Brief Report

Defining Serious Illness Among Adult Surgical Patients

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Abstract

Context. Palliative care (PC) for seriously ill surgical patients, including aligning treatments with patients' goals and managing symptoms, is associated with improved patient-oriented outcomes and decreased health care utilization. However, efforts to integrate PC alongside restorative surgical care are limited by the lack of a consensus definition for serious illness in the perioperative context.

Objectives. The objectives of this study were to develop a serious illness definition for surgical patients and identify a denominator for quality measurement efforts.

Methods. We developed a preliminary definition including a set of criteria for 11 conditions and health states. Using the RAND-UCLA Appropriateness Method, a 12-member expert advisory panel rated the criteria for each condition and health state twice, once after an in-person moderated discussion, for validity (primary outcome) and feasibility of measurement.

Results. All panelists completed both rounds of rating. All 11 conditions and health states defining serious illness for surgical patients were rated as valid. During the in-person discussion, panelists refined and narrowed criteria for two conditions (vulnerable elder, heart failure). The final definition included the following 11 conditions and health states: vulnerable elder, heart failure, advanced cancer, oxygen-dependent pulmonary disease, cirrhosis, end-stage renal disease, dementia, critical trauma, frailty, nursing home residency, and American Society of Anesthesiology Risk Score IV-V.

Conclusion. We identified a consensus definition for serious illness in surgery. Opportunities remain in measuring the prevalence, identifying health trajectories, and developing screening criteria to integrate PC with restorative surgical care. J Pain Symptom Manage 2019;58:844–850. © *2019 American Academy of Hospice and Palliative Medicine. Published by Elsevier Inc. All rights reserved.*

Key Words

Surgical palliative care, serious illness, quality improvement, quality measurement, RAND-UCLA Appropriateness Method, Delphi methods

Introduction

Palliative care (PC) is interdisciplinary care aimed at improving quality of life and reducing suffering for seriously ill patients and families. When delivered alongside curative or restorative surgical care, PC decreases symptom burden, reduces health care utilization, and improves the quality of end-of-life care without impacting mortality.[1–3] In light of these benefits, there have been increasing calls to integrate PC with surgical care, including a statement of principles from the American College of Surgeons (ACS), a national research agenda sponsored by the National Institute of Aging and National Palliative Care Research Center,

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the release of PC best practice guidelines within ACS quality improvement programs, and ACS endorsement of the National Consensus Project Clinical Practice Guidelines for Quality Palliative Care.[4–8] Furthermore, there are ongoing efforts to develop quality indicators to guide primary PC delivery by surgical teams, which would measure access to and the quality of PC delivered across the surgical episode.[9]

However, efforts to integrate PC into routine surgical care are hindered by the lack of consensus around the seriously ill population that would benefit most from receiving PC concurrent with surgical care. Serious illness is a broader definition of high-risk patients, defined as "a health condition that carries a high risk of mortality and either negatively impacts a person's daily function or quality of life or excessively strains their caregivers."[8,10] This definition accounts for the burden of symptoms and treatment for serious medical conditions and includes the functional and social impact of illness on the patients and their family. Although there are ongoing efforts to operationalize a serious illness definition among medical populations,[11–14] these definitions may not be sensitive enough to capture serious illness within the dynamic context of the surgical episode. In particular, the physical resiliency necessary to recover after a health stressor such as surgery is a key characteristic that highlights a need to operationalize a definition for serious illness for surgical populations that is separate from medical populations.[15] For example, healthy patients or those with earlier stages of chronic medical illness may acutely worsen during the perioperative period or after traumatic injury, placing them at high risk of mortality or chronic functional and cognitive impairment. Therefore, a surgical patient may be seriously ill preoperatively due to their underlying health condition or become seriously ill perioperatively due to the physiological impact of the surgical condition or procedure.

A crucial step toward integrating PC with surgical care is to develop a highly sensitive definition of serious illness, one that broadly identifies a population that could benefit from early primary PC during the surgical episode and could be detected in the electronic health record. We engaged a multidisciplinary expert advisory panel to develop a consensus definition for serious illness among adults in the perioperative setting. Our objective was to define the denominator population to which surgical PC quality indicators should be applied.

Methods

We used the RAND/University of California, Los Angeles Appropriateness Method (RAM), a modified Delphi method, for this study. Although originally developed to reach consensus on the appropriateness of clinical interventions,[16] this method has been modified in other studies and shown to be a reliable and valid method for developing definitions for quality indicator or standards in other settings.[17–20] The RAM process relies on both evidence-based research and expert panel review to achieve consensus on an issue. We adapted this method to develop a threshold definition of serious illness, one that would be highly sensitive to identify a seriously ill surgical patient preoperatively.

