

Appropriateness of Allogeneic Red Blood Cell Transfusion: The International Consensus Conference on Transfusion Outcomes

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An international multidisciplinary panel of 15 experts reviewed 494 published articles and used the RAND/UCLA Appropriateness Method to determine the appropriateness of allogeneic red blood cell (RBC) transfusion based on its expected impact on outcomes of stable nonbleeding patients in 450 typical inpatient medical, surgical, or trauma scenarios. Panelists rated allogeneic RBC transfusion as appropriate in 53 of the scenarios (11.8%), inappropriate in 267 (59.3%), and uncertain in 130 (28.9%). Red blood cell transfusion was most often rated appropriate (81%) in scenarios featuring patients with hemoglobin (Hb) level 7.9 g/dL or less, associated comorbidities, and age older than 65 years. Red blood cell transfusion was rated inappropriate in all

scenarios featuring patients with Hb level 10 g/dL or more and in 71.3% of scenarios featuring patients with Hb level 8 to 9.9 g/dL. Conversely, no scenario with patient's Hb level of 8 g/dL or more was rated as appropriate. Nearly one third of all scenarios were rated uncertain, indicating the need for more research. The observation that allogeneic RBC transfusions were rated as either inappropriate or uncertain in most scenarios in this study supports a more judicious transfusion strategy. In addition, the large number of scenarios in which RBC transfusions were rated as uncertain can serve as a road map to identify areas in need of further investigation.

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For a list of voting participants, see Appendix 1.

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IN 2006, MORE than 14 million units of allogeneic red blood cells (RBCs) were transfused in the United States alone.¹ From 1997 to 2007, the hospital discharges in the United States in which patients' record indicated RBC transfusion increased from 5% to 10.4%, with blood transfusion becoming the most common inpatient hospital procedure.² Red blood cell transfusion rates in other countries are variable but often comparably high.³⁻⁵

Although therapeutic modalities routinely undergo rigorous evaluation of their efficacy and safety before entering clinical practice, RBC transfusion has not been subjected to similar examination.⁶⁻⁹ In addition to known transfusion complications,¹⁰ a large (and increasing) number of studies indicate that RBC transfusion is associated with unfavorable general outcomes.¹¹ Similarly, the available large randomized clinical trials¹²⁻¹⁵ and prospective observational studies^{16,17} that have assessed the efficacy/effectiveness of allogeneic RBC transfusion have indicated that restricting RBC transfusions in nonhemorrhaging patients has no significant negative effect on patient outcomes and may even improve outcomes in some populations.

Decisions to transfuse RBCs are often based on unsubstantiated hemoglobin (Hb) level or hematocrit "triggers" and are further complicated by regulatory constraints, fear of future litigation, and public expectations rather than on the

clinical evidence.¹⁸ Despite these limitations, rational RBC transfusion practices have still been sought, but in the absence of definitive answers, clinicians are often left with no option other than consensus guidelines.¹⁹

In view of the uncertainty regarding the health benefits of transfusion, the International Consensus Conference on Transfusion Outcomes (ICCTO) was convened to rate the appropriateness of allogeneic RBC transfusion based on its impact on patients' outcomes.

METHODS

The authors used the RAND/UCLA Appropriateness Method (RUAM), a structured process for integrating evidence from the scientific literature with experts' clinical judgment to produce explicit criteria for determining the appropriateness of specific procedures when high-quality and definitive evidence (usually from large randomized controlled trials) are missing.²⁰⁻²³ The RUAM is an important clinical tool that has been used worldwide for more than 2 decades to identify criteria for the appropriateness of numerous procedures and interventions.²⁴⁻³² Various components of the process are detailed below. An overview of the process is depicted in [Figure 1](#).

The Panel

The authors assembled a multinational, multidisciplinary 15-member panel to rate the appropriateness of allogeneic RBC transfusion ([Table 1](#)). The panelists were selected based on their expertise in various aspects of blood transfusion (as indicated by their publication records, academic positions, prior membership in expert/advisory boards, etc) and their willingness to participate in the study. They had backgrounds in critical care, primary care, anesthesiology, hematology, oncology, pathology/laboratory medicine, surgery/trauma/cardiac surgery, epidemiology, and transfusion medicine. The authors also selected the panel moderators: 1 experienced in the RUAM process (A.F.), and the other, a clinician experienced in transfusion medicine (A.S.).

Literature Search

The authors performed a systematic search and review of available literature reporting on the outcomes of allogeneic blood transfusion. The search was limited to English-language articles

indexed in PubMed and published from January 1995 to October 2008 (shortly before the panel was convened). A rather general search term ([“Erythrocyte Transfusion” {Mesh} OR [transfus* AND {blood OR “red cell” OR “packed cell” OR rbc OR prbc OR erythrocyte}]) was used to ensure maximal inclusion of the studies. The review did not include studies focusing exclusively on blood components other than allogeneic RBCs or whole blood; animal studies; those on pediatric populations; publication types other than clinical trials, observational studies, reviews, meta-analyses, and case reports/series; and duplicate reports with no additional information. The review also did not include studies on actively bleeding or hemodynamically unstable patients (except patients recovering from controlled recent bleeding) and studies in which outcomes of RBC transfused patients were compared with outcomes of patients receiving interventions other than no or less RBC transfusion. The review did accept blood conservation interventions if they were applied uniformly to the study arms. The authors also searched the references of the identified secondary literature (meta-analyses and reviews) for other potentially eligible studies that might have been missed by the search strategy.

After manual review of the retrieved articles, the authors selected 494 studies that compared the outcomes of RBC transfusion in at least 2 groups of patients: one of which received allogeneic RBCs, whereas the second group received a lesser quantity or did not receive any allogeneic RBCs ([Appendix 1](#)—available online).

For each study, the authors extracted the related clinical scenario(s); the medical, surgical, or trauma setting in which the patient presented; purpose of the study, definition of the study interventions and control; sample size in each arm; key patient demographic characteristics; baseline Hb level/hematocrit; transfusion data; and reported outcomes. The authors indexed these fields with the available full-text articles into a searchable database that was distributed among the panelists.

The Scenarios

The authors asked the panelists to rate the appropriateness of allogeneic RBC transfusion in 38 clinical settings featuring stable and nonbleeding patients ([Table 2](#)) who were chosen based on consideration of situations in which transfusion is commonly considered/used. Of the 38 settings, 15

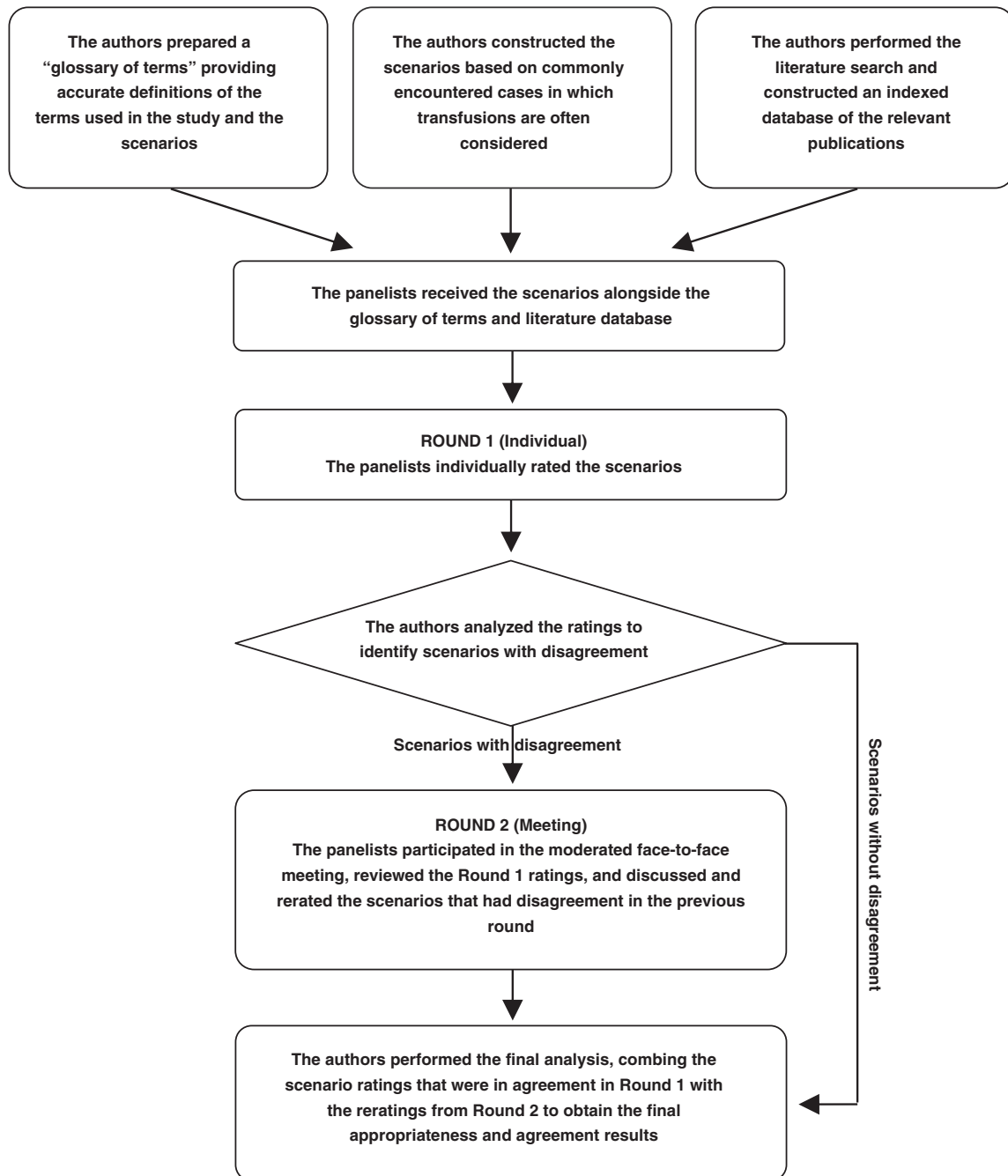


Fig 1. Overview of the RUAM used in this study.

were related to medical (nonsurgical) situations; 20, to surgical situations; and 3, to trauma (Table 2). The authors' clinical experience (situations that they had encountered in their practice in which blood transfusions were commonly considered) and the literature (patient population/clinical conditions

that have been commonly addressed in transfusion studies) were the bases for choosing the scenarios, but they confirmed their relevance by asking the panelists as part of the panel process.

Within each setting, separate scenarios were defined for 12 different sets of patient characteristics

Table 1. The Voting ICCTO Panelists in Alphabetical Order

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based on permutations of age (≤ 64 or ≥ 65 years old), presence or absence of any major comorbidities, and severity of anemia, expressed as 3 ranges of Hb concentration (Hb level ≤ 7.9 g/dL, Hb level 8-9.9 g/dL, Hb level ≥ 10 g/dL). The major comorbidities (defined according to those used by the State of New Jersey Department of Health and Senior Services [www.nj.gov/health]) included any of the following, alone or in combination: heart disease (coronary artery disease, arrhythmia, congestive heart disease), chronic obstructive pulmonary disease, chronic renal failure, high blood pressure, malignancy, sepsis/overt infection, diabetes mellitus (insulin-dependent or independent), and obesity. The choice of Hb level ranges was arbitrary and based on commonly cited transfusion guidelines and common transfusion practices. The 10 g/dL threshold was chosen to reflect the “10/30” rule.³³ Although it has been challenged and repeatedly debated that transfusions are unlikely to be beneficial when Hb level is 10 g/dL or more, this threshold is still occasionally used in practice as well as in clinical studies.^{19,34-39} The choice of the other threshold was more challenging, as various guidelines recommended Hb level–based transfusion thresholds ranging from 6 to 9 g/dL based on the setting and patient condition. The actual utilization data showed even more variation among clinicians and institutions across various patient conditions/

procedures, but a threshold of 8 g/dL appeared to be a middle ground for the lowest acceptable pre-transfusion Hb level threshold in practice.⁴⁰⁻⁴⁴ Both thresholds were vetted by the ICCTO panel. Defining a higher number of Hb level ranges based on more thresholds was deemed impractical because of the increased total number of resulting scenarios. Accordingly, 456 (38×12) scenarios were originally created by the authors. The panel subsequently excluded 6 scenarios because they lacked clinical relevance (ie, patients 65 years or older being status postcesarean section).

Glossary of Terms

Several terms used in this study were likely to be interpreted differently or needed additional descriptions to ensure uniform understanding among the panelists. For example, *RBC transfusion* in this study referred to leukoreduced donated and banked allogeneic RBC units stored for an average period, prepared and stored according to current blood banking standards. To ensure that the panelists shared the same definitions for the key terms of the study and the scenarios, the authors provided the panelists with a list of these terms alongside with their definitions in the context of this study. Additional qualifiers were added to more accurately define the terms when necessary.

Table 2. Clinical Settings for Allogeneic RBC Transfusion Considered in This Study

Settings	Scenarios
Medical	Patient is admitted to the cardiac unit with suspected acute coronary syndrome
	Patient is admitted to the ICU with noncardiogenic shock
	Patient is admitted to the ICU with sepsis
	Patient is admitted to the ICU with multiple organ failure
	Patient is admitted to the ICU with respiratory failure requiring the use of ventilatory support
	Patient has been on mechanical ventilation and is due to be weaned
	Patient has been diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in- or outpatient)
	Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever
	Patient with myelodysplastic syndrome is admitted with fever
	Patient with sickle cell disease is admitted for elective surgery
	Patient is admitted with acute brain attack (stroke)
	Patient is admitted with subarachnoid/intracranial bleeding with potential for vasospasm
	Patient is admitted to the ED with upper GI bleeding
	Patient is admitted to the ED with lower GI bleeding
Surgical	Patient is admitted with acute pancreatitis
	Patient is admitted for elective CABG
	Patient is admitted for elective valve replacement
	Patient is admitted for CABG/valve replacement
	Patient is admitted for PCI
	Patient is admitted for large bowel surgery (may be cancer)
	Patient is admitted for elective large joint replacement
	Patient is admitted for elective large spinal reconstruction
	Patient is admitted to ED with hip fracture requiring surgical repair
	Patient is admitted for semielective ovarian tumor debulking
	Patient is immediately status postcesarean section
	Patient is admitted for elective total abdominal hysterectomy
	Patient with a high-prevalence cancer is admitted for elective cancer surgery
	Patient with a high-prevalence metastatic carcinoma is admitted for surgery
	Patient is admitted for femoral distal bypass
	Patient is admitted for abdominal aortic aneurism repair (surgical or stenting)
	Patient is admitted for renal transplantation
Patient is admitted for liver transplantation	
Patient is admitted status postabdominal flap	
Patient is admitted for a major urology surgery (may be cancer)	
Patient is admitted for a major head and neck surgery (may be cancer)	
Trauma	Patient with GCS of 14 is admitted to ED with blunt trauma
	Patient is admitted to ED with traumatic brain injury (GCS < 10)
	Patient is admitted to service with 70% of body with third-degree burns

Abbreviations: ICU, intensive care unit; ED, emergency department; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention; GCS, Glasgow Coma Score.

The Rating Process

Panelists rated the appropriateness of transfusion in clinical scenarios based on its expected effect on patients' outcomes in 2 rounds (Fig 1). In the first round, which was done remotely, the panelists received a package in the mail containing the rating sheets in addition to the glossary of the terms and the literature review on the outcomes of RBC transfusion and were asked to use them in conjunction with their clinical experience to rate the appropriateness of RBC transfusion in each clinical scenario. The panelists submitted the rating sheets to the authors, and their ratings were

analyzed, as described under the [Data Analysis](#) section below, to identify the scenarios with disagreement in the ratings (see below for how "disagreement" was defined). At the second round, the panelists focused on the scenarios with disagreement in the first round. The second round was a moderated face-to-face meeting that took place in Phoenix, Arizona. During the meeting, summaries of the group's overall ratings and each panelist's individual ratings of the scenarios with disagreement in the first round were provided to each panelist, and the scenarios were discussed. Once each scenario was adequately discussed (indicated

by panels' unanimous vote to proceed), the panelists individually rerated the scenarios, and their rating sheets were collected by the authors.

During the ratings, the panelists were instructed to focus on the expected effect of transfusion on patients' outcomes. The outcomes of interest were chosen by the authors and included mortality, morbidity, and quality of life. *Morbidity* was defined as new onset or worsening of either of the following: infections (not transmitted by transfusion), acute lung injury, respiratory failure, renal failure, congestive heart disease, arrhythmia, acute coronary syndrome/myocardial infarction, liver function abnormality, hyperkalemia, cerebral vascular attack, venous thromboembolism, end-organ ischemia, multiple organ failure, systemic inflammatory response syndrome, or recurrence of tumor. When applicable, the same definitions as those used for the comorbidities (see above) were used. *Quality of life* was defined as physical activity/function status, cognitive activity, or emotional well-being.

For each scenario, panelists rated allogeneic RBC transfusion to be "appropriate," "inappropriate," or "uncertain" on a scale of 1 to 9 points, with 1 representing the lowest benefit-to-risk ratio and 9 being the highest. An appropriate scenario (rating, 7-9) was one in which RBC transfusion was considered a reasonable approach, was generally acceptable, and was likely to improve a typical patient's chances of good health outcomes or survival. An inappropriate scenario (rating, 1-3) was one in which RBC transfusion was not generally acceptable, was not a reasonable approach for the scenario, and was unlikely to improve the chances of good health outcomes or survival. An uncertain scenario (rating, 4-6) was one in which RBC transfusion might be acceptable and might be a reasonable approach, but more research and/or patient information was needed to make a definitive decision.

The panelists were instructed not to consider cost or competing therapies in rating the scenarios. For each scenario, panelists were asked to compare patient outcomes after providing an allogeneic RBC transfusion to outcomes without an RBC transfusion rather than a transfusion alternative. The panelists were asked to assume the following during rating the scenarios: (1) the decision to transfuse RBCs was being made by the average physician for the average patient (not an extreme case) in the average facility; (2) the patient situation

required immediate medical attention but was not sufficiently dire to require resuscitation; (3) in the surgical setting, the RBC transfusion was being given perioperatively; (4) the patient was not actively bleeding, and the vital signs were stable and nonthreatening; (5) procedures related to blood donation and banking had been done correctly; (6) the RBC units considered for transfusion were leukoreduced and of average storage age; (7) the RBC transfusion process was performed correctly; and (8) outcomes related to RBC transfusions were dose dependent.

Data Analysis

For each scenario, the median of the ratings of all panelists was calculated to determine the appropriateness of RBC transfusion for that scenario: inappropriate if the median was 1 to 3, uncertain if the median was 4 to 6, and appropriate if the median was 7 to 9. "Disagreement" for each scenario was determined objectively based on the dispersion and symmetry of ratings using a slightly modified version of a previously validated method developed by investigators at the Unidad de Investigación en Servicios de Salud de the Carlos III Health Institute in Madrid, Spain.²¹ This method is based on calculation of the interquartile range (IQR), a measure of dispersion of the distribution of scores, and the IQR adjusted for symmetry (IQRAS), a value of IQR that has been corrected for asymmetry of rating values with respect to the middle of the scale, as follows:

$$IQRAS = 2.35 + (AI \times 1.5), \text{ where}$$

AI is the asymmetry index, calculated as the distance between the middle of the rating scale (ie, 5) and the central point of the IQR. In the equation above, the value 2.35 is the predetermined IQR beyond which disagreement is declared when perfect symmetry exists among the ratings, and the value 1.5 is the predetermined correction factor of asymmetry.²¹ For each scenario ratings, the IQR and IQRAS were calculated and compared, and the ratings were flagged as "in disagreement" if the IQR was greater than IQRAS and flagged as "not in disagreement" if IQR was less than IQRAS. It should be noted that this method originally used the range between the 30th and 70th percentiles, but the authors opted to use IQR instead for increased sensitivity to detect disagreement. All the ratings

were analyzed using the original as well as the modified method to ensure that all ratings that were flagged as in disagreement using the original method were also identified as in disagreement using the modified method.

The univariate effect of clinical settings and patient characteristics on disagreement and ratings were assessed using appropriate statistical tests. The multivariate effect of these factors on final appropriateness and median rating of scenarios was analyzed using ordinal regression analysis, and the Nagelkerke R^2 values and parameter estimates are reported. Values are expressed as median (IQR) (or median [IQR] if within parentheses) unless otherwise specified. $P < .05$ was considered to be statistically significant. Analyses were performed using SPSS (version 13.0; SPSS, Chicago, IL).

RESULTS

In the first round of panel ratings, there was disagreement on the appropriateness rating of 63 (14%) of 450 scenarios. Clinical setting, age, and comorbidities were not significantly associated with disagreement, but most scenarios with disagreement (68.3%) had Hb level 7.9 g/L or less, and there was no scenario with disagreement with Hb level 10 g/L or more ($P < .001$ compared with scenarios without disagreement). The median of the ratings in scenarios with disagreement was significantly higher compared with those without disagreement (5 [2] vs 3 [4], $P < .001$).

These 63 scenarios were rerated after moderated discussions at the live panel meeting in round 2. Using the IQR/IQRAS method described above, none of the scenarios was flagged to be in disagreement in the second round. Median ratings of these 63 scenarios were generally lower in round 2 compared with round 1 (overall median of 5 [2] in round 1 vs 4 [2] in round 2, $P < .001$ for paired test, Fig 2). As such, from the first to the second round, there was a rerating trend from appropriate toward uncertain and from uncertain toward inappropriate, whereas the dispersion of the ratings was reduced. Of the 10 scenarios with median rating in the inappropriate range (1-3) in the first round, all 10 were also rerated as inappropriate in the second round. Of the 50 scenarios with uncertain median rating (4-6) in the first round, 35 were rerated uncertain and 14 were rated inappropriate in the second round. Finally, all 3 scenarios with median rating in the appropriate

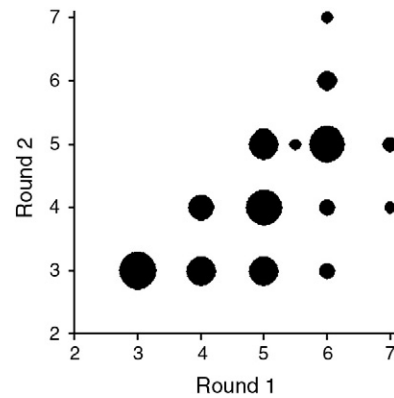


Fig 2. Median ratings in first and second rounds for 63 scenarios that had disagreement in first round. The size (area) of the markers is proportional to the number of the scenarios, with the smallest markers representing 1 scenario. The numbers on the axes represent the appropriateness ratings for the scenarios on a scale of 1 to 9 (1-3, inappropriate; 4-6, uncertain; 7-9, appropriate).

range (7-9) in the first round were rated as uncertain in the second round.

The following analyses are based on the combined data from 387 scenarios that were rated with agreement in the first round and 63 scenarios that were rated with agreement in the second round. Of the 450 potential scenarios for allogeneic RBC transfusion considered by the panel, RBC transfusion was considered inappropriate and unlikely to improve outcomes in 267 scenarios (59.3%). In 130 scenarios (28.9%), the panel agreed that there was insufficient evidence to make a decision regarding the effect of RBC transfusion on outcomes, and the scenarios were rated as uncertain. In the remaining 53 scenarios (11.8%), RBC transfusion was rated as appropriate and likely to improve patient outcomes as supported by the medical literature.

There was no significant difference in the relative proportion of appropriate, inappropriate, and uncertain ratings within the 3 groupings of clinical settings in univariate analysis ($P = .123$, Table 3). A complete listing of the final appropriateness ratings for all scenarios can be found in Appendix 2 (available online).

The median ratings were not statistically significantly different between the scenarios focusing on patients who were 64 years or younger vs those 65 years or older (3 [4] vs 3 [4], respectively; $P = .070$). However, in 66.0% of the 53 scenarios rated as appropriate, patient age was 65 years or older

Table 3. Appropriateness Rating of Scenarios by Type of Clinical Setting

Scenarios	Medical (n = 180)	Surgical (n = 234)	Trauma (n = 36)
Rating			
Appropriate, n (%)	23 (12.8)	27 (11.5)	3 (8.3)
Inappropriate, n (%)	94 (52.2)	148 (63.3)	25 (69.5)
Uncertain, n (%)	63 (35.0)	59 (25.2)	8 (22.2)

NOTE. Distribution of the appropriateness ratings was not statistically significantly different among the scenarios (overall $P = .123$ for 3×3 table).

