Topic Brief: Interventions to Decrease Hospital Length of Stay

Date: 8/6/2019
Nomination Number: 866

Purpose: This document summarizes the information addressing a nomination submitted on 6/28/2019 through the Effective Health Care Website. This information was used to inform the Evidence-based Practice Center (EPC) Program decisions about whether to produce an evidence report on the topic, and if so, what type of evidence report would be most suitable.

Issue: Unnecessary days in the hospital can lead to patient complications and increases costs. Complications include healthcare-associated infections, falls, and delirium. Delays in hospital discharge may be related to unnecessary waiting, poor organization of care, delays in decision-making, or difficulties related to discharge planning. There are many ways to prevent delays in discharge, and information is needed about their effectiveness to assist in decision-making on the part of health systems.

Program Decision: The EPC Program will develop a new technical brief based on this nomination. To sign up for notification when this and other Effective Health Care (EHC) Program topics are posted for public comment, please go to https://effectivehealthcare.ahrq.gov/email-updates.

Key findings

- We found over 100 completed and in-process systematic reviews relevant to the broad scope of this nomination.
    - Almost all SR focused on a single intervention; only two looked more broadly at a range of interventions to reduce LOS.
    - 40% focused on ERAS, and almost all found decreased LOS.
    - These reviews covered a variety of interventions such as Lean, discharge planning, availability of after-hours services, multidisciplinary rounding, and staffing.
- We found a small number of studies focused on vulnerable populations, specifically those of high social risk, including the homeless.

Background

- There were 35.4 million inpatient hospital stays in 2014. 4.1 million were maternity-related admissions; 3.9 million were neonatal; 9 million were surgical; and 17 million were medical.[1]
- The top 5 diagnosis for hospital stays in 2014 were: pregnancy/childbirth, newborns/neonates, septicemia, osteoarthritis, and congestive heart failure.[1]

- Unnecessary days in the hospital can lead to patient complications and increased costs. Patient complications include healthcare-associated infections and falls. In addition it can impact negatively both patient and staff experience.[2]
- Delays in hospital discharge may be related to unnecessary waiting, poor organization of care, delays in decision-making, or difficulties related to discharge planning.[2, 3]
- A systems-level approach could address the multiple levels contributing to unnecessary delays in hospital discharge. [2]
- This nomination overlaps in scope with a nomination on major joint replacement (#864). It is focused on interventions to improve outcomes of joint replacement surgery including enhanced recovery after surgery (ERAS), clinical pathways, and different delivery methods for physical therapy. Length of stay is included as an outcome in its scope.

Nomination Summary

- The nominators from the Learning Health System panel prioritized this topic highly in June 2019.
- They plan to use findings from this report to promote interventions that will decrease LOS at their respective institutions.
- Engagement with the nominators helped to shape the populations, types of interventions, and settings in the PICOTS.
- Because no reviews were found on tailoring of organizational interventions, we broadened question 2 to those that targeted vulnerable populations.

Scope

1. What are the benefits and harms of organizational interventions to reduce length of stay?
2. What are the benefits and harms for organizational interventions to reduce length of stay for vulnerable populations?

Table 1. Questions and PICOTS (population, intervention, comparator, outcome, timing and setting)

Questions	1. Organizational interventions	2. Organizational interventions for vulnerable populations
Population	Hospitalized patients Subgroups: • Age • Specific medical conditions • Multimorbidity	Hospitalized vulnerable patients (e.g. concurrent mental health issues, frailty, dementia, limited English proficiency, patients with higher levels of social risks such as housing instability and social isolation)
Interventions	Hospital-based organizational interventions, such as clinical pathways and ERAS pathways to standardize care; staffing models; discharge planning; multidisciplinary teams; coordination of services; case management	Hospital-based organizational interventions
Comparators	Usual care Other active intervention	Usual care Other active interventions
Outcomes	Length of stay Patient outcomes Readmission Harms Unintended consequences, such as cost, staffing	Length of stay Patient outcomes Readmission Harms Unintended consequences
Timing	All	All

Setting	Acute care hospital, including NICU, postpartum. Exclude studies focused solely on ICU stays.	Acute care hospital, including NICU, postpartum. Exclude studies focused solely on ICU stays.

Abbreviations: ERAS=enhanced recovery after surgery; ICU=intensive care unit; NICU=neonatal intensive care unit

Assessment Methods

See Appendix A.

Summary of Literature Findings

We found over 100 systematic reviews addressing this nomination. These reviews covered a variety of interventions, conditions, and patient populations. Collectively they cover many interventions relevant to question 1. All except two looked at a single type of intervention on LOS. Forty reviews addressed ERAS for a large spectrum of surgeries. Almost all found decreased LOS with the use of ERAS. Few reviews looked at vulnerable populations, and none addressed homeless or others with high levels of social risk.

A search for primary studies for question 2 identified six studies and two in-process studies. All addressed different interventions.

For details of the literature findings, see Appendix B.

Table 2. Literature identified for each Question

Question	Systematic reviews (7/2016-8/2019)	Primary studies (8/2014-9/2019)
Question 1: Organizational interventions	Total: 111 • ERAS-40 o Cochrane-1 o AHRQ-0 o Other-38 o VA ESP-1 • Specialized care units-5 o Cochrane-1 o Other-4 • Staffing-8 o Cochrane-1 o JBI-1 o Other-6 • Clinical pathways-6 o Other-6 o Scoping review-1 • Care bundles-2 o Other-2 • Availability/timing of care-5 o Other-5 • Physical structure-5 o Cochrane-1 o Other-4 • Discharge planning-3 o Cochrane-2 o JBI-1 • QI/process improvement	Not done

Question	Systematic reviews (7/2016-8/2019)	Primary studies (8/2014-9/2019)
	○ Cochrane-1 ○ JBI-1 ○ Other-6 • Case management-1 ○ Other-1 • Decision support-2 ○ Other-2 • Multidisciplinary rounding-2 ○ JBI-1 ○ Other-1 • Collaboration-5 ○ Cochrane-1 ○ Other-4 • Technology-6 ○ AHRQ-1 ○ Other-5 • Comprehensive geriatric assessment-2 ○ Cochrane-2 • Other interventions-2 ○ Other-2 • Subgroups-7 ○ Other-7	
Question 2: Vulnerable populations	Total: 2 • Dementia-1 (realist review) ○ Other-1 • Migrant/refugee-1 ○ JBI-1	Total: 6 • RCT-1 • Cluster randomized trial-1 • Pre-post-2 • Case study-1 • Cohort-1 Clinicaltrials.gov • Recruiting: patient-related factors are not specified, and could include those related to vulnerabilities. These are therefor included here for completeness. • NCT01515670 TKA comorbid conditions • NCT03153722 Pediatric ward QI

Abbreviations: ERAS=enhanced recovery after surgery; ESP=Evidence Synthesis Program; JBI=Joanna Briggs Institute; QI=quality improvement; RCT=randomized controlled trial; TKA=total knee arthroplasty; QI=quality improvement; VA=Veterans Affairs

Summary of Selection Criteria Assessment

This nomination met all selection criteria except for feasibility for question 2. The nomination is very broad, encompassing a large number of potential interventions and populations. This is a prevalent issue and is of high interest to health systems, particularly the AHRQ-funded Learning Health System panel. Although we found high-quality systematic reviews, the information about different interventions is scattered across many sources (systematic reviews and primary studies).

Despite the feasibility limitations, a new evidence report on the entire scope of the nomination would be highly valuable and potentially impactful. Because of these factors after consultation with the nominators, we recommend a technical brief that pulls together available systematic reviews on this topic. A similar approach was taken in the Telehealth evidence map[5], which provided a map of systematic reviews, and identified areas to focus a follow-on systematic review.

Please see Appendix B for detailed assessments of individual EPC Program selection criteria.

Related Resources

We identified additional information in the course of our assessment that might be useful.

- Bakker et al. Hospital Care for Frail Elderly Adults: From Specialized Geriatric Units to Hospital-wide Interventions.[6] This 2015 article provides an overview of potential hospital-based interventions that could be used to optimize care of frail elderly adults. This was not a systematic review.
- Several studies that did not fit the PICOTS but might be of interest to the nominators
    - Chan et al. The Effect of a Care Transition Intervention on the Patient Experience of Older Multi-Lingual Adults in the Safety Net: Results of a Randomized Controlled Trial. [7] This RCT assessed the impact of a nurse-led hospital-based care transition intervention on patient experience for older multilingual adults hospitalized at a safety net hospital. It included Spanish and Chinese speakers. Outcomes were communication and patient experience. It did not include LOS.
    - Noublanche et al. The development of gerontechnology for hospitalized frail elderly people: The ALLEGRO hospital-based geriatric living lab.[8] This article describes an experimental hospital room that engages older adults in the design of hospital facilities and hospital care that meets their needs. This study did not include mention of length of stay.
    - Ansryan et al. Systems Addressing Frail Elders (SAFE) Care: Description of Successful Partnerships Across Hospitals.[9] This article described a partnership across hospitals to disseminate and implement a model of team-based care to decrease LOS in frail older adults.
    - Mackenzie et al. A Discharge Panel At Denver Health, Focused On Complex Patients, May Have Influenced Decline In Length-Of-Stay.[10] A discharge panel at Denver Health, focused on complex patients, may have influenced decline in length-of-stay. This article describes a complex discharge subcommittee that focuses on patients with LOS more than 10 days, are ready for discharge, and do not have a safe discharge plan because of issues unrelated to their medical readiness. This article was published in 2012, outside of the range of our targeted literature search.

References

1. McDermott KW EA, Sun R. Trends in Hospital Inpatient Stays in the United States, 2005-2014. Rockville, MD: Agency for Healthcare Research and Quality; June 2017. www.hcup-us.ahrq.gov/reports/statbriefs/sb225-Inpatient-US-Stays-Trends.pdf.