Definitions Development Process

The American Society of Anesthesiologists (ASA) risk score has been used to identify "high-risk" patients. However, the score is a subjective measure that relies on clinical judgment without objective criteria. There is not yet an operationalized definition for which older surgical adults are considered seriously ill. Therefore, we drew from a) existing literature on defining serious medical illnesses,[11–14] b) PC quality indicators in geriatrics, palliative medicine, and other specialties related to surgery,[17,21–24] c) guidelines for goals and decision-making in geriatric surgery[20,25,26] and PC guidelines in oncology and trauma,[6,7,27,28] and d) and a review of the literature regarding the impact of high-risk conditions[29–66] and health states, such as frailty[67–76] or nursing home residency,[77–80] on postoperative outcomes including mortality, morbidity, and functional disability. The preliminary definition included detailed criteria for 11 conditions and health states encompassing serious illness in the perioperative context, independent of the procedural risk (Appendix Table 1).

Expert Advisory Panel

An expert advisory panel comprising 12 experts in surgery, anesthesia, palliative care, geriatrics, health policy, quality improvement, nursing, and patient advocacy was recruited from a geographically broad range of academic and private institutions. Many had extensive experience conducting health services research or developing quality indicators.

Definition Rating Criteria

Consistent with the RAM process, panelists independently rated the preliminary definition for validity and feasibility in two rounds: 1) remotely and 2) during an in-person meeting on a scale of 1–9 for validity and feasibility, where 1 is definitely not valid or feasible and 9 is definitely valid or feasible. Validity was defined as "Adequate scientific evidence or professional consensus exists to support that this definition describes serious illness in the context of patients considering surgery and could be applied to surgical patients." Feasibility was defined as "Whether hospitals and/or surgeons within a range of practice settings (private or public, academic or nonacademic,

urban or rural) could identify a patient with the definition given reasonable effort." Panelists reviewed a monograph of the supporting literature for the preliminary definition before returning their first-round ratings electronically. For each of the criteria, we calculated a median score and a measure of agreement for both validity and feasibility. We considered agreement among panel members if three or fewer panelists rated outside the median tertile. A median score of 7 or greater without disagreement was considered to reflect a valid or feasible rating. A median score of 4–6 or evidence of disagreement in the dispersion of ratings was considered to reflect uncertain validity or feasibility. A median score of less than 4 was considered invalid or infeasible.

The second round of ratings took place on April 24, 2019 in Portland, Oregon, with 11 panelists participating in-person and one panelist participating remotely. Individualized summary sheets were distributed to each panelist with their individual rating, median score, and the dispersion of the group. A discussion, led by an independent facilitator with extensive experience in moderating RAM and Delphi panels, focused on areas where there was disagreement and/or uncertainty among panelists. The proposed criteria were then modified based on panel discussion, and panelists subsequently rerated the criteria electronically. Those rated as valid were included in the final serious illness definition. No criteria were excluded based on feasibility.

Results

All 12 panelists completed both rounds of ratings. After the first round of ratings, none of the proposed criteria for the 11 conditions and health states were rated as invalid, two were rated with uncertain validity (vulnerable elder, heart failure), and nine were rated as valid. None of the proposed criteria were considered infeasible, four were rated to have uncertain feasibility, and seven were rated as feasible. After extensive discussion of the supporting evidence, criteria for two of the conditions were modified by panelists during the in-person meeting before the second round of rating (Appendix Table 1). These modifications included the following: a) increasing the age cutoff for vulnerable elder from >74 years to >84 years old to better target the at-risk older surgical population; then b) clarifying the heart failure definition to indicate all-cause hospitalization and changing the time period of hospital use from the last three years to the last six months before surgery to better target symptomatic disease in the time period proximate to the surgical episode.