(odds ratio [OR], 2.184; 95% confidence interval [CI], 1.196-3.985; $P = .010$; Fig 3A).

Appropriateness ratings were higher in scenarios with comorbidity compared with those without comorbidity (median ratings, 3 [5] vs 3 [3], respectively; $P = .001$). Scenarios rated as appropriate were far more likely to have comorbidities (88.7% with comorbidity vs 11.3% without; OR, 9.638; 95% CI, 4.028-23.060; $P < .001$; Fig 3A). Conversely, 55.4% of scenarios rated as inappropriate did not have comorbidity (OR, 0.584; 95% CI, 0.399-0.854; $P = .005$; Fig 3B).

Median appropriateness ratings of the scenarios were inversely related to Hb levels: 6 (2) for Hb level 7.9 g/dL or less category, 3 (1) for Hb level 8 to 9.9 g/dL category, and 1 (0) for Hb level 10 g/dL or more category ($P < .001$). All 53 scenarios rated as appropriate had Hb level 7.9 g/dL or less (OR 1.546; 95% CI 1.374-1.741; $P < .001$; Fig 3A). Conversely, among scenarios rated as inappropriate, only 3.7% had an Hb level 7.9 g/dL or less (OR, 0.012; 95% CI, 0.006-0.025; $P < .001$), 40.1% had an Hb level 8 to 9.9 g/dL (OR, 2.177; 95% CI, 1.430-3.315; $P < .001$), and 56.2% had an Hb level 10 g/dL or more (OR, 0.390; 95% CI, 0.339-0.449; $P < .001$; Fig 3B). Finally, no scenario with an Hb level 10 g/dL or more was rated as uncertain (OR, 0.567; 95% CI, 0.513-0.626; $P < .001$; Fig 3C).

The combined effect of the patient characteristics (age group, presence/absence of comorbidities, Hb level group) on median appropriateness ratings and final appropriateness of 450 scenarios is summarized in Table 4. In scenarios with a combination of age 65 years or older and Hb level 7.9 g/dL or less in presence of comorbidity, RBC transfusion was most likely to be rated as appropriate regardless of the setting; 81.1% of these scenarios were rated as appropriate. The same combination without comorbidity resulted in 44.7% of scenarios being rated as

appropriate, but 52.6% of such scenarios were rated as uncertain. Most (83.3%) scenarios with age 65 years or older combined with Hb level 7.9 g/dL or less without comorbidity and 76.3% of scenarios with age 64 years or younger combined with an Hb level 7.9 g/dL or less without comorbidity were rated as uncertain.

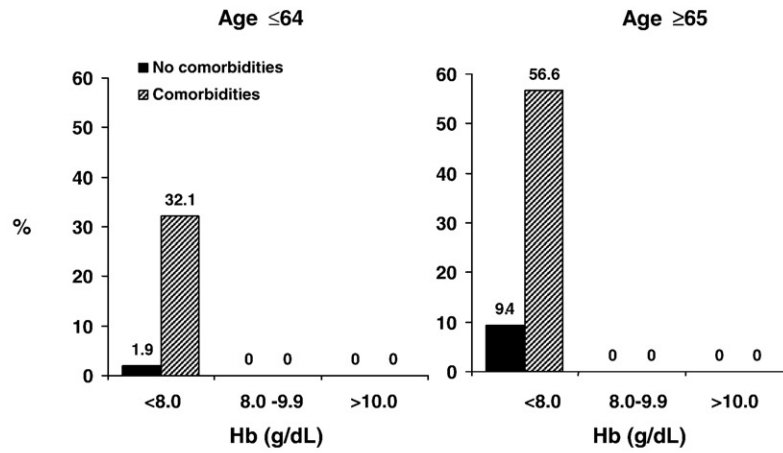
Dispersion of the ratings (as reflected by the IQR) was not associated with patients' age ($P = .113$) or comorbidity ($P = .196$). The greatest dispersion was found in the ratings of the scenarios concerning patients with an Hb level 8 to 9.9 g/dL, and scenarios concerning patients with an Hb level 10 g/dL or more had the least dispersion in the ratings ($P < .001$ for the difference between IQR of the ratings among Hb level ≤ 7.9 , Hb level 8-9.9, and Hb level ≥ 10 g/dL; Table 4).

An ordinal regression model with appropriateness ratings on a scale of 1 to 9 as the dependent variable and patient characteristics as independent factors was statistically significant and had an R^2 of 0.885 ($P < .001$). Hemoglobin level 7.9 g/dL or less, Hb level 8 to 9.9 g/dL, having comorbidity, age 65 years or older, and medical scenarios were statistically significantly associated with higher appropriateness ratings (Table 5). Similarly, an ordinal regression model with final appropriateness as dependent variable and patient characteristics as independent factors was statistically significant and had an R^2 of 0.706, $P < .001$. Because of quasi-complete separation of the data, the Hb level 8 to 9.9 g/dL and Hb level 10 g/dL or more categories were merged into 1 category and compared with the Hb level 7.9 g/dL or less category. Hemoglobin level 7.9 g/dL or less, having comorbidity, age 65 years or older, and medical scenarios were statistically significantly associated with scenarios being rated appropriate or uncertain (Table 6).

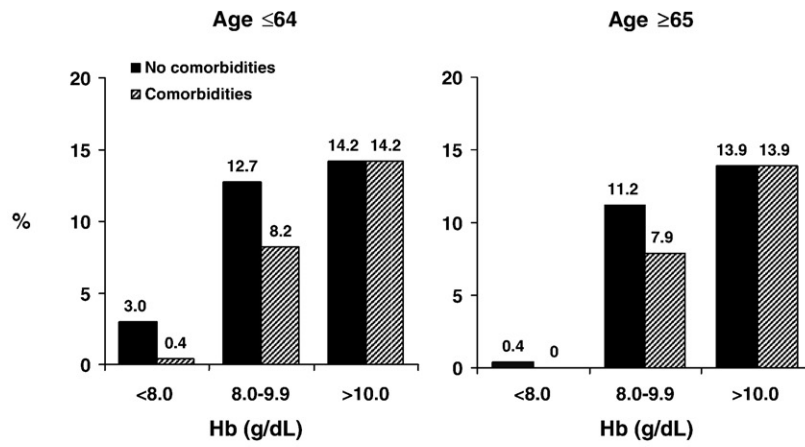
DISCUSSION

The panel rated allogeneic RBC transfusion as inappropriate and unlikely to improve patient outcomes in most of the scenarios discussed in this study, which were based on hypothetical not actively bleeding average (not extreme) patients with stable vital signs. These included all scenarios in which patients had an Hb level 10 g/dL or more as well as more than 70% of scenarios featuring patients with an Hb level 8 to 9.9 g/dL and 6.7% of scenarios with an Hb level 7.9 g/dL or less. In scenarios with an Hb level 8 to 9.9 g/dL, the main

A. Appropriate scenarios



B. Inappropriate scenarios



C. Uncertain scenarios

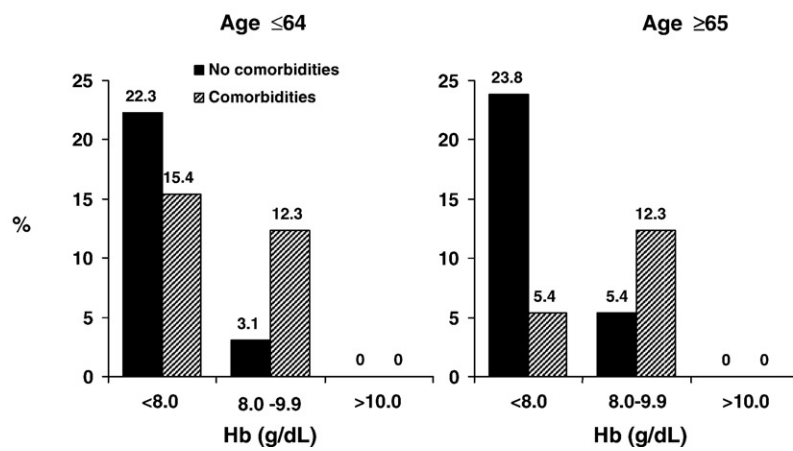


Fig 3. Patient characteristics of clinical scenarios rated as appropriate (panel A), inappropriate (panel B), and uncertain (panel C) for allogeneic RBC transfusion.

Table 4. Appropriateness of Blood Transfusions According to the Patient Characteristics

Age (y)	Comorbidity	Hb level (g/dL)	Inappropriate (1-3)	Uncertain (4-6)	Appropriate (7-9)	Median rating [IQR]
≤64	Absent	≤7.9	8 (21.1%)	29 (76.3%)	1 (2.6%)	4 [1]
		8-9.9	34 (89.5%)	4 (10.5%)	0	2 [1]
		≥10	38 (100%)	0	0	1 [0]
	Present	≤7.9	1 (2.6%)	20 (52.6%)	17 (44.7%)	6 [1]
		8-9.9	22 (57.9%)	16 (42.1%)	0	3 [1]
		≥10	38 (100%)	0	0	1 [0]
≥65	Absent	≤7.9	1 (2.7%)	31 (83.8%)	5 (13.5%)	5 [1]
		8-9.9	30 (81.1%)	7 (18.9%)	0	3 [0]
		≥10	37 (100%)	0	0	1 [0]
	Present	≤7.9	0	7 (18.9%)	30 (81.1%)	7 [0]
		8-9.9	21 (56.8%)	16 (43.2%)	0	3 [1]
		≥10	37 (100%)	0	0	1 [0]

NOTE. Median appropriateness ratings (on a scale of 1-9) and final appropriateness (1-3, inappropriate; 4-6, uncertain; and 7-9, appropriate) of the 450 scenarios according to patients' characteristics.

factor associated with transfusion being rated as inappropriate was absence of comorbidity. Similarly, scenarios with an Hb level 7.9 g/dL or less rated as inappropriate were predominantly concerning patients aged 64 years or younger and without comorbidity. The panel rated transfusions likely to improve patients' outcomes in less than 12% of the scenarios. These scenarios were concerning patients who invariably had an Hb level 7.9 g/dL or less, and most (88%) had comorbidity. Clinical settings were not found to be significant determinants of the ratings; rather, patient characteristics were significant. Of the patient characteristics evaluated in this study (age, comorbidity, and Hb level), the Hb level

was the most significant determinant of the panel rating.

Hemoglobin level is the most commonly used parameter to make RBC transfusion decisions and is commonly considered in transfusion indications in various RBC transfusion guidelines.^{37,45} It is generally accepted that during escalating hemodilution/anemia, oxygen consumption is not adversely affected unless tissue oxygenation becomes supply-dependent and a so-called critical Hb level concentration is reached. Studies indicate the dismal consequences of profound anemia (Hb levels <5-6 g/dL), as evidenced by a steep increase in mortality rate in surgical and trauma patients.⁴⁶⁻⁵⁰ However, most

Table 5. Ordinal Regression of Appropriateness Ratings (on a Scale of 1-9, With 1 Being Most Inappropriate and 9 Being Most Appropriate) and Scenario/Patient Factors

Factor	Parameter estimate	95% CI		P	Univariate R ²
		Lower bound	Upper bound		
Setting: medical	1.418	0.602	2.235	.001	0.009
Setting: surgical	0.190	-0.602	0.982	.638	0.005
Age ≤64 y	-1.294	-1.726	-0.862	<.001	0.007
No comorbidity	-2.550	-3.057	-2.043	<.001	0.026
Hb level ≤7.9 g/dL	14.563	12.657	16.470	<.001	0.579
Hb level 8-9.9 g/dL	9.267	7.602	10.932	<.001	0.002

NOTE. For each factor, the missing category is the reference group.

Table 6. Ordinal Regression of Appropriateness (Inappropriate, 0; Uncertain, 1; Appropriate, 2) and Scenario/Patient Factors

Factor	Parameter estimate	95% CI		P	Univariate R ²
		Lower bound	Upper bound		
Setting: medical	-1.746	-2.588	-0.425	.006	0.014
Setting: surgical	-0.695	-1.761	0.370	.201	0.006
Age ≤64 y	-0.865	-1.374	-0.356	.001	0.007
No comorbidity	-2.203	-2.806	-1.600	<.001	0.041
Hb level ≤7.9 g/dL	-5.725	-6.600	-4.849	<.001	0.604

NOTE. For each factor, the missing category is the reference group. To avoid quasi-complete separation of the data, the Hb level 8-9.9 g/dL and Hb level ≥10 g/dL categories were combined into 1 category and compared with Hb level ≤7.9 g/dL category.

patients who are routinely transfused with RBCs do not have (or are not at imminent risk of having) Hb levels anywhere near these critically low concentrations.⁶ Our scenarios were constructed with the assumption that the patients were stable, not extreme cases, and not actively bleeding. Thus, even patients belonging to the Hb level 7.9 g/dL or less group are most likely to have Hb level values near the upper limit (7.9 g/dL) and not in the extremely low ranges. As such, an Hb level 7.9 g/dL or less was not necessarily rated to be an indicator of transfusion being likely to improve patients' outcomes. In fact, only 35% (53/150) of the scenarios concerning patients with Hb level 7.9 g/dL or less were rated appropriate and deemed likely to improve outcomes based on available literature. Nonetheless, this level is an often cited trigger for recommending RBC transfusion in several guidelines.³⁷ Although the relentless search for transfusion Hb level triggers has driven a considerable part of RBC transfusion investigation, in this study, we attempted to establish a different approach for one of the most difficult clinical decisions by focusing on the impact of RBC transfusion on patients' outcomes.

The lack of definitive information regarding the outcomes of RBC transfusions in the available literature can be inferred from the fact that the ICCTO panel rated 29% of the total clinical scenarios reviewed to be of uncertain appropriateness. Scenarios rated as uncertain all occurred at Hb level values of less than 10 g/dL and were equally divided among younger and older patients. Most scenarios concerning patients with an Hb level 7.9 g/dL or less (58%) were rated to be of uncertain benefit by the panel, another indicator that the commonly held thresholds for RBC transfusion are arbitrary numbers and likely to be irrelevant to the outcomes in many patients. A similar paucity of robust outcomes data for guiding RBC transfusion policy was noted in an earlier review of transfusion thresholds.⁴⁵ Future clinical research to determine the effectiveness of RBC transfusion in scenarios rated as uncertain in this study should be given a priority. In the absence of additional data, RBC transfusion should be withheld or given with caution in these clinical scenarios. Other important future directions include the role of patients' age and comorbidities in outcomes of RBC transfusion, given the paucity of evidence currently available regarding these factors.

The primary limitations of the ICCTO panel findings are associated with the assumptions that were made regarding the scenarios. Although the panelists agreed that most patients given RBC transfusions in the United States fall within the parameters established for this project, the panel's conclusions were limited to patients who were stable and not bleeding, being treated in an inpatient setting. There was some discussion regarding the ranges of Hb concentration that were used to define the clinical scenarios, particularly the use of Hb level 7.9 g/dL or less as the lowest range of Hb level. Some panelists stated that decisions regarding appropriateness in some scenarios might have been different depending on whether the Hb level was in the lower or upper end of the 0 to 7.9 g/dL Hb level range. However, discussion reaffirmed that given the assumption of the patients not being extreme cases, the Hb level 7.9 g/dL or less category was most likely to include patients with higher Hb level values as opposed to severely anemic patients with exceedingly low Hb levels, and the panelists agreed unanimously with this assumption. We originally justified choosing this range of Hb concentration by noting that an Hb concentration of 8 or 9 g/dL is the most common threshold for RBC transfusion in the United States, although this Hb level threshold is likely to lack clinical significance.³⁷ Other issues include the limited number of patient characteristics and the limited number of levels in each category. Likewise, the choice of age groups was based on loose and arbitrary definitions of middle vs older age, and it does not necessarily have clinical relevance. Elderly patients are usually at higher risk of being transfused,⁵ but the physiologic basis for higher need to blood transfusion in these patients is not fully established; it may be related to higher prevalence of comorbidities in this age group.⁵¹ Indeed, of the 3 patient characteristics evaluated in this study, age had the least impact on the appropriateness ratings. Inclusion of a longer list of factors with more detailed levels in each was desirable, but it became clear that such an approach would result in a substantial increase of the total number of the scenarios to the point of making the RUAM impractical.

In rating the scenarios, the panelists were asked to compare RBC transfusion with no or limited RBC transfusion and to not consider other modalities (alternatives) that could reduce RBC transfusion.

Although consideration of these alternatives in the decision-making process might have changed the results, we believe the net effect would have been in favor of rating even more scenarios as inappropriate or uncertain. Regardless, the decision not to include the alternatives to RBC transfusion was based on feasibility considerations and to allow evaluation of efficacy of RBC transfusions independent of other alternatives.

The authors focused on PubMed for the search, given that it is generally accepted and used as the primary electronic source to retrieve peer-reviewed biomedical publications. However, they recognize that this source may not be comprehensive and that there is potential that other relevant studies were not included. Similarly, the language and period of search were limited according to the available resources.

Finally, although the panelists were asked to rate the appropriateness of RBC transfusion based on its effect on patient outcome in each scenario, the “outcome” in question was a heterogeneous combination of mortality, various morbidities, and quality-of-life measures. However, the effects of RBC transfusions on all these distinct outcomes are not necessarily in concordance, and RBC transfusion may positively affect 1 outcome (eg, short-term functional status) while at the same time negatively affecting another outcome (eg, morbidity). During the ratings, the panelists considered the overall net effect on the outcomes, giving precedence to mortality, followed by morbidity.

The results of the ICCTO appropriateness panel reinforce a growing body of studies suggesting that allogeneic RBC transfusion has limited benefit and may contribute to adverse outcomes in a large number of clinical settings.^{16,17,52-55} The scenarios in this study were chosen, based on our clinical experience and validated by the panel, to mirror the commonly encountered clinical situations in which RBC transfusions are likely to be considered. We believe that a substantial percentage of RBC transfusions in hospitals today are given to patients who fall in one of the scenarios presented and discussed here. Nonetheless, we did not cover outpatient transfusions as well as those given to patients with chronic anemia, which could account for a substantial proportion of all allogeneic blood units transfused.

This study has several implications for clinical practice. First, to the extent that the ratings

contained in this publication provide a snapshot of the status of perceived outcomes related to transfusion, we hope that clinicians will use them as a part of the decision-making process when considering RBC transfusion. Use of the findings in this fashion or within other approaches such as blood utilization review can limit inappropriate allogeneic RBC transfusions. Particularly, consideration of the impact of RBC transfusion on patients’ health and outcomes in lieu of using arbitrary triggers is expected to yield better patient-centered decisions. Second, the observation that approximately 30% of the scenarios considered were rated uncertain is indicative of the strong and unmet need for clinical outcomes research in RBC transfusion. We suggest that the uncertain scenarios identified by the panel can serve to highlight gaps in current clinical knowledge and thus provide a roadmap for future research in RBC transfusion outcomes. Finally, the findings of the ICCTO panel can be used to develop tools to assist in the blood utilization review process at medical centers. Although this study attempted to link RBC transfusions with patients’ outcomes and did not intend to propose RBC transfusion guidelines or recommendations, a closer scrutiny of allogeneic RBC transfusion practices during the utilization review process based on findings of this study may help to limit inappropriate usage and further define and validate appropriate settings for this procedure.

CONCLUSIONS

The findings of the ICCTO panel suggest that clinical situations in which allogeneic RBC transfusion has demonstrated unequivocal benefit based on available data are uncommon. In the most rated scenarios, RBC transfusions are not deemed likely to improve outcomes and, in fact, may lead to harm. In a substantial number of cases, the impact of RBC transfusion on outcomes still remains uncertain and in need of further investigation. These observations, in combination with data indicating that RBC transfusion is associated with adverse events in a wide variety of clinical settings, provide a rationale for more judicious use of allogeneic RBC transfusion in many patients who are routinely transfused.

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APPENDIX 1

**The Complete List of the 494 Articles on Effects of Allogeneic Blood Transfusion on Patient Outcomes Reviewed by the Panelists
(to be provided online)**

Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
The Swiss Group for Clinical Cancer Research (SAKK)	Association between blood transfusion and survival in a randomised multicentre trial of perioperative adjuvant portal chemotherapy in patients with colorectal cancer. The Swiss Group for Clinical Cancer Research (SAKK)	<i>Eur J Surg</i>	1997	163	9	693	701
Vamvakas EC, Carven JH	RBC transfusion and postoperative length of stay in the hospital or the intensive care unit among patients undergoing coronary artery bypass graft surgery: the effects of confounding factors	<i>Transfusion</i>	2000	40	7	832	839
Shorr AF, Duh MS, Kelly KM, Kollef MH	Red blood cell transfusion and ventilator-associated pneumonia: a potential link?	<i>Crit Care Med</i>	2004	32	3	666	674
Shorr AF, Jackson WL, Kelly KM, Fu M, Kollef MH	Transfusion practice and blood stream infections in critically ill patients	<i>Chest</i>	2005	127	5	1722	1728
Vichinsky EP, Haberkern CM, Neumayr L, Earles AN, Black D, Koshy M, Pegelow C, Abboud M, Ohene-Frempong K, Iyer RV	A comparison of conservative and aggressive transfusion regimens in the perioperative management of sickle cell disease. The Preoperative Transfusion in Sickle Cell Disease Study Group	<i>N Engl J Med</i>	1995	333	4	206	213
Haberkern CM, Neumayr LD, Orringer EP, Earles AN, Robertson SM, Black D, Abboud MR, Koshy M, Idowu O, Vichinsky EP,	Cholecystectomy in sickle cell anemia patients: perioperative outcome of 364 cases from the National Preoperative Transfusion Study. Preoperative Transfusion in Sickle Cell Disease Study Group	<i>Blood</i>	1997	89	5	1533	1542
Hebert PC, Wells G, Blajchman MA, Marshall J, Martin C, Pagliarello G, Tweeddale M, Schweitzer I, Yetisir E	A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group	<i>N Engl J Med</i>	1999	340	6	409	417

(continued on next page)

Appendix 1 (continued)

Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Bracey AW, Radovancevic R, Riggs SA, Houston S, Cozart H, Vaughn WK, Radovancevic B, McAllister HA, Cooley DA	Lowering the hemoglobin threshold for transfusion in coronary artery bypass procedures: effect on patient outcome	<i>Transfusion</i>	1999	39	10	1070	1077
Hebert PC, Yetisir E, Martin C, Blajchman MA, Wells G, Marshall J, Tweeddale M, Pagliarello G, Schweitzer I	Is a low transfusion threshold safe in critically ill patients with cardiovascular diseases?	<i>Crit Care Med</i>	2001	29	2	227	234
Hebert PC, Blajchman MA, Cook DJ, Yetisir E, Wells G, Marshall J, Schweitzer I	Do blood transfusions improve outcomes related to mechanical ventilation?	<i>Chest</i>	2001	119	6	1850	1857
McIntyre L, Hebert PC, Wells G, Fergusson D, Marshall J, Yetisir E, Blajchman MJ	Is a restrictive transfusion strategy safe for resuscitated and critically ill trauma patients?	<i>J Trauma</i>	2004	57	3	563	568
Grover M, Talwalkar S, Casbard A, Boralessa H, Contreras M, Boralessa H, Brett S, Goldhill DR, Soni N	Silent myocardial ischaemia and haemoglobin concentration: a randomized controlled trial of transfusion strategy in lower limb arthroplasty	<i>Vox Sang</i>	2006	90	2	105	112
Busch OR, Hop WC, Marquet RL, Jeekel J	The effect of blood transfusions on survival after surgery for colorectal cancer	<i>Eur J Cancer</i>	1995	31A	7-8	1226	1228
Hebert PC, Wells G, Marshall J, Martin C, Tweeddale M, Pagliarello G, Blajchman M	Transfusion requirements in critical care. A pilot study. Canadian Critical Care Trials Group	<i>JAMA</i>	1995	273	18	1439	1444
Bush RL, Pevac WC, Holcroft JW	A prospective, randomized trial limiting perioperative red blood cell transfusions in vascular patients	<i>Am J Surg</i>	1997	174	2	143	148
Carson JL, Terrin ML, Barton FB, Aaron R, Greenburg AG, Heck DA, Magaziner J, Merlino FE, Bunce G, McClelland B, Duff A, Noveck H	A pilot randomized trial comparing symptomatic vs. hemoglobin-level-driven red blood cell transfusions following hip fracture	<i>Transfusion</i>	1998	38	6	522	529
Elizalde JI, Moitinho E, Garcia-Pagan JC, Cirera I, Escorsell A, Bandi JC, Jimenez W, Bosch J, Pique JM, Rodes J	Effects of increasing blood hemoglobin levels on systemic hemodynamics of acutely anemic cirrhotic patients	<i>J Hepatol</i>	1998	29	5	789	795
McIntyre LA, Fergusson DA, Hutchison JS, Pagliarello G, Marshall JC, Yetisir E, Hare GM, Hebert PC	Effect of a liberal versus restrictive transfusion strategy on mortality in patients with moderate to severe head injury	<i>Neurocrit Care</i>	2006	5	1	4	9
Styles LA, Abboud M, Larkin S, Lo M, Kuypers FA	Transfusion prevents acute chest syndrome predicted by elevated secretory phospholipase A2	<i>Br J Haematol</i>	2007	136	2	343	344

