of 10 complications per study and substantial variability

in inclusion criteria. This heterogeneity reduces generalizability and complicates cross-institutional and international comparisons. Furthermore, the adoption of FTR is fragmented: not all surgical subspecialties routinely report FTR, and the literature remains concentrated in high-income countries, raising questions about global representativeness and applicability.

Condition being studied Surgery and death following post-operative complications.

METHODS

Search strategy A comprehensive literature search was performed in May 2024 using PubMed and PubMed Central databases. Two complementary search queries were designed to maximize retrieval of clinical surgical studies reporting FTR: Query 1: (("failure"[All Fields] OR "failures"[All Fields]) AND ("rescue"[All Fields] OR "rescued"[All Fields] OR "rescues"[All Fields] OR "rescuing"[All Fields])) AND ((y_5[Filter]) AND (classical article[Filter] OR clinical study[Filter] OR clinical trial[Filter] OR multicenter study[Filter] OR observational study[Filter] OR randomized controlled trial[Filter]) AND (humans[Filter]) AND (english[Filter])); Query 2: ("ftr"[All Fields]) AND ((y_5[Filter]) AND (clinical study[Filter] OR clinical trial[Filter] OR multicenter study[Filter] OR observational study[Filter] OR randomized controlled trial[Filter]) AND (humans[Filter]) AND (English[Filter]))

Search filters limited results to human studies, English language, and clinical study types published between January 1, 2019, and May 31, 2024.

Inclusion criteria were: clinical studies (observational, comparative, randomized trials) reporting FTR as an outcome; surgical populations (any subspecialty); publication date: 2019–2024; English language; and reporting of patient-level or system-level FTR data. Exclusion criteria were: case reports, editorials, letters, conference abstracts; studies not focused on FTR or not presenting clinical data; non-surgical populations; and duplicate publications.

Duplicate references were removed semi-automatically using Microsoft Excel. Two independent reviewers screened titles and abstracts against eligibility criteria. Full-text articles were retrieved for potentially eligible studies, and final inclusion was determined by consensus.

For each included manuscript, the following data were extracted using a standardized form: Bibliographic information (Author(s), year, journal name, Journal Impact Factor (JIF) from the most recent Journal Citation Reports [17]); Study

characteristics (study design, country of corresponding author, surgical subspecialty, sample size); FTR operationalization (Outcome hierarchy: primary or secondary outcome; Indicator type: Structure -hospital/system characteristics, Process -care pathways, protocols, interventions-, or Clinical Outcome -patient-level mortality-, according to Donabedian's framework[4]); Bibliometric data (citations from Scopus[18] and Google Scholar[19] -retrieved via DOI search); Altmetric Attention Score[20]); Keywords (Medical Subject Headings (MeSH) terms assigned in PubMed).

Participant or population Adult patients (age ≥ 18 years) undergoing any surgical procedure in any surgical subspecialty (general surgery, emergency surgery, cardiovascular surgery, thoracic surgery, hepatobiliary surgery, colorectal surgery, urologic surgery, orthopedic surgery, neurosurgery, gynecologic surgery, or other surgical disciplines).

Intervention Occurrence of one or more postoperative complications as defined by individual studies. No restrictions were placed on complication types or definitions to capture the full heterogeneity of FTR operationalization.

Comparator Studies with or without comparator groups were eligible. Comparators, when present, included different hospital types (teaching vs. non-teaching, high-volume vs. low-volume), different care processes (rapid response teams vs. standard care, different time-to-intervention thresholds), or different patient populations (stratified by age, comorbidity, or complication severity).

Study designs to be included Clinical studies including prospective or retrospective cohort studies, case-control studies, comparative observational studies, clinical trials (randomized or non-randomized), and multicenter registry-based studies. Case reports, editorials, commentaries, letters, conference abstracts, and narrative reviews were excluded.

Eligibility criteria Inclusion criteria were: clinical studies (observational, comparative, randomized trials) reporting FTR as an outcome; surgical populations (any subspecialty); publication date: 2019–2024; English language; and reporting of patient-level or system-level FTR data. Exclusion criteria were: case reports, editorials, letters, conference abstracts; studies not focused on FTR or not presenting clinical data; non-surgical populations; and duplicate publications.

Information sources Pubmed.

Main outcome(s) Primary outcomes of interest are: temporal trends in FTR clinical studies (2019–2024); FTR as primary vs. secondary outcome; and FTR operationalization: structure, process, or clinical outcome indicator.

Additional outcome(s) Secondary outcomes include: geographic distribution of contributing authors (by country); surgical subspecialty representation; Bibliometric impact: Scopus citations, Google Scholar citations, Altmetric scores and MeSH term frequency analysis.

Data management Data were extracted and computed in a dedicated Excel database.

Quality assessment / Risk of bias analysis All included studies were assessed for methodological quality using the Newcastle-Ottawa Scale (NOS), which evaluates cohort and case-control studies across three domains: selection of study groups, comparability of groups, and ascertainment of outcome or exposure. Studies were rated as low, moderate, or high risk of bias.

Strategy of data synthesis Descriptive statistics (mean, standard deviation, median, range, frequencies, percentages) are calculated for all variables. Bibliometric indices are compared across indicator categories (structure/process/outcome) and surgical subspecialties using one-way analysis of variance (ANOVA). Statistical significance was set at $p < 0.05$. All analyses are performed using Microsoft Excel and R (version 4.x).

Subgroup analysis Bibliometric indices are compared across indicator categories (structure/process/outcome) and surgical subspecialties using one-way analysis of variance (ANOVA). Statistical significance was set at $p < 0.05$. All analyses are performed using Microsoft Excel and R (version 4.x).

Sensitivity analysis None.

Language restriction English.

Country(ies) involved Italy.

Other relevant information None.

Keywords Failure to rescue; Surgical outcomes; Healthcare quality; Patient safety; Quality indicators; Systematic review; Postoperative complications.

Dissemination plans Publication in a scientific international journal.

Contributions of each author

Author 1 - Claudia Varrella - CV performed bibliographic search, extracted data and drafted the analysis.

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