After rerating, all definitions were rated as valid, 10 (91%) definitions were rated as feasible, and one (9%, ASA Risk) was rated as uncertain feasibility (Appendix Table 2). The final definition of serious illness consisted of the following conditions and health states with specified criteria:

1. ASA Risk score: Class IV or V
2. Vulnerable elder (older adult > 84 years old, older adult > 64 with any functional or cognitive disability)
3. Advanced cancer (Stage III or IV solid cancers and hematologic malignancies) and at least one hospitalization in prior year
4. Oxygen-dependent pulmonary disease
5. Heart failure diagnosis with any all-cause hospitalization or at least two ED visits in past six months
6. Cirrhosis with any Child-Turcotte-Pugh (CTP) Class or Model for End-Stage Liver Disease (MELD) score
7. End-stage renal disease on dialysis or eligible for dialysis
8. Dementia with impaired daily function and at least one hospitalization in prior year
9. Frailty
10. Trauma patients with
    a. Severe traumatic brain injury (TBI) with Abbreviated Injury Scale (AIS) score of 3 or greater, or Glasgow Coma Scale score of 3–8; or
    b. Critical injury (Injury Severity Score >25 and/or >24 hours intensive care unit admission)
11. Nursing home residents.

Discussion

Conceptually, a serious illness definition for surgical patients is critical to identify the denominator population for PC quality measurement and improvement efforts, recognizing that one single condition or health state is inadequate to encompass the entire high-risk surgical population who should receive primary PC. In this study, we reached a consensus on a definition of serious illness in the perioperative context and extensively expand on ASA Risk and age, which have traditionally been the predominate markers of serious illness in surgery. We also included severe traumatic injury, a novel addition that is unique to surgical care. A key difference from existing definitions for serious medical illness is that the panel included chronic conditions in earlier stages of advanced disease in the definition of serious illness in surgery. For example, as part of work by Walling et al. to develop PC quality indicators for patients with cirrhosis, an expert panel defined the denominator population as patients with end-stage disease, with either a CTP Class C or MELD

≥20.[17] However, our panel determined that patients in earlier stages of cirrhosis are also at risk for poor postoperative outcomes and can experience acute decompensation after surgery.[46,48] Therefore, the panel included patients with a diagnosis of cirrhosis at any stage as seriously ill in the perioperative context. Finally, unlike other serious illness definitions, the panel also included high-risk health states such as frailty and nursing home residency. The definition identified in this study provides the basis for future quality improvement efforts to integrate PC processes for seriously ill surgical patients.

The ability to identify the population who are at the highest risk for mortality or functional disability in the perioperative setting is central to measuring the population-level impact of PC processes on surgical outcomes. Most of the 11 conditions and health states in this definition, such as heart failure and advanced cancer, are easily identifiable from administrative data sets and the electronic health record. Frailty may be a notable exception because there are multiple scoring instruments that are difficult to standardize. However, panelists agreed that including frailty within the serious illness definition is highly valid and encourages health systems to standardize a method of frailty measurement. Already, there are efforts to include functional impairment in geriatric surgery risk assessment and operationalize a definition of frailty from data sets, such as the ACS National Surgical Quality Improvement Program (NSQIP) and Medicare claims, that will likely increase the feasibility of frailty measurement in the near future.[81,82] Functional and cognitive impairment are also conditions that are often not concretely defined or consistently included in administrative data. However, the NSQIP Geriatric Surgery Pilot Project showed that collecting such data from the electronic health record is feasible using trained data abstractors.[83]

Although the intention of this study is to develop a highly sensitive definition to determine whom high-quality surgical PC should be delivered to, a more specific, high-resource utilization group will need to be identified for large-scale quality improvement efforts. Presently, clinical quality improvement programs such as ACS NSQIP have existing data collection structures that can identify the definition's criteria for the 11 conditions and health states from standardized clinical elements in the electronic health record. However, a more specific, operational definition will be needed for large-scale quality measurement. Health systems could use the electronic health record and computer-assisted data abstraction to identify seriously ill surgical patients and examine their outcomes.[84] A critical next step will be to measure the prevalence of the serious illness definition for surgical patients, then investigate their health trajectories and outcomes using a variety of data sources.

Traditionally, PC delivery has been targeted near end of life and is underutilized by surgical teams in the earlier stages of the surgical episode, thereby depriving the seriously ill surgical patient of the benefits, such as care focused on quality of life. In this study, we identified a definition that can be applied to establish screening criteria for earlier primary PC delivery. Population-based interventions, such as systemic screening criteria for serious illness, can deliver PC early and also improve surgical outcomes.[1] For example, Ernst et al. implemented a systemic frailty risk calculator to trigger preoperative PC consultation before elective surgery for older patients who were the highest risk for mortality.[2] After implementation of the frailty trigger, the proportion of surgeon-initiated PC consults and the proportion of preoperative versus postoperative consults doubled. Although this study did not examine functional or caregiver outcomes, the relative risk of one-year mortality was reduced by 33%, coinciding with lower rates of patients undergoing surgery (94% pre, 81% post). Like this study, health systems can use screening criteria based on underlying illness to identify surgical patients who should receive early primary PC concurrent with their surgical care.