2. Rojas-Garcia A, Turner S, Pizzo E, et al. Impact and experiences of delayed discharge: A mixed-studies systematic review. Health Expect. 2018 Feb;21(1):41-56. doi: 10.1111/hex.12619. PMID: 28898930. https://www.ncbi.nlm.nih.gov/pubmed/28898930

3. Ragavan MV, Svec D, Shieh L. Barriers to timely discharge from the general medicine service at an academic teaching hospital. Postgrad Med J. 2017 Sep;93(1103):528-33. doi: 10.1136/postgradmedj-2016-134529. PMID: 28450581.
https://www.ncbi.nlm.nih.gov/pubmed/28450581
4. Holland DE, Pacyna JE, Gillard KL, et al. Tracking Discharge Delays: Critical First Step Toward Mitigating Process Breakdowns and Inefficiencies. J Nurs Care Qual. 2016 Jan-Mar;31(1):17-23. doi: 10.1097/NCQ.0000000000000141. PMID: 26166435.
https://www.ncbi.nlm.nih.gov/pubmed/26166435
5. Totten AM, Womack DM, Eden KB, et al. Telehealth: Mapping the Evidence for Patient Outcomes From Systematic Reviews. Rockville (MD); 2016.
6. Bakker FC, Olde Rikkert MG. Hospital Care for Frail Elderly Adults: From Specialized Geriatric Units to Hospital-Wide Interventions. Interdiscip Top Gerontol Geriatr. 2015;41:95-106. doi: 10.1159/000381171. PMID: 26301983.
https://www.ncbi.nlm.nih.gov/pubmed/26301983
7. Chan B, Goldman LE, Sarkar U, et al. The Effect of a Care Transition Intervention on the Patient Experience of Older Multi-Lingual Adults in the Safety Net: Results of a Randomized Controlled Trial. J Gen Intern Med. 2015 Dec;30(12):1788-94. doi: 10.1007/s11606-015-3362-y. PMID: 25986136. https://www.ncbi.nlm.nih.gov/pubmed/25986136
8. Noublanche F, Jaglin-Grimonprez C, Sacco G, et al. The development of gerontechnology for hospitalized frail elderly people: The ALLEGRO hospital-based geriatric living lab. Maturitas. 2019 Jul;125:17-9. doi: 10.1016/j.maturitas.2019.04.002. PMID: 31133211.
https://www.ncbi.nlm.nih.gov/pubmed/31133211
9. Ansryan LZ, Aronow HU, Coleman B, et al. Systems Addressing Frail Elders (SAFE) Care: Description of Successful Partnerships Across Hospitals. Nurs Adm Q. 2018 Oct/Dec;42(4):350-6. doi: 10.1097/NAQ.0000000000000317. PMID: 30180081.
https://www.ncbi.nlm.nih.gov/pubmed/30180081
10. MacKenzie TD, Kukolja T, House R, et al. A discharge panel at Denver Health, focused on complex patients, may have influenced decline in length-of-stay. Health Aff (Millwood). 2012 Aug;31(8):1786-95. doi: 10.1377/hlthaff.2012.0515. PMID: 22869657.
https://www.ncbi.nlm.nih.gov/pubmed/22869657
11. Greer NL, Gunnar WP, Dahm P, et al. Enhanced Recovery Protocols for Adults Undergoing Colorectal Surgery: A Systematic Review and Meta-analysis. Dis Colon Rectum. 2018 Sep;61(9):1108-18. doi: 10.1097/DCR.0000000000001160. PMID: 30086061.
https://www.ncbi.nlm.nih.gov/pubmed/30086061
12. Wong WT, Lai VK, Chee YE, et al. Fast-track cardiac care for adult cardiac surgical patients. Cochrane Database Syst Rev. 2016 Sep 12;9:CD003587. doi: 10.1002/14651858.CD003587.pub3. PMID: 27616189.
https://www.ncbi.nlm.nih.gov/pubmed/27616189
13. Strom C, Stefansson JS, Fabritius ML, et al. Hospitalisation in short-stay units for adults with internal medicine diseases and conditions. Cochrane Database Syst Rev. 2018 Aug 13;8:CD012370. doi: 10.1002/14651858.CD012370.pub2. PMID: 30102428.
https://www.ncbi.nlm.nih.gov/pubmed/30102428
14. Butler M, Schultz TJ, Halligan P, et al. Hospital nurse-staffing models and patient- and staff-related outcomes. Cochrane Database Syst Rev. 2019 Apr 23;4:CD007019. doi: 10.1002/14651858.CD007019.pub3. PMID: 31012954.
https://www.ncbi.nlm.nih.gov/pubmed/31012954
15. Goncalves-Bradley DC, Lannin NA, Clemson LM, et al. Discharge planning from hospital. Cochrane Database Syst Rev. 2016 Jan 27(1):CD000313. doi: 10.1002/14651858.CD000313.pub5. PMID: 26816297.
https://www.ncbi.nlm.nih.gov/pubmed/26816297

16. Hall KK, Petsky HL, Chang AB, et al. Caseworker-assigned discharge plans to prevent hospital readmission for acute exacerbations in children with chronic respiratory illness. Cochrane Database Syst Rev. 2018 Nov 2;11:CD012315. doi: 10.1002/14651858.CD012315.pub2. PMID: 30387126. https://www.ncbi.nlm.nih.gov/pubmed/30387126
17. Mabire C, Dwyer A, Garnier A, et al. Meta-analysis of the effectiveness of nursing discharge planning interventions for older inpatients discharged home. J Adv Nurs. 2018 Apr;74(4):788-99. doi: 10.1111/jan.13475. PMID: 28986920. https://www.ncbi.nlm.nih.gov/pubmed/28986920
18. Honeycutt LC, Keller SD. Effectiveness of the Lean process compared to other quality improvement initiatives on length of stay and wait times in healthcare organizations: a systematic review protocol. JBI Database System Rev Implement Rep. 2018 Jan;16(1):12-20. doi: 10.11124/JBISRIR-2016-003304. PMID: 29324550. https://www.ncbi.nlm.nih.gov/pubmed/29324550
19. Rotter T PC, Adegboyega L, Fiander M, Harrison E, Flynn R, Chan J, Kinsman L. Lean management in health care: effects on patient outcomes, professional practice, and healthcare systems [Cochrane protocol]. 04 December 2017 ed: PROSPERO; 2017. https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42017083366
20. Mercedes A, Fairman P, Hogan L, et al. Effectiveness of structured multidisciplinary rounding in acute care units on length of stay and satisfaction of patients and staff: a quantitative systematic review. JBI Database System Rev Implement Rep. 2016 Jul;14(7):131-68. doi: 10.11124/JBISRIR-2016-003014. PMID: 27532795. https://www.ncbi.nlm.nih.gov/pubmed/27532795
21. Reeves S, Pelone F, Harrison R, et al. Interprofessional collaboration to improve professional practice and healthcare outcomes. Cochrane Database Syst Rev. 2017 Jun 22;6(6):CD000072. doi: 10.1002/14651858.CD000072.pub3. PMID: 28639262. https://www.ncbi.nlm.nih.gov/pubmed/28639262
22. Totten AM HR, Wagner J, Stillman L, Ivlev I, Davis-O'Reilly C, Towle C, Erickson JM, Erten-Lyons D, Fu R, Fann J, Babigumira JB, Palm-Cruz KJ, Avery M, McDonagh MS. . Telehealth for Acute and Chronic Care Consultations. Comparative Effectiveness Review No. 216. AHRQ Publication No. 19-EHC012-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2019.
23. Ellis G, Gardner M, Tsiachristas A, et al. Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane Database Syst Rev. 2017 Sep 12;9:CD006211. doi: 10.1002/14651858.CD006211.pub3. PMID: 28898390. https://www.ncbi.nlm.nih.gov/pubmed/28898390
24. Eamer G, Taheri A, Chen SS, et al. Comprehensive geriatric assessment for older people admitted to a surgical service. Cochrane Database Syst Rev. 2018 Jan 31;1(1):CD012485. doi: 10.1002/14651858.CD012485.pub2. PMID: 29385235. https://www.ncbi.nlm.nih.gov/pubmed/29385235
25. Nunns M SL, Briscoe S, Coon JT, Anderson A. What is the effectiveness and cost-effectiveness of hospital-based multi-component strategies to reduce the length of stay of planned inpatient admissions of older adults? . 02 November 2017 ed: PROSPERO; 2017. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017080637
26. Boylen S, Wilson S, Gill F, et al. Impact of professional interpreters on outcomes of hospitalized children from migrant and refugee families with low English proficiency: a systematic review protocol. JBI Database System Rev Implement Rep. 2017 Feb;15(2):202-11. doi: 10.11124/JBISRIR-2016-003264. PMID: 28178013. https://www.ncbi.nlm.nih.gov/pubmed/28178013