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Park SH, Nam E, Bang SM, Cho EK, Shin DB, Lee JH	A randomized trial of anemia correction with two different hemoglobin targets in the first-line chemotherapy of advanced gastric cancer	<i>Cancer Chemother Pharmacol</i>	2008	62	1	1	9
Fernandes CJ, Akamine N, De Marco FV, De Souza JA, Lagudis S, Knobel E	Red blood cell transfusion does not increase oxygen consumption in critically ill septic patients	<i>Crit Care</i>	2001	5	6	362	367
Jansen AJ, Caljouw MA, Hop WC, van Rhenen DJ, Schipperus MR	Feasibility of a restrictive red-cell transfusion policy for patients treated with intensive chemotherapy for acute myeloid leukaemia	<i>Transfus Med</i>	2004	14	1	33	38
Celikkanat S, Koc C, Akyol MU, Ozdem C	Effect of blood transfusion on tumor recurrence and postoperative pharyngocutaneous fistula formation in patients subjected to total laryngectomy	<i>Acta Otolaryngol</i>	1995	115	4	566	568
Donohue JH, Williams S, Cha S, Windschitl HE, Witzig TE, Nelson H, Fitzgibbons RJ, Wieand HS, Moertel CG	Perioperative blood transfusions do not affect disease recurrence of patients undergoing curative resection of colorectal carcinoma: a Mayo/North Central Cancer Treatment Group study	<i>J Clin Oncol</i>	1995	13	7	1671	1678
Corwin HL, Parsonnet KC, Gettinger A	RBC transfusion in the ICU. Is there a reason?	<i>Chest</i>	1995	108	3	767	771
Morris PC, Haugen J, Tomjack J, Anderson B, Buller RE	Blood transfusion and the risk of recurrence in stage IB cervical cancer	<i>Gynecol Oncol</i>	1995	57	3	401	406
Choi JH, Chung HC, Yoo NC, Lee HR, Lee KH, Kim JH, Roh JK, Min JS, Lee KS, Kim BS	Perioperative blood transfusions and prognosis in patients with curatively resected locally advanced gastric cancer	<i>Oncology</i>	1995	52	2	170	175
Monk BJ, Tewari K, Gamboa-Vujicic G, Burger RA, Manetta A, Berman ML	Does perioperative blood transfusion affect survival in patients with cervical cancer treated with radical hysterectomy?	<i>Obstet Gynecol</i>	1995	85	3	343	348
Hollaar GL, Gooszen HG, Post S, Williams JG, Sutherland LR	Perioperative blood transfusion does not prevent recurrence in Crohn's disease. A pooled analysis	<i>J Clin Gastroenterol</i>	1995	21	2	134	138
Itasaka H, Yamamoto K, Taketomi A, Higashi H, Kamakura T, Matsumata T	Influence of blood transfusion on postoperative long-term liver function in patients with hepatocellular carcinoma	<i>Hepatogastroenterology</i>	1995	42	5	465	468

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Chiarugi M, Bucciante P, di SM, Galatioto C, Goletti O, Cavina E	Association between perioperative blood transfusion and dehiscence of anastomosis after rectal resection for cancer	<i>Acta Chir Belg</i>	1996	96	3	108	111
Rainio P, Bloigu R, Satta J, Pokela R, Paakko P	Ten-year survival after resection for lung carcinoma. Effect of blood transfusion and tumour stage on outcome	<i>Scand J Thorac Cardiovasc Surg</i>	1996	30	2	87	91
Koneru B, Harrison D, Rizwan M, Holland BK, Ippolito T, Holman MJ, Leevy CB	Blood transfusions in liver recipients: a conundrum or a clear benefit in the cyclosporine/tacrolimus era?	<i>Transplantation</i>	1997	63	11	1587	1590
Moore FA, Moore EE, Sauaia A	Blood transfusion. An independent risk factor for postinjury multiple organ failure	<i>Arch Surg</i>	1997	132	6	620	624
Tan MH, Mankin HJ	Blood transfusion and bone allografts. Effect on infection and outcome	<i>Clin Orthop Relat Res</i>	1997		340	207	214
Quintiliani L, Pescini A, Di GM, Iudicone P, Martini F, Guglielmetti M, Buzzonetti A, Fascioli S	Relationship of blood transfusion, post-operative infections and immunoreactivity in patients undergoing surgery for gastrointestinal cancer	<i>Haematologica</i>	1997	82	3	318	323
Koval KJ, Rosenberg AD, Zuckerman JD, Aharonoff GB, Skovron ML, Bernstein RL, Su E, Chakka M	Does blood transfusion increase the risk of infection after hip fracture?	<i>J Orthop Trauma</i>	1997	11	4	260	265
Sanchez-Bueno F, Garcia-Marcilla JA, Perez-Abad JM, Vicente R, Aranda F, Lujan JA, Parrilla P	Does perioperative blood transfusion influence long-term prognosis of gastric cancer?	<i>Dig Dis Sci</i>	1997	42	10	2072	2076
Sturgis EM, Congdon DJ, Mather FJ, Miller RH	Perioperative transfusion, postoperative infection, and recurrence of head and neck cancer	<i>South Med J</i>	1997	90	12	1217	1224
Carson JL, Duff A, Berlin JA, Lawrence VA, Poses RM, Huber EC, O'Hara DA, Noveck H, Strom BL	Perioperative blood transfusion and postoperative mortality	<i>JAMA</i>	1998	279	3	199	205
Vamvakas EC, Carven JH	Allogeneic blood transfusion, hospital charges, and length of hospitalization: a study of 487 consecutive patients undergoing colorectal cancer resection	<i>Arch Pathol Lab Med</i>	1998	122	2	145	151
Edna TH, Bjerkeset T	Perioperative blood transfusions reduce long-term survival following surgery for colorectal cancer	<i>Dis Colon Rectum</i>	1998	41	4	451	459

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Lentz SS, Shelton BJ, Toy NJ	Effects of perioperative blood transfusion on prognosis in early-stage cervical cancer	<i>Ann Surg Oncol</i>	1998	5	3	216	219
Edna TH, Bjerkeset T	Association between transfusion of stored blood and infective bacterial complications after resection for colorectal cancer	<i>Eur J Surg</i>	1998	164	6	449	456
Craig SR, Adam DJ, Yap PL, Leaver HA, Elton RA, Cameron EW, Sang CT, Walker WS	Effect of blood transfusion on survival after esophagogastrectomy for carcinoma	<i>Ann Thorac Surg</i>	1998	66	2	356	361
Wolterbeek JH, Soeters R, Van WL, Van d, Peters AA	Is there an effect of perioperative blood transfusion on the outcome of radical hysterectomy with lymphadenectomy for cervical cancer in South Africa?	<i>Eur J Gynaecol Oncol</i>	1998	19	5	458	463
Cacciarelli TV, Keeffe EB, Moore DH, Burns W, Busque S, Concepcion W, So SK, Esquivel CO	Effect of intraoperative blood transfusion on patient outcome in hepatic transplantation	<i>Arch Surg</i>	1999	134	1	25	29
Tachibana M, Tabara H, Kotoh T, Kinugasa S, Dhar DK, Hishikawa Y, Masunaga R, Kubota H, Nagasue N	Prognostic significance of perioperative blood transfusions in resectable thoracic esophageal cancer	<i>Am J Gastroenterol</i>	1999	94	3	757	765
Azuma C, Koyama M, Inagaki M, Ito S, Sawada M, Saji F, Ozaki M	The influence of perioperative blood transfusion during radical hysterectomy on the prognosis of uterine cervical cancer	<i>Transfus Sci</i>	1997	18	1	55	62
Asahara T, Katayama K, Itamoto T, Yano M, Hino H, Okamoto Y, Nakahara H, Dohi K, Moriwaki K, Yuge O	Perioperative blood transfusion as a prognostic indicator in patients with hepatocellular carcinoma	<i>World J Surg</i>	1999	23	7	676	680
Carson JL, Altman DG, Duff A, Noveck H, Weinstein MP, Sonnenberg FA, Hudson JI, Provenzano G	Risk of bacterial infection associated with allogeneic blood transfusion among patients undergoing hip fracture repair	<i>Transfusion</i>	1999	39	7	694	700
Grogan M, Thomas GM, Melamed I, Wong FL, Pearcey RG, Joseph PK, Portelance L, Crook J, Jones KD	The importance of hemoglobin levels during radiotherapy for carcinoma of the cervix	<i>Cancer</i>	1999	86	8	1528	1536
Fransen E, Maessen J, Dentener M, Senden N, Buurman W	Impact of blood transfusions on inflammatory mediator release in patients undergoing cardiac surgery	<i>Chest</i>	1999	116	5	1233	1239

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Chang H, Hall GA, Geerts WH, Greenwood C, McLeod RS, Sher GD	Allogeneic red blood cell transfusion is an independent risk factor for the development of postoperative bacterial infection	<i>Vox Sang</i>	2000	78	1	13	18
Torchia MG, Danzinger RG	Perioperative blood transfusion and albumin administration are independent risk factors for the development of postoperative infections after colorectal surgery	<i>Can J Surg</i>	2000	43	3	212	216
Dresner SM, Lamb PJ, Shenfine J, Hayes N, Griffin SM	Prognostic significance of peri-operative blood transfusion following radical resection for oesophageal carcinoma	<i>Eur J Surg Oncol</i>	2000	26	5	492	497
Chiarugi M, Buccianti P, Disarli M, Galatioto C, Cavina E	Effect of blood transfusions on disease-free interval after rectal cancer surgery	<i>Hepatogastroenterology</i>	2000	47	34	1002	1005
Dhar DK, Kubota H, Tachibana M, Kotoh T, Kinugasa S, Shibakita M, Kohno H, Nagasue N	A tailored perioperative blood transfusion might avoid undue recurrences in gastric carcinoma patients	<i>Dig Dis Sci</i>	2000	45	9	1737	1742
Mynster T, Christensen IJ, Moesgaard F, Nielsen HJ	Effects of the combination of blood transfusion and postoperative infectious complications on prognosis after surgery for colorectal cancer. Danish RANX05 Colorectal Cancer Study Group	<i>Br J Surg</i>	2000	87	11	1553	1562
Kwon AH, Matsui Y, Kamiyama Y	Perioperative blood transfusion in hepatocellular carcinomas: influence of immunologic profile and recurrence free survival	<i>Cancer</i>	2001	91	4	771	778
Leal-Noval SR, Rincon-Ferrari MD, Garcia-Curiel A, Herruzo-Aviles A, Camacho-Larana P, Garnacho-Montero J, maya-Villar R	Transfusion of blood components and postoperative infection in patients undergoing cardiac surgery	<i>Chest</i>	2001	119	5	1461	1468
Wu WC, Rathore SS, Wang Y, Radford MJ, Krumholz HM	Blood transfusion in elderly patients with acute myocardial infarction	<i>N Engl J Med</i>	2001	345	17	1230	1236
Nozoe T, Miyazaki M, Saeki H, Ohga T, Sugimachi K	Significance of allogenic blood transfusion on decreased survival in patients with esophageal carcinoma	<i>Cancer</i>	2001	92	7	1913	1918

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Dunne JR, Malone D, Tracy JK, Gannon C, Napolitano LM	Perioperative anemia: an independent risk factor for infection, mortality, and resource utilization in surgery	<i>J Surg Res</i>	2002	102	2	237	244
Hyung WJ, Noh SH, Shin DW, Huh J, Huh BJ, Choi SH, Min JS	Adverse effects of perioperative transfusion on patients with stage III and IV gastric cancer	<i>Ann Surg Oncol</i>	2002	9	1	5	12
Chelemer SB, Prato BS, Cox PM, O'Connor GT, Morton JR	Association of bacterial infection and red blood cell transfusion after coronary artery bypass surgery	<i>Ann Thorac Surg</i>	2002	73	1	138	142
Park SJ, Kim SW, Jang JY, Lee KU, Park YH	Intraoperative transfusion: is it a real prognostic factor of periampullary cancer following pancreatoduodenectomy?	<i>World J Surg</i>	2002	26	4	487	492
Claridge JA, Sawyer RG, Schulman AM, McLemore EC, Young JS	Blood transfusions correlate with infections in trauma patients in a dose-dependent manner	<i>Am Surg</i>	2002	68	7	566	572
Spirtos NM, Westby CM, Averette HE, Soper JT	Blood transfusion and the risk of recurrence in squamous cell carcinoma of the cervix: a gynecologic oncology group study	<i>Am J Clin Oncol</i>	2002	25	4	398	403
Kapp KS, Poschauko J, Geyer E, Berghold A, Oechs AC, Petru E, Lahousen M, Kapp DS	Evaluation of the effect of routine packed red blood cell transfusion in anemic cervix cancer patients treated with radical radiotherapy	<i>Int J Radiat Oncol Biol Phys</i>	2002	54	1	58	66
Vincent JL, Baron JF, Reinhart K, Gattinoni L, Thijs L, Webb A, Meier-Hellmann A, Nollet G, Peres-Bota D	Anemia and blood transfusion in critically ill patients	<i>JAMA</i>	2002	288	12	1499	1507
Engoren MC, Habib RH, Zacharias A, Schwann TA, Riordan CJ, Durham SJ	Effect of blood transfusion on long-term survival after cardiac operation	<i>Ann Thorac Surg</i>	2002	74	4	1180	1186
Kooby DA, Stockman J, Ben-Porat L, Gonen M, Jarnagin WR, DeMatteo RP, Tuorto S, Wuest D, Blumgart LH, Fong Y	Influence of transfusions on perioperative and long-term outcome in patients following hepatic resection for colorectal metastases	<i>Ann Surg</i>	2003	237	6	860	869
Nosotti M, Rebulli P, Riccardi D, Baisi A, Bellaviti N, Rosso L, Santambrogio L	Correlation between perioperative blood transfusion and prognosis of patients subjected to surgery for stage I lung cancer	<i>Chest</i>	2003	124	1	102	107
Bortul M, Calligaris L, Roseano M, Leggeri A	Blood transfusions and results after curative resection for gastric cancer	<i>Suppl Tumori</i>	2003	2	5	S27	S30

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Rzyman W, Dziadziuszko R, Skokowski J, Wilimski R, Raiter A, Szymanowska A, Jassem J	The influence of blood transfusion on survival in operated non-small cell lung cancer patients	<i>J Thorac Cardiovasc Surg</i>	2003	126	3	755	760
Halm EA, Wang JJ, Boockvar K, Penrod J, Silberzweig SB, Magaziner J, Koval KJ, Siu AL	Effects of blood transfusion on clinical and functional outcomes in patients with hip fracture	<i>Transfusion</i>	2003	43	10	1358	1365
Taniguchi Y, Okura M	Prognostic significance of perioperative blood transfusion in oral cavity squamous cell carcinoma	<i>Head Neck</i>	2003	25	11	931	936
Ramos E, Dalmau A, Sabate A, Lama C, Llado L, Figueras J, Jaurrieta E	Intraoperative red blood cell transfusion in liver transplantation: influence on patient outcome, prediction of requirements, and measures to reduce them	<i>Liver Transpl</i>	2003	9	12	1320	1327
Corwin HL, Gettinger A, Pearl RG, Fink MP, Levy MM, Abraham E, MacIntyre NR, Shabot MM, Duh MS, Shapiro MJ	The CRIT Study: anemia and blood transfusion in the critically ill—current clinical practice in the United States	<i>Crit Care Med</i>	2004	32	1	39	52
Hughes MG, Evans HL, Lightfoot L, Chong TW, Smith RL, Raymond DP, Pelletier SJ, Claridge JA, Pruett TL, Sawyer RG	Does prior transfusion worsen outcomes from infection in surgical patients?	<i>Surg Infect (Larchmt)</i>	2003	4	4	335	343
Rui JA, Zhou L, Liu FD, Chu QF, Wang SB, Chen SG, Qu Q, Wei X, Han K, Zhang N, Zhao HT	Major hepatectomy without blood transfusion: report of 51 cases	<i>Chin Med J (Engl)</i>	2004	117	5	673	676
Smith MJ, Le Roux PD, Elliott JP, Winn HR	Blood transfusion and increased risk for vasospasm and poor outcome after subarachnoid hemorrhage	<i>J Neurosurg</i>	2004	101	1	1	7
Ghosh S, Ahmed K, Hopkinson DN, Vaughan R	Pulmonary adenocarcinoma is associated with poor long-term survival after surgical resection. Effect of allogeneic blood transfusion	<i>Cancer</i>	2004	101	9	2058	2066
Rao SV, Jollis JG, Harrington RA, Granger CB, Newby LK, Armstrong PW, Moliterno DJ, Lindblad L, Pieper K, Topol EJ, Stamler JS, Califf RM	Relationship of blood transfusion and clinical outcomes in patients with acute coronary syndromes	<i>JAMA</i>	2004	292	13	1555	1562
Ali ZA, Lim E, Motalleb-Zadeh R, Ali AA, Callaghan CJ, Gerrard C, Vuylsteke A, Foweraker J, Tsui S	Allogenic blood transfusion does not predispose to infection after cardiac surgery	<i>Ann Thorac Surg</i>	2004	78	5	1542	1546

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Innerhofer P, Klingler A, Klimmer C, Fries D, Nussbaumer W	Risk for postoperative infection after transfusion of white blood cell-filtered allogeneic or autologous blood components in orthopedic patients undergoing primary arthroplasty	<i>Transfusion</i>	2005	45	1	103	110
Massicotte L, Sassine MP, Lenis S, Seal RF, Roy A	Survival rate changes with transfusion of blood products during liver transplantation	<i>Can J Anaesth</i>	2005	52	2	148	155
Dunne JR, Malone DL, Tracy JK, Napolitano LM	Allogenic blood transfusion in the first 24 hours after trauma is associated with increased systemic inflammatory response syndrome (SIRS) and death	<i>Surg Infect (Larchmt)</i>	2004	5	4	395	404
Robinson WP, Ahn J, Stiffler A, Rutherford EJ, Hurd H, Zarzaur BL, Baker CC, Meyer AA, Rich PB	Blood transfusion is an independent predictor of increased mortality in nonoperatively managed blunt hepatic and splenic injuries	<i>J Trauma</i>	2005	58	3	437	444
Kuduvalli M, Oo AY, Newall N, Grayson AD, Jackson M, Desmond MJ, Fabri BM, Rashid A	Effect of peri-operative red blood cell transfusion on 30-day and 1-year mortality following coronary artery bypass surgery	<i>Eur J Cardiothorac Surg</i>	2005	27	4	592	598
Hanazaki K, Kajikawa S, Shimozawa N, Matsushita A, Machida T, Shimada K, Yazawa K, Koide N, Adachi W, Amano J	Perioperative blood transfusion and survival following curative hepatic resection for hepatocellular carcinoma	<i>Hepatogastroenterology</i>	2005	52	62	524	529
Weber EW, Slappendel R, Prins MH, van der Schaaf DB, Durieux ME, Strumper D	Perioperative blood transfusions and delayed wound healing after hip replacement surgery: effects on duration of hospitalization	<i>Anesth Analg</i>	2005	100	5	1416	21, table
Fernandez FG, Jaramillo A, Ewald G, Rogers J, Pasque MK, Mohanakumar T, Moazami N	Blood transfusions decrease the incidence of acute rejection in cardiac allograft recipients	<i>J Heart Lung Transplant</i>	2005	24	7	S255	S261
Sreeram GM, Welsby IJ, Sharma AD, Phillips-Bute B, Smith PK, Slaughter TF	Infectious complications after cardiac surgery: lack of association with fresh frozen plasma or platelet transfusions	<i>J Cardiothorac Vasc Anesth</i>	2005	19	4	430	434
Croce MA, Tolley EA, Claridge JA, Fabian TC	Transfusions result in pulmonary morbidity and death after a moderate degree of injury	<i>J Trauma</i>	2005	59	1	19	23

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Yang X, Alexander KP, Chen AY, Roe MT, Brindis RG, Rao SV, Gibler WB, Ohman EM, Peterson ED	The implications of blood transfusions for patients with non–ST-segment elevation acute coronary syndromes: results from the CRUSADE National Quality Improvement Initiative	<i>J Am Coll Cardiol</i>	2005	46	8	1490	1495
Silverboard H, Aisiku I, Martin GS, Adams M, Rozycki G, Moss M	The role of acute blood transfusion in the development of acute respiratory distress syndrome in patients with severe trauma	<i>J Trauma</i>	2005	59	3	717	723
Banbury MK, Brizzio ME, Rajeswaran J, Lytle BW, Blackstone EH	Transfusion increases the risk of postoperative infection after cardiovascular surgery	<i>J Am Coll Surg</i>	2006	202	1	131	138
Nardo B, Bertelli R, Montalti R, Beltempo P, Puviani L, Pacile V, Cavallari A	Red blood cell transfusion in liver transplantation: a case-control study	<i>Transplant Proc</i>	2005	37	10	4389	4392
Paul R, Schmid R, Busch R, van RH, Alschibaja M, Scholer S, Hartung R	Influence of blood transfusions during radical retropubic prostatectomy on disease outcome	<i>Urology</i>	2006	67	1	137	141
Beale E, Zhu J, Chan L, Shulman I, Harwood R, Demetriades D	Blood transfusion in critically injured patients: a prospective study	<i>Injury</i>	2006	37	5	455	465
Miki C, Hiro J, Ojima E, Inoue Y, Mohri Y, Kusunoki M	Perioperative allogeneic blood transfusion, the related cytokine response and long-term survival after potentially curative resection of colorectal cancer	<i>Clin Oncol (R Coll Radiol)</i>	2006	18	1	60	66
Szakmany T, Dodd M, Dempsey GA, Lowe D, Brown JS, Vaughan ED, Rogers SN	The influence of allogenic blood transfusion in patients having free-flap primary surgery for oral and oropharyngeal squamous cell carcinoma	<i>Br J Cancer</i>	2006	94	5	647	653
Madbouly KM, Senagore AJ, Remzi FH, Delaney CP, Waters J, Fazio VW	Perioperative blood transfusions increase infectious complications after ileoanal pouch procedures (IPAA)	<i>Int J Colorectal Dis</i>	2006	21	8	807	813
Palmieri TL, Caruso DM, Foster KN, Cairns BA, Peck MD, Gamelli RL, Mozingo DW, Kagan RJ, Wahl W, Kemalyan NA, Fish JS, Gomez M, Sheridan RL, Faucher LD, Latenser BA, Gibran NS, Klein RL, Solem LD, Saffle JR, Morris SE, Jeng JC, Voigt D, Howard PA, Molitor F, Greenhalgh DG	Effect of blood transfusion on outcome after major burn injury: a multicenter study	<i>Crit Care Med</i>	2006	34	6	1602	1607