There are a few limitations to note. First, the overall prevalence and the degree of overlap between the criteria for each of the 11 conditions and health states are presently unknown. Thus, although this definition may be highly sensitive, future study is needed to determine the specificity, mainly whether outcomes and health trajectories are consistent with serious illness in the perioperative context. We did not include pediatric patients in these efforts. Future study can also include conditions where there was limited evidence to link with poor outcomes in the surgical population, such as neurodegenerative diseases. However, the panel discussed that those patients with significant functional impairment would likely be captured under frailty. Finally, while we included one nurse and one patient advocate, we did not include any patients or caregivers on the panel. Future work to refine this definition could consider including these representatives.

Conclusion

PC delivery is critical to improve the value and quality of surgical care for seriously ill patients. The definition identified in this study, supported by the RAND-UCLA Appropriateness Method, serves as a denominator for quality improvement for seriously ill surgical patients. We highlight opportunities to determine the prevalence of this population, measure health trajectories and outcomes, and develop systemic trigger criteria for surgical PC delivery.

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References

1. Lilley EJ, Khan KT, Johnston FM, et al. Palliative care interventions for surgical patients: a systematic review. JAMA Surg 2016;151:172–183.

2. Ernst KF, Hall DE, Schmid KK, et al. Surgical palliative care consultations over time in relationship to systemwide frailty screening. JAMA Surg 2014;149:1121–1126.

3. Badgwell BD, Aloia TA, Garrett J, et al. Indicators of symptom improvement and survival in inpatients with advanced cancer undergoing palliative surgical consultation. J Surg Oncol 2013;107:367–371.

4. American College of Surgeons Task Force on Surgical Palliative Care and Committee on Ethics. Statement of principles of palliative care. Bull Am Coll Surgeons 2005;90:34–35.

5. Lilley EJ, Cooper Z, Schwarze ML, Mosenthal AC. Palliative care in surgery: defining the research priorities. J Palliat Med 2017;20:702–709.

6. American College of Surgeons Trauma Quality Improvement Program. ACS TQIP palliative care best practice guidelines. Chicago, IL: American College of Surgeons, 2018.

7. ACS Commission on Cancer. Cancer Program Standards (2016 Edition) 2016. Available from: https://www.facs.org/~/media/files/quality%20programs/cancer/coc/programstandards2012.ashx. Accessed December 18, 2018.

8. National Consensus Project for Quality Palliative Care. Clinical Practice Guidelines for Quality Palliative Care, 4th ed. Richmond, VA: National Coalition for Hospice and Palliative Care, 2018.

9. Lee KC, Senglaub SS, Walling AM, Mosenthal AC, Cooper Z. Quality measures in surgical palliative care: adapting existing palliative care measures to improve care for seriously ill surgical patients. Ann Surg 2019;269:607–609.

10. Kelley AS. Defining "serious illness". J Palliat Med 2014;17:985.

11. Kelley AS, Bollens-Lund E. Identifying the population with serious illness: the "denominator" challenge. J Palliat Med 2018;21:S7–S16.

12. Kelley AS, Bollens-Lund E, Covinsky KE, Skinner JS, Morrison RS. Prospective identification of patients at risk for unwarranted variation in treatment. J Palliat Med 2018;21:44–54.

13. Kelley AS, Covinsky KE, Gorges RJ, et al. Identifying older adults with serious illness: a critical step toward improving the value of health care. Health Serv Res 2017;52:113–131.

14. Kelley AS, Langa KM, Smith AK, et al. Leveraging the health and retirement study to advance palliative care research. J Palliat Med 2014;17:506–511.

15. Whitson HE, Duan-Porter W, Schmader KE, et al. Physical resilience in older adults: systematic review and development of an emerging construct. J Gerontol A Biol Sci Med Sci 2016;71:489–495.

16. Fitch K, Fitch K, Bernstein SJ, et al. The RAND/UCLA appropriateness method user's manual. Los Angeles, CA: RAND Corporation, 2001.

17. Walling AM, Ahluwalia SC, Wenger NS, et al. Palliative care quality indicators for patients with end-stage liver disease due to cirrhosis. Dig Dis Sci 2017;62:84–92.

18. McGory ML, Kao KK, Shekelle PG, et al. Developing quality indicators for elderly surgical patients. Ann Surg 2009;250:338–347.