27. Adizie J BA. A review of the impact of hospital resources and organisation of care on patient outcome. 15 August 2017 ed: PROSPERO; 2017. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017074510
28. Kalogera E, Glaser GE, Kumar A, et al. Enhanced Recovery after Minimally Invasive Gynecologic Procedures with Bowel Surgery: A Systematic Review. J Minim Invasive Gynecol. 2019 Feb;26(2):288-98. doi: 10.1016/j.jmig.2018.10.016. PMID: 30366117. https://www.ncbi.nlm.nih.gov/pubmed/30366117
29. Corso E, Hind D, Beever D, et al. Enhanced recovery after elective caesarean: a rapid review of clinical protocols, and an umbrella review of systematic reviews. BMC Pregnancy Childbirth. 2017 Mar 20;17(1):91. doi: 10.1186/s12884-017-1265-0. PMID: 28320342. https://www.ncbi.nlm.nih.gov/pubmed/28320342
30. Lindemann K, Kok PS, Stockler M, et al. Enhanced Recovery After Surgery for Advanced Ovarian Cancer: A Systematic Review of Interventions Trialed. Int J Gynecol Cancer. 2017 Jul;27(6):1274-82. doi: 10.1097/IGC.0000000000000981. PMID: 28498237. https://www.ncbi.nlm.nih.gov/pubmed/28498237
31. Zhu S, Qian W, Jiang C, et al. Enhanced recovery after surgery for hip and knee arthroplasty: a systematic review and meta-analysis. Postgrad Med J. 2017 Dec;93(1106):736-42. doi: 10.1136/postgradmedj-2017-134991. PMID: 28751437. https://www.ncbi.nlm.nih.gov/pubmed/28751437
32. Deng QF, Gu HY, Peng WY, et al. Impact of enhanced recovery after surgery on postoperative recovery after joint arthroplasty: results from a systematic review and meta-analysis. Postgrad Med J. 2018 Dec;94(1118):678-93. doi: 10.1136/postgradmedj-2018-136166. PMID: 30665908. https://www.ncbi.nlm.nih.gov/pubmed/30665908
33. Dietz N, Sharma M, Adams S, et al. Enhanced Recovery After Surgery (ERAS) for Spine Surgery: A Systematic Review. World Neurosurg. 2019 Jul 2;130:415-26. doi: 10.1016/j.wneu.2019.06.181. PMID: 31276851. https://www.ncbi.nlm.nih.gov/pubmed/31276851
34. Elsarrag M, Soldozy S, Patel P, et al. Enhanced recovery after spine surgery: a systematic review. Neurosurg Focus. 2019 Apr 1;46(4):E3. doi: 10.3171/2019.1.FOCUS18700. PMID: 30933920. https://www.ncbi.nlm.nih.gov/pubmed/30933920
35. Licina A SA, Laughlin H. Proposed pathway for patients undergoing enhanced recovery after spinal surgery - protocol for a systematic narrative review of evidence. 25 July 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019135289
36. Pisarska M, Malczak P, Major P, et al. Enhanced recovery after surgery protocol in oesophageal cancer surgery: Systematic review and meta-analysis. PLoS One. 2017;12(3):e0174382. doi: 10.1371/journal.pone.0174382. PMID: 28350805. https://www.ncbi.nlm.nih.gov/pubmed/28350805
37. Liu F, Wang W, Wang C, et al. Enhanced recovery after surgery (ERAS) programs for esophagectomy protocol for a systematic review and meta-analysis. Medicine (Baltimore). 2018 Feb;97(8):e0016. doi: 10.1097/MD.0000000000010016. PMID: 29465538. https://www.ncbi.nlm.nih.gov/pubmed/29465538
38. Ding J, Sun B, Song P, et al. The application of enhanced recovery after surgery (ERAS)/fast-track surgery in gastrectomy for gastric cancer: a systematic review and meta-analysis. Oncotarget. 2017 Sep 26;8(43):75699-711. doi: 10.18632/oncotarget.18581. PMID: 29088903. https://www.ncbi.nlm.nih.gov/pubmed/29088903
39. A Z-V. Enhanced recovery after colorectal surgery and postoperative acute kidney injury: a systematic review and meta-analysis. 21 January 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019120856

40. Malczak P, Pisarska M, Piotr M, et al. Enhanced Recovery after Bariatric Surgery: Systematic Review and Meta-Analysis. Obes Surg. 2017 Jan;27(1):226-35. doi: 10.1007/s11695-016-2438-z. PMID: 27817086. https://www.ncbi.nlm.nih.gov/pubmed/27817086
41. Singh PM, Panwar R, Borle A, et al. Efficiency and Safety Effects of Applying ERAS Protocols to Bariatric Surgery: a Systematic Review with Meta-Analysis and Trial Sequential Analysis of Evidence. Obes Surg. 2017 Feb;27(2):489-501. doi: 10.1007/s11695-016-2442-3. PMID: 27878754. https://www.ncbi.nlm.nih.gov/pubmed/27878754
42. Rouxel P, Beloeil H. Enhanced recovery after hepatectomy: A systematic review. Anaesth Crit Care Pain Med. 2019 Feb;38(1):29-34. doi: 10.1016/j.accpm.2018.05.003. PMID: 29807132. https://www.ncbi.nlm.nih.gov/pubmed/29807132
43. Zhao Y, Qin H, Wu Y, et al. Enhanced recovery after surgery program reduces length of hospital stay and complications in liver resection: A PRISMA-compliant systematic review and meta-analysis of randomized controlled trials. Medicine (Baltimore). 2017 Aug;96(31):e7628. doi: 10.1097/MD.0000000000007628. PMID: 28767578. https://www.ncbi.nlm.nih.gov/pubmed/28767578
44. Visioni A, Shah R, Gabriel E, et al. Enhanced Recovery After Surgery for Noncolorectal Surgery?: A Systematic Review and Meta-analysis of Major Abdominal Surgery. Ann Surg. 2018 Jan;267(1):57-65. doi: 10.1097/SLA.0000000000002267. PMID: 28437313. https://www.ncbi.nlm.nih.gov/pubmed/28437313
45. Li Z, Zhao Q, Bai B, et al. Enhanced Recovery After Surgery Programs for Laparoscopic Abdominal Surgery: A Systematic Review and Meta-analysis. World J Surg. 2018 Nov;42(11):3463-73. doi: 10.1007/s00268-018-4656-0. PMID: 29750324. https://www.ncbi.nlm.nih.gov/pubmed/29750324
46. Fiore JF, Jr., Bejjani J, Conrad K, et al. Systematic review of the influence of enhanced recovery pathways in elective lung resection. J Thorac Cardiovasc Surg. 2016 Mar;151(3):708-15 e6. doi: 10.1016/j.jtcvs.2015.09.112. PMID: 26553460. https://www.ncbi.nlm.nih.gov/pubmed/26553460
47. Li S, Zhou K, Che G, et al. Enhanced recovery programs in lung cancer surgery: systematic review and meta-analysis of randomized controlled trials. Cancer Manag Res. 2017;9:657-70. doi: 10.2147/CMAR.S150500. PMID: 29180901. https://www.ncbi.nlm.nih.gov/pubmed/29180901
48. Offodile AC, 2nd, Gu C, Boukovalas S, et al. Enhanced recovery after surgery (ERAS) pathways in breast reconstruction: systematic review and meta-analysis of the literature. Breast Cancer Res Treat. 2019 Jan;173(1):65-77. doi: 10.1007/s10549-018-4991-8. PMID: 30306426. https://www.ncbi.nlm.nih.gov/pubmed/30306426
49. Soteropulos CE, Tang SYQ, Poore SO. Enhanced Recovery after Surgery in Breast Reconstruction: A Systematic Review. J Reconstr Microsurg. 2019 Aug 1. doi: 10.1055/s-0039-1693699. PMID: 31370092. https://www.ncbi.nlm.nih.gov/pubmed/31370092
50. Sebai ME, Siotos C, Payne RM, et al. Enhanced Recovery after Surgery Pathway for Microsurgical Breast Reconstruction: A Systematic Review and Meta-Analysis. Plast Reconstr Surg. 2019 Mar;143(3):655-66. doi: 10.1097/PRS.0000000000005300. PMID: 30589825. https://www.ncbi.nlm.nih.gov/pubmed/30589825
51. Giannarini G, Crestani A, Inferrera A, et al. Impact of enhanced recovery after surgery protocols versus standard of care on perioperative outcomes of radical cystectomy: a systematic review and meta-analysis of comparative studies. Minerva Urol Nefrol. 2019 Aug;71(4):309-23. doi: 10.23736/S0393-2249.19.03376-9. PMID: 31241271. https://www.ncbi.nlm.nih.gov/pubmed/31241271
52. Tyson MD, Chang SS. Enhanced Recovery Pathways Versus Standard Care After Cystectomy: A Meta-analysis of the Effect on Perioperative Outcomes. Eur Urol. 2016

Dec;70(6):995-1003. doi: 10.1016/j.eururo.2016.05.031. PMID: 27297680. https://www.ncbi.nlm.nih.gov/pubmed/27297680
53. P H. Enhanced recovery system regimen versus standard care after radical cystectomy in patients with bladder cancer: a systematic review & meta-analysis of the postoperative outcomes. . 4 October 2018 ed: PROSPERO; 2018. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018109715
54. Casans-Frances R A-GA, Ripollés-Melchor J, Espinosa A, Roberto-Alcácer AT, Ferrer-Ferrer ML, Calvo-Vecino JM. . Traditional vs ERAS radical cystectomy: systematic review, meta-analysis and trial sequential analysis. 20 September 2016 ed: PROSPERO; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016048045
55. McGinigle KL, Eldrup-Jorgensen J, McCall R, et al. A systematic review of enhanced recovery after surgery for vascular operations. J Vasc Surg. 2019 Aug;70(2):629-40 e1. doi: 10.1016/j.jvs.2019.01.050. PMID: 30922754. https://www.ncbi.nlm.nih.gov/pubmed/30922754
56. Gotlib Conn L, Rotstein OD, Greco E, et al. Enhanced recovery after vascular surgery: protocol for a systematic review. Syst Rev. 2012 Nov 2;1:52. doi: 10.1186/2046-4053-1-52. PMID: 23121841. https://www.ncbi.nlm.nih.gov/pubmed/23121841
57. Antoniou S NS, Torella F, Antoniou G. Fast track surgery programmes for abdominal aortic aneurysm surgery 15 August 2016 ed: PROSPERO; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016045936
58. Paduraru M, Ponchietti L, Casas IM, et al. Enhanced Recovery after Emergency Surgery: A Systematic Review. Bull Emerg Trauma. 2017 Apr;5(2):70-8. PMID: 28507993. https://www.ncbi.nlm.nih.gov/pubmed/28507993
59. Balasubramanian I, Creavin B, Winter D. Impact of an acute surgical unit in appendicectomy outcomes: A systematic review and meta-analysis. Int J Surg. 2018 Feb;50:114-20. doi: 10.1016/j.ijsu.2017.12.033. PMID: 29337180. https://www.ncbi.nlm.nih.gov/pubmed/29337180
60. Mendis N, Hamilton GM, McIsaac DI, et al. A Systematic Review of the Impact of Surgical Special Care Units on Patient Outcomes and Health Care Resource Utilization. Anesth Analg. 2019 Mar;128(3):533-42. doi: 10.1213/ANE.0000000000003942. PMID: 30676348. https://www.ncbi.nlm.nih.gov/pubmed/30676348
61. DeGirolamo K, Murphy PB, D'Souza K, et al. Processes of Health Care Delivery, Education, and Provider Satisfaction in Acute Care Surgery: A Systematic Review. Am Surg. 2017 Dec 1;83(12):1438-46. PMID: 29336769. https://www.ncbi.nlm.nih.gov/pubmed/29336769
62. Reid LE, Dinesen LC, Jones MC, et al. The effectiveness and variation of acute medical units: a systematic review. Int J Qual Health Care. 2016 Sep;28(4):433-46. doi: 10.1093/intqhc/mzw056. PMID: 27313174. https://www.ncbi.nlm.nih.gov/pubmed/27313174
63. Assaye AM WR, Schultz T, Feo R. . Impact of nurse staffing on patient and nurse workforce outcomes in acute care settings in low- and middle-income countries: a systematic review protocol. 11 January 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019119428
64. Woo BFY, Lee JXY, Tam WWS. The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: a systematic review. Hum Resour Health. 2017 Sep 11;15(1):63. doi: 10.1186/s12960-017-0237-9. PMID: 28893270. https://www.ncbi.nlm.nih.gov/pubmed/28893270
65. Audet LA PL, Lavoie-Tremblay M, Kilpatrick K. The association between advanced practice nursing roles and patient outcomes in adults following cardiac surgery: a systematic review of randomized controlled trials. 07 May 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019130718
66. Snowdon D SB, Davis A. What is the effect of allied health professional delegation of therapy to allied health assistants on patient and organisational outcomes? A systematic review.