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Koch CG, Li L, Duncan AI, Mihaljevic T, Cosgrove DM, Loop FD, Starr NJ, Blackstone EH	Morbidity and mortality risk associated with red blood cell and blood-component transfusion in isolated coronary artery bypass grafting	<i>Crit Care Med</i>	2006	34	6	1608	1616
Koch CG, Li L, Duncan AI, Mihaljevic T, Loop FD, Starr NJ, Blackstone EH	Transfusion in coronary artery bypass grafting is associated with reduced long-term survival	<i>Ann Thorac Surg</i>	2006	81	5	1650	1657
Jagoditsch M, Pozgainer P, Klingler A, Tschmelitsch J	Impact of blood transfusions on recurrence and survival after rectal cancer surgery	<i>Dis Colon Rectum</i>	2006	49	8	1116	1130
Koch CG, Khandwala F, Li L, Estafanous FG, Loop FD, Blackstone EH	Persistent effect of red cell transfusion on health-related quality of life after cardiac surgery	<i>Ann Thorac Surg</i>	2006	82	1	13	20
Surgenor SD, DeFoe GR, Fillinger MP, Likosky DS, Groom RC, Clark C, Helm RE, Kramer RS, Leavitt BJ, Klemperer JD, Krumholz CF, Westbrook BM, Galatis DJ, Frumiento C, Ross CS, Olmstead EM, O'Connor GT	Intraoperative red blood cell transfusion during coronary artery bypass graft surgery increases the risk of postoperative low-output heart failure	<i>Circulation</i>	2006	114	1 Suppl	143	148
Taylor RW, O'Brien J, Trottier SJ, Manganaro L, Cytron M, Lesko MF, Arnszen K, Cappadoro C, Fu M, Plisco MS, Sadaka FG, Veremakis C	Red blood cell transfusions and nosocomial infections in critically ill patients	<i>Crit Care Med</i>	2006	34	9	2302	2308
Dunne JR, Riddle MS, Danko J, Hayden R, Petersen K	Blood transfusion is associated with infection and increased resource utilization in combat casualties	<i>Am Surg</i>	2006	72	7	619	625
Shen JG, Cheong JH, Hyung WJ, Kim J, Choi SH, Noh SH	Adverse effect of splenectomy on recurrence in total gastrectomy cancer patients with perioperative transfusion	<i>Am J Surg</i>	2006	192	3	301	305
Naidech AM, Drescher J, Ault ML, Shaibani A, Batjer HH, Alberts MJ	Higher hemoglobin is associated with less cerebral infarction, poor outcome, and death after subarachnoid hemorrhage	<i>Neurosurgery</i>	2006	59	4	775	779
Stamou SC, White T, Barnett S, Boyce SW, Corso PJ, Lefrak EA	Comparisons of cardiac surgery outcomes in Jehovah's versus non-Jehovah's Witnesses	<i>Am J Cardiol</i>	2006	98	9	1223	1225
Thomas P, Michelet P, Barlesi F, Thirion X, Doddoli C, Giudicelli R, Fuentes P	Impact of blood transfusions on outcome after pneumonectomy for thoracic malignancies	<i>Eur Respir J</i>	2007	29	3	565	570
Kwan P, Gomez M, Cartotto R	Safe and successful restriction of transfusion in burn patients	<i>J Burn Care Res</i>	2006	27	6	826	834

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Johnston P, Wynn-Jones H, Chakravarty D, Boyle A, Parker MJ	Is perioperative blood transfusion a risk factor for mortality or infection after hip fracture?	<i>J Orthop Trauma</i>	2006	20	10	675	679
Rovera F, Dionigi G, Boni L, Imperatori A, Tabacchi A, Carcano G, Diurni M, Dionigi R	Postoperative infections after oesophageal resections: the role of blood transfusions	<i>World J Surg Oncol</i>	2006	4		80	
Rogers MA, Blumberg N, Saint SK, Kim C, Nallamotheu BK, Langa KM	Allogeneic blood transfusions explain increased mortality in women after coronary artery bypass graft surgery	<i>Am Heart J</i>	2006	152	6	1028	1034
Nursal TZ, Hamaloglu E	The effect of preoperative blood transfusion on morbidity and survival in colorectal malignancy	<i>Turk J Gastroenterol</i>	2006	17	4	283	287
Charles A, Shaikh AA, Walters M, Huehl S, Pomerantz R	Blood transfusion is an independent predictor of mortality after blunt trauma	<i>Am Surg</i>	2007	73	1	1	5
Nilsson KR, Berenholtz SM, Garrett-Mayer E, Dorman T, Klag MJ, Pronovost PJ	Association between venous thromboembolism and perioperative allogeneic transfusion	<i>Arch Surg</i>	2007	142	2	126	132
Yeh JJ, Gonen M, Tomlinson JS, Idrees K, Brennan MF, Fong Y	Effect of blood transfusion on outcome after pancreaticoduodenectomy for exocrine tumour of the pancreas	<i>Br J Surg</i>	2007	94	4	466	472
Sugita S, Sasaki A, Iwaki K, Uchida H, Kai S, Shibata K, Ohta M, Kitano S	Prognosis and postoperative lymphocyte count in patients with hepatocellular carcinoma who received intraoperative allogenic blood transfusion: a retrospective study	<i>Eur J Surg Oncol</i>	2008	34	3	339	345
Palo R, Ahonen J, Salo H, Salmenpera M, Krusius T, Maki T	Transfusion of red blood cells: no impact on length of hospital stay in moderately anaemic parturients	<i>Acta Anaesthesiol Scand</i>	2007	51	5	565	569
Singla I, Zahid M, Good CB, Macioce A, Sonel AF	Impact of blood transfusions in patients presenting with anemia and suspected acute coronary syndrome	<i>Am J Cardiol</i>	2007	99	8	1119	1121
Netzer G, Shah CV, Iwashyna TJ, Lanken PN, Finkel B, Fuchs B, Guo W, Christie JD	Association of RBC transfusion with mortality in patients with acute lung injury	<i>Chest</i>	2007	132	4	1116	1123

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Rinker BD, Bowling JT, Vasconez HC	Blood transfusion and risk of metastatic disease or recurrence in patients undergoing immediate TRAM flap breast reconstruction: a clinical study and meta-analysis	<i>Plast Reconstr Surg</i>	2007	119	7	2001	2007
Ruttinger D, Wolf H, Kuchenhoff H, Jauch KW, Hartl WH	Red cell transfusion: an essential factor for patient prognosis in surgical critical illness?	<i>Shock</i>	2007	28	2	165	171
Verma V, Schwarz RE	Factors influencing perioperative blood transfusions in patients with gastrointestinal cancer	<i>J Surg Res</i>	2007	141	1	97	104
Park JO, Gonen M, D'Angelica MI, DeMatteo RP, Fong Y, Wuest D, Blumgart LH, Jarnagin WR	Autologous versus allogeneic transfusions: no difference in perioperative outcome after partial hepatectomy. Autologous transfusion on hepatectomy outcome	<i>J Gastrointest Surg</i>	2007	11	10	1286	1293
Whitson BA, Huddleston SJ, Savik K, Shumway SJ	Bloodless cardiac surgery is associated with decreased morbidity and mortality	<i>J Card Surg</i>	2007	22	5	373	378
Kader AS, Lim JT, Berthelet E, Petersen R, Ludgate D, Truong PT	Prognostic significance of blood transfusions in patients with esophageal cancer treated with combined chemoradiotherapy	<i>Am J Clin Oncol</i>	2007	30	5	492	497
Murphy GJ, Reeves BC, Rogers CA, Rizvi SI, Culliford L, Angelini GD	Increased mortality, postoperative morbidity, and cost after red blood cell transfusion in patients having cardiac surgery	<i>Circulation</i>	2007	116	22	2544	2552
Rogers MA, Blumberg N, Heal JM, Hicks GL	Increased risk of infection and mortality in women after cardiac surgery related to allogeneic blood transfusion	<i>J Womens Health (Larchmt)</i>	2007	16	10	1412	1420
Borgman MA, Spinella PC, Perkins JG, Grathwohl KW, Repine T, Beekley AC, Sebesta J, Jenkins D, Wade CE, Holcomb JB	The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital	<i>J Trauma</i>	2007	63	4	805	813
Vincent JL, Sakr Y, Sprung C, Harboe S, Damas P	Are blood transfusions associated with greater mortality rates? Results of the Sepsis Occurrence in Acutely Ill Patients study	<i>Anesthesiology</i>	2008	108	1	31	39

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
de Boer MT, Christensen MC, Asmussen M, van der Hilst CS, Hendriks HG, Slooff MJ, Porte RJ	The impact of intraoperative transfusion of platelets and red blood cells on survival after liver transplantation	<i>Anesth Analg</i>	2008	106	1	32	44, table
Scott BH, Seifert FC, Grimson R	Blood transfusion is associated with increased resource utilisation, morbidity and mortality in cardiac surgery	<i>Ann Card Anaesth</i>	2008	11	1	15	19
Kim P, Dixon S, Eisenbrey AB, O'Malley B, Boura J, O'Neill W	Impact of acute blood loss anemia and red blood cell transfusion on mortality after percutaneous coronary intervention	<i>Clin Cardiol</i>	2007	30	10 Suppl 2	1135	1143
Jani SM, Smith DE, Share D, Kline-Rogers E, Khanal S, O'Donnell MJ, Gardin J, Moscucci M	Blood transfusion and in-hospital outcomes in anemic patients with myocardial infarction undergoing percutaneous coronary intervention	<i>Clin Cardiol</i>	2007	30	10 Suppl 2	1149	1156
Hanprasertpong J, Chichareon S, Wootipoom V, Buhachat R, Tasee S, Geater A	Lack of effect of perioperative blood transfusion during radical hysterectomy with lymph node dissection on the prognosis of cervical cancer stage Ib	<i>Asian Pac J Cancer Prev</i>	2007	8	4	476	480
George ME, Skarda DE, Watts CR, Pham HD, Beilman GJ	Aggressive red blood cell transfusion: no association with improved outcomes for victims of isolated traumatic brain injury	<i>Neurocrit Care</i>	2008	8	3	337	343
Chase AJ, Fretz EB, Warburton WP, Klinke WP, Carere RG, Pi D, Berry B, Hilton JD	Association of the arterial access site at angioplasty with transfusion and mortality: the M.O.R.T.A.L study (Mortality benefit Of Reduced Transfusion after percutaneous coronary intervention via the Arm or Leg)	<i>Heart</i>	2008	94	8	1019	1025
Clark E, Connor S, Taylor MA, Hendry CL, Madhavan KK, Garden OJ, Parks RW	Perioperative transfusion for pancreaticoduodenectomy and its impact on prognosis in resected pancreatic ductal adenocarcinoma	<i>HPB (Oxford)</i>	2007	9	6	472	477
Ford BS, Sharma S, Rezaishiraz H, Huben RS, Mohler JL	Effect of perioperative blood transfusion on prostate cancer recurrence	<i>Urol Oncol</i>	2008	26	4	364	367
Panagopoulos ND, Karakantza M, Koletsis E, Apostolakis E, Sakellaropoulos GC, Filos KS, Eleni T, Dougenis D	Influence of blood transfusions and preoperative anemia on long-term survival in patients operated for non-small cell lung cancer	<i>Lung Cancer</i>	2008	62	2	273	280

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Chee CE, Steensma DP, Wu W, Hanson CA, Tefferi A	Neither serum ferritin nor the number of red blood cell transfusions affect overall survival in refractory anemia with ringed sideroblasts	<i>Am J Hematol</i>	2008	83	8	611	613
Zilberberg MD, Stern LS, Wiederkehr DP, Doyle JJ, Shorr AF	Anemia, transfusions and hospital outcomes among critically ill patients on prolonged acute mechanical ventilation: a retrospective cohort study	<i>Crit Care</i>	2008	12	2	R60	
Boin IF, Leonardi MI, Luzo AC, Cardoso AR, Caruy CA, Leonardi LS	Intraoperative massive transfusion decreases survival after liver transplantation	<i>Transplant Proc</i>	2008	40	3	789	791
Duane TM, Mayglothling J, Grandhi R, Warrior N, Aboutanos MB, Wolfe LG, Malhotra AK, Ivatury RR	The effect of anemia and blood transfusions on mortality in closed head injury patients	<i>J Surg Res</i>	2008	147	2	163	167
Alexander KP, Chen AY, Wang TY, Rao SV, Newby LK, LaPointe NM, Ohman EM, Roe MT, Boden WE, Harrington RA, Peterson ED	Transfusion practice and outcomes in non-ST-segment elevation acute coronary syndromes	<i>Am Heart J</i>	2008	155	6	1047	1053
Kramer AH, Gurka MJ, Nathan B, Dumont AS, Kassell NF, Bleck TP	Complications associated with anemia and blood transfusion in patients with aneurysmal subarachnoid hemorrhage	<i>Crit Care Med</i>	2008	36	7	2070	2075
Bochicchio GV, Napolitano L, Joshi M, Bochicchio K, Meyer W, Scalea TM	Outcome analysis of blood product transfusion in trauma patients: a prospective, risk-adjusted study	<i>World J Surg</i>	2008	32	10	2185	2189
Yao HS, Wang Q, Wang WJ, Hu ZQ	Intraoperative allogeneic red blood cell transfusion in ampullary cancer outcome after curative pancreatoduodenectomy: a clinical study and meta-analysis	<i>World J Surg</i>	2008	32	9	2038	2046
Aronson D, Dann EJ, Bonstein L, Blich M, Kapeliovich M, Beyar R, Markiewicz W, Hammerman H	Impact of red blood cell transfusion on clinical outcomes in patients with acute myocardial infarction	<i>Am J Cardiol</i>	2008	102	2	115	119
Salim A, Hadjizacharia P, DuBose J, Brown C, Inaba K, Chan L, Margulies DR	Role of anemia in traumatic brain injury	<i>J Am Coll Surg</i>	2008	207	3	398	406
Sood N, Coleman CI, Kluger J, White CM, Padala A, Baker WL	The association among blood transfusions, white blood cell count, and the frequency of post-cardiothoracic surgery atrial fibrillation: a nested cohort study from the atrial fibrillation suppression trials I, II, and III	<i>J Cardiothorac Vasc Anesth</i>	2008				

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
McCulloch TM, VanDaele DJ, Hillel A	Blood transfusion as a risk factor for death in stage III and IV operative laryngeal cancer. The Department of Veterans Affairs Laryngeal Cancer Study Group	<i>Arch Otolaryngol Head Neck Surg</i>	1995	121	11	1227	1235
Hebert PC, Wells G, Tweeddale M, Martin C, Marshall J, Pham B, Blajchman M, Schweitzer I, Pagliarello G	Does transfusion practice affect mortality in critically ill patients? Transfusion Requirements in Critical Care (TRICC) Investigators and the Canadian Critical Care Trials Group	<i>Am J Respir Crit Care Med</i>	1997	155	5	1618	1623
Werther K, Christensen IJ, Nielsen HJ	The association between preoperative concentration of soluble vascular endothelial growth factor, perioperative blood transfusion, and survival in patients with primary colorectal cancer	<i>Eur J Surg</i>	2001	167	4	287	292
Langley SM, Alexiou C, Bailey DH, Weeden DF	The influence of perioperative blood transfusion on survival after esophageal resection for carcinoma	<i>Ann Thorac Surg</i>	2002	73	6	1704	1709
Taylor RW, Manganaro L, O'Brien J, Trottier SJ, Parkar N, Veremakis C	Impact of allogenic packed red blood cell transfusion on nosocomial infection rates in the critically ill patient	<i>Crit Care Med</i>	2002	30	10	2249	2254
Ikuta S, Miki C, Hatada T, Inoue Y, Araki T, Tanaka K, Tonouchi H, Kusunoki M	Allogenic blood transfusion is an independent risk factor for infective complications after less invasive gastrointestinal surgery	<i>Am J Surg</i>	2003	185	3	188	193
Weitz J, D'Angelica M, Gonen M, Klimstra D, Coit DG, Brennan MF, Karpeh MS	Interaction of splenectomy and perioperative blood transfusions on prognosis of patients with proximal gastric and gastroesophageal junction cancer	<i>J Clin Oncol</i>	2003	21	24	4597	4603
Higgins RM, Raymond NT, Krishnan NS, Veerasamy M, Rahmati M, Lam FT, Kashi H, West N	Acute rejection after renal transplantation is reduced by approximately 50% by prior therapeutic blood transfusions, even in tacrolimus-treated patients	<i>Transplantation</i>	2004	77	3	469	471
Talbot TR, D'Agata EM, Brinsko V, Lee B, Speroff T, Schaffner W	Perioperative blood transfusion is predictive of poststernotomy surgical site infection: marker for morbidity or true immunosuppressant?	<i>Clin Infect Dis</i>	2004	38	10	1378	1382

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Gong MN, Thompson BT, Williams P, Pothier L, Boyce PD, Christiani DC	Clinical predictors of and mortality in acute respiratory distress syndrome: potential role of red cell transfusion	<i>Crit Care Med</i>	2005	33	6	1191	1198
Berardi R, Brunelli A, Tamburrano T, Verdecchia L, Onofri A, Zuccatosta L, Gasparini S, Santinelli A, Scartozzi M, Valeri G, Giovagnoni A, Giuseppetti GM, Fabris G, Marmorale C, Fianchini A, Cascinu S	Perioperative anemia and blood transfusions as prognostic factors in patients undergoing resection for non-small cell lung cancers	<i>Lung Cancer</i>	2005	49	3	371	376
Carlson AP, Schermer CR, Lu SW	Retrospective evaluation of anemia and transfusion in traumatic brain injury	<i>J Trauma</i>	2006	61	3	567	571
Ranucci M, Biagioli B, Scolletta S, Grillone G, Cazzaniga A, Cattabriga I, Isgro G, Giomarelli P	Lowest hematocrit on cardiopulmonary bypass impairs the outcome in coronary surgery: an Italian multicenter study from the National Cardioanesthesia Database	<i>Tex Heart Inst J</i>	2006	33	3	300	305
Walz JM, Paterson CA, Seligowski JM, Heard SO	Surgical site infection following bowel surgery: a retrospective analysis of 1446 patients	<i>Arch Surg</i>	2006	141	10	1014	1018
Koch CG, Li L, Van Wagener DR, Duncan AI, Gillinov AM, Blackstone EH	Red cell transfusion is associated with an increased risk for postoperative atrial fibrillation	<i>Ann Thorac Surg</i>	2006	82	5	1747	1756
Zilberberg MD, Carter C, Lefebvre P, Raut M, Vekeman F, Duh MS, Shorr AF	Red blood cell transfusions and the risk of acute respiratory distress syndrome among the critically ill: a cohort study	<i>Crit Care</i>	2007	11	3	R63	
Yamashita K, Sakuramoto S, Kikuchi S, Katada N, Kobayashi N, Watanabe M	Transfusion alert for patients with curable cancer	<i>World J Surg</i>	2007	31	12	2315	2322
Ranucci M, Pazzaglia A, Bianchini C, Bozzetti G, Isgro G	Body size, gender, and transfusions as determinants of outcome after coronary operations	<i>Ann Thorac Surg</i>	2008	85	2	481	486
Al-Samak ZM, Al-Falaki MM, Pasha AA	Assessment of perioperative transfusion therapy and complications in sickle cell disease patients undergoing surgery	<i>Middle East J Anesthesiol</i>	2008	19	5	983	995
Bhide SA, Ahmed M, Rengarajan V, Powell C, Miah A, Newbold K, Nutting CM, Harrington KJ	Anemia during sequential induction chemotherapy and chemoradiation for head and neck cancer: the impact of blood transfusion on treatment outcome	<i>Int J Radiat Oncol Biol Phys</i>	2008				

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Bohicchio GV, Napolitano L, Joshi M, Bohicchio K, Shih D, Meyer W, Scalea TM	Blood product transfusion and ventilator-associated pneumonia in trauma patients	<i>Surg Infect (Larchmt)</i>	2008	9	4	415	422
Dutton RP, Lefering R, Lynn M	Database predictors of transfusion and mortality	<i>J Trauma</i>	2006	60	6 Suppl	S70	S77
Auroy Y, Lienhart A, Pequignot F, Benhamou D	Complications related to blood transfusion in surgical patients: data from the French national survey on anesthesia-related deaths	<i>Transfusion</i>	2007	47	2 Suppl	184S	189S
Kamper-Jorgensen M, Ahlgren M, Rostgaard K, Melbye M, Edgren G, Nyren O, Reilly M, Norda R, Titlestad K, Tynell E, Hjalgrim H	Survival after blood transfusion	<i>Transfusion</i>	2008				
Monti M, Castellani L, Berlusconi A, Cunietti E	Use of red blood cell transfusions in terminally ill cancer patients admitted to a palliative care unit	<i>J Pain Symptom Manage</i>	1996	12	1	18	22
Barkana Y, Stein M, Maor R, Lynn M, Eldad A	Prehospital blood transfusion in prolonged evacuation	<i>J Trauma</i>	1999	46	1	176	180
Wong YC, Wang LJ, Ng CJ, Tseng IC, See LC	Mortality after successful transcatheter arterial embolization in patients with unstable pelvic fractures: rate of blood transfusion as a predictive factor	<i>J Trauma</i>	2000	49	1	71	75
Palomo JC, Jimenez C, Moreno E, Garcia MA, Bercedo J, Loinaz C, Palma F, Ibanez J, Corral MA	Effects of intraoperative blood transfusion on rejection and survival after orthotopic liver transplantation	<i>Transplant Proc</i>	1995	27	4	2326	2327
Gleeson C, Spencer D	Blood transfusion and its benefits in palliative care	<i>Palliat Med</i>	1995	9	4	307	313
Heiss MM, Allgayer H, Gruetzner KU, Tarabichi A, Babic R, Mempel W, Jauch KW, Schildberg FW	Prognostic influence of blood transfusion on minimal residual disease in resected gastric cancer patients	<i>Anticancer Res</i>	1997	17	4A	2657	2661
Fujimoto J, Okamoto E, Yamanaka N, Tanaka T, Tanaka W	Adverse effect of perioperative blood transfusions on survival after hepatic resection for hepatocellular carcinoma	<i>Hepatogastroenterology</i>	1997	44	17	1390	1396
Levi N, Sandberg T	Blood transfusion and postoperative wound infection in intracapsular femoral neck fractures	<i>Bull Hosp Jt Dis</i>	1998	57	2	69	73
Palomo Sanchez JC, Jimenez C, Moreno GE, Garcia I, Palma F, Loinaz C, Gonzalez GA	Effects of intraoperative blood transfusion on postoperative complications and survival after orthotopic liver transplantation	<i>Hepatogastroenterology</i>	1998	45	22	1026	1033

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Makino Y, Yamanoi A, Kimoto T, El-Assal ON, Kohno H, Nagasue N	The influence of perioperative blood transfusion on intrahepatic recurrence after curative resection of hepatocellular carcinoma	<i>Am J Gastroenterol</i>	2000	95	5	1294	1300
Malone DL, Dunne J, Tracy JK, Putnam AT, Scalea TM, Napolitano LM	Blood transfusion, independent of shock severity, is associated with worse outcome in trauma	<i>J Trauma</i>	2003	54	5	898	905
Santin AD, Bellone S, Parrish RS, Coke C, Dunn D, Roman J, Theus JW, Cannon MJ, Parham GP, Pecorelli S	Influence of allogeneic blood transfusion on clinical outcome during radiotherapy for cancer of the uterine cervix	<i>Gynecol Obstet Invest</i>	2003	56	1	28	34
Mostafa G, Gunter OL, Norton HJ, McElhiney BM, Bailey DF, Jacobs DG	Age, blood transfusion, and survival after trauma	<i>Am Surg</i>	2004	70	4	357	363
Elechi EN, Elechi GN	Surgical management of patients with severe anaemia due to acute blood loss: a case for withholding perioperative blood transfusion	<i>East Afr Med J</i>	1995	72	6	343	344
Di PS, Giangreco L, Vignali A, Carlucci M, Staudacher C	Surgery in the very old patient: evaluation of factors linked to postoperative morbidity and mortality	<i>Aging (Milano)</i>	1995	7	2	110	116
Aksnes J, Abdelnoor M, Mathisen O	Risk factors associated with mortality and morbidity after elective splenectomy	<i>Eur J Surg</i>	1995	161	4	253	258
Uitley JR, Wilde EF, Leyland SA, Morgan MS, Johnson HD	Intraoperative blood transfusion is a major risk factor for coronary artery bypass grafting in women	<i>Ann Thorac Surg</i>	1995	60	3	570	574
Allema JH, Reinders ME, van Gulik TM, Koelemay MJ, Van Leeuwen DJ, de Wit LT, Gouma DJ, Obertop H	Prognostic factors for survival after pancreaticoduodenectomy for patients with carcinoma of the pancreatic head region	<i>Cancer</i>	1995	75	8	2069	2076
Docì R, Gennari L, Bignami P, Montalto F, Morabito A, Bozzetti F, Bonalumi MG	Morbidity and mortality after hepatic resection of metastases from colorectal cancer	<i>Br J Surg</i>	1995	82	3	377	381
Zimmerman J, Meroz Y, Arnon R, Tsvang E, Siguencia J	Predictors of mortality in hospitalized patients with secondary upper gastrointestinal haemorrhage	<i>J Intern Med</i>	1995	237	3	331	337
Subramaniam P, Parker S, Lim SL, Wilkinson G, Sinha SN	Review of liver trauma management in Tasmania: an analysis of risk factors for mortality and morbidity	<i>Aust N Z J Surg</i>	1995	65	12	861	864