19. Shekelle PG, MacLean CH, Morton SC, Wenger NS. Assessing care of vulnerable elders: methods for developing quality indicators. Ann Intern Med 2001;135:647–652.

20. Berian JR, Rosenthal RA, Baker TL, et al. Hospital standards to promote optimal surgical care of the older adult: a report from the coalition for quality in geriatric surgery. Ann Surg 2018;26:280–290.

21. National Quality Forum. National voluntary consensus standards: palliative care and end-of-life care–A consensus report. 2012. Available from: http://www.qualityforum.org/Publications/2012/04/Palliative_Care_and_End-of-Life_Care%E2%80%94A_Consensus_Report.aspx. Accessed November 5, 2018.

22. Wenger NS, Roth CP, Shekelle P, Investigators A. Introduction to the assessing care of vulnerable elders-3 quality indicator measurement set. J Am Geriatr Soc 2007;55(Suppl 2):S247–S252.

23. Lorenz KA, Rosenfeld K, Wenger N. Quality indicators for palliative and end-of-life care in vulnerable elders. J Am Geriatr Soc 2007;55(Suppl 2):S318–S326.

24. Nelson JE, Mulkerin CM, Adams LL, Pronovost PJ. Improving comfort and communication in the ICU: a practical new tool for palliative care performance measurement and feedback. Qual Saf Health Care 2006;15:264–271.

25. American College of Surgeons. ACS NSQIP/AGS best practice guidelines: optimal preoperative assessment of the geriatric surgical patient. Available from: https://www.facs.org/~/media/files/quality%20programs/nsqip/acsnsqipagsgeriatric2012guidelines.ashx. Accessed May 17, 2018.

26. American College of Surgeons. Optimal Perioperative Care of the Geriatric Patient: Best Practices Guideline from ACS NSQIP®/American Geriatrics Society 2016. Available from: https://www.facs.org/quality-programs/acs-nsqip/geriatric-periop-guideline. Accessed January 3, 2019.

27. Ferrell BR, Temel JS, Temin S, et al. Integration of palliative care into standard oncology care: American Society of Clinical Oncology Clinical Practice Guideline Update. J Clin Oncol 2017;35:96–112.

28. Mosenthal AC, Weissman DE, Curtis JR, et al. Integrating palliative care in the surgical and trauma intensive care unit: a report from the Improving Palliative Care in the Intensive Care Unit (IPAL-ICU) project advisory board and the center to advance palliative care. Crit Care Med 2012;40:1199–1206.

29. Cooper Z, Scott JW, Rosenthal RA, Mitchell SL. Emergency major abdominal surgical procedures in older adults: a systematic review of mortality and functional outcomes. J Am Geriatr Soc 2015;63:2563–2571.

30. Cooper Z, Mitchell SL, Gorges RJ, et al. Predictors of mortality up to 1 Year after emergency major abdominal surgery in older adults. J Am Geriatr Soc 2015;63:2572–2579.

31. Olufajo OA, Reznor G, Lipsitz SR, et al. Preoperative assessment of surgical risk: creation of a scoring tool to estimate 1-year mortality after emergency abdominal surgery in the elderly patient. Am J Surg 2017;213:771–777.e1.

32. Rangel EL, Cooper Z, Olufajo OA, et al. Mortality after emergency surgery continues to rise after discharge in the elderly: predictors of 1-year mortality. J Trauma Acute Care Surg 2015;79:349–358.

33. Bateni SB, Meyers FJ, Bold RJ, Canter RJ. Increased rates of prolonged length of stay, readmissions, and discharge to care facilities among postoperative patients with disseminated malignancy: implications for clinical practice. PLoS One 2016;11:e0165315.

34. Cauley CE, Panizales MT, Reznor G, et al. Outcomes after emergency abdominal surgery in patients with advanced cancer: opportunities to reduce complications and improve palliative care. J Trauma Acute Care Surg 2015;79:399–406.

35. Havens JM, Olufajo OA, Cooper ZR, et al. Defining rates and risk factors for readmissions following emergency general surgery. JAMA Surg 2016;151:330–336.

36. Shah AA, Haider AH, Zogg CK, et al. National estimates of predictors of outcomes for emergency general surgery. J Trauma Acute Care Surg 2015;78:482–490; discussion 490-491.

37. Lidsky ME, Thacker JK, Lagoo-Deenadayalan SA, Scarborough JE. Advanced age is an independent predictor for increased morbidity and mortality after emergent surgery for diverticulitis. Surgery 2012;152:465–472.