12 June 2019 ed: PROSPERO; 2019.
http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019127449
67. Heaton HA, Castaneda-Guarderas A, Trotter ER, et al. Effect of scribes on patient throughput, revenue, and patient and provider satisfaction: a systematic review and meta-analysis. Am J Emerg Med. 2016 Oct;34(10):2018-28. doi: 10.1016/j.ajem.2016.07.056. PMID: 27534432. https://www.ncbi.nlm.nih.gov/pubmed/27534432
68. Johal J, Dodd A. Physician extenders on surgical services: a systematic review. Can J Surg. 2017 Jun;60(3):172-8. doi: 10.1503/cjs.001516. PMID: 28327274.
https://www.ncbi.nlm.nih.gov/pubmed/28327274
69. Kerlin MP, Adhikari NK, Rose L, et al. An Official American Thoracic Society Systematic Review: The Effect of Nighttime Intensivist Staffing on Mortality and Length of Stay among Intensive Care Unit Patients. Am J Respir Crit Care Med. 2017 Feb 1;195(3):383-93. doi: 10.1164/rccm.201611-2250ST. PMID: 28145766.
https://www.ncbi.nlm.nih.gov/pubmed/28145766
70. de Burlet KJ, Ing AJ, Larsen PD, et al. Systematic review of diagnostic pathways for patients presenting with acute abdominal pain. Int J Qual Health Care. 2018 Nov 1;30(9):678-83. doi: 10.1093/intqhc/mzy079. PMID: 29668935. https://www.ncbi.nlm.nih.gov/pubmed/29668935
71. Gordon SA, Reiter ER. Effectiveness of critical care pathways for head and neck cancer surgery: A systematic review. Head Neck. 2016 Sep;38(9):1421-7. doi: 10.1002/hed.24265. PMID: 27387590. https://www.ncbi.nlm.nih.gov/pubmed/27387590
72. Plishka CT, Rotter T, Penz ED, et al. Effects of Clinical Pathways for COPD on Patient, Professional, and Systems Outcomes: A Systematic Review. Chest. 2019 May 28. doi: 10.1016/j.chest.2019.04.131. PMID: 31150639.
https://www.ncbi.nlm.nih.gov/pubmed/31150639
73. Shabaninejad H, Alidoost S, Delgoshaei B. Identifying and classifying indicators affected by performing clinical pathways in hospitals: a scoping review. Int J Evid Based Healthc. 2018 Mar;16(1):3-24. doi: 10.1097/XEB.0000000000000126. PMID: 29176429.
https://www.ncbi.nlm.nih.gov/pubmed/29176429
74. Neame MT, Chacko J, Surace AE, et al. A systematic review of the effects of implementing clinical pathways supported by health information technologies. J Am Med Inform Assoc. 2019 Apr 1;26(4):356-63. doi: 10.1093/jamia/ocy176. PMID: 30794311.
https://www.ncbi.nlm.nih.gov/pubmed/30794311
75. Parhar KK ND, Stelfox HT, Doig C, Soo A, Robertson HL, Premji Z, Rubenfeld G, Knight G. Standardized management pathways for hypoxemic respiratory failure and Acute Respiratory Distress Syndrome (ARDS): a systematic review and meta-analysis. 04 January 2019 ed: PROSPERO; 2019.
http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019099921
76. van Hoeve J VR, Lawal A, Siesling S, Rotter T. Effects of oncological care pathways on patient, professional and systems outcomes: a systematic review. 17 February 2017 ed: PROSPERO; 2017.
http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017057592
77. Gilhooly D GS, Moonesinghe R A systematic review of care bundle design and implementation strategies to assess the enablers and barriers to successful outcomes from their implementation. 03 December 2015 ed: PROSPERO; 2015.
http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42015029963
78. Catalano L BD, Levy M, Trikalinos T Using bundles to standardize care in sepsis, severe sepsis, and septic shock: a systematic review and empirical appraisal of the literature. 17 March 2014 ed: PROSPERO; 2014.
http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42014008958

79. Sarkies MN, White J, Henderson K, et al. Additional weekend allied health services reduce length of stay in subacute rehabilitation wards but their effectiveness and cost-effectiveness are unclear in acute general medical and surgical hospital wards: a systematic review. J Physiother. 2018 Jul;64(3):142-58. doi: 10.1016/j.jphys.2018.05.004. PMID: 29929739. https://www.ncbi.nlm.nih.gov/pubmed/29929739
80. Summers B NR, Pritchard E Model of care in weekend allied health services: a systematic review and meta-analysis. 09 November 2017 ed: PROSPERO; 2017. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017070412
81. Moshynskyy A SE, Mailman J. . Night-time transfers in intensive care unit and patient outcomes. 25 October 2017 ed: PROSPERO; 2017. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017074082
82. Buehler SS, Madison B, Snyder SR, et al. Effectiveness of Practices To Increase Timeliness of Providing Targeted Therapy for Inpatients with Bloodstream Infections: a Laboratory Medicine Best Practices Systematic Review and Meta-analysis. Clin Microbiol Rev. 2016 Jan;29(1):59-103. doi: 10.1128/CMR.00053-14. PMID: 26598385. https://www.ncbi.nlm.nih.gov/pubmed/26598385
83. Cortegiani A MG. Effect of nighttime surgery on mortality and adverse events: a systematic review and meta-analysis. 17 May 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019128534
84. Voor in 't holt A SJ, van Vianen W, Verkaik N, Vos M. Do single patient rooms prevent transmission of microorganisms? A systematic review and meta-analysis. 13 April 2016 ed; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016037699
85. Disher T, Dol J, Richardson B, et al. Single room versus open-bay design in neonatal intensive care units for improvement in infant outcomes: a systematic review protocol. JBI Database System Rev Implement Rep. 2017 Oct;15(10):2480-6. doi: 10.11124/JBISRIR-2017-003346. PMID: 29035959. https://www.ncbi.nlm.nih.gov/pubmed/29035959
86. O'Callaghan N, Dee A, Philip RK. Evidence-based design for neonatal units: a systematic review. Matern Health Neonatol Perinatol. 2019;5:6. doi: 10.1186/s40748-019-0101-0. PMID: 31061714. https://www.ncbi.nlm.nih.gov/pubmed/31061714
87. van Veenendaal NR, Heideman WH, Limpens J, et al. Hospitalising preterm infants in single family rooms versus open bay units: a systematic review and meta-analysis. Lancet Child Adolesc Health. 2019 Mar;3(3):147-57. doi: 10.1016/S2352-4642(18)30375-4. PMID: 30630745. https://www.ncbi.nlm.nih.gov/pubmed/30630745
88. Morag I, Ohlsson A. Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database Syst Rev. 2016 Aug 10(8):CD006982. doi: 10.1002/14651858.CD006982.pub4. PMID: 27508358. https://www.ncbi.nlm.nih.gov/pubmed/27508358
89. Tlapa D Z-LC, Limon-Romero J, Baez-Lopez Y, Tortorella G, Alvarado-Iniesta A, Aguilar-Duque J Assessing the effect of lean intervention within inpatient care. 02 July 2019 ed: PROSPERO; 2019. https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42019134287
90. Nowak M, Pfaff H, Karbach U. Does Value Stream Mapping affect the structure, process, and outcome quality in care facilities? A systematic review. Syst Rev. 2017 Aug 24;6(1):170. doi: 10.1186/s13643-017-0563-y. PMID: 28838320. https://www.ncbi.nlm.nih.gov/pubmed/28838320
91. Mardis M, Davis J, Benningfield B, et al. Shift-to-Shift Handoff Effects on Patient Safety and Outcomes. Am J Med Qual. 2017 Jan/Feb;32(1):34-42. doi: 10.1177/1062860615612923. PMID: 26518882. https://www.ncbi.nlm.nih.gov/pubmed/26518882