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Tartter PI	Postoperative stay associated with prognosis of patients with colorectal cancer	<i>Ann Surg</i>	1996	223	4	351	356
Chmell MJ, Schwartz HS	Analysis of variables affecting wound healing after musculoskeletal sarcoma resections	<i>J Surg Oncol</i>	1996	61	3	185	189
Sim PH, Razack AH, Jalleh RP	A preliminary study of possible prognostic factors of traumatic liver injury seen at University Hospital, 1984-1991	<i>Med J Malaysia</i>	1995	50	4	346	352
Gramm J, Smith S, Gamelli RL, Dries DJ	Effect of transfusion on oxygen transport in critically ill patients	<i>Shock</i>	1996	5	3	190	193
Jensen LS, Kissmeyer-Nielsen P, Wolff B, Qvist N	Randomised comparison of leucocyte-depleted versus buffy-coat-poor blood transfusion and complications after colorectal surgery	<i>Lancet</i>	1996	348	9031	841	845
Rebollo MH, Bernal JM, Llorca J, Rabasa JM, Revuelta JM	Nosocomial infections in patients having cardiovascular operations: a multivariate analysis of risk factors	<i>J Thorac Cardiovasc Surg</i>	1996	112	4	908	913
Michalopoulos A, Tzelepis G, Pavlides G, Kriaras J, Dafni U, Geroulanos S	Determinants of duration of ICU stay after coronary artery bypass graft surgery	<i>Br J Anaesth</i>	1996	77	2	208	212
Zacharias A, Habib RH	Factors predisposing to median sternotomy complications. Deep vs superficial infection	<i>Chest</i>	1996	110	5	1173	1178
Wolters U, Stutzer H, Keller HW, Schroder U, Pichlmaier H	Colorectal cancer—a multivariate analysis of prognostic factors	<i>Eur J Surg Oncol</i>	1996	22	6	592	597
Ombrellaro MP, Freeman MB, Stevens SL, Diamond DL, Goldman MH	Predictors of survival after inferior vena cava injuries	<i>Am Surg</i>	1997	63	2	178	183
Hessman O, Bergkvist L, Strom S	Colorectal cancer in patients over 75 years of age—determinants of outcome	<i>Eur J Surg Oncol</i>	1997	23	1	13	19
Dillioglulil O, Leibman BD, Leibman NS, Kattan MW, Rosas AL, Scardino PT	Risk factors for complications and morbidity after radical retropubic prostatectomy	<i>J Urol</i>	1997	157	5	1760	1767
Vamvakas EC, Moore SB	Length of survival after perioperative transfusion	<i>Transfus Med</i>	1997	7	2	115	121
Ho CH	The effect of transfusion on cardiac function in patients with chronic anemia	<i>Transfusion</i>	1997	37	10	1066	1069

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Godet G, Fleron MH, Vicaut E, Zubicki A, Bertrand M, Riou B, Kieffer E, Coriat P	Risk factors for acute postoperative renal failure in thoracic or thoracoabdominal aortic surgery: a prospective study	<i>Anesth Analg</i>	1997	85	6	1227	1232
Purdy FR, Tweeddale MG, Merrick PM	Association of mortality with age of blood transfused in septic ICU patients	<i>Can J Anaesth</i>	1997	44	12	1256	1261
Rady MY, Ryan T, Starr NJ	Perioperative determinants of morbidity and mortality in elderly patients undergoing cardiac surgery	<i>Crit Care Med</i>	1998	26	2	225	235
Bakalakos EA, Kim JA, Young DC, Martin EW	Determinants of survival following hepatic resection for metastatic colorectal cancer	<i>World J Surg</i>	1998	22	4	399	404
Schonhofer B, Bohrer H, Kohler D	Blood transfusion facilitating difficult weaning from the ventilator	<i>Anaesthesia</i>	1998	53	2	181	184
Lin HJ, Tseng GY, Lo WC, Lee FY, Perng CL, Chang FY, Lee SD	Predictive factors for rebleeding in patients with peptic ulcer bleeding after multipolar electrocoagulation: a retrospective analysis	<i>J Clin Gastroenterol</i>	1998	26	2	113	116
Vamvakas EC, Carven JH	Transfusion of white-cell containing allogeneic blood components and postoperative wound infection: effect of confounding factors	<i>Transfus Med</i>	1998	8	1	29	36
Peerless JR, Alexander JJ, Pinchak AC, Piotrowski JJ, Malangoni MA	Oxygen delivery is an important predictor of outcome in patients with ruptured abdominal aortic aneurysms	<i>Ann Surg</i>	1998	227	5	726	732
Seifert JK, Morris DL	Prognostic factors after cryotherapy for hepatic metastases from colorectal cancer	<i>Ann Surg</i>	1998	228	2	201	208
Spieß BD, Ley C, Body SC, Siegel LC, Stover EP, Maddi R, D'Ambra M, Jain U, Liu F, Herskowitz A, Mangano DT, Levin J	Hematocrit value on intensive care unit entry influences the frequency of Q-wave myocardial infarction after coronary artery bypass grafting. The Institutions of the Multicenter Study of Perioperative Ischemia (McSPI) Research Group	<i>J Thorac Cardiovasc Surg</i>	1998	116	3	460	467

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Asahara T, Dohi K, Katayama K, Itamoto T, Okamoto Y, Nakahara H, Ono E, Sugino K, Marubayashi S, Yahata H, Kitamoto M, Nakanishi T, Azuma K, Ito K, Shimamoto F	Factors affecting postoperative prognosis in the solitary-nodule type of hepatocellular carcinoma: experience of 132 cases in our institute	<i>Hiroshima J Med Sci</i>	1998	47	3	99	104
Schonhofer B, Wenzel M, Geibel M, Kohler D	Blood transfusion and lung function in chronically anemic patients with severe chronic obstructive pulmonary disease	<i>Crit Care Med</i>	1998	26	11	1824	1828
Marcantonio ER, Goldman L, Orav EJ, Cook EF, Lee TH	The association of intraoperative factors with the development of postoperative delirium	<i>Am J Med</i>	1998	105	5	380	384
Rady MY, Ryan T	Perioperative predictors of extubation failure and the effect on clinical outcome after cardiac surgery	<i>Crit Care Med</i>	1999	27	2	340	347
Previdi JK, Cayten CG, Byrne DW	Early predictors of sepsis in the motor-vehicle crash trauma victim	<i>Prehosp Disaster Med</i>	1996	11	1	27	36
Tornetta P, Mostafavi H, Riina J, Turen C, Reimer B, Levine R, Behrens F, Geller J, Ritter C, Homel P	Morbidity and mortality in elderly trauma patients	<i>J Trauma</i>	1999	46	4	702	706
Harpole DH, DeCamp MM, Daley J, Hur K, Oprian CA, Henderson WG, Khuri SF	Prognostic models of thirty-day mortality and morbidity after major pulmonary resection	<i>J Thorac Cardiovasc Surg</i>	1999	117	5	969	979
Gol MK, Karahan M, Ulus AT, Erdil N, Iscan Z, Karabiber N, Tasdemir O, Bayazit K	Bloodstream, respiratory, and deep surgical wound infections after open heart surgery	<i>J Card Surg</i>	1998	13	4	252	259
Kama NA, Coskun T, Yuksek YN, Yazgan A	Factors affecting post-operative mortality in malignant biliary tract obstruction	<i>Hepatogastroenterology</i>	1999	46	25	103	107
Innerhofer P, Walleczek C, Luz G, Hobisch-Hagen P, Benzer A, Stockl B, Hessenberger G, Nussbaumer W, Schobersberger W	Transfusion of buffy coat-depleted blood components and risk of postoperative infection in orthopedic patients	<i>Transfusion</i>	1999	39	6	625	632
Millikan KW, Deziel DJ, Silverstein JC, Kanjo TM, Christein JD, Doolas A, Prinz RA	Prognostic factors associated with resectable adenocarcinoma of the head of the pancreas	<i>Am Surg</i>	1999	65	7	618	623
Vamvakas EC, Carven JH	Transfusion and postoperative pneumonia in coronary artery bypass graft surgery: effect of the length of storage of transfused red cells	<i>Transfusion</i>	1999	39	7	701	710
Jadallah F, McCall JL, van Rij AM	Recurrence and survival after potentially curative surgery for colorectal cancer	<i>N Z Med J</i>	1999	112	1091	248	250

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Collins TC, Daley J, Henderson WH, Khuri SF	Risk factors for prolonged length of stay after major elective surgery	<i>Ann Surg</i>	1999	230	2	251	259
Skillings JR, Rogers-Melamed I, Nabholtz JM, Sawka C, Gwadry-Sridhar F, Moquin JP, Rubinger M, Ganguly P, Burnell M, Shustik C, Dryer D, McLaughlin M, White D	An epidemiological review of red cell transfusions in cancer chemotherapy	<i>Cancer Prev Control</i>	1999	3	3	207	212
Iwanaga T, Suzuki H	Perioperative allogenic blood transfusion and serum levels of immunosuppressive acidic protein in patients undergoing resection of colorectal carcinoma	<i>Dig Dis Sci</i>	1999	44	8	1601	1604
Tachibana M, Kinugasa S, Dhar DK, Kotoh T, Shibakita M, Ohno S, Masunaga R, Kubota H, Kohno H, Nagasue N	Prognostic factors after extended esophagectomy for squamous cell carcinoma of the thoracic esophagus	<i>J Surg Oncol</i>	1999	72	2	88	93
Vichinsky EP, Neumayr LD, Haberkern C, Earles AN, Eckman J, Koshy M, Black DM	The perioperative complication rate of orthopedic surgery in sickle cell disease: report of the National Sickle Cell Surgery Study Group	<i>Am J Hematol</i>	1999	62	3	129	138
Papia G, McLellan BA, El-Helou P, Louie M, Rachlis A, Szalai JP, Simor AE	Infection in hospitalized trauma patients: incidence, risk factors, and complications	<i>J Trauma</i>	1999	47	5	923	927
Kubo S, Kinoshita H, Hirohashi K, Tanaka H, Tsukamoto T, Hamba H, Shuto T, Yamamoto T, Ikebe T, Wakasa K	Patterns of and risk factors for recurrence after liver resection for well-differentiated hepatocellular carcinoma: a special reference to multicentric carcinogenesis after operation	<i>Hepatogastroenterology</i>	1999	46	30	3212	3215
Mynster T, Nielsen HJ	The impact of storage time of transfused blood on postoperative infectious complications in rectal cancer surgery. Danish RANX05 Colorectal Cancer Study Group	<i>Scand J Gastroenterol</i>	2000	35	2	212	217
Karl RC, Schreiber R, Boulware D, Baker S, Coppola D	Factors affecting morbidity, mortality, and survival in patients undergoing Ivor Lewis esophagogastrectomy	<i>Ann Surg</i>	2000	231	5	635	643
Kubota H, Kotoh T, Dhar DK, Masunaga R, Tachibana M, Tabara H, Kohno H, Nagasue N	Gastric resection in the aged (> or = 80 years) with gastric carcinoma: a multivariate analysis of prognostic factors	<i>Aust N Z J Surg</i>	2000	70	4	254	257

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Leal-Noval SR, Marquez-Vacaro JA, Garcia-Curiel A, Camacho-Larana P, Rincon-Ferrari MD, Ordonez-Fernandez A, Flores-Cordero JM, Loscertales-Abril J	Nosocomial pneumonia in patients undergoing heart surgery	<i>Crit Care Med</i>	2000	28	4	935	940
Montagnino G, Tarantino A, Maccario M, Elli A, Cesana B, Ponticelli C	Long-term results with cyclosporine monotherapy in renal transplant patients: a multivariate analysis of risk factors	<i>Am J Kidney Dis</i>	2000	35	6	1135	1143
Benassai G, Mastrorilli M, Quarto G, Cappiello A, Giani U, Mosella G	Survival after pancreaticoduodenectomy for ductal adenocarcinoma of the head of the pancreas	<i>Chir Ital</i>	2000	52	3	263	270
Kelsey MC, Mitchell CA, Griffin M, Spencer RC, Emmerson AM	Prevalence of lower respiratory tract infections in hospitalized patients in the United Kingdom and Eire—results from the Second National Prevalence Survey	<i>J Hosp Infect</i>	2000	46	1	12	22
Dente CJ, Tyburski J, Wilson RF, Collinge J, Steffes C, Carlin A	Ostomy as a risk factor for posttraumatic infection in penetrating colonic injuries: univariate and multivariate analyses	<i>J Trauma</i>	2000	49	4	628	634
Hatori N, Yoshizu H, Shimizu M, Hinokiyama K, Takeshima S, Kimura T, Iizuka Y, Tanaka S	Prognostic factors in the surgical treatment of ruptured abdominal aortic aneurysms	<i>Surg Today</i>	2000	30	9	785	790
Staudacher C, Chiappa A, Zbar AP, Bertani E, Biella F	Curative resection for colorectal cancer in the elderly. Prognostic factors and five-year follow-up	<i>Ann Ital Chir</i>	2000	71	4	491	496
Flores JM, Jimenez PI, Rincon MD, Marquez JA, Navarro H, Arteta D, Murillo F	Early risk factors for sepsis in patients with severe blunt trauma	<i>Injury</i>	2001	32	1	5	12
Milot J, Perron J, Lacasse Y, Letourneau L, Cartier PC, Maltais F	Incidence and predictors of ARDS after cardiac surgery	<i>Chest</i>	2001	119	3	884	888
Kawahito K, Adachi H, Yamaguchi A, Ino T	Preoperative risk factors for hospital mortality in acute type A aortic dissection	<i>Ann Thorac Surg</i>	2001	71	4	1239	1243
Waggoner JR, Wass CT, Polis TZ, Faust RJ, Schroeder DR, Offord KP, Piepgras DG, Joyner MJ	The effect of changing transfusion practice on rates of perioperative stroke and myocardial infarction in patients undergoing carotid endarterectomy: a retrospective analysis of 1114 Mayo Clinic patients. Mayo Perioperative Outcomes Group	<i>Mayo Clin Proc</i>	2001	76	4	376	383

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Sehgal LR, Zebala LP, Takagi I, Curran RD, Votapka TV, Caprini JA	Evaluation of oxygen extraction ratio as a physiologic transfusion trigger in coronary artery bypass graft surgery patients	<i>Transfusion</i>	2001	41	5	591	595
Bernard A, Deschamps C, Allen MS, Miller DL, Trastek VF, Jenkins GD, Pairolero PC	Pneumonectomy for malignant disease: factors affecting early morbidity and mortality	<i>J Thorac Cardiovasc Surg</i>	2001	121	6	1076	1082
Poon RT, Fan ST, Lo CM, Ng IO, Liu CL, Lam CM, Wong J	Improving survival results after resection of hepatocellular carcinoma: a prospective study of 377 patients over 10 years	<i>Ann Surg</i>	2001	234	1	63	70
Ho CH	The changes of cardiac ejection fraction up to 72 h after transfusion in patients with chronic anaemia	<i>Transfus Med</i>	2001	11	3	189	192
Tyburnski JG, Wilson RF, Dente C, Steffes C, Carlin AM	Factors affecting mortality rates in patients with abdominal vascular injuries	<i>J Trauma</i>	2001	50	6	1020	1026
Alfieri S, Carriero C, Caprino P, Di GA, Sgadari A, Crucitti F, Doglietto GB	Avoiding early postoperative complications in liver surgery. A multivariate analysis of 254 patients consecutively observed	<i>Dig Liver Dis</i>	2001	33	4	341	346
Titlestad IL, Ebbesen LS, Ainsworth AP, Lillevang ST, Qvist N, Georgsen J	Leukocyte-depletion of blood components does not significantly reduce the risk of infectious complications. Results of a double-blinded, randomized study	<i>Int J Colorectal Dis</i>	2001	16	3	147	153
Dougenis D, Patrino V, Filos KS, Theodori E, Vagianos K, Maniati A	Blood use in lung resection for carcinoma: perioperative elective anaemia does not compromise the early outcome	<i>Eur J Cardiothorac Surg</i>	2001	20	2	372	377
Mynster T, Nielsen HJ	Storage time of transfused blood and disease recurrence after colorectal cancer surgery	<i>Dis Colon Rectum</i>	2001	44	7	955	964
Tang R, Chen HH, Wang YL, Changchien CR, Chen JS, Hsu KC, Chiang JM, Wang JY	Risk factors for surgical site infection after elective resection of the colon and rectum: a single-center prospective study of 2,809 consecutive patients	<i>Ann Surg</i>	2001	234	2	181	189
van Geenen RC, van Gulik TM, Offerhaus GJ, de Wit LT, Busch OR, Obertop H, Gouma DJ	Survival after pancreaticoduodenectomy for periampullary adenocarcinoma: an update	<i>Eur J Surg Oncol</i>	2001	27	6	549	557

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Cardenas A, Gines P, Uriz J, Bessa X, Salmeron JM, Mas A, Ortega R, Calahorra B, De Las HD, Bosch J, Arroyo V, Rodes J	Renal failure after upper gastrointestinal bleeding in cirrhosis: incidence, clinical course, predictive factors, and short-term prognosis	<i>Hepatology</i>	2001	34	4 Pt 1	671	676
nett-Guerrero E, Feierman DE, Barclay GR, Parides MK, Sheiner PA, Mythen MG, Levine DM, Parker TS, Carroll SF, White ML, Winfree WJ	Preoperative and intraoperative predictors of postoperative morbidity, poor graft function, and early rejection in 190 patients undergoing liver transplantation	<i>Arch Surg</i>	2001	136	10	1177	1183
Arozullah AM, Khuri SF, Henderson WG, Daley J	Development and validation of a multifactorial risk index for predicting postoperative pneumonia after major noncardiac surgery	<i>Ann Intern Med</i>	2001	135	10	847	857
Chang SS, Baumgartner RG, Wells N, Cookson MS, Smith JA	Causes of increased hospital stay after radical cystectomy in a clinical pathway setting	<i>J Urol</i>	2002	167	1	208	211
Ghosh S, Roberts N, Firmin RK, Jameson J, Spyt TJ	Risk factors for intestinal ischaemia in cardiac surgical patients	<i>Eur J Cardiothorac Surg</i>	2002	21	3	411	416
Carlin AM, Tyburski JG, Wilson RF, Steffes C	Factors affecting the outcome of patients with splenic trauma	<i>Am Surg</i>	2002	68	3	232	239
Christein JD, Hollinger EF, Millikan KW	Prognostic factors associated with resectable carcinoma of the esophagus	<i>Am Surg</i>	2002	68	3	258	262
Kuo RL, Eachempati SR, Makhuli MJ, Reed RL	Factors affecting management and outcome in blunt renal injury	<i>World J Surg</i>	2002	26	4	416	419
Vamvakas EC, Carven JH	Allogeneic blood transfusion and postoperative duration of mechanical ventilation: effects of red cell supernatant, platelet supernatant, plasma components and total transfused fluid	<i>Vox Sang</i>	2002	82	3	141	149
Farwell DG, Reilly DF, Weymuller EA, Greenberg DL, Staiger TO, Futran NA	Predictors of perioperative complications in head and neck patients	<i>Arch Otolaryngol Head Neck Surg</i>	2002	128	5	505	511
Apaydin AZ, Posacioglu H, Islamoglu F, Calkavur T, Yagdi T, Buket S, Durmaz I	Analysis of perioperative risk factors in mortality and morbidity after modified Bentall operation	<i>Jpn Heart J</i>	2002	43	2	151	157
Zindrou D, Taylor KM, Bagger JP	Preoperative haemoglobin concentration and mortality rate after coronary artery bypass surgery	<i>Lancet</i>	2002	359	9319	1747	1748

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Olsen MA, Lock-Buckley P, Hopkins D, Polish LB, Sundt TM, Fraser VJ	The risk factors for deep and superficial chest surgical-site infections after coronary artery bypass graft surgery are different	<i>J Thorac Cardiovasc Surg</i>	2002	124	1	136	145
Baumgartner RG, Wells N, Chang SS, Cookson MS, Smith JA	Causes of increased length of stay following radical cystectomy	<i>Urol Nurs</i>	2002	22	5	319	23, 339
Sharma AD, Slaughter TF, Clements FM, Sreeram G, Newman MF, Phillips-Bute B, Bredehoeft SJ, Smith PK, Stafford-Smith M	Association of leukocyte-depleted blood transfusions with infectious complications after cardiac surgery	<i>Surg Infect (Larchmt)</i>	2002	3	2	127	133
Wei AC, Tung-Ping PR, Fan ST, Wong J	Risk factors for perioperative morbidity and mortality after extended hepatectomy for hepatocellular carcinoma	<i>Br J Surg</i>	2003	90	1	33	41
Bailey SH, Bull DA, Harpole DH, Rentz JJ, Neumayer LA, Pappas TN, Daley J, Henderson WG, Krasnicka B, Khuri SF	Outcomes after esophagectomy: a ten-year prospective cohort	<i>Ann Thorac Surg</i>	2003	75	1	217	222
Apaydin AZ, Buket S, Posacioglu H, Islamoglu F, Calkavur T, Yagdi T, Ozbaran M, Yuksel M	Perioperative risk factors for mortality in patients with acute type A aortic dissection	<i>Ann Thorac Surg</i>	2002	74	6	2034	2039
Chen MF, Tsai HP, Jeng LB, Lee WC, Yeh CN, Yu MC, Hung CM	Prognostic factors after resection for hepatocellular carcinoma in noncirrhotic livers: univariate and multivariate analysis	<i>World J Surg</i>	2003	27	4	443	447
Torella F, Haynes SL, McCollum CN	Cerebral and peripheral oxygen saturation during red cell transfusion	<i>J Surg Res</i>	2003	110	1	217	221
Herget-Rosenthal S, Gerken G, Philipp T, Holtmann G	Serum ferritin and survival of renal transplant recipients: a prospective 10-year cohort study	<i>Transpl Int</i>	2003	16	9	642	647
Grazi GL, Cescon M, Ravaioli M, Ercolani G, Gardini A, Del GM, Vetrone G, Cavallari A	Liver resection for hepatocellular carcinoma in cirrhotics and noncirrhotics. Evaluation of clinicopathologic features and comparison of risk factors for long-term survival and tumour recurrence in a single centre	<i>Aliment Pharmacol Ther</i>	2003	17		119	129
Makela JT, Kiviniemi H, Laitinen S	Risk factors for anastomotic leakage after left-sided colorectal resection with rectal anastomosis	<i>Dis Colon Rectum</i>	2003	46	5	653	660