38. Tseng WH, Yang X, Wang H, et al. Nomogram to predict risk of 30-day morbidity and mortality for patients with disseminated malignancy undergoing surgical intervention. Ann Surg 2011;254:333–338.

39. Krouse RS, Nelson RA, Farrell BR, et al. Surgical palliation at a cancer center: incidence and outcomes. Arch Surg 2001;136:773–778.

40. McCahill LE, Krouse R, Chu D, et al. Indications and use of palliative surgery-results of Society of Surgical Oncology survey. Ann Surg Oncol 2002;9:104–112.

41. McCahill LE, Dunn GP, Mosenthal AC, Milch RA, Krouse RS. Palliation as a core surgical principle: part 1. J Am Coll Surg United States 2004;199:149–160.

42. Calland JF, Ingraham AM, Martin N, et al. Evaluation and management of geriatric trauma: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg 2012;73:S345–S350.

43. Santry HP, Psoinos CM, Wilbert CJ, et al. Quadrimodal distribution of death after trauma suggests that critical injury is a potentially terminal Disease. J Crit Care 2015;30:656.e1–656.e7.

44. Turrentine FE, Sohn MW, Jones RS. Congestive heart failure and noncardiac operations: risk of serious morbidity, readmission, reoperation, and mortality. J Am Coll Surg 2016;222:1220–1229.

45. Lerman BJ, Popat RA, Assimes TL, Heidenreich PA, Wren SM. Association of left ventricular ejection fraction and symptoms with mortality after elective noncardiac surgery among patients with heart failure. JAMA 2019;321:572–579.

46. Potosek J, Curry M, Buss M, Chittenden E. Integration of palliative care in end-stage liver disease and liver transplantation. J Palliat Med 2014;17:1271–1277.

47. Telem DA, Schiano T, Goldstone R, et al. Factors that predict outcome of abdominal operations in patients with advanced cirrhosis. Clin Gastroenterol Hepatol 2010;8:451–457. quiz e58.

48. Hanje AJ, Patel T. Preoperative evaluation of patients with liver disease. Nat Clin Pract Gastroenterol Hepatol 2007;4:266–276.

49. Neeff H, Mariaskin D, Spangenberg HC, Hopt UT, Makowiec F. Perioperative mortality after non-hepatic general surgery in patients with liver cirrhosis: an analysis of 138 operations in the 2000s using Child and MELD scores. J Gastrointest Surg 2011;15:1–11.

50. Northup PG, Friedman LS, Kamath PS. AGA clinical practice update on surgical risk assessment and perioperative management in cirrhosis: expert review. Clin Gastroenterol Hepatol 2019;17:595–606.

51. Teh SH, Nagorney DM, Stevens SR, et al. Risk factors for mortality after surgery in patients with cirrhosis. Gastroenterology 2007;132:1261–1269.

52. Bhangui P, Laurent A, Amathieu R, Azoulay D. Assessment of risk for non-hepatic surgery in cirrhotic patients. J Hepatol 2012;57:874–884.

53. Gajdos C, Hawn MT, Kile D, et al. The risk of major elective vascular surgical procedures in patients with end-stage renal disease. Ann Surg 2013;257:766–773.

54. Gajdos C, Hawn MT, Kile D, Robinson TN, Henderson WG. Risk of major nonemergent inpatient general surgical procedures in patients on long-term dialysis. JAMA Surg 2013;148:137–143.

55. Singh T, Peters SR, Tirschwell DL, Creutzfeldt CJ. Palliative care for hospitalized patients with stroke: results from

the 2010 to 2012 national inpatient sample. Stroke 2017;48:2534–2540.

56. Luan Erfe BM, Boehme J, Erfe JM, et al. Postoperative outcomes in primary total knee arthroplasty patients with preexisting cognitive impairment: a systematic review. Geriatr Orthop Surg Rehabil 2018;9. 2151459318816482.

57. Luan Erfe BM, Erfe JM, Brovman EY, et al. Postoperative outcomes in SAVR/TAVR patients with cognitive impairment: a systematic review. Semin Thorac Cardiovasc Surg 2019;31:370–380.

58. Viramontes O, Luan Erfe BM, Erfe JM, et al. Cognitive impairment and postoperative outcomes in patients undergoing primary total hip arthroplasty: a systematic review. J Clin Anesth 2019;56:65–76.