92. Clegg A SA, Hill J, Reed J. Effectiveness of continuous quality improvement for developing professional practice and improving healthcare outcomes. 14 February 2018 ed: PROSPERO; 2018. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018088309
93. Wood C T-CJ, Richards D, Pentecost C, Wilkinson L. A systematic review of the effectiveness of the use of 'Aggregation of Marginal Gains' in driving change in healthcare. 13 October 2016 ed: PROSPERO; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016042097
94. Rosenthal JL, Doiron R, Haynes SC, et al. The Effectiveness of Standardized Handoff Tool Interventions During Inter- and Intra-facility Care Transitions on Patient-Related Outcomes: A Systematic Review. Am J Med Qual. 2018 Mar/Apr;33(2):193-206. doi: 10.1177/1062860617708244. PMID: 28467104. https://www.ncbi.nlm.nih.gov/pubmed/28467104
95. Joo JY, Huber DL. Case Management Effectiveness on Health Care Utilization Outcomes: A Systematic Review of Reviews. West J Nurs Res. 2019 Jan;41(1):111-33. doi: 10.1177/0193945918762135. PMID: 29542405. https://www.ncbi.nlm.nih.gov/pubmed/29542405
96. Prgomet M, Li L, Niazkhani Z, et al. Impact of commercial computerized provider order entry (CPOE) and clinical decision support systems (CDSSs) on medication errors, length of stay, and mortality in intensive care units: a systematic review and meta-analysis. J Am Med Inform Assoc. 2017 Mar 1;24(2):413-22. doi: 10.1093/jamia/ocw145. PMID: 28395016. https://www.ncbi.nlm.nih.gov/pubmed/28395016
97. Vasey B BN, Marlow N, Ursprung S, McCulloch P Effects of clinical diagnostic decision support systems based on machine learning on physicians' performance – a systematic review. 26 July 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019140075
98. Al Samihan S FB, Jani Y Multidisciplinary ward rounds and medication safety in inpatient settings: a systematic narrative review. . 21 June 2016 ed: PROSPERO; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016039141
99. Van Grootven B, Flamaing J, Dierckx de Casterle B, et al. Effectiveness of in-hospital geriatric co-management: a systematic review and meta-analysis. Age Ageing. 2017 Nov 1;46(6):903-10. doi: 10.1093/ageing/afx051. PMID: 28444116. https://www.ncbi.nlm.nih.gov/pubmed/28444116
100. Pantha S PB, Jones M, Gray R. Inter-professional collaboration and patient mortality: a systematic review of experimental and observational studies. . 29 July 2019 ed: PROSPERO; 2019. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019133543
101. Mazzarello S, McIsaac DI, Montroy J, et al. Postoperative shared-care for patients undergoing non-cardiac surgery: a systematic review and meta-analysis. Can J Anaesth. 2019 Sep;66(9):1095-105. doi: 10.1007/s12630-019-01433-5. PMID: 31290119. https://www.ncbi.nlm.nih.gov/pubmed/31290119
102. Shaw SE, Preece R, Stenson KM, et al. Short Stay EVAR is Safe and Cost Effective. Eur J Vasc Endovasc Surg. 2019 Mar;57(3):368-73. doi: 10.1016/j.ejvs.2018.10.008. PMID: 30442563. https://www.ncbi.nlm.nih.gov/pubmed/30442563
103. van der Klis-Busink A AM, Daams J, Latour C, Buurman B. The effectiveness of hospital-based care coordination on patient satisfaction and hospital length of stay: a systematic review.: PROSPERO; 2016. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016033456
104. Keasberry J, Scott IA, Sullivan C, et al. Going digital: a narrative overview of the clinical and organisational impacts of eHealth technologies in hospital practice. Aust Health Rev. 2017 Dec;41(6):646-64. doi: 10.1071/AH16233. PMID: 28063462. https://www.ncbi.nlm.nih.gov/pubmed/28063462

105. Chen J, Sun D, Yang W, et al. Clinical and Economic Outcomes of Telemedicine Programs in the Intensive Care Unit: A Systematic Review and Meta-Analysis. J Intensive Care Med. 2018 Jul;33(7):383-93. doi: 10.1177/0885066617726942. PMID: 28826282. https://www.ncbi.nlm.nih.gov/pubmed/28826282
106. Mackintosh N, Terblanche M, Maharaj R, et al. Telemedicine with clinical decision support for critical care: a systematic review. Syst Rev. 2016 Oct 18;5(1):176. doi: 10.1186/s13643-016-0357-7. PMID: 27756376. https://www.ncbi.nlm.nih.gov/pubmed/27756376
107. Kalankesh LR, Pourasghar F, Nicholson L, et al. Effect of Telehealth Interventions on Hospitalization Indicators: A Systematic Review. Perspect Health Inf Manag. 2016 fall;13(Fall):1h. PMID: 27843425. https://www.ncbi.nlm.nih.gov/pubmed/27843425
108. Lloyd C LG, Maddern G, Story D What health service initiatives undertaken within operating suite recovery rooms have been shown to improve patient outcomes after adult non-cardiac surgery? 20 August 2018 ed: PROSPERO; 2018. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018106093
109. Chen J OJ. Application of agent-based modeling in healthcare operation and service delivery: a systematic review of its scope, quality and implementation. 21 May 2018 ed: PROSPERO; 2018. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018094769
110. Albalawi Z, Laffin M, Gramlich L, et al. Enhanced Recovery After Surgery (ERAS((R))) in Individuals with Diabetes: A Systematic Review. World J Surg. 2017 Aug;41(8):1927-34. doi: 10.1007/s00268-017-3982-y. PMID: 28321553. https://www.ncbi.nlm.nih.gov/pubmed/28321553
111. Fagard K, Wolthuis A, D'Hoore A, et al. A systematic review of the intervention components, adherence and outcomes of enhanced recovery programmes in older patients undergoing elective colorectal surgery. BMC Geriatr. 2019 Jun 6;19(1):157. doi: 10.1186/s12877-019-1158-3. PMID: 31170933. https://www.ncbi.nlm.nih.gov/pubmed/31170933
112. Launay-Savary MV, Mathonnet M, Theissen A, et al. Are enhanced recovery programs in colorectal surgery feasible and useful in the elderly? A systematic review of the literature. J Visc Surg. 2017 Feb;154(1):29-35. doi: 10.1016/j.jviscsurg.2016.09.016. PMID: 27842907. https://www.ncbi.nlm.nih.gov/pubmed/27842907
113. Paduraru M, Ponchietti L, Casas IM, et al. Enhanced Recovery After Surgery (ERAS) - The Evidence in Geriatric Emergency Surgery: A Systematic Review. Chirurgia (Bucur). 2017 Sept-Oct;112(5):546-57. doi: 10.21614/chirurgia.112.5.546. PMID: 29088554. https://www.ncbi.nlm.nih.gov/pubmed/29088554
114. Villatte G, Mathonnet M, Villeminot J, et al. Interest of enhanced recovery programs in the elderly during total hip arthroplasty A systematic review. Geriatr Psychol Neuropsychiatr Vieil. 2019 Sep 1;17(3):234-42. doi: 10.1684/pnv.2019.0796. PMID: 31251213. https://www.ncbi.nlm.nih.gov/pubmed/31251213
115. Kumba C BT, De Cock A, Willems A, Harte C, Querciagrossa S, Orliaguet G, MELOT C. . Rapid recovery pathways after surgery in children: a systematic review and meta-analysis. 1 August 2018 ed: PROSPERO; 2018. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018103518
116. Do-Wyeld M, Rogerson T, Court-Kowalski S, et al. Fast-track surgery for acute appendicitis in children: a systematic review of protocol-based care. ANZ J Surg. 2019 Apr 15. doi: 10.1111/ans.15125. PMID: 30989778. https://www.ncbi.nlm.nih.gov/pubmed/30989778
117. Handley M, Bunn F, Goodman C. Dementia-friendly interventions to improve the care of people living with dementia admitted to hospitals: a realist review. BMJ Open. 2017 Jul 16;7(7):e015257. doi: 10.1136/bmjopen-2016-015257. PMID: 28713073. https://www.ncbi.nlm.nih.gov/pubmed/28713073

118. Ansryan LZ, Aronow HU, Borenstein JE, et al. Systems Addressing Frail Elder Care: Description of a Successful Model. J Nurs Adm. 2018 Jan;48(1):11-7. doi: 10.1097/NNA.0000000000000564. PMID: 29219905. https://www.ncbi.nlm.nih.gov/pubmed/29219905
119. Hempenius L, Slaets JP, van Asselt D, et al. Long Term Outcomes of a Geriatric Liaison Intervention in Frail Elderly Cancer Patients. PLoS One. 2016;11(2):e0143364. doi: 10.1371/journal.pone.0143364. PMID: 26901417. https://www.ncbi.nlm.nih.gov/pubmed/26901417
120. Imam T, Goldsby-West R, Hashemi N, et al. The acute care of the elderly unit: providing rapid specialised care for frail older people. Future Healthc J. 2019 Mar;6(Suppl 1):10. doi: 10.7861/futurehosp.6-1-s10. PMID: 31363535. https://www.ncbi.nlm.nih.gov/pubmed/31363535
121. Wit MA, Bos-Schaap AJ, Umans VA. Care for Vulnerable Elderly in Cardiology: A Program for Daily Practice. Crit Pathw Cardiol. 2017 Mar;16(1):22-6. doi: 10.1097/HPC.0000000000000102. PMID: 28195939. https://www.ncbi.nlm.nih.gov/pubmed/28195939
122. Boltz M, Cuellar NG, Cole C, et al. Comparing an on-site nurse practitioner with telemedicine physician support hospitalist programme with a traditional physician hospitalist programme. J Telemed Telecare. 2019 May;25(4):213-20. doi: 10.1177/1357633X18758744. PMID: 29498301. https://www.ncbi.nlm.nih.gov/pubmed/29498301
123. Borenstein JE, Aronow HU, Bolton LB, et al. Identification and team-based interprofessional management of hospitalized vulnerable older adults. Nurs Outlook. 2016 Mar-Apr;64(2):137-45. doi: 10.1016/j.outlook.2015.11.014. PMID: 26833250. https://www.ncbi.nlm.nih.gov/pubmed/26833250

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Appendix A: Methods

We assessed nomination for priority for a systematic review or other AHRQ Effective Health Care report with a hierarchical process using established selection criteria. Assessment of each criteria determined the need to evaluate the next one. See Appendix B for detailed description of the criteria.

Appropriateness and Importance

We assessed the nomination for appropriateness and importance.

Desirability of New Review/Absence of Duplication

We searched for high-quality, completed or in-process evidence reviews published in the last three years July 2016 to August 2019 on the questions of the nomination from these sources:

- AHRQ: Evidence reports and technology assessments
  - AHRQ Evidence Reports https://www.ahrq.gov/research/findings/evidence-based-reports/index.html
  - EHC Program https://effectivehealthcare.ahrq.gov/
  - US Preventive Services Task Force https://www.uspreventiveservicestaskforce.org/
  - AHRQ Technology Assessment Program https://www.ahrq.gov/research/findings/ta/index.html
- US Department of Veterans Affairs Products publications
  - Evidence Synthesis Program https://www.hsrd.research.va.gov/publications/esp/
  - VA/Department of Defense Evidence-Based Clinical Practice Guideline Program https://www.healthquality.va.gov/
- Cochrane Systematic Reviews https://www.cochranelibrary.com/
- PROSPERO Database (international prospective register of systematic reviews and protocols) http://www.crd.york.ac.uk/prospero/
- PubMed https://www.ncbi.nlm.nih.gov/pubmed/
- Campbell Collaboration http://www.campbellcollaboration.org/
- McMaster Health System Evidence https://www.healthsystemsevidence.org/
- Joanna Briggs Institute http://joannabriggs.org/
- WHO Health Evidence Network http://www.euro.who.int/en/data-and-evidence/evidence-informed-policy-making/health-evidence-network-hen

Impact of a New Evidence Review

The impact of a new evidence review was qualitatively assessed by analyzing the current standard of care, the existence of potential knowledge gaps, and practice variation. We considered whether it was possible for this review to influence the current state of practice through various dissemination pathways (practice recommendation, clinical guidelines, etc.).