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Hsia CY, Chau GY, King KL, Loong CC, Lui WY, Wu CW	Factors for prolonged length of stay after elective hepatectomy for hepatocellular carcinoma. The surgeon's role in the managed care era	<i>Hepatogastroenterology</i>	2003	50	51	798	804
Morris CD, Sepkowitz K, Fonshell C, Margetson N, Eagan J, Miransky J, Boland PJ, Healey J	Prospective identification of risk factors for wound infection after lower extremity oncologic surgery	<i>Ann Surg Oncol</i>	2003	10	7	778	782
Lima EQ, Zanetta DM, Castro I, Massarollo PC, Mies S, Machado MM, Yu L	Risk factors for development of acute renal failure after liver transplantation	<i>Ren Fail</i>	2003	25	4	553	560
Shapiro MJ, Gettinger A, Corwin HL, Napolitano L, Levy M, Abraham E, Fink MP, MacIntyre N, Pearl RG, Shabot MM	Anemia and blood transfusion in trauma patients admitted to the intensive care unit	<i>J Trauma</i>	2003	55	2	269	273
D'Amico G, De FR	Upper digestive bleeding in cirrhosis. Post-therapeutic outcome and prognostic indicators	<i>Hepatology</i>	2003	38	3	599	612
Bilbao I, Figueras J, Grande L, Cleries M, Jaurrieta E, Visa J, Margarit C	Risk factors for death following liver retransplantation	<i>Transplant Proc</i>	2003	35	5	1871	1873
Kinnaird TD, Stabile E, Mintz GS, Lee CW, Canos DA, Gevorkian N, Pinnow EE, Kent KM, Pichard AD, Satler LF, Weissman NJ, Lindsay J, Fuchs S	Incidence, predictors, and prognostic implications of bleeding and blood transfusion following percutaneous coronary interventions	<i>Am J Cardiol</i>	2003	92	8	930	935
Fan ST, Lo CM, Liu CL, Yong BH, Wong J	Determinants of hospital mortality of adult recipients of right lobe live donor liver transplantation	<i>Ann Surg</i>	2003	238	6	864	869
Lawrence VA, Silverstein JH, Cornell JE, Pederson T, Noveck H, Carson JL	Higher Hb level is associated with better early functional recovery after hip fracture repair	<i>Transfusion</i>	2003	43	12	1717	1722
Axelrod DA, Stanley JC, Upchurch GR, Khuri S, Daley J, Henderson W, Demonner S, Henke PK	Risk for stroke after elective noncarotid vascular surgery	<i>J Vasc Surg</i>	2004	39	1	67	72
Seifert JK, Junginger T	Prognostic factors for cryotherapy of colorectal liver metastases	<i>Eur J Surg Oncol</i>	2004	30	1	34	40
Munstedt K, Volzing M, Von GR	Hemoglobin levels during radiation therapy and their influence on local control and survival of patients with endometrial carcinoma	<i>Oncol Rep</i>	2004	11	3	711	717
Shibata A, Ogimoto I, Kurozawa Y, Nose T, Yoshimura T, Suzuki H, Iwai N, Sakata R, Fujita Y, Ichikawa S, Fukuda K, Tamakoshi A	Past medical history and risk of death due to hepatocellular carcinoma, univariate analysis of JACC study data	<i>Kurume Med J</i>	2003	50	3-4	109	119

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Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Williams M, Carlin AM, Tyburski JG, Blocksom JM, Harvey EH, Steffes CP, Wilson RF	Predictors of mortality in patients with traumatic diaphragmatic rupture and associated thoracic and/or abdominal injuries	<i>Am Surg</i>	2004	70	2	157	162
Islamoglu F, Posacioglu H, Apaydin AZ, Calkavur T, Yagdi T, Atay Y, Buket S	Perioperative determinants of mortality and morbidity in distal arch and proximal descending aortic aneurysm surgery	<i>Med Sci Monit</i>	2004	10	4	CR137	CR142
Sekikawa Z, Takebayashi S, Kurihara H, Lee J, Niwa T, Kawamoto M, Yamamoto T, Suzuki J, Sugiyama M, Inoue T	Factors affecting clinical outcome of patients who undergo transcatheter arterial embolisation in splenic injury	<i>Br J Radiol</i>	2004	77	916	308	311
Bilgin YM, van de Watering LM, Eijsman L, Versteegh MI, Brand R, van Oers MH, Brand A	Double-blind, randomized controlled trial on the effect of leukocyte-depleted erythrocyte transfusions in cardiac valve surgery	<i>Circulation</i>	2004	109	22	2755	2760
Ciesla DJ, Moore EE, Johnson JL, Sauaia A, Cothren CC, Moore JB, Burch JM	Multiple organ dysfunction during resuscitation is not postinjury multiple organ failure	<i>Arch Surg</i>	2004	139	6	590	594
Wallis JP, Wells AW, Matthews JN, Chapman CE	Long-term survival after blood transfusion: a population based study in the North of England	<i>Transfusion</i>	2004	44	7	1025	1032
Minnema B, Vearncombe M, Augustin A, Gollish J, Simor AE	Risk factors for surgical-site infection following primary total knee arthroplasty	<i>Infect Control Hosp Epidemiol</i>	2004	25	6	477	480
Tassiopoulos AK, Kwon SS, Labropoulos N, Damani T, Littooy FN, Mansour MA, Kang SS, Baker WH	Predictors of early discharge following open abdominal aortic aneurysm repair	<i>Ann Vasc Surg</i>	2004	18	2	218	222
Suttner S, Piper SN, Kumle B, Lang K, Rohm KD, Isgro F, Boldt J	The influence of allogeneic red blood cell transfusion compared with 100% oxygen ventilation on systemic oxygen transport and skeletal muscle oxygen tension after cardiac surgery	<i>Anesth Analg</i>	2004	99	1	2	11
Thanni LO, Aigoro NO	Surgical site infection complicating internal fixation of fractures: incidence and risk factors	<i>J Natl Med Assoc</i>	2004	96	8	1070	1072
Cloke DJ, Green JE, Khan AL, Hodgkinson PD, McLean NR	Factors influencing the development of wound infection following free-flap reconstruction for intra-oral cancer	<i>Br J Plast Surg</i>	2004	57	6	556	560
El-Masri MM, Hammad TA, McLeskey SW, Joshi M, Korniewicz DM	Predictors of nosocomial bloodstream infections among critically ill adult trauma patients	<i>Infect Control Hosp Epidemiol</i>	2004	25	8	656	663

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Chiappa A, Zbar AP, Biffi R, Bellomi M, Orecchia R, Marsiglia H, Bertani E, De BF, Crotti C, Andreoni B	Primary and recurrent retroperitoneal sarcoma: factors affecting survival and long-term outcome	<i>Hepatogastroenterology</i>	2004	51	59	1304	1309
Bove T, Calabro MG, Landoni G, Aletti G, Marino G, Crescenzi G, Rosica C, Zangrillo A	The incidence and risk of acute renal failure after cardiac surgery	<i>J Cardiothorac Vasc Anesth</i>	2004	18	4	442	445
Crabtree TD, Codd JE, Fraser VJ, Bailey MS, Olsen MA, Damiano RJ	Multivariate analysis of risk factors for deep and superficial sternal infection after coronary artery bypass grafting at a tertiary care medical center	<i>Semin Thorac Cardiovasc Surg</i>	2004	16	1	53	61
Kinugasa S, Tachibana M, Yoshimura H, Ueda S, Fujii T, Dhar DK, Nakamoto T, Nagasue N	Postoperative pulmonary complications are associated with worse short- and long-term outcomes after extended esophagectomy	<i>J Surg Oncol</i>	2004	88	2	71	77
Yamagata K, Onizawa K, Yusa H, Wakatsuki T, Yanagawa T, Yoshida H	Risk factors for postoperative delirium in patients undergoing head and neck cancer surgery	<i>Int J Oral Maxillofac Surg</i>	2005	34	1	33	36
Couture F, Turner AR, Melosky B, Xiu L, Plante RK, Lau CY, Quirt I	Prior red blood cell transfusions in cancer patients increase the risk of subsequent transfusions with or without recombinant human erythropoietin management	<i>Oncologist</i>	2005	10	1	63	71
MacLaren G, Anderson M	Bloodless intensive care: a case series and review of Jehovah's Witnesses in ICU	<i>Anaesth Intensive Care</i>	2004	32	6	798	803
Hendriks HG, van der MJ, de Wolf JT, Peeters PM, Porte RJ, de JK, Lip H, Post WJ, Slooff MJ	Intraoperative blood transfusion requirement is the main determinant of early surgical re-intervention after orthotopic liver transplantation	<i>Transpl Int</i>	2005	17	11	673	679
Micek ST, Isakow W, Shannon W, Kollef MH	Predictors of hospital mortality for patients with severe sepsis treated with Drotrecogin alfa (activated)	<i>Pharmacotherapy</i>	2005	25	1	26	34
Tynell E, Norda R, Montgomery SM, Bjorkman A	Diagnosis and procedure-specific survival among transfusion of recipients in 1993 and 2000, Orebro County, Sweden	<i>Vox Sang</i>	2005	88	3	181	188
O'Sullivan RE, White TO, Keating JF	Major pelvic fractures: identification of patients at high risk	<i>J Bone Joint Surg Br</i>	2005	87	4	530	533

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Sakamoto Y, Kosuge T, Shimada K, Sano T, Ojima H, Yamamoto J, Yamasaki S, Takayama T, Makuuchi M	Prognostic factors of surgical resection in middle and distal bile duct cancer: an analysis of 55 patients concerning the significance of ductal and radial margins	<i>Surgery</i>	2005	137	4	396	402
Joseph JE, Low J, Courtenay B, Neil MJ, McGrath M, Ma D	A single-centre prospective study of clinical and haemostatic risk factors for venous thromboembolism following lower limb arthroplasty	<i>Br J Haematol</i>	2005	129	1	87	92
Hanazaki K, Matsushita A, Nakagawa K, Misawa R, Amano J	Risk factors of intrahepatic recurrence after curative resection of hepatocellular carcinoma	<i>Hepatogastroenterology</i>	2005	52	62	580	586
Matinlauri IH, Nurminen MM, Hockerstedt KA, Isoniemi HM	Risk factors predicting survival of liver transplantation	<i>Transplant Proc</i>	2005	37	2	1155	1160
Smith MJ, Stiefel MF, Magge S, Frangos S, Bloom S, Gracias V, Le Roux PD	Packed red blood cell transfusion increases local cerebral oxygenation	<i>Crit Care Med</i>	2005	33	5	1104	1108
Nemes B, Sarvary E, Sotonyi P, Gerlei Z, Doros A, Galffy Z, Fehervari I, Fazakas J, Jaray J, Kobori L	Factors in association with sepsis after liver transplantation: the Hungarian experience	<i>Transplant Proc</i>	2005	37	5	2227	2228
Jiang SP, Li ZY, Huang LW, Zhang W, Lu ZQ, Zheng ZY	Multivariate analysis of the risk for pulmonary complication after gastrointestinal surgery	<i>World J Gastroenterol</i>	2005	11	24	3735	3741
Criddle LM, Eldredge DH, Walker J	Variables predicting trauma patient survival following massive transfusion	<i>J Emerg Nurs</i>	2005	31	3	236	242
El-Masri MM, Hammad TA, Fox-Wasylyshyn SM	Predicting nosocomial bloodstream infections using surrogate markers of injury severity: clinical and methodological perspectives	<i>Nurs Res</i>	2005	54	4	273	279
Okura M, Isomura ET, Iida S, Kogo M	Long-term outcome and factors influencing bridging plates for mandibular reconstruction	<i>Oral Oncol</i>	2005	41	8	791	798
Habib RH, Zacharias A, Schwann TA, Riordan CJ, Engoren M, Durham SJ, Shah A	Role of hemodilutional anemia and transfusion during cardiopulmonary bypass in renal injury after coronary revascularization: implications on operative outcome.	<i>Crit Care Med</i>	2005	33	8	1749	1756
Alvarez JA, Baldonado RF, Bear IG, Truan N, Pire G, Alvarez P	Obstructing colorectal carcinoma: outcome and risk factors for morbidity and mortality	<i>Dig Surg</i>	2005	22	3	174	181

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Sun HC, Qin LX, Wang L, Ye QH, Wu ZQ, Fan J, Tang ZY	Risk factors for postoperative complications after liver resection	<i>Hepatobiliary Pancreat Dis Int</i>	2005	4	3	370	374
El Solh AA, Bhora M, Pineda L, Dhillon R	Nosocomial pneumonia in elderly patients following cardiac surgery	<i>Respir Med</i>	2006	100	4	729	736
James AH, Bushnell CD, Jamison MG, Myers ER	Incidence and risk factors for stroke in pregnancy and the puerperium	<i>Obstet Gynecol</i>	2005	106	3	509	516
Mazza BF, Machado FR, Mazza DD, Hassmann V	Evaluation of blood transfusion effects on mixed venous oxygen saturation and lactate levels in patients with SIRS/sepsis	<i>Clinics</i>	2005	60	4	311	316
Macadam R, Yeomans N, Wilson J, Case W, White C, Lovegrove J, Lyndon P	Factors affecting morbidity, mortality and survival in patients undergoing surgery for rectal cancer in a district general hospital	<i>Ann R Coll Surg Engl</i>	2005	87	5	334	338
Blumberg N, Fine L, Gettings KF, Heal JM	Decreased sepsis related to indwelling venous access devices coincident with implementation of universal leukoreduction of blood transfusions	<i>Transfusion</i>	2005	45	10	1632	1639
du CD, Parienti JJ, Fekih-Hassen M, Daubin C, Charbonneau P	Impact of anemia on outcome in critically ill patients with severe acute renal failure	<i>Intensive Care Med</i>	2005	31	11	1529	1536
Laurent C, Blanc JF, Nobili S, Sa CA, le BB, Bioulac-Sage P, Balabaud C, Capdepon M, Saric J	Prognostic factors and longterm survival after hepatic resection for hepatocellular carcinoma originating from noncirrhotic liver	<i>J Am Coll Surg</i>	2005	201	5	656	662
Pawar M, Mehta Y, Ansari A, Nair R, Trehan N	Nosocomial infections and balloon counterpulsation: risk factors and outcome	<i>Asian Cardiovasc Thorac Ann</i>	2005	13	4	316	320
Celkan MA, Ustunsoy H, Daglar B, Kazaz H, Kocoglu H	Readmission and mortality in patients undergoing off-pump coronary artery bypass surgery with fast-track recovery protocol	<i>Heart Vessels</i>	2005	20	6	251	255
Asaad SM, Jubelirer SJ, Welch CA	Prognostic indicators for stage II (Dukes' stage B) adenocarcinoma of the colon	<i>W V Med J</i>	2005	101	5	210	213
Grotz MR, Gummerson NW, Gansslen A, Petrowsky H, Keel M, Allami MK, Tzioupis C, Trentz O, Krettek C, Pape HC, Giannoudis PV	Staged management and outcome of combined pelvic and liver trauma. An international experience of the deadly duo	<i>Injury</i>	2006	37	7	642	651
Davis KA, Reed RL, Santaniello J, Abodeely A, Esposito TJ, Poulakidas SJ, Luchette FA	Predictors of the need for nephrectomy after renal trauma	<i>J Trauma</i>	2006	60	1	164	169

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Claridge JA, Croce MA, Weinberg JA, Forsythe RM, Miller C, Fabian TC	The real predictors of disposition in patients with spinal cord injuries	<i>J Trauma</i>	2006	60	1	178	186
Michalopoulos A, Geroulanos S, Rosmarakis ES, Falagas ME	Frequency, characteristics, and predictors of microbiologically documented nosocomial infections after cardiac surgery	<i>Eur J Cardiothorac Surg</i>	2006	29	4	456	460
Bufalari A, Giustozzi G, Burattini MF, Servili S, Bussotti C, Lucaroni E, Ricci E, Sciannameo F	Rectal cancer surgery in the elderly: a multivariate analysis of outcome risk factors	<i>J Surg Oncol</i>	2006	93	3	173	180
Ayed AK, Bazerbashi S, Chandrasekaran C, Sukumar M, Jamaledin H	Pulmonary complications following major lung resection for benign and malignant lung diseases	<i>Med Princ Pract</i>	2006	15	2	114	119
Abdel WM, Fathy O, Elghwalby N, Sultan A, Elebidy E, Abdalla T, Elshobary M, Mostafa M, Foad A, Kandeel T, Abdel RA, Salah T, Abu ZM, Abu EA, Gad EN, ElFiky A, Ezzat F	Resectability and prognostic factors after resection of hilar cholangiocarcinoma	<i>Hepatogastroenterology</i>	2006	53	67	5	10
Cabezuelo JB, Ramirez P, Rios A, Acosta F, Torres D, Sansano T, Pons JA, Bru M, Montoya M, Bueno FS, Robles R, Parrilla P	Risk factors of acute renal failure after liver transplantation	<i>Kidney Int</i>	2006	69	6	1073	1080
Liang H, Wang XN, Wang BG, Pan Y, Liu N, Wang DC, Hao XS	Prognostic factors of young patients with colon cancer after surgery	<i>World J Gastroenterol</i>	2006	12	9	1458	1462
von HC, Sander M, Foer A, Heinemann A, Spiess B, Braun J, Kramer M, Grosse J, Dohmen P, Dushe S, Halle J, Konertz WF, Wernecke KD, Spies C	The impact of an hematocrit of 20% during normothermic cardiopulmonary bypass for elective low risk coronary artery bypass graft surgery on oxygen delivery and clinical outcome—a randomized controlled study [ISRCTN35655335]	<i>Crit Care</i>	2006	10	2	R58	
Chiappa A, Zbar AP, Bertani E, Biffi R, Luca F, Crotti C, Testori A, Lazzaro G, De PT, Pace U, Andreoni B	Primary and recurrent retroperitoneal soft tissue sarcoma: prognostic factors affecting survival	<i>J Surg Oncol</i>	2006	93	6	456	463
Nemes B, Polak W, Ther G, Hendriks H, Kobori L, Porte RJ, Sarvary E, de Jong KP, Doros A, Gerlei Z, van den Berg AP, Fehervari I, Gorog D, Peeters PM, Jaray J, Slooff MJ	Analysis of differences in outcome of two European liver transplant centers	<i>Transpl Int</i>	2006	19	5	372	380
Balachandran P, Sikora SS, Kapoor S, Krishnani N, Kumar A, Saxena R, Kapoor VK	Long-term survival and recurrence patterns in ampullary cancer	<i>Pancreas</i>	2006	32	4	390	395

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Rana R, Afessa B, Keegan MT, Whalen FX, Nuttall GA, Evenson LK, Peters SG, Winters JL, Hubmayr RD, Moore SB, Gajic O	Evidence-based red cell transfusion in the critically ill: quality improvement using computerized physician order entry	<i>Crit Care Med</i>	2006	34	7	1892	1897
Kozar RA, Moore FA, Cothren CC, Moore EE, Sena M, Bulger EM, Miller CC, Eastridge B, Acheson E, Brundage SI, Tataria M, McCarthy M, Holcomb JB	Risk factors for hepatic morbidity following nonoperative management: multicenter study	<i>Arch Surg</i>	2006	141	5	451	458
Tan FL, Tan YM, Chung AY, Cheow PC, Chow PK, Ooi LL	Factors affecting early mortality in spontaneous rupture of hepatocellular carcinoma	<i>ANZ J Surg</i>	2006	76	6	448	452
Nakajima T, Kawazoe K, Izumoto H, Kataoka T, Niinuma H, Shirahashi N	Risk factors for hypoxemia after surgery for acute type A aortic dissection	<i>Surg Today</i>	2006	36	8	680	685
Kwon B, Yoo JU, Furey CG, Rowbottom J, Emery SE	Risk factors for delayed extubation after single-stage, multi-level anterior cervical decompression and posterior fusion	<i>J Spinal Disord Tech</i>	2006	19	6	389	393
Muraoka M, Tagawa T, Akamine S, Oka T, Tsuchiya T, Araki M, Hayashi T, Nagayasu T	Acute interstitial pneumonia following surgery for primary lung cancer	<i>Eur J Cardiothorac Surg</i>	2006	30	4	657	662
Benzoni E, Cojutti A, Lorenzin D, Adani GL, Baccarani U, Favero A, Zompicchiati A, Bresadola F, Uzzau A	Liver resective surgery: a multivariate analysis of postoperative outcome and complication	<i>Langenbecks Arch Surg</i>	2007	392	1	45	54
Jabbour N, Gagandeep S, Shah H, Mateo R, Stapfer M, Genyk Y, Sher L, Zwierzchoniowska M, Selby R, Zeger G	Impact of a transfusion-free program on non-Jehovah's Witness patients undergoing liver transplantation	<i>Arch Surg</i>	2006	141	9	913	917
van de WL, Lorinser J, Versteegh M, Westendorp R, Brand A	Effects of storage time of red blood cell transfusions on the prognosis of coronary artery bypass graft patients	<i>Transfusion</i>	2006	46	10	1712	1718
Leal-Noval SR, Rincon-Ferrari MD, Marin-Niebla A, Cayuela A, Reillano-Orden V, Marin-Caballeros A, Maya-Villar R, Ferrandiz-Millon C, Murillo-Cabeza F	Transfusion of erythrocyte concentrates produces a variable increment on cerebral oxygenation in patients with severe traumatic brain injury: a preliminary study	<i>Intensive Care Med</i>	2006	32	11	1733	1740
Marrelli D, Pedrazzani C, Neri A, Corso G, DeStefano A, Pinto E, Roviello F	Complications after extended (D2) and superextended (D3) lymphadenectomy for gastric cancer: analysis of potential risk factors	<i>Ann Surg Oncol</i>	2007	14	1	25	33

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Boyle JM, Moualla S, Arrigain S, Worley S, Bakri MH, Starling RC, Heyka R, Thakar CV	Risks and outcomes of acute kidney injury requiring dialysis after cardiac transplantation	<i>Am J Kidney Dis</i>	2006	48	5	787	796
Menon KV, Al-Mukhtar A, Aldouri A, Prasad RK, Lodge PA, Toogood GJ	Outcomes after major hepatectomy in elderly patients	<i>J Am Coll Surg</i>	2006	203	5	677	683
Benzoni E, Lorenzin D, Baccarani U, Adani GL, Favero A, Cojutti A, Bresadola F, Uzzau A	Resective surgery for liver tumor: a multivariate analysis of causes and risk factors linked to postoperative complications	<i>Hepatobiliary Pancreat Dis Int</i>	2006	5	4	526	533
Yang TB, Zeng FH, Sun ZQ	Prognostic factors for primary superficial transitional cell carcinoma of the bladder: a retrospective cohort study	<i>Chin Med J (Engl)</i>	2006	119	21	1821	1828
Miki C, Inoue Y, Mohri Y, Kobayashi M, Kusunoki M	Site-specific patterns of surgical site infections and their early indicators after elective colorectal cancer surgery	<i>Dis Colon Rectum</i>	2006	49	10 Suppl	S45	S52
Wei Y, Zhang L, Lin H, Li J, Li B, Yan L, Wen T, Zeng Y, Lu S	Factors related to post-liver transplantation acute renal failure	<i>Transplant Proc</i>	2006	38	9	2982	2984
Suzuki A, Lymp J, Donlinger J, Mendes F, Angulo P, Lindor K	Clinical predictors for hepatocellular carcinoma in patients with primary biliary cirrhosis	<i>Clin Gastroenterol Hepatol</i>	2007	5	2	259	264
Huber-Wagner S, Qvick M, Mussack T, Euler E, Kay MV, Mutschler W, Kanz KG	Massive blood transfusion and outcome in 1062 polytrauma patients: a prospective study based on the Trauma Registry of the German Trauma Society	<i>Vox Sang</i>	2007	92	1	69	78
Liu SA, Wong YK, Poon CK, Wang CC, Wang CP, Tung KC	Risk factors for wound infection after surgery in primary oral cavity cancer patients	<i>Laryngoscope</i>	2007	117	1	166	171
Smith W, Williams A, Agudelo J, Shannon M, Morgan S, Stahel P, Moore E	Early predictors of mortality in hemodynamically unstable pelvis fractures	<i>J Orthop Trauma</i>	2007	21	1	31	37
Patard JJ, Pantuck AJ, Crepel M, Lam JS, Bellec L, Albouy B, Lopes D, Bernhard JC, Guille F, Lacroix B, De La TA, Salomon L, Pfister C, Soulie M, Tostain J, Ferriere JM, Abbou CC, Colombel M, Belldegrun AS	Morbidity and clinical outcome of nephron-sparing surgery in relation to tumour size and indication	<i>Eur Urol</i>	2007	52	1	148	154
Linden PA, Yeap BY, Chang MY, Henderson WG, Jaklitsch MT, Khuri S, Sugarbaker DJ, Bueno R	Morbidity of lung resection after prior lobectomy: results from the Veterans Affairs National Surgical Quality Improvement Program	<i>Ann Thorac Surg</i>	2007	83	2	425	431