59. Bekelis K, Missios S, Shu J, MacKenzie TA, Mayerson B. Surgical outcomes for patients diagnosed with dementia: a coarsened exact matching study. J Clin Neurosci 2018;53:160–164.

60. Smetana GW, Lawrence VA, Cornell JE, American College of Physicians. Preoperative pulmonary risk stratification for noncardiothoracic surgery: systematic review for the American College of Physicians. Ann Intern Med 2006;144:581–595.

61. Smetana GW, Pfeifer KJ, Slawski BA, et al. Risk factors for postoperative pulmonary complications: an update of the literature. Hosp Pract (1995) 2014;42:126–131.

62. Gupta H, Ramanan B, Gupta PK, et al. Impact of COPD on postoperative outcomes: results from a national database. Chest 2013;143:1599–1606.

63. Fields AC, Divino CM. Surgical outcomes in patients with chronic obstructive pulmonary disease undergoing abdominal operations: an analysis of 331,425 patients. Surgery 2016;159:1210–1216.

64. Bonne S, Schuerer DJ. Trauma in the older adult: epidemiology and evolving geriatric trauma principles. Clin Geriatr Med 2013;29:137–150.

65. McIntyre A, Mehta S, Aubut J, Dijkers M, Teasell RW. Mortality among older adults after a traumatic brain injury: a meta-analysis. Brain Inj 2013;27:31–40.

66. McIntyre A, Mehta S, Janzen S, Aubut J, Teasell RW. A meta-analysis of functional outcome among older adults with traumatic brain injury. NeuroRehabilitation 2013;32:409–414.

67. Velanovich V, Antoine H, Swartz A, Peters D, Rubinfeld I. Accumulating deficits model of frailty and postoperative mortality and morbidity: its application to a national database. J Surg Res 2013;183:104–110.

68. Wahl TS, Graham LA, Hawn MT, et al. Association of the modified frailty index with 30-day surgical readmission. JAMA Surg 2017;152:749–757.

69. Subramaniam S, Aalberg JJ, Soriano RP, Divino CM. New 5-factor modified frailty index using American College of surgeons NSQIP data. J Am Coll Surg 2018;226:173–181.e8.

70. Joseph B, Pandit V, Zangbar B, et al. Validating trauma-specific frailty index for geriatric trauma patients: a prospective analysis. J Am Coll Surg 2014;219:10–17.e1.

71. Joseph B, Zangbar B, Pandit V, et al. Emergency general surgery in the elderly: too old or too frail? J Am Coll Surg 2016;222:805–813.

72. Joseph B, Orouji Jokar T, Hassan A, et al. Redefining the association between old age and poor outcomes after trauma: the impact of frailty syndrome. J Trauma Acute Care Surg 2017;82:575–581.

73. Karam J, Tsiouris A, Shepard A, Velanovich V, Rubinfeld I. Simplified frailty index to predict adverse outcomes and mortality in vascular surgery patients. Ann Vasc Surg 2013;27:904–908.

74. Arya S, Kim SI, Duwayri Y, et al. Frailty increases the risk of 30-day mortality, morbidity, and failure to rescue after elective abdominal aortic aneurysm repair independent of age and comorbidities. J Vasc Surg 2015;61:324–331.

75. Mrdutt MM, Papaconstantinou HT, Robinson BD, Bird ET, Isbell CL. Preoperative frailty correlates with surgical outcomes across diverse surgical subspecialties in a large health care system. J Am Coll Surgeons 2019;228:482–490.

76. Maxwell CA, Mion LC, Mukherjee K, et al. Preinjury physical frailty and cognitive impairment among geriatric trauma patients determine postinjury functional recovery and survival. J Trauma Acute Care Surg 2016;80:195–203.

77. Finlayson E, Wang L, Landefeld CS, Dudley RA. Major abdominal surgery in nursing home residents: a national study. Ann Surg 2011;254:921–926.

78. Finlayson E, Zhao S, Boscardin WJ, et al. Functional status after colon cancer surgery in elderly nursing home residents. J Am Geriatr Soc 2012;60:967–973.

79. Tang V, Zhao S, Boscardin J, et al. Functional status and survival after breast cancer surgery in nursing home residents. JAMA Surg 2018;153:1090–1096.

80. Oresanya L, Zhao S, Gan S, et al. Functional outcomes after lower extremity revascularization in nursing home residents: a national cohort study. JAMA Intern Med 2015;175:951–957.

81. Kim DH, Schneeweiss S, Glynn RJ, et al. Measuring frailty in Medicare data: development and validation of a claims-based frailty index. J Gerontol A Biol Sci Med Sci 2018;73:980–987.