Feasibility of New Evidence Review

We conducted a limited literature search in PubMed from the last five years 2014-2019 for question 3, on vulnerable populations. We reviewed all identified titles and abstracts for inclusion and classified identified studies by question and study design to estimate the size and scope of a potential evidence review.

Search strategy
Limits: English, 2014-2019

(Vulnerable Populations[mesh] OR Frail Elderly[mesh] OR Homeless Persons[mesh] OR Disabled Persons[mesh] OR Child, Orphaned[mesh] OR Child, Abandoned[mesh] OR Child of Impaired Parents[mesh] OR Child, Foster[mesh] OR Child, Unwanted[mesh] OR Developmental Disabilities[mesh] OR underserved[tiab] OR disadvantaged[tiab] OR vulnerable[tiab])
AND
(Geriatric Assessment[mesh] OR Health Plan Implementation[mesh] OR Patient Care Team[mesh] OR Patient-Centered Care[mesh] OR Patient Care Planning[mesh] OR Patient Care Management[mesh:noexp] OR “enhanced recovery”[tiab] OR “discharge planning”[tiab] OR “discharge process”[tiab] OR “discharge processes”[tiab] OR “discharge procedure”[tiab] OR “discharge procedures”[tiab] OR “discharge plan”[tiab] OR “discharge plans”[tiab] OR “discharge program”[tiab] OR “discharge programs”[tiab] OR "geriatric assessment"[tiab] OR "geriatric assessments"[tiab] OR “model of care”[tiab] OR “models of care”[tiab] OR “care model”[tiab] OR “care models”[tiab] OR “clinical pathway”[tiab] OR “clinical pathways”[tiab] OR “critical pathway”[tiab] OR “critical pathways”[tiab] OR “organizational intervention”[tiab] OR “organizational interventions”[tiab] OR navigator[tiab] OR navigators[tiab] OR navigation[tiab] OR “patient centered”[tiab])
AND
(Length of stay[mesh] OR “reducing length of stay”[tiab] OR “length of stay”[tiab] OR Patient Readmission[mesh] OR readmission[tiab] OR readmissions[tiab] OR Patient harm[mesh] OR harm[tiab] OR harms[tiab] OR unintended[tiab] OR “patient outcome”[tiab] OR “patient outcomes”[tiab])
AND
("Systematic Review" [Publication Type] OR "Controlled Clinical Trial" [Publication Type] OR “Randomized Controlled Trial”[Publication Type] OR "Comparative Study" [Publication Type] OR "Observational Study" [Publication Type] OR Interrupted Time Series Analysis[mesh] OR “systematic review”[ti] OR “controlled trial”[ti] OR “control trial”[ti] OR “time series”[ti])

https://clinicaltrials.gov/ct2/results?term=length+of+hospital+stay&recrs=abdf

Value

We assessed the nomination for value. We considered whether or not the clinical, consumer, or policymaking context had the potential to respond with evidence-based change; and if a partner organization would use this evidence review to influence practice.

Appendix B. Selection Criteria Assessment

Selection Criteria	Assessment
1. Appropriateness	
1a. Does the nomination represent a health care drug, intervention, device, technology, or health care system/setting available (or soon to be available) in the U.S.?	Yes
1b. Is the nomination a request for an evidence report?	Yes
1c. Is the focus on effectiveness or comparative effectiveness?	Yes
1d. Is the nomination focus supported by a logic model or biologic plausibility? Is it consistent or coherent with what is known about the topic?	Yes
2. Importance	
2a. Represents a significant disease burden; large proportion of the population	There were 35.4 million inpatient hospital stays in 2014. 4.1 million were maternal; 3.9 million were neonatal; 9 million were surgical; and 17 million were medical. The top 5 diagnosis for hospital stays in 2014 were: pregnancy/childbirth, newborns/neonates, septicemia, osteoarthritis, and congestive heart failure.[1] A "delayed discharge" as one where a patient was ready to leave the hospital from a medical standpoint, but had stayed more than 24 hours in the hospital. Extra bed-days could account for up to 30.7% of total costs and cause cancellations of elective operations, treatment delay and repercussions for subsequent services, especially for elderly patients.[2] Unnecessary prolonged length of stay reduces a hospital's capacity to match supply of beds to demand, control patient occupancy, and manage costs. Delayed discharge also impacts quality of care and patient satisfaction.[3] A 2015 study of a teaching hospital found 28.7% patients experienced a delayed discharge over a 5 week timeframe. The mean delay was 3.15 days (median 2 days) with a range of 1-42 days. The top 5 barriers were:[3] • Family or patient's readiness to leave hospital • Prolonged wait time for procedures, test results, or prescriptions

	• Appropriate discharge site could not be found • Patient awaiting recommendation from consult service • Unable to find follow-up care with medical provider for patient
2b. Is of high public interest; affects health care decision making, outcomes, or costs for a large proportion of the US population or for a vulnerable population	Yes. Unnecessary delays in discharge incurs high costs for health systems, and is of high interest for health systems, including those represented on the AHRQ Learning Health System Panel.
2c. Incorporates issues around both clinical benefits and potential clinical harms	Yes
2d. Represents high costs due to common use, high unit costs, or high associated costs to consumers, to patients, to health care systems, or to payers	Yes. A review of studies about the economic impact of unnecessary delays found that the average cost of an extra day was estimated at around £200-£565 (about $230-700) per patient per day.[2]
3. Desirability of a New Evidence Review/Absence of Duplication	
3. A recent high-quality systematic review or other evidence review is not available on this topic	A new review would be partly duplicative. We found 111 reviews that addressed Question 1, and 3 that addressed Question 2. However the reviews related to question 2 did not address all the different groups of interest to the nominators such as the homeless, and those with high social risk. Question 1. We found 111 systematic reviews that addressed the majority of potential interventions, and a few subgroups. All except 2 addressed a single intervention. Both are in-process reviews. One is focused on older adults, and will be published in the near future. The other is focused on adults and we are uncertain when the review will be completed. We found high-quality reviews that addressed • Enhanced recovery after surgery (ERAS) in colorectal surgery[11] • ERAS/fast track cardiac surgery[12] • Short stay units[13] • Nurse staffing[14] • Discharge planning[15-17] • Lean[18, 19] • Multidisciplinary rounding[20] • Interprofessional collaboration[21] • Telehealth[22] • Comprehensive geriatric assessment[23, 24] • Older adults[25] • Migrant/refugees[26]

Question 1-General

One in-process review will focus broadly on hospital-based interventions for decreasing LOS in adults. It will look at hospital resources and care organization on outcomes, including LOS.[27] We reached out to the investigators about the status of the review and no reply has been received.

Question 1-ERAS

We found 40 systematic reviews on ERAS, addressing a variety of surgeries. One review was from the VA Evidence Synthesis Program (ESP)[11]. Most included randomized and nonrandomized studies. The number of studies in SR ranged from 0 to 37. Most reviews found that ERAS led to decreased LOS. Reviews included a range of study types, such as cohort, before/after studies, and interrupted time series.

Gynecologic surgery

- Minimally invasive gynecologic surgery with bowel surgery. This 2019 systematic review[28] studied LOS, postoperative outcomes, cost, complications and readmissions. This review found one study on gynecologic surgery with bowel surgery; they expanded the scope to include 12 additional studies on minimally invasive colorectal resections.
- Elective cesarean section. This is a 2017 rapid review of ERAS protocols and review of reviews[29]. It assessed the evidence for individual components of protocols and ERAS packages.
- Surgery for advanced ovarian cancer. This 2017 review[30] looked at ERAS protocols and components of the ERAS protocols.

Orthopedic surgery

- Hip and knee arthroplasty. This was addressed by two completed reviews, published in 2017[31] and 2018[32]
- Spine. This was addressed by two completed systematic reviews and one in-process systematic review. An abstract of the Dietz et al SR[33] was not available. Elsarrag et al[34] assessed ERAS protocols in adults. The in-process review will look at components of ERAS protocols and ERAS packages in adults and children.[35]

Gastrointestinal surgery

- Esophageal cancer surgery. One completed SR[36] and one in-process SR[37] addresses this area. The in-process review will focus specifically on esophagectomy with radical lymphadenectomy.
- Gastrectomy.
    - This 2017 systematic review[38] focused on laparoscopic-assisted gastrectomy for gastric cancer.
    - A second 2018 review assessed ERAS and fast track surgery for gastrectomy.
- Colorectal surgery. We found two completed systematic reviews and one in-process systematic review. The VA ESP SR[11] assessed outcomes in patients undergoing elective colorectal surgery. The other SR, focused on minimally invasive gynecologic surgery with colorectal surgery is described above.[28] An in-process SR will focus on postoperative acute kidney injury after colorectal surgery with ERAS.[39]
- Bariatric surgery. Two SR both published in 2017[40, 41] assessed ERAS. One review restricted studies to those that included four prespecified ERAS components.[40]

- Liver surgery. One review focused on all liver surgeries except for transplantation[42]; and the other focused on liver resection.[43]
- Noncolorectal surgery. This SR[44] focused on ERAS and fast track surgery for noncolorectal abdominal surgery.
- Laparoscopic abdominal surgery. This 2018 SR[45] assessed LOS, time to first flatus, postoperative complication rate and hospital cost.

Pulmonary surgery

- Lung resection. This 2016 systematic review[46] focused on elective lung resection in adults.
- Lung cancer. This 2017 SR[47] focused on surgeries for lung cancer. ERAS protocols had to include more than four components within at least two phases of perioperative care.