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Gangireddy C, Rectenwald JR, Upchurch GR, Wakefield TW, Khuri S, Henderson WG, Henke PK	Risk factors and clinical impact of postoperative symptomatic venous thromboembolism	<i>J Vasc Surg</i>	2007	45	2	335	341
Ogunyemi D	Risk factors for acute pulmonary edema in preterm delivery	<i>Eur J Obstet Gynecol Reprod Biol</i>	2007	133	2	143	147
Kaibori M, Saito T, Matsui Y, Uchida Y, Ishizaki M, Kamiyama Y	A review of the prognostic factors in patients with recurrence after liver resection for hepatocellular carcinoma	<i>Am J Surg</i>	2007	193	4	431	437
Cruz JR	Reduction of maternal mortality: the need for voluntary blood donors	<i>Int J Gynaecol Obstet</i>	2007	98	3	291	293
Pham TM, Fujino Y, Tokui N, Ide R, Kubo T, Shirane K, Mizoue T, Ogimoto I, Yoshimura T	Mortality and risk factors for stroke and its subtypes in a cohort study in Japan	<i>Prev Med</i>	2007	44	6	526	530
Crabtree T, Aitchison D, Meyers BF, Tymkew H, Smith JR, Guthrie TJ, Munfakh N, Moon MR, Pasque MK, Lawton J, Moazami N, Damiano RJ	<i>Clostridium difficile</i> in cardiac surgery: risk factors and impact on postoperative outcome	<i>Ann Thorac Surg</i>	2007	83	4	1396	1402
Tang ZY, Guo EQ, Yan HC, Xie QP, Lian JA, Wu YL	Risk factors for infectious morbidity in gallbladder cancer patients treated surgically	<i>Hepatogastroenterology</i>	2007	54	73	22	27
Benzoni E, Molaro R, Cedolini C, Favero A, Cojutti A, Lorenzin D, Intini S, Adani GL, Baccarani U, Bresadola F, Uzzacu A	Liver resection for HCC: analysis of causes and risk factors linked to postoperative complications	<i>Hepatogastroenterology</i>	2007	54	73	186	189
Kostopanagioutou G, Pandazi A, Matsota P, Arkadopoulos N, Dalamanga N, Politou M, Traulou O, Smyrniotis V	Effect of packed red blood cells transfusion on plasma fibronectin during liver resection	<i>Transfus Med</i>	2007	17	2	115	118
Artioukh DY, Smith RA, Gokul K	Risk factors for impaired healing of the perineal wound after abdominoperineal resection of rectum for carcinoma	<i>Colorectal Dis</i>	2007	9	4	362	367
Newgard CD, Hedges JR, Adams A, Mullins RJ	Secondary triage: early identification of high-risk trauma patients presenting to non-tertiary hospitals	<i>Prehosp Emerg Care</i>	2007	11	2	154	163
Munoz M, Campos A, Ramirez G	Massive blood transfusion and mortality in polytrauma patients	<i>Vox Sang</i>	2007	92	4	381	
Sakr Y, Chierago M, Piagnerelli M, Verdant C, Dubois MJ, Koch M, Creteur J, Gullo A, Vincent JL, De BD	Microvascular response to red blood cell transfusion in patients with severe sepsis	<i>Crit Care Med</i>	2007	35	7	1639	1644
Mutsaerts E, Zoetmulder F, Hart A, van CF	Perioperative morbidity in hepatic surgery	<i>Hepatogastroenterology</i>	2007	54	74	458	462

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Nazli O, Derici H, Tansug T, Yaman I, Bozdog AD, Isguder AS, Bolukbasi H	Survival analysis after surgical treatment of gastric cancer: review of 121 cases	<i>Hepatogastroenterology</i>	2007	54	74	625	629
Wass CT, Long TR, Faust RJ, Yaszemski MJ, Joyner MJ	Changes in red blood cell transfusion practice during the past two decades: a retrospective analysis, with the Mayo database, of adult patients undergoing major spine surgery	<i>Transfusion</i>	2007	47	6	1022	1027
Zeyneloglu P, Pirat A, Guner M, Torgay A, Karakayali H, Arslan G	Predictors of immediate tracheal extubation in the operating room after liver transplantation	<i>Transplant Proc</i>	2007	39	4	1187	1189
Rogers SO, Kilaru RK, Hosokawa P, Henderson WG, Zinner MJ, Khuri SF	Multivariable predictors of postoperative venous thromboembolic events after general and vascular surgery: results from the patient safety in surgery study	<i>J Am Coll Surg</i>	2007	204	6	1211	1221
Ploeg A, Lange C, Lardenoye JW, Breslau P	Nosocomial infections after peripheral arterial bypass surgery	<i>World J Surg</i>	2007	31	8	1687	1692
Huber-Wagner S, Lefering R, Qvick M, Kay MV, Paffrath T, Mutschler W, Kanz KG	Outcome in 757 severely injured patients with traumatic	<i>Resuscitation</i>	2007	75	2	276	285
Tyson GH, Rodriguez E, Elci OC, Koutlas TC, Chitwood WR, Ferguson TB, Kypson AP	cardiorespiratory arrest Cardiac procedures in patients with a body mass index exceeding 45: outcomes and long-term results	<i>Ann Thorac Surg</i>	2007	84	1	3	9
Wang SH, Wei TS, Chen CP	Prognostic analysis of patients with blunt chest trauma admitted to an intensive care unit	<i>J Formos Med Assoc</i>	2007	106	6	444	451
Cheon JH, Kim JS, Ko SJ, Ye BD, Kim SG, Jung HC, Song IS	Risk factors for upper gastrointestinal rebleeding in critically ill patients	<i>Hepatogastroenterology</i>	2007	54	75	766	769
Eckstein HH, Bruckner T, Heider P, Wolf O, Hanke M, Niedermeier HP, Noppeney T, Umscheid T, Wenk H	The relationship between volume and outcome following elective open repair of abdominal aortic aneurysms (AAA) in 131 German hospitals	<i>Eur J Vasc Endovasc Surg</i>	2007	34	3	260	266
Gomez D, Malik HZ, Bonney GK, Wong V, Toogood GJ, Lodge JP, Prasad KR	Steatosis predicts postoperative morbidity following hepatic resection for colorectal metastasis	<i>Br J Surg</i>	2007	94	11	1395	1402
Zhou L, Rui JA, Wang SB, Chen SG, Qu Q, Chi TY, Wei X, Han K, Zhang N, Zhao HT	Outcomes and prognostic factors of cirrhotic patients with hepatocellular carcinoma after radical major hepatectomy	<i>World J Surg</i>	2007	31	9	1782	1787

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Kulier A, Levin J, Moser R, Rumpold-Seitlinger G, Tudor IC, Snyder-Ramos SA, Moehnle P, Mangano DT	Impact of preoperative anemia on outcome in patients undergoing coronary artery bypass graft surgery	<i>Circulation</i>	2007	116	5	471	479
Plurad D, Martin M, Green D, Salim A, Inaba K, Belzberg H, Demetriades D, Rhee P	The decreasing incidence of late posttraumatic acute respiratory distress syndrome: the potential role of lung protective ventilation and conservative transfusion practice	<i>J Trauma</i>	2007	63	1	1	7
Tralhao JG, Kayal S, Dagher I, Sanhueza M, Vons C, Franco D	Resection of hepatocellular carcinoma: the effect of surgical margin and blood transfusion on long-term survival. Analysis of 209 consecutive patients	<i>Hepatogastroenterology</i>	2007	54	76	1200	1206
Comfere TB, Sprung J, Case KA, Dye PT, Johnson JL, Hall BA, Schroeder DR, Hanson AC, Marienau ME, Warner DO	Predictors of mortality following symptomatic pulmonary embolism in patients undergoing noncardiac surgery	<i>Can J Anaesth</i>	2007	54	8	634	641
Ydy LR, Shhessarenko N, de Aguilar-Nascimento JE	Effect of perioperative allogeneic red blood cell transfusion on the immune-inflammatory response after colorectal cancer resection	<i>World J Surg</i>	2007	31	10	2044	2051
Sjo OH, Lunde OC, Nygaard K, Sandvik L, Nesbakken A	Tumour location is a prognostic factor for survival in colonic cancer patients	<i>Colorectal Dis</i>	2008	10	1	33	40
Musau P	Risk indicators of morbidity and mortality in abdominal injuries	<i>East Afr Med J</i>	2006	83	12	644	650
Malcovati L, Germing U, Kuendgen A, la Porta MG, Pascutto C, Invernizzi R, Giagounidis A, Hildebrandt B, Bernasconi P, Knipp S, Strupp C, Lazzarino M, Aul C, Cazzola M	Time-dependent prognostic scoring system for predicting survival and leukemic evolution in myelodysplastic syndromes	<i>J Clin Oncol</i>	2007	25	23	3503	3510
BuSaba NY, Schaumberg DA	Predictors of prolonged length of stay after major elective head and neck surgery	<i>Laryngoscope</i>	2007	117	10	1756	1763
Augoustides JG, Pochettino A, McGarvey ML, Cowie D, Weiner J, Gambone AJ, Pinchasik D, Bavaria JE	Clinical predictors for mortality in adults undergoing thoracic aortic surgery requiring deep hypothermic circulatory arrest	<i>Ann Card Anaesth</i>	2006	9	2	114	119
Naidech AM, Jovanovic B, Wartenberg KE, Parra A, Ostapkovich N, Connolly ES, Mayer SA, Commichau C	Higher hemoglobin is associated with improved outcome after subarachnoid hemorrhage	<i>Crit Care Med</i>	2007	35	10	2383	2389

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Friedman ND, Bull AL, Russo PL, Leder K, Reid C, Billah B, Marasco S, McBryde E, Richards MJ	An alternative scoring system to predict risk for surgical site infection complicating coronary artery bypass graft surgery	<i>Infect Control Hosp Epidemiol</i>	2007	28	10	1162	1168
Skandberg J, Lundholm K, Haglund E	Effects of blood transfusion with leucocyte depletion on length of hospital stay, respiratory assistance and survival after curative surgery for colorectal cancer	<i>Acta Oncol</i>	2007	46	8	1123	1130
Ho C, Sucato DJ, Richards BS	Risk factors for the development of delayed infections following posterior spinal fusion and instrumentation in adolescent idiopathic scoliosis patients	<i>Spine</i>	2007	32	20	2272	2277
Mathew JP, Mackensen GB, Phillips-Bute B, Stafford-Smith M, Podgoreanu MV, Grocott HP, Hill SE, Smith PK, Blumenthal JA, Reves JG, Newman MF	Effects of extreme hemodilution during cardiac surgery on cognitive function in the elderly	<i>Anesthesiology</i>	2007	107	4	577	584
Webert KE, Cook RJ, Couban S, Carruthers J, Lee KA, Blajchman MA, Lipton JH, Brandwein JM, Heddle NM	A multicenter pilot-randomized controlled trial of the feasibility of an augmented red blood cell transfusion strategy for patients treated with induction chemotherapy for acute leukemia or stem cell transplantation	<i>Transfusion</i>	2008	48	1	81	91
Rosmarakis ES, Prapas SN, Rellos K, Michalopoulos A, Samonis G, Falagas ME	Nosocomial infections after off-pump coronary artery bypass surgery: frequency, characteristics, and risk factors	<i>Interact Cardiovasc Thorac Surg</i>	2007	6	6	759	767
Landoni G, Bove T, Crivellari M, Poli D, Fochi O, Marchetti C, Romano A, Marino G, Zangrillo A	Acute renal failure after isolated CABG surgery: six years of experience	<i>Minerva Anestesiol</i>	2007	73	11	559	565
Blumetti J, Luu M, Sarosi G, Hartless K, McFarlin J, Parker B, Dineen S, Huerta S, Asolati M, Varela E, Anthony T	Surgical site infections after colorectal surgery: do risk factors vary depending on the type of infection considered?	<i>Surgery</i>	2007	142	5	704	711
Arnaoutakis GJ, Bihorac A, Martin TD, Hess PJ, Klodell CT, Ejaz AA, Garvan C, Tribble CG, Beaver TM	RIFLE criteria for acute kidney injury in aortic arch surgery	<i>J Thorac Cardiovasc Surg</i>	2007	134	6	1554	1560
Arru M, Aldrighetti L, Castoldi R, Di PS, Orsenigo E, Stella M, Pulitano C, Gavazzi F, Ferla G, Di C, Staudacher C	Analysis of prognostic factors influencing long-term survival after hepatic resection for metastatic colorectal cancer	<i>World J Surg</i>	2008	32	1	93	103

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Boyd SD, Stenard F, Lee DK, Goodnough LT, Esquivel CO, Fontaine MJ	Alloimmunization to red blood cell antigens affects clinical outcomes in liver transplant patients	<i>Liver Transpl</i>	2007	13	12	1654	1661
Cislaghi F, Conдеми AM, Corona A	Predictors of prolonged mechanical ventilation in a cohort of 3,269 CABG patients	<i>Minerva Anesthesiol</i>	2007	73	12	615	621
Boin IF, Almeida LV, Udo EY, Stucchi RS, Cardoso AR, Caruy CA, Leonardi MI, Leonardi LS	Survival analysis of obese patients undergoing liver transplantation	<i>Transplant Proc</i>	2007	39	10	3225	3227
Pratt W, Joseph S, Callery MP, Vollmer CM	POSSUM accurately predicts morbidity for pancreatic resection	<i>Surgery</i>	2008	143	1	8	19
Karkouti K, Wijeyesundera DN, Beattie WS	Risk associated with preoperative anemia in cardiac surgery: a multicenter cohort study	<i>Circulation</i>	2008	117	4	478	484
Karkouti K, Wijeyesundera DN, Yau TM, McCluskey SA, van RA, Beattie WS	The influence of baseline hemoglobin concentration on tolerance of anemia in cardiac surgery	<i>Transfusion</i>	2008	48	4	666	672
Dowsey MM, Choong PF	Obesity is a major risk factor for prosthetic infection after primary hip arthroplasty	<i>Clin Orthop Relat Res</i>	2008	466	1	153	158
Bambha K, Kim WR, Pedersen R, Bida JP, Kremers WK, Kamath PS	Predictors of early re-bleeding and mortality after acute variceal haemorrhage in patients with cirrhosis	<i>Gut</i>	2008	57	6	814	820
Jia X, Malhotra A, Saeed M, Mark RG, Talmor D	Risk factors for ARDS in patients receiving mechanical ventilation for >48 h	<i>Chest</i>	2008	133	4	853	861
Ngaage DL, Cowen ME, Griffin S, Guvendik L, Cale AR	Early neurological complications after coronary artery bypass grafting and valve surgery in octogenarians	<i>Eur J Cardiothorac Surg</i>	2008	33	4	653	659
Antolovic D, Koch M, Hinz U, Schottler D, Schmidt T, Heger U, Schmidt J, Buchler MW, Weitz J	Ischemic colitis-analysis of risk factors for postoperative mortality	<i>Langenbecks Arch Surg</i>	2008	393	4	507	512
Goh BK, Tan YM, Cheow PC, Chung YF, Chow PK, Wong WK, Ooi LL	Outcome of distal pancreatectomy for pancreatic adenocarcinoma	<i>Dig Surg</i>	2008	25	1	32	38
Hwang SY, Choi YC	Prognostic determinants in patients with traumatic pancreatic injuries	<i>J Korean Med Sci</i>	2008	23	1	126	130
Muller MH, Moubarak P, Wolf H, Kuchenhoff H, Jauch KW, Hartl WH	Independent determinants of early death in critically ill surgical patients	<i>Shock</i>	2008	30	1	11	16

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Mohri Y, Tonouchi H, Miki C, Kobayashi M, Kusunoki M	Incidence and risk factors for hospital-acquired pneumonia after surgery for gastric cancer: results of prospective surveillance	<i>World J Surg</i>	2008	32	6	1045	1050
Kawano Y, Sasaki A, Kai S, Endo Y, Iwaki K, Uchida H, Shibata K, Ohta M, Kitano S	Prognosis of patients with intrahepatic recurrence after hepatic resection for hepatocellular carcinoma: a retrospective study	<i>Eur J Surg Oncol</i>	2008				
Nakano J, Okabayashi H, Hanyu M, Soga Y, Nomoto T, Arai Y, Matsuo T, Kai M, Kawatou M	Risk factors for wound infection after off-pump coronary artery bypass grafting: should bilateral internal thoracic arteries be harvested in patients with diabetes?	<i>J Thorac Cardiovasc Surg</i>	2008	135	3	540	545
Lorenzo CS, Limm WM, Lurie F, Wong LL	Factors affecting outcome in liver resection	<i>HPB (Oxford)</i>	2005	7	3	226	230
Christein JD, Kendrick ML, Que FG	What affects mortality after the operative management of hepatic abscess?	<i>HPB (Oxford)</i>	2006	8	3	175	178
de PM, McRae K, Anraku M, Karkouti K, Waddell TK, Pierre AF, Darling G, Keshavjee S, Johnston MR	Risk factors for major complications after extrapleural pneumonectomy for malignant pleural mesothelioma	<i>Ann Thorac Surg</i>	2008	85	4	1206	1210
Wahl WL, Hemmila MR, Maggio PM, Arbab S	Restrictive red blood cell transfusion: not just for the stable intensive care unit patient	<i>Am J Surg</i>	2008	195	6	803	806
Spinella PC, Perkins JG, Grathwohl KW, Beekley AC, Niles SE, McLaughlin DF, Wade CE, Holcomb JB	Effect of plasma and red blood cell transfusions on survival in patients with combat related traumatic injuries	<i>J Trauma</i>	2008	64	2 Suppl	S69	S77
Hamilton H, Jamieson J	Deep infection in total hip arthroplasty	<i>Can J Surg</i>	2008	51	2	111	117
Yanar H, Ertekin C, Taviloglu K, Kabay B, Bakkaloglu H, Guloglu R	Nonoperative treatment of multiple intra-abdominal solid organ injury after blunt abdominal trauma	<i>J Trauma</i>	2008	64	4	943	948
Moore FA, Nelson T, McKinley BA, Moore EE, Nathens AB, Rhee P, Puyana JC, Beilman GJ, Cohn SM	Massive transfusion in trauma patients: tissue hemoglobin oxygen saturation predicts poor outcome	<i>J Trauma</i>	2008	64	4	1010	1023
Jegger D, Revelly JP, Horisberger J, von Segesser LK, Ruchat P	Establishing an association between a peri-operative perfusion score system (PerfSCORE) and post-operative patient morbidity/mortality during CPB cardiac surgery	<i>Perfusion</i>	2007	22	5	311	316

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Appendix 1 (continued)

Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Valente A, Sorrentino L, La TG, Draisci G	Post-transfusional variation in urinary oxygen tension in surgical patients	<i>Clin Exp Pharmacol Physiol</i>	2008	35	9	1109	1112
Tang H, Chelamcharla M, Baird BC, Shihab FS, Koford JK, Goldfarb-Rumyantzev AS	Factors affecting kidney-transplant outcome in recipients with lupus nephritis	<i>Clin Transplant</i>	2008	22	3	263	272
Husted H, Holm G, Jacobsen S	Predictors of length of stay and patient satisfaction after hip and knee replacement surgery: fast-track experience in 712 patients	<i>Acta Orthop</i>	2008	79	2	168	173
Roy P, Raya V, Okabe T, Pinto Slottow TL, Steinberg DH, Smith K, Xue Z, Satler LF, Kent KM, Suddath WO, Pichard AD, Lindsay J, Waksman R	Incidence, predictors, and outcomes of post-percutaneous coronary intervention nephropathy in patients with diabetes mellitus and normal baseline serum creatinine levels	<i>Am J Cardiol</i>	2008	101	11	1544	1549
Poultides GA, Kim CJ, Orlando R, Peros G, Hallisey MJ, Vignati PV	Angiographic embolization for gastroduodenal hemorrhage: safety, efficacy, and predictors of outcome	<i>Arch Surg</i>	2008	143	5	457	461
Asensio A, Ramos A, Cuervas-Mons V, Cordero E, Sanchez-Turrion V, Blanes M, Cervera C, Gavalda J, Aguado JM, Torre-Cisneros J	Effect of antibiotic prophylaxis on the risk of surgical site infection in orthotopic liver transplant	<i>Liver Transpl</i>	2008	14	6	799	805
Duzgun AP, Ozmen MM, Saylam B, Coskun F	Factors influencing mortality in traumatic ruptures of diaphragm	<i>Ulus Travma Acil Cerrahi Derg</i>	2008	14	2	132	138
Wu JS, Sheng L, Wang SH, Gu J, Ma YF, Zhang M, Gan JX, Xu SW, Zhou W, Xu SX, Li Q, Jiang GY	The impact of clinical risk factors in the conversion from acute lung injury to acute respiratory distress syndrome in severe multiple trauma patients	<i>J Int Med Res</i>	2008	36	3	579	586
Naidech AM, Kahn MJ, Soong W, Green D, Batjer HH, Bleck TP	Packed red blood cell transfusion causes greater hemoglobin rise at a lower starting hemoglobin in patients with subarachnoid hemorrhage	<i>Neurocrit Care</i>	2008	9	2	198	203
Strate LL, Ayanian JZ, Kotler G, Syngal S	Risk factors for mortality in lower intestinal bleeding	<i>Clin Gastroenterol Hepatol</i>	2008	6	9	1004	1010
Yap CH, Lau L, Krishnaswamy M, Gaskell M, Yii M	Age of transfused red cells and early outcomes after cardiac surgery	<i>Ann Thorac Surg</i>	2008	86	2	554	559
Gomez D, Morris-Stiff G, Wyatt J, Toogood GJ, Lodge JP, Prasad KR	Surgical technique and systemic inflammation influences long-term disease-free survival following hepatic resection for colorectal metastasis	<i>J Surg Oncol</i>	2008	98	5	371	376

Appendix 1 (continued)

Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Bostrom PJ, Kossi J, Laato M, Nurmi M	Risk factors for mortality and morbidity related to radical cystectomy	<i>BJU Int</i>	2008				
Weinberg JA, McGwin G, Griffin RL, Huynh VQ, Cherry SA, Marques MB, Reiff DA, Kerby JD, Rue LW	Age of transfused blood: an independent predictor of mortality despite universal leukoreduction	<i>J Trauma</i>	2008	65	2	279	282
Fathy O, Wahab MA, Elghwalby N, Sultan A, EL-Ebidy G, Hak NG, Abu ZM, bd-Allah T, El-Shobary M, Fouad A, Kandeel T, Abo EA, bd El-Raouf A, Hamdy E, Sultan AM, Hamdy E, Ezzat F	216 cases of pancreaticoduodenectomy: risk factors for postoperative complications	<i>Hepatogastroenterology</i>	2008	55	84	1093	1098
Chen JS, Changchien CR, Tang R	Postoperative fever and survival in patients after open resection for colorectal cancer: a long-term follow-up study of 2,311 prospectively enrolled patients	<i>Dis Colon Rectum</i>	2008	51	11	1649	1655
Olsen MA, Lefta M, Dietz JR, Brandt KE, Aft R, Matthews R, Mayfield J, Fraser VJ	Risk factors for surgical site infection after major breast operation	<i>J Am Coll Surg</i>	2008	207	3	326	335
Manguso F, Riccio E, Bennato R, Picascia S, Martino R, De NG, Fiorito R, Balzano A	In-hospital mortality in non-variceal upper gastrointestinal bleeding Forrest 1 patients	<i>Scand J Gastroenterol</i>	2008			1	10
Gao R, Yang ZZ, Li M, Shi ZC, Fu Q	Probable risk factors for postoperative delirium in patients undergoing spinal surgery	<i>Eur Spine J</i>	2008				
Senay S, Toraman F, Gunaydin S, Kilercik M, Karabulut H, Alhan C	The impact of allogenic red cell transfusion and coated bypass circuit on the inflammatory response during cardiopulmonary bypass: a randomized study	<i>Interact Cardiovasc Thorac Surg</i>	2008				
Magnason S, Kristinsson KG, Stefansson T, Erlendsdottir H, Jonsdottir K, Kristjansson M, Jonmundsson E, Baldursdottir L, Sigvaldason H, Gudmundsson S	Risk factors and outcome in ICU-acquired infections	<i>Acta Anaesthesiol Scand</i>	2008	52	9	1238	1245
Estrera AL, Miller CC, Lee TY, Shah P, Safi HJ	Ascending and transverse aortic arch repair: the impact of retrograde cerebral perfusion	<i>Circulation</i>	2008	118	14	S160	S166
Cartin-Ceba R, Gajic O, Iyer V, Vlahakis NE	Fetal outcomes of critically ill pregnant women admitted to the intensive care unit for nonobstetric causes	<i>Crit Care Med</i>	2008				
Antonello M, Frigatti P, Maturi C, Lepidi S, Noventa F, Pittoni G, Deriu GP, Grego F	Open repair for ruptured abdominal aortic aneurysm: is it possible to predict survival?	<i>Ann Vasc Surg</i>	2008				