82. Makary MA, Segev DL, Pronovost PJ, et al. Frailty as a predictor of surgical outcomes in older patients. J Am Coll Surg 2010;210:901–908.

83. Berian JR, Zhou L, Hornor MA, et al. Optimizing surgical quality datasets to care for older adults: lessons from the American College of surgeons NSQIP geriatric surgery Pilot. J Am Coll Surg 2017;225:702–712.e1.

84. Udelsman B, Chien I, Ouchi K, et al. Needle in a haystack: natural language processing to identify serious illness. J Palliat Med 2019;22:179–182.

85. Harrington SE, Rogers E, Davis M. Palliative care and chronic obstructive pulmonary disease: where the lines meet. Curr Opin Pulm Med 2017;23:154–160.

86. Vermylen JH, Szmuilowicz E, Kalhan R. Palliative care in COPD: an unmet area for quality improvement. Int J Chron Obstruct Pulmon Dis 2015;10:1543–1551.

Appendix Table 1

Preliminary and Modified Serious Illness Definitions Presented to the Expert Advisory Panel

Preliminary Definition	Modifications After Expert Advisory Panel In-Person Discussion
ASA Risk: Class IV or V	NC
Vulnerable elder[19–22,24,25] • Older adult >74 years old • Older adult >64 with any functional or cognitive disability	Vulnerable elder • Older adult > 84 years old • Older adult >64 with any functional or cognitive disability
Advanced cancer[7,11,13,26] • Stage III and IV solid cancers OR hematologic malignancies • AND at least one hospitalization in prior year	NC
Oxygen-dependent pulmonary disease[11,13,59–62,84,85]	NC
Heart failure diagnosis with any hospitalization or at least two ED visits in the past three years[11,13,43,44]	Heart failure diagnosis with any all-cause hospitalization or at least two ED visits in the past six months
Cirrhosis with any Child-Turcotte-Pugh Class or Model for End-Stage Liver Disease score[11,13,45–48,50,86]	NC
End-stage renal disease on dialysis or eligible for dialysis[52–54]	NC
Dementia with impaired daily function and at least one hospitalization in prior year[11]	NC
Trauma patients[6,27] • Severe traumatic brain injury with Abbreviated Injury Scale of 3 or greater • Critical injury (Injury Severity Score >25 or >24 hours intensive care unit admission)	NC
Frailty[66–75]	NC
Nursing home resident[76–79]	NC

ASA = American Society of Anesthesiology; NC = no change; ED = emergency department.

Appendix Table 2

Validity and Feasibility Ratings of Serious Illness Definitions After Two Rounds of Expert Advisory Panel Rating

Serial Number	Definition	Median Score for Validity[a]	Median Score for Feasibility[b]
1.	ASA Risk: Class IV or V	8.5	6.5
2.	Vulnerable elder • Older adult >84 years old • Older adult >64 with any functional or cognitive disability	8	8
3.	Advanced cancer • Stage III and IV solid cancers OR hematologic malignancies • AND at least one hospitalization in prior year	8	7.5
4.	Oxygen-dependent pulmonary disease	8	8
5.	Heart failure diagnosis with any all-cause hospitalization or at least two ED visits in past six months	8	7
6.	Cirrhosis with any Child-Turcotte-Pugh (CTP) Class or Model for End-Stage Liver Disease (MELD) score	8	7.5
7.	End-stage renal disease on dialysis or eligible for dialysis	9	9
8.	Dementia with impaired daily function and at least one hospitalization in prior year	8	7
9.	Frailty	7.5	7
10.	Trauma patients • Severe traumatic brain injury with Abbreviated Injury Scale score of 3 or greater • Critical injury (Injury Severity Score >25 or >24 hours intensive care unit admission)	8	9
11.	Nursing home resident	8	8.5

ASA = American Society of Anesthesiology; ED = emergency department.

[a]Validity was defined as adequate scientific evidence or professional consensus exists to support that a) this definition describes serious illness in the context of patients considering surgery and b) this definition could be applied to surgical patients. Validity was scored on a scale of 1−9, where 1 was definitely not valid and 9 was definitely valid.

[b]Feasibility was defined as whether hospitals and/or surgeons within a range of practice settings (private or public, academic or nonacademic, urban or rural) could identify a patient with the definition given reasonable effort. Feasibility was scored on a scale of 1−9, where 1 was definitely not feasible and 9 was definitely feasible.