Breast surgery

- Breast reconstruction. Two 2019 SR addressed breast reconstruction after mastectomy.[48, 49]
- Microsurgical breast reconstruction. This 2019 review[50] included LOS and 30-day postoperative morbidity.

Genitourinary surgery

- Cystectomy. Two completed reviews (one on cystectomy, and the other on radical cystectomy) [51, 52] and two in-process SR on radical cystectomy addressed this area.[53, 54]

Vascular surgery

- Vascular surgery. We identified one complete[55] and one in-process[56] systematic review. The completed SR assessed LOS, postoperative diet and ambulation.
- Abdominal aortic aneurysm. This in-process Cochrane SR[57] will assess LOS, LOS in the ICU, need for unplanned postoperative mechanical ventilation, readmissions and health-related quality of life. We confirmed that this review is still in-progress.
- Cardiac surgery. This 2016 Cochrane review focused on fast track care for adult cardiac surgical patients. Types of surgeries included coronary artery bypass grafts, aortic valve replacement, and mitral valve replacement.[12]

Other

- Emergency surgery. Outcomes for the 2017 SR[58] included postoperative complications, mortality, length of stay (LOS) and readmission rate.

Question 1-specialized care units

Five systematic reviews looked at different types of specialized care units within a hospital. One was developed under the Cochrane Collaboration.

- Specialized surgical unit. One 2018 SR[59] focused on acute surgical unit, a consultant led, independent surgical team that is solely responsible for acute surgical cases with access to dedicated emergency theatre time, for appendectomy. A 2019 review of surgical special care units included all types of surgeries and all ages.[60] A 2017 review looked at acute care surgery services.[61] Most studies found an increase in daytime operating, improved patient transit from emergency department to operating room to home, and decreased length of stay.
- Acute medical unit. An AMU is defined as a dedicated facility within a hospital that acts as the focus for acute medical care for patients who have presented as medical emergencies to hospital. A 2016 SR[62] assessed LOS, readmission, mortality, and patient and staff satisfaction; and compared components of different models.

- Short-stay. This 2018 Cochrane SR[13] assessed the evidence for short-stay units. It focused on adults with medical conditions

Question 1-staffing model, Skill mix-role expansion, task shifting, substitution

Eight completed and in-process SR are focused on this area. One was developed under the Cochrane Collaboration and another by the Joanna Briggs Institute.

- Nursing. A 2019 Cochrane SR[14] looked at the effect of hospital nurse-staffing models on outcomes. Interventions included advanced or specialist nurses, nursing assistive personnel, primary nursing and staffing models. An in-process Joanna Briggs Institute (JBI) SR will be focusing on nurse staffing in low and middle-income countries.[63] It is uncertain whether the scope might be broadened to include countries applicable to the US.
- Advanced care nursing. Woo et al (2017)[64] looked at the impact of advanced practice nursing in the emergency and critical care settings. Outcomes included length of stay, time to consultation/treatment, mortality, patient satisfaction, and cost savings. The in-process review[65] looks at the association between advanced practice nursing roles and patient outcomes in adults following cardiac surgery; it will be restricted to RCTs.
- Allied health assistants. This in-process review looked at the delegation of therapy to allied health assistants on patient and organizational outcomes.[66]
- Scribes. This 2016 review looked at scribe effect on patient throughput, revenue, and patient and provider satisfaction.[67] The settings included were broad and included all clinical settings including ED, outpatient, and inpatient areas. Fourteen of the studies were conducted in an ED, two were in outpatient clinics, and one was conducted on a hospital ward.
- Surgical physician extenders. This 2017 SR[68] looked at NPs and PAs on adult surgical and trauma services on complications, length of stay, readmission rates, patient satisfaction and perceived quality of care, resident workload, resident work hours, resident sleep hours, resident satisfaction, resident perceived quality of care, other health care worker satisfaction and perceived quality of care, and economic impact assessments.
- Night-time intensivist staffing. This SR for the American Thoracic Society reviewed the association of nighttime intensivist staffing with outcomes of intensive care unit (ICU) patients, including ICU and hospital length of stay.[69]

Question 1-Clinical pathways, standardized care

We found 6 completed and in-process SR, and one scoping review on the use of pathways. The number of studies included ranged from 10 to 47.

- Abdominal pain. This 2018 SR[70] identified the current evidence for diagnostic pathways and their use of imaging and effect on final outcomes. Quality assessment of primary studies was performed using MINORS and Level of Evidence. It found that pathways incorporating routine imaging will improve early diagnosis, but has not been proven to reduce complication rates or hospital length of stay.
- ENT surgery. This 2016 SR of critical care pathways for head and neck surgery[71] found that they decreased length of stay and cost of care. However they recommended controlled studies as the evidence base was comprised of 10 before/after studies.

- COPD. This 2019 review of the use of clinical pathways on care with people with COPD[72] found a statistically significant reduction in complications, readmissions, and length of stay but did not show changes in mortality or quality of life. The review did not restrict based on study design and included RoB assessment
- General.
    - A 2018 scoping review[73] analyzed the evidence regarding indicators affected by clinical pathways (CPW) in hospitals. Quality of included studies was assessed by using the Critical Appraisal Skills Program for clinical trials and cohort studies and the Joanna Briggs Institute Critical Appraisal Tool for Quasi-Experimental Studies. The majority of included studies had pretest-posttest quasi-experimental design and had been done in developed countries, especially the United States. The abstract described the frequency of outcomes across primary studies but did not present results.
    - A 2019 SR reviewed the effects of implementing HIT-supported clinical pathways.[74] Methods included risk of bias assessment of studies. It found improvements in patient outcomes, quality of care, and healthcare resource utilization.
- ARDS. An in-process SR will assess the use management pathways and protocols for people with ARDS and respiratory failure on outcomes, including length of stay. The protocol indicates that the review will include a broad range of study types and RoB assessment will be done using Newcastle-Ottawa Quality Assessment Scale (NOS), the ROBINS-I tool, or Cochrane Collaboration risk of bias tool.[75]
- Oncology care. An in-process SR will look at the use of clinical pathways in oncology care across a variety of settings, including the hospital.[76] The protocol describes methods for RoB assessment, and plans subgroup analysis based on setting.

Question 1-Care bundles

Two in-process SR focused on the use of care bundles in hospitals.

- General. This in-process SR will assess what factors in care bundle design and implementation strategy makes them successful or not in adoption by clinical staff, and on quality of care and patient outcomes. Methods for RoB are described.[77] We contacted the investigators about the status of the review, but have not yet received a response.
- Sepsis. An in-process SR will focus on bundles to standardize care in sepsis, severe sepsis, and septic shock.[78] While the protocol indicates that ROB will be assessed no further details are provided. We contacted the investigators and confirmed that the review is in-process.

Question 1-Availability and timing of care

Five SR relate to the availability and timing of different health services in the hospital. One review was developed for the CDC.

- Weekend/off hours availability. One completed SR[79] and one in-process SR from JBI[80] focused on allied health professional weekend availability.
- Night-time transfer. An in-process SR focused on outcomes of night-time transfers to the ICU. The review will focus on adults, and describes methods for ROB assessment.[81]
- Laboratory medicine. This SR focuses on practices to increase Timeliness of Providing Targeted Therapy for Inpatients with Bloodstream

Infections.[82] Studies show a significant and homogeneous reduction in mortality associated with rapid molecular testing combined with direct communication. Data about length of stay was sought. The review was performed by applying the Centers for Disease Control and Prevention's (CDC's) Laboratory Medicine Best Practices Initiative (LMBP) systematic review methods.

- Night-time surgery. This in-process SR looked at the impact surgical procedures under anesthesia performed at nighttime on outcomes.[83] Outcomes include mortality, incidence of adverse events (both intraoperative and postoperative); hospital length of stay; unplanned admission to the Intensive Care Unit; and Intensive Care Unit length of stay.

Question 1-Physical structure

Five systematic reviews focused on physical features of patient rooms. One was developed under the Cochrane Collaboration.

- This in-process review will assess the literature on single bed hospital rooms for adults on patient outcomes, resource utilization including length of stay and cost.[84] This review is on-hold and may not be completed (personal correspondence with lead investigator).
- Two systematic reviews focused on the NICU. A completed SR[85] reviewed the literature on neonatal intensive care unit design features that could lead to improved neonatal, parental and staff outcomes. ROB was described in the abstract. A second systematic review of NICU design published in 2019 focused on design features that could improve neonatal, parental and staff outcomes.[86]
- Another SR[87] looked at the literature on single family rooms vs. open bays for preterm infants and the impact on hospital and clinical outcomes.
- A Cochrane SR focused on cycled light in the NICU for preterm and low birth weight infants.[88]

Question 1-Discharge planning

We identified three SR on discharge planning. Two were developed by the Cochrane Collaboration, and one from JBI.

- A 2018 Cochrane SR[16] focused on caseworker assigned discharge planning for children hospitalized for respiratory illness. The four included studies did not provide information about hospital length of stay.
- A 2018 JBI SR[17] assessed the effectiveness of nursing discharge planning interventions on health-related outcomes for older inpatients discharged home. Findings suggest that nursing discharge planning for older inpatients discharged home increases the length of stay yet neither reduces readmission rate nor improves quality of life.
- A 2016 Cochrane SR[15] focused on discharge planning from the hospital. This review indicates that a personalized discharge plan probably brings about a small reduction in hospital length of stay and readmission rates for elderly patients who were admitted to hospital with a medical condition, and may increase patient satisfaction.

Question 1-Quality improvement, Process improvement

We identified eight completed and in-process SR that focused on quality improvement or process improvement interventions.

- Lean. Three in-process SR,[18, 19, 89] including one from the Cochrane Collaboration[19] and one from JBI[18], looked at the effect of Lean on LOS and other outcomes.