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Appendix 1 (continued)

Authors	Title	Journal	Year	Volume	Issue	Start Page	End Page
Bower WF, Cheung CS, Lai RW, Underwood MJ, van Hasselt CA	An audit of risk factors for wound infection in patients undergoing coronary artery bypass grafting or valve replacement	<i>Hong Kong Med J</i>	2008	14	5	371	378
Sareyyupoglu B, Kirali K, Goksedef D, Rabus MB, Tuncer A, Erentug V, Mansuroglu D, Yakut C	Factors associated with long-term survival following cardiac transplantation	<i>Anadolu Kardiyol Derg</i>	2008	8	5	360	366
Holguin F, Ramadan B, Gal AA, Roman J	Prognostic factors for hospital mortality and ICU admission in patients with ANCA-related pulmonary vasculitis	<i>Am J Med Sci</i>	2008	336	4	321	326
Ramos M, Khalpey Z, Lipsitz S, Steinberg J, Panizales MT, Zinner M, Rogers SO	Relationship of perioperative hyperglycemia and postoperative infections in patients who undergo general and vascular surgery	<i>Ann Surg</i>	2008	248	4	585	591
Teixeira PG, Oncel D, Demetriades D, Inaba K, Shulman I, Green D, Plurad D, Rhee P	Blood transfusions in trauma: six-year analysis of the transfusion practices at a level I trauma center	<i>Am Surg</i>	2008	74	10	953	957

Appendix 2

Final Appropriateness Ratings

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	Yes	≤7.9	Appropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	Yes	≤7.9	Appropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	No	≤7.9	Appropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	Yes	≤7.9	Appropriate
1.3.2. Patient is admitted to ICU with sepsis	≥65	Yes	≤7.9	Appropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	Yes	≤7.9	Appropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	Yes	≤7.9	Appropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	Yes	≤7.9	Appropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	Yes	≤7.9	Appropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	Yes	≤7.9	Appropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	Yes	≤7.9	Appropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	No	≤7.9	Appropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	Yes	≤7.9	Appropriate

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	Yes	≤7.9	Appropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	Yes	≤7.9	Appropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	Yes	≤7.9	Appropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	Yes	≤7.9	Appropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	No	≤7.9	Appropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	Yes	≤7.9	Appropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	Yes	≤7.9	Appropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	No	≤7.9	Appropriate
1.7.4. Patient is admitted with acute pancreatitis	≤64	Yes	≤7.9	Appropriate
1.7.4. Patient is admitted with acute pancreatitis	≥65	Yes	≤7.9	Appropriate
2.1.1. Patient is admitted for elective CABG	≤64	Yes	≤7.9	Appropriate
2.1.1. Patient is admitted for elective CABG	≥65	Yes	≤7.9	Appropriate
2.1.2. Patient is admitted for elective valve replacement	≤64	Yes	≤7.9	Appropriate
2.1.2. Patient is admitted for elective valve replacement	≥65	Yes	≤7.9	Appropriate
2.1.3. Patient is admitted for CABG/valve replacement	≤64	Yes	≤7.9	Appropriate
2.1.3. Patient is admitted for CABG/valve replacement	≥65	Yes	≤7.9	Appropriate
2.1.5. Patient is admitted for PCI	≤64	Yes	≤7.9	Appropriate
2.1.5. Patient is admitted for PCI	≥65	Yes	≤7.9	Appropriate
2.2.1. Patient is admitted for large bowel surgery	≥65	Yes	≤7.9	Appropriate
2.3.1. Patient is admitted for elective large joint replacement	≥65	Yes	≤7.9	Appropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≥65	Yes	≤7.9	Appropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	Yes	≤7.9	Appropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	Yes	≤7.9	Appropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	No	≤7.9	Appropriate
2.4.1. Patient is admitted for semi-elective ovarian tumor debulking	≤64	Yes	≤7.9	Appropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	Yes	≤7.9	Appropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	Yes	≤7.9	Appropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	Yes	≤7.9	Appropriate
2.6.1. Patient is admitted for femoral distal bypass	≥65	Yes	≤7.9	Appropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	Yes	≤7.9	Appropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	Yes	≤7.9	Appropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	No	≤7.9	Appropriate
2.7.3. Patient is admitted for liver transplantation	≤64	Yes	≤7.9	Appropriate
2.7.3. Patient is admitted for liver transplantation	≥65	Yes	≤7.9	Appropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	Yes	≤7.9	Appropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	Yes	≤7.9	Appropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	Yes	≤7.9	Appropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	Yes	≤7.9	Appropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	Yes	≤7.9	Appropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	Yes	≤7.9	Appropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	Yes	≥10	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	No	8-9.9	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	No	≥10	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	Yes	≥10	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	No	8-9.9	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	No	≥10	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	Yes	8-9.9	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	Yes	≥10	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	No	8-9.9	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	No	≥10	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	Yes	≥10	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	No	8-9.9	Inappropriate
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	No	≥10	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≤64	Yes	8-9.9	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≤64	Yes	≥10	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≤64	No	8-9.9	Inappropriate

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Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
1.3.2. Patient is admitted to ICU with sepsis	≤64	No	≥10	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≥65	Yes	8-9.9	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≥65	Yes	≥10	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≥65	No	8-9.9	Inappropriate
1.3.2. Patient is admitted to ICU with sepsis	≥65	No	≥10	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	Yes	8-9.9	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	Yes	≥10	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	No	8-9.9	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	No	≥10	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	Yes	8-9.9	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	Yes	≥10	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	No	8-9.9	Inappropriate
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	No	≥10	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	Yes	8-9.9	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	Yes	≥10	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	No	8-9.9	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	No	≥10	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	Yes	8-9.9	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	Yes	≥10	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	No	8-9.9	Inappropriate
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	No	≥10	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	Yes	8-9.9	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	Yes	≥10	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	No	≤7.9	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	No	8-9.9	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	No	≥10	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	Yes	8-9.9	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	Yes	≥10	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	No	8-9.9	Inappropriate
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	No	≥10	Inappropriate
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	Yes	≥10	Inappropriate
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	No	≥10	Inappropriate
1.4.1. Patient is diagnosed with a high prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	Yes	≥10	Inappropriate
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	No	≥10	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	Yes	8-9.9	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	Yes	≥10	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	No	8-9.9	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	No	≥10	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	Yes	8-9.9	Inappropriate

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	Yes	≥10	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	No	8-9.9	Inappropriate
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	No	≥10	Inappropriate
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	Yes	≥10	Inappropriate
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	No	8-9.9	Inappropriate
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	No	≥10	Inappropriate
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	Yes	≥10	Inappropriate
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	No	≥10	Inappropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	Yes	≥10	Inappropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	No	8-9.9	Inappropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	No	≥10	Inappropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	Yes	≥10	Inappropriate
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	No	≥10	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	Yes	≥10	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	No	8-9.9	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	No	≥10	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	Yes	≥10	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	No	8-9.9	Inappropriate
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	No	≥10	Inappropriate
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≤64	Yes	≥10	Inappropriate
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≤64	No	≥10	Inappropriate
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	Yes	≥10	Inappropriate
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	No	≥10	Inappropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	Yes	≥10	Inappropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	No	≥10	Inappropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	Yes	≥10	Inappropriate
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	No	≥10	Inappropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	Yes	≥10	Inappropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	No	≥10	Inappropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	Yes	≥10	Inappropriate
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	No	≥10	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≤64	Yes	8-9.9	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≤64	Yes	≥10	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≤64	No	8-9.9	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≤64	No	≥10	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≥65	Yes	8-9.9	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≥65	Yes	≥10	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≥65	No	8-9.9	Inappropriate
1.7.4. Patient is admitted with acute pancreatitis	≥65	No	≥10	Inappropriate
2.1.1. Patient is admitted for elective CABG	≤64	Yes	≥10	Inappropriate
2.1.1. Patient is admitted for elective CABG	≤64	No	8-9.9	Inappropriate
2.1.1. Patient is admitted for elective CABG	≤64	No	≥10	Inappropriate
2.1.1. Patient is admitted for elective CABG	≥65	Yes	8-9.9	Inappropriate
2.1.1. Patient is admitted for elective CABG	≥65	Yes	≥10	Inappropriate
2.1.1. Patient is admitted for elective CABG	≥65	No	8-9.9	Inappropriate
2.1.1. Patient is admitted for elective CABG	≥65	No	≥10	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≤64	Yes	≥10	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≤64	No	8-9.9	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≤64	No	≥10	Inappropriate

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Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
2.1.2. Patient is admitted for elective valve replacement	≥65	Yes	8-9.9	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≥65	Yes	≥10	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≥65	No	8-9.9	Inappropriate
2.1.2. Patient is admitted for elective valve replacement	≥65	No	≥10	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≤64	Yes	8-9.9	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≤64	Yes	≥10	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≤64	No	8-9.9	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≤64	No	≥10	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≥65	Yes	8-9.9	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≥65	Yes	≥10	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≥65	No	8-9.9	Inappropriate
2.1.3. Patient is admitted for CABG/valve replacement	≥65	No	≥10	Inappropriate
2.1.5. Patient is admitted for PCI	≤64	Yes	≥10	Inappropriate
2.1.5. Patient is admitted for PCI	≤64	No	8-9.9	Inappropriate
2.1.5. Patient is admitted for PCI	≤64	No	≥10	Inappropriate
2.1.5. Patient is admitted for PCI	≥65	Yes	8-9.9	Inappropriate
2.1.5. Patient is admitted for PCI	≥65	Yes	≥10	Inappropriate
2.1.5. Patient is admitted for PCI	≥65	No	8-9.9	Inappropriate
2.1.5. Patient is admitted for PCI	≥65	No	≥10	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≤64	Yes	8-9.9	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≤64	Yes	≥10	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≤64	No	≤7.9	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≤64	No	8-9.9	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≤64	No	≥10	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≥65	Yes	8-9.9	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≥65	Yes	≥10	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≥65	No	8-9.9	Inappropriate
2.2.1. Patient is admitted for large bowel surgery	≥65	No	≥10	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≤64	Yes	8-9.9	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≤64	Yes	≥10	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≤64	No	8-9.9	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≤64	No	≥10	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≥65	Yes	8-9.9	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≥65	Yes	≥10	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≥65	No	8-9.9	Inappropriate
2.3.1. Patient is admitted for elective large joint replacement	≥65	No	≥10	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	Yes	8-9.9	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	Yes	≥10	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	No	8-9.9	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	No	≥10	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction.	≥65	Yes	≥10	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≥65	No	8-9.9	Inappropriate
2.3.2. Patient is admitted for elective large spinal reconstruction	≥65	No	≥10	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	Yes	≥10	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	No	8-9.9	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	No	≥10	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	Yes	≥10	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	No	8-9.9	Inappropriate
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	No	≥10	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≤64	Yes	8-9.9	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≤64	Yes	≥10	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≤64	No	8-9.9	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≤64	No	≥10	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	Yes	≥10	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	No	8-9.9	Inappropriate
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	No	≥10	Inappropriate
2.4.2. Patient is immediately status postcesarean section	≤64	Yes	8-9.9	Inappropriate

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
2.4.2. Patient is immediately status postcesarean section	≤64	Yes	≥10	Inappropriate
2.4.2. Patient is immediately status postcesarean section	≤64	No	≤7.9	Inappropriate
2.4.2. Patient is immediately status postcesarean section	≤64	No	8-9.9	Inappropriate
2.4.2. Patient is immediately status postcesarean section	≤64	No	≥10	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	Yes	8-9.9	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	Yes	≥10	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	No	≤7.9	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	No	8-9.9	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	No	≥10	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	Yes	8-9.9	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	Yes	≥10	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	No	8-9.9	Inappropriate
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	No	≥10	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	Yes	8-9.9	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	Yes	≥10	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	No	8-9.9	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	No	≥10	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	Yes	8-9.9	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	Yes	≥10	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	No	8-9.9	Inappropriate
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	No	≥10	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	Yes	8-9.9	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	Yes	≥10	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	No	8-9.9	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	No	≥10	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	Yes	8-9.9	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	Yes	≥10	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	No	8-9.9	Inappropriate
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	No	≥10	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≤64	Yes	≥10	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≤64	No	8-9.9	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≤64	No	≥10	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≥65	Yes	≥10	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≥65	No	8-9.9	Inappropriate
2.6.1. Patient is admitted for femoral distal bypass	≥65	No	≥10	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	Yes	8-9.9	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	Yes	≥10	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	No	8-9.9	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	No	≥10	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	Yes	8-9.9	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	Yes	≥10	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	No	8-9.9	Inappropriate
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≥65	No	≥10	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	Yes	8-9.9	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	Yes	≥10	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	No	≤7.9	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	No	8-9.9	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	No	≥10	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	Yes	8-9.9	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	Yes	≥10	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	No	8-9.9	Inappropriate
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	No	≥10	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≤64	Yes	≥10	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≤64	No	≤7.9	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≤64	No	8-9.9	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≤64	No	≥10	Inappropriate

(continued on next page)

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
2.7.3. Patient is admitted for liver transplantation	≥65	Yes	≥10	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≥65	No	8-9.9	Inappropriate
2.7.3. Patient is admitted for liver transplantation	≥65	No	≥10	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≤64	Yes	≥10	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≤64	No	8-9.9	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≤64	No	≥10	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≥65	Yes	≥10	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≥65	No	8-9.9	Inappropriate
2.8.1. Patient is admitted status postabdominal flap	≥65	No	≥10	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	Yes	8-9.9	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	Yes	≥10	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	No	8-9.9	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	No	≥10	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	Yes	8-9.9	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	Yes	≥10	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	No	8-9.9	Inappropriate
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	No	≥10	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	Yes	8-9.9	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	Yes	≥10	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	No	8-9.9	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	No	≥10	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	Yes	8-9.9	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	Yes	≥10	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	No	8-9.9	Inappropriate
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	No	≥10	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	Yes	≤7.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	Yes	8-9.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	Yes	≥10	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	No	≤7.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	No	8-9.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≤64	No	≥10	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	Yes	8-9.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	Yes	≥10	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	No	≤7.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	No	8-9.9	Inappropriate
3.1.0. Patient with GCS of 14 is admitted to ED with blunt trauma	≥65	No	≥10	Inappropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	Yes	≥10	Inappropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	No	8-9.9	Inappropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	No	≥10	Inappropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	Yes	≥10	Inappropriate
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	No	≥10	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	Yes	8-9.9	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	Yes	≥10	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	No	≤7.9	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	No	8-9.9	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	No	≥10	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	Yes	8-9.9	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	Yes	≥10	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	No	8-9.9	Inappropriate
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	No	≥10	Inappropriate
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	Yes	8-9.9	Uncertain
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≤64	No	≤7.9	Uncertain
1.2.1. Patient is admitted to the cardiac unit with (suspected) acute coronary syndrome	≥65	Yes	8-9.9	Uncertain
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	Yes	≤7.9	Uncertain
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≤64	No	≤7.9	Uncertain
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	Yes	8-9.9	Uncertain
1.3.1. Patient is admitted to ICU with noncardiogenic shock	≥65	No	≤7.9	Uncertain

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
1.3.2. Patient is admitted to ICU with sepsis	≤64	Yes	≤7.9	Uncertain
1.3.2. Patient is admitted to ICU with sepsis	≤64	No	≤7.9	Uncertain
1.3.2. Patient is admitted to ICU with sepsis	≥65	No	≤7.9	Uncertain
1.3.3. Patient is admitted to ICU with multiple organ failure	≤64	No	≤7.9	Uncertain
1.3.3. Patient is admitted to ICU with multiple organ failure	≥65	No	≤7.9	Uncertain
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≤64	No	≤7.9	Uncertain
1.3.4. Patient is admitted to ICU with respiratory failure requiring use of ventilatory support	≥65	No	≤7.9	Uncertain
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≤64	Yes	≤7.9	Uncertain
1.3.6. Patient has been on mechanical ventilation and is due to be weaned	≥65	No	≤7.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	Yes	≤7.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	Yes	8-9.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	No	≤7.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≤64	No	8-9.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	Yes	≤7.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	Yes	8-9.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	No	≤7.9	Uncertain
1.4.1. Patient is diagnosed with a high-prevalence cancer and is undergoing radiotherapy (in/outpatient)	≥65	No	8-9.9	Uncertain
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	Yes	≤7.9	Uncertain
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≤64	No	≤7.9	Uncertain
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	Yes	≤7.9	Uncertain
1.4.2. Patient with cancer-related and/or chemotherapy-induced anemia is admitted with fever	≥65	No	≤7.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	Yes	≤7.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	Yes	8-9.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≤64	No	≤7.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	Yes	≤7.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	Yes	8-9.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	No	≤7.9	Uncertain
1.4.8. Patient with myelodysplastic syndrome is admitted with fever	≥65	No	8-9.9	Uncertain
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≤64	Yes	8-9.9	Uncertain
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	Yes	8-9.9	Uncertain
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	No	≤7.9	Uncertain
1.4.9. Patient with sickle cell disease is admitted for elective surgery	≥65	No	8-9.9	Uncertain
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	Yes	8-9.9	Uncertain
1.5.1. Patient is admitted with acute brain attack (stroke)	≤64	No	≤7.9	Uncertain
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	Yes	8-9.9	Uncertain
1.5.1. Patient is admitted with acute brain attack (stroke)	≥65	No	≤7.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≤64	Yes	≤7.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≤64	Yes	8-9.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding	≤64	No	≤7.9	Uncertain

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Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
with potential for vasospasm				
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≤64	No	8-9.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	Yes	≤7.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	Yes	8-9.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	No	≤7.9	Uncertain
1.5.2. Patient is admitted with subarachnoid/intercranial bleeding with potential for vasospasm	≥65	No	8-9.9	Uncertain
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	Yes	8-9.9	Uncertain
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	No	≤7.9	Uncertain
1.7.1. Patient is admitted to ED with upper GI bleeding	≤64	No	8-9.9	Uncertain
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	Yes	8-9.9	Uncertain
1.7.1. Patient is admitted to ED with upper GI bleeding	≥65	No	8-9.9	Uncertain
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	Yes	8-9.9	Uncertain
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	No	≤7.9	Uncertain
1.7.2. Patient is admitted to ED with lower GI bleeding	≤64	No	8-9.9	Uncertain
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	Yes	8-9.9	Uncertain
1.7.2. Patient is admitted to ED with lower GI bleeding	≥65	No	8-9.9	Uncertain
1.7.4. Patient is admitted with acute pancreatitis	≤64	No	≤7.9	Uncertain
1.7.4. Patient is admitted with acute pancreatitis	≥65	No	≤7.9	Uncertain
2.1.1. Patient is admitted for elective CABG	≤64	Yes	8-9.9	Uncertain
2.1.1. Patient is admitted for elective CABG	≤64	No	≤7.9	Uncertain
2.1.1. Patient is admitted for elective CABG	≥65	No	≤7.9	Uncertain
2.1.2. Patient is admitted for elective valve replacement	≤64	Yes	8-9.9	Uncertain
2.1.2. Patient is admitted for elective valve replacement	≤64	No	≤7.9	Uncertain
2.1.2. Patient is admitted for elective valve replacement	≥65	No	≤7.9	Uncertain
2.1.3. Patient is admitted for CABG/valve replacement	≤64	No	≤7.9	Uncertain
2.1.3. Patient is admitted for CABG/ valve replacement	≥65	No	≤7.9	Uncertain
2.1.5. Patient is admitted for PCI	≤64	Yes	8-9.9	Uncertain
2.1.5. Patient is admitted for PCI	≤64	No	≤7.9	Uncertain
2.1.5. Patient is admitted for PCI	≥65	No	≤7.9	Uncertain
2.2.1. Patient is admitted for large bowel surgery	≤64	Yes	≤7.9	Uncertain
2.2.1. Patient is admitted for large bowel surgery	≥65	No	≤7.9	Uncertain
2.3.1. Patient is admitted for elective large joint replacement	≤64	Yes	≤7.9	Uncertain
2.3.1. Patient is admitted for elective large joint replacement	≤64	No	≤7.9	Uncertain
2.3.1. Patient is admitted for elective large joint replacement	≥65	No	≤7.9	Uncertain
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	Yes	≤7.9	Uncertain
2.3.2. Patient is admitted for elective large spinal reconstruction	≤64	No	≤7.9	Uncertain
2.3.2. Patient is admitted for elective large spinal reconstruction	≥65	Yes	8-9.9	Uncertain
2.3.2. Patient is admitted for elective large spinal reconstruction	≥65	No	≤7.9	Uncertain
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	Yes	8-9.9	Uncertain
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≤64	No	≤7.9	Uncertain
2.3.3. Patient is admitted to ED with hip fracture requiring surgical repair	≥65	Yes	8-9.9	Uncertain
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≤64	No	≤7.9	Uncertain
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	Yes	8-9.9	Uncertain
2.4.1. Patient is admitted for semielective ovarian tumor debulking	≥65	No	≤7.9	Uncertain
2.4.2. Patient is immediately status postcesarean section	≤64	Yes	≤7.9	Uncertain
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≤64	Yes	≤7.9	Uncertain
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	Yes	≤7.9	Uncertain
2.4.3. Patient is admitted for elective total abdominal hysterectomy	≥65	No	≤7.9	Uncertain
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	Yes	≤7.9	Uncertain
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≤64	No	≤7.9	Uncertain
2.5.1. Patient with a high-prevalence cancer is admitted for elective cancer surgery	≥65	No	≤7.9	Uncertain
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	Yes	≤7.9	Uncertain

Appendix 2 (continued)

Scenario	Age (y)	Comorbidity	Hb level (g/dL)	Appropriateness
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≤64	No	≤7.9	Uncertain
2.5.2. Patient with high prevalent metastatic cancer is admitted for surgery	≥65	No	≤7.9	Uncertain
2.6.1. Patient is admitted for femoral distal bypass	≤64	Yes	≤7.9	Uncertain
2.6.1. Patient is admitted for femoral distal bypass	≤64	Yes	8-9.9	Uncertain
2.6.1. Patient is admitted for femoral distal bypass	≤64	No	≤7.9	Uncertain
2.6.1. Patient is admitted for femoral distal bypass	≥65	Yes	8-9.9	Uncertain
2.6.1. Patient is admitted for femoral distal bypass	≥65	No	≤7.9	Uncertain
2.6.2. Patient is admitted for elective AAA repair (surgical or stenting)	≤64	No	≤7.9	Uncertain
2.7.2. Dialysis patient is admitted for renal transplantation	≤64	Yes	≤7.9	Uncertain
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	Yes	≤7.9	Uncertain
2.7.2. Dialysis patient is admitted for renal transplantation	≥65	No	≤7.9	Uncertain
2.7.3. Patient is admitted for liver transplantation	≤64	Yes	8-9.9	Uncertain
2.7.3. Patient is admitted for liver transplantation	≥65	Yes	8-9.9	Uncertain
2.7.3. Patient is admitted for liver transplantation	≥65	No	≤7.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≤64	Yes	≤7.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≤64	Yes	8-9.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≤64	No	≤7.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≥65	Yes	≤7.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≥65	Yes	8-9.9	Uncertain
2.8.1. Patient is admitted status postabdominal flap	≥65	No	≤7.9	Uncertain
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≤64	No	≤7.9	Uncertain
2.9.0. Patient is admitted for a major urology surgery (can be malignancy)	≥65	No	≤7.9	Uncertain
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	Yes	≤7.9	Uncertain
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≤64	No	≤7.9	Uncertain
2.A.0. Patient is admitted for a major head and neck surgery (can be malignancy)	≥65	No	≤7.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	Yes	≤7.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	Yes	8-9.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≤64	No	≤7.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	Yes	8-9.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	No	≤7.9	Uncertain
3.2.0. Patient is admitted to ED with traumatic brain injury (GCS <10)	≥65	No	8-9.9	Uncertain
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≤64	Yes	≤7.9	Uncertain
3.3.0. Patient is admitted to service with 70% of body with third-degree burns	≥65	No	≤7.9	Uncertain

Abbreviations: ICU, intensive care unit; ED, emergency department; GI, gastrointestinal; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention; GCS, Glasgow Coma Score.