- Value stream mapping. This 2017 SR[90, 91] found that Value Stream Mapping has positive effects on the time dimension of process and outcome quality. It seems to reduce non-value-added time (e.g., waiting time) and length of stay. The evidence base consisted of before-after studies.
- Continuous Quality Improvement. This in-process review will focus on CQI across all healthcare settings, including the hospital.[92] Interventions to be included are broad, and will include Lean.
- Aggregation of marginal gains. This in-process review will include all populations and healthcare settings.[93] RoB assessment methods are described in the protocol. No subgroup analysis is planned.
- Processes. Two reviews looked at healthcare processes. One looked at shift to shift hand-off processes; a second on hand-off processes during transitions of care.[94] The review reported mixed results on LOS. Abstracts for both reviews did not report on methods for RoB assessment.

Question 1-Case management

One systematic review on case management[95] looked at resource utilization, including LOS. It was not clear from the abstract whether the review focused on hospital settings or settings more broadly. RoB assessment was not described in the abstract.

Question 1-Decision support

One completed and one in-process SR looked at decision support.

- The 2017 review[96] looked at CPOE and decision support in the ICU on outcomes, including hospital LOS. RoB was not described in the abstract.
- The in-process review will be looking at diagnostic clinical decision support systems based on machine learning.[97] The review will include both inpatient and outpatient settings. ROB methods are described. Anticipated completion is November 2019.

Question 1-Multidisciplinary rounding

One completed JBI SR and one in-process SR assessed multidisciplinary rounding.

- The 2016 JBI SR[20] looked at its effectiveness in acute care units. Its effect on LOS was inconsistent.
- The in-process SR plans to look at the effect of multidisciplinary rounds on adult and pediatric inpatients.[98] Investigators were contacted about status of SR.

Question 1-Collaboration

Two completed reviews, including one from Cochrane, and four in-process review focus on collaboration between health professionals.

- The 2017 Cochrane[21] review focused on interprofessional collaboration at primary, secondary, tertiary and community care settings. It found that compared to multidisciplinary audio conferencing, multidisciplinary video conferencing may reduce the average length of treatment and may reduce the number of multidisciplinary conferences needed per patient and the patient length of stay.
- One review focused on co-management of geriatric patients[99]. It found that LOS was decreased. RoB was deemed to be high.
- An in-process review will focus on collaboration between physicians and nurses caring for inpatients. Methods for RoB assessment are described.[100]
- Two in-process reviews[101, 102] will focus on shared care of surgical patients.

- One in-process review will assess in-hospital care coordination for adults.[103] The lead investigator could not be reached by email.

Question 1-Technology

Six completed SR, with one from AHRQ, focuses on technology.

- EHealth. This 2017 narrative review[104] included electronic medical records (EMRs), computerized physician order entry (CPOE), electronic prescribing (ePrescribing) and computerised decision support systems (CDSS) in hospital settings.
- Telemedicine.[105, 106] Two reviews focused on telemedicine in the ICU.
- CPOE. One review[96] looked at CPOE in the ICU.
- Telehealth. This 2019 AHRQ SR[22] found that remote ICU teleconsultation did not affect LOS; and inpatient telehealth consultations may reduce length of stay and costs. A 2016 review[107] found that the effect of telehealth on the all-cause length of stay was statistically significant in 36 percent of the studies and nonsignificant in 64 percent.

Question 1-Comprehensive geriatric assessment

We identified two relevant Cochrane SR: a 2017 SR focused on older adults admitted to a medical ward[23]; and a 2018 SR focused on older adults admitted to a surgical service[24].

Question 1-Other interventions

- Recovery room and non-cardiac surgery in adults. This systematic review will include any intervention based in the postoperative recovery period.[108] RoB assessment was described in the protocol. The review is complete and has been submitted for publication.
- Modeling. One of the questions in this in-process SR looks at how agent-based modeling are being implemented and their impact on clinical outcomes.[109] RoB assessment was described in the protocol.

Question 1: Subpopulations

Seven SR addressed subpopulations. Six focused on ERAS.

- Diabetes. This 2017 SR[110] found no studies of ERAS focused solely on people with diabetes.
- Older adults.
    - Four completed SR[111-114] assess ERAS in older adults undergoing emergency surgery, total hip arthroplasty, and colorectal surgery.
    - One in-process SR will focus on broadly on planned hospitalization of older adults.[25] Interventions may include ERAS, comprehensive geriatric assessment to inform a care pathway, and fast-track programs. This review was commissioned by the NIHR HS&DR program. The review includes RoB assessment of primary studies. The scope included activities before hospital admission, during hospitalization. Categories included enhanced recovery protocols, prehabilitation, preoperative assessment, rehabilitation, specialist ward and staff mix. We reached out to the PI; this review is complete and will be published in the next month.
- Children. This in-process review will include studies of ERAS in people up to 18 years who are undergoing any type of surgery.[115] Outcomes include postoperative complications and LOS. A 2019 SR focused on fast track

	surgery for acute appendicitis in children; it found decreased LOS and decreased complication rate across studies[116]. **Question 2-Vulnerable groups** One SR and one realist review looked at vulnerable patient groups • Dementia. This 2017 realist review[117] looked at features of programmes and approaches to make healthcare delivery in hospitals more dementia-friendly, providing an understanding of how interventions achieve outcomes for people living with dementia. • Migrant/refugee. This in-process JBI SR[26] will look at the impact of professional interpreters on outcomes for hospitalized children of parents with low English proficiency.
4. Impact of a New Evidence Review	
4a. Is the standard of care unclear (guidelines not available or guidelines inconsistent, indicating an information gap that may be addressed by a new evidence review)?	There are many ways to potentially impact LOS, and the choice of strategy will depend on the priorities and resources of health systems. Some interventions have consistent evidence, such as ERAS.
4b. Is there practice variation (guideline inconsistent with current practice, indicating a potential implementation gap and not best addressed by a new evidence review)?	There is likely diversity of approaches among different health systems.
5. Primary Research	
5. Effectively utilizes existing research and knowledge by considering: - Adequacy (type and volume) of research for conducting a systematic review - Newly available evidence (particularly for updates or new technologies)	A new systematic review of the primary literature focused solely on question 2 is not feasible. We identified 6 studies; populations included frail older adults[118-121], rural[122], and vulnerable older adults[123]. All studied different interventions. These included: advanced practice nurse-led team[121]; geriatric liaison intervention[119]; specialized care unit for frail elderly[120]; and interprofessional team-based care [9, 123]. Study types were diverse and included: • RCT-1[119] • Cluster randomized trial-1[123] • Pre-post-2 [120, 121] • Case study-1[118] • Cohort-1[122]
6. Value	
6a. The proposed topic exists within a clinical,	Yes, health systems are actively looking for ways to decrease delayed discharges.

consumer, or policy-making context that is amenable to evidence-based change	
6b. Identified partner who will use the systematic review to influence practice (such as a guideline or recommendation)	Yes, this topic was prioritized highly by the LHS Panel. They plan to use findings from the proposed review in their respective institutions.

Abbreviations: AHRQ=Agency for Healthcare Research and Quality; JBI=Joanna Briggs Institute; CPOE=computerized physician order entry; EMR=Electronic medical record ; ERAS=enhanced recovery after surgery; ESP=evidence synthesis program; ICU=intensive care unit; LHS=Learning Health System; LOS=length of stay; NICU=neonatal intensive care unit; RCT=randomized controlled trial; RoB= risk of bias; SR systematic review

Appendix C: Topic Nomination

Topic Suggestion Description

Date submitted: June 28, 2019

Length of Stay

Topic Suggestion

1. What is the decision or change you are facing or struggling with where a summary of the evidence would be helpful?

- What are the types of effective strategies/interventions to reduce length of stay (LOS) in the hospital while maintaining or improving patient outcomes?
- What are the patient-centered benefits and harms associated with these strategies/interventions?
- What are effective strategies for health systems to tailor these interventions for vulnerable populations (e.g. limited English proficiency, patients with higher levels of social risks such as housing instability)?

Population: All inpatients including adult patients, pediatric patients, and NICU patients – with an emphasis on those needing complex care (or those without other care options) and/or vulnerable populations
Intervention: Implementation strategies/interventions to reduce LOS—strategies may include:

- Clinical care approaches to reducing LOS (e.g., switching from IV to oral medications earlier, Enhanced Recovery After Surgery (ERAs) pathways, care/clinical pathways)
- Care coordination process approaches (e.g., making sure all case managers know where the patient will go upon discharge, partnering with home health care and long-term care facilities to provide options for continued care beyond the hospital setting)

Comparator: None specified
Outcomes: Length of Stay
Timing: None specified
Setting: Inpatient

2. Why are you struggling with this issue?

Most academic centers are overutilized because of complexity of care/cost shifting from smaller hospitals (by transferring patients to academic medical centers). Thus, the inability to reduce LOS prevents access to care for patients who do not have other care options (or need to be transferred to the academic medical center, for example). In addition:

- Reducing LOS reduces the risk of patient harms in the hospital and the cost of care for health systems, thereby improving health systems' bottom line; it may also reduce costs for payers and patients.

- Indirectly, reducing LOS increases hospital volume capacity for those hospitals that have greater patient demand than bed supply including many safety net hospitals and academic medical centers.

3. What do you want to see changed? How will you know that your issue is improving or has been addressed?

Hospital and health systems would like to be able to implement a comprehensive system or process initiative in which providers and patients have a timeline and plan prior to admission, stated goals, and discharge criteria, thereby allowing for the anticipated LOS to be stated prior to admission.

In addition, hospitals and health systems would like to be able to offer better access to care, including access to complex care, for their local communities. Specifically, they would like to see/experience:

- Fewer patients being boarded in emergency departments and hallways—many for days—while waiting for a hospital bed
- Fewer patients being denied transfer to tertiary/quaternary care hospitals because the "hospital is full"
- Fewer ambulance diversions for special populations
- Improved patient and provider satisfaction related to care planning.

4. When do you need the evidence report?

Fri, 11/01/2019

5. What will you do with the evidence report?

Hospitals and health systems, including CEOs, will use this information to improve patient safety and access to care within their health systems.

Supporting Document

Reducing Hospital Length of Stay: Topic Nomination from the LHS Panel Project (June 27, 2019) (PDF, 90 KB)

(Optional) About You

What is your role or perspective?

Learning Health System

If you are you making a suggestion on behalf of an organization, please state the name of the organization.

Dartmouth Hitchcock Health

May we contact you if we have questions about your nomination?

Yes