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. Delays in hospital discharge may be related to unnecessary waiting, poor organization of care, delays in decision-making, or difficulties related to discharge planning. A systems-level approach could address the multiple levels contributing to unnecessary delays in hospital discharge. 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>
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<tr>
<th>Table 1. Questions and PICOTS (population, intervention, comparator, outcome, timing and setting)</th>
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<tbody>
<tr>
<td><strong>Questions</strong></td>
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<td><strong>Interventions</strong></td>
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<td><strong>Timing</strong></td>
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**Setting**
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 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 |
### 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).

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<td>o JBI-1</td>
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<td>o Other-6</td>
<td>• Cluster randomized trial-1</td>
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<td>• Case management-1</td>
<td>• Pre-post-2</td>
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<td>• Decision support-2</td>
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<td>• Multidisciplinary rounding-2</td>
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<td>o JBI-1</td>
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<td>o Cochrane-1</td>
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<td></td>
<td>• Comprehensive geriatric assessment-2</td>
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<td>o Cochrane-2</td>
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<td>• Subgroups-7</td>
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Clinicaltrials.gov
- Recruiting: patient-related factors are not specified, and could include those related to vulnerabilities. These are therefore included here for completeness.
  - [NCT01515670](https://clinicaltrials.gov/ct2/show/NCT01515670) TKA comorbid conditions
  - [NCT03153722](https://clinicaltrials.gov/ct2/show/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; VA=Veterans Affairs
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


http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017074510


http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019135289


http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019120856


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.


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


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Conflict of Interest: None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

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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
  - EHC Program [https://effectivehealthcare.ahrq.gov/](https://effectivehealthcare.ahrq.gov/)
  - AHRQ Technology Assessment Program [https://www.ahrq.gov/research/findings/ta/index.html](https://www.ahrq.gov/research/findings/ta/index.html)
- US Department of Veterans Affairs Products publications
  - VA/Department of Defense Evidence-Based Clinical Practice Guideline Program [https://www.healthquality.va.gov/](https://www.healthquality.va.gov/)
- Cochrane Systematic Reviews [https://www.cochranelibrary.com/](https://www.cochranelibrary.com/)
- PROSPERO Database (international prospective register of systematic reviews and protocols) [http://www.crd.york.ac.uk/prospero/](http://www.crd.york.ac.uk/prospero/)
- McMaster Health System Evidence [https://www.healthsystemsevidence.org/](https://www.healthsystemsevidence.org/)

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
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.

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

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>1. Appropriateness</td>
<td>Yes</td>
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<tr>
<td>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.?</td>
<td>Yes</td>
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<td>1b. Is the nomination a request for an evidence report?</td>
<td>Yes</td>
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<td>1c. Is the focus on effectiveness or comparative effectiveness?</td>
<td>Yes</td>
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<td>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?</td>
<td>Yes</td>
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<th>Selection Criteria</th>
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<td>2. Importance</td>
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<td>2a. Represents a significant disease burden; large proportion of the population</td>
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<td>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</td>
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<td>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.</td>
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<td>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</td>
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<td>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</td>
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<td>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</td>
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<td>• Family or patient’s readiness to leave hospital</td>
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<td>• Prolonged wait time for procedures, test results, or prescriptions</td>
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<td>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</td>
<td>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.</td>
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<td>2c. Incorporates issues around both clinical benefits and potential clinical harms</td>
<td>Yes</td>
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<td>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</td>
<td>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.</td>
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<td>3. A recent high-quality systematic review or other evidence review is not available on this topic</td>
<td>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</td>
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<tr>
<td></td>
<td>• Enhanced recovery after surgery (ERAS) in colorectal surgery</td>
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<td>• ERAS/fast track cardiac surgery</td>
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<td>• Multidisciplinary rounding</td>
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<td>• Comprehensive geriatric assessment</td>
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<td>• Migrant/refugees</td>
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B-2
**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; and the other focused on liver resection. Noncolorectal surgery. This SR focused on ERAS and fast track surgery for noncolorectal abdominal surgery. Laparoscopic abdominal surgery. This 2018 SR assessed LOS, time to first flatus, postoperative complication rate and hospital cost.

Pulmonary surgery
- Lung resection. This 2016 systematic review focused on elective lung resection in adults.
- Lung cancer. This 2017 SR 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. Microsurgical breast reconstruction. This 2019 review included LOS and 30-day postoperative morbidity.

Genitourinary surgery
- Cystectomy. Two completed reviews (one on cystectomy, and the other on radical cystectomy) and two in-process SR on radical cystectomy addressed this area.

Vascular surgery
- Vascular surgery. We identified one complete and one in-process systematic review. The completed SR assessed LOS, postoperative diet and ambulation.
- Abdominal aortic aneurysm. This in-process Cochrane SR 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.

Other
- Emergency surgery. Outcomes for the 2017 SR 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 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. A 2017 review looked at acute care surgery services. 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 assessed LOS, readmission, mortality, and patient and staff satisfaction; and compared components of different models.
• Short-stay. This 2018 Cochrane SR\textsuperscript{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\textsuperscript{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.\textsuperscript{63} It is uncertain whether the scope might be broadened to include countries applicable to the US.

- **Advanced care nursing.** Woo et al (2017)\textsuperscript{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\textsuperscript{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.\textsuperscript{66}

- **Scribes.** This 2016 review looked at scribe effect on patient throughput, revenue, and patient and provider satisfaction.\textsuperscript{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\textsuperscript{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.\textsuperscript{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\textsuperscript{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\textsuperscript{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\textsuperscript{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.
  o A 2018 scoping review\textsuperscript{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.
  o A 2019 SR reviewed the effects of implementing HIT-supported clinical pathways.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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\textsuperscript{79} and one in-process SR from JBI\textsuperscript{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.\textsuperscript{81}

• Laboratory medicine. This SR focuses on practices to increase Timeliness of Providing Targeted Therapy for Inpatients with Bloodstream...
Infections. 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. 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. 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 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.

- Another SR 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.

**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 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 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 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, including one from the Cochrane Collaboration and one from JBI, looked at the effect of Lean on LOS and other outcomes.
• Value stream mapping. This 2017 SR\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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\textsuperscript{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\textsuperscript{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.\textsuperscript{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\textsuperscript{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.\textsuperscript{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\textsuperscript{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\textsuperscript{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.\textsuperscript{100}

- Two in-process reviews\textsuperscript{101, 102} will focus on shared care of surgical patients.
One in-process review will assess in-hospital care coordination for adults. 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 included electronic medical records (EMRs), computerized physician order entry (CPOE), electronic prescribing (ePrescribing) and computerised decision support systems (CDSS) in hospital settings.
- Telemedicine. Two reviews focused on telemedicine in the ICU.
- CPOE. One review looked at CPOE in the ICU.
- Telehealth. This 2019 AHRQ SR found that remote ICU teleconsultation did not affect LOS; and inpatient telehealth consultations may reduce length of stay and costs. A 2016 review 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; and a 2018 SR focused on older adults admitted to a surgical service.

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. 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. RoB assessment was described in the protocol.

Question 1: Subpopulations
Seven SR addressed subpopulations. Six focused on ERAS.
- Diabetes. This 2017 SR found no studies of ERAS focused solely on people with diabetes.
- Older adults.
  - Four completed SR assess ERAS in older adults undergoing emergency surgery, total hip arthroplasty, and colorectal surgery.
  - One in-process SR will focus broadly on planned hospitalization of older adults. 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. 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.\textsuperscript{116}

**Question 2-Vulnerable groups**
One SR and one realist review looked at vulnerable patient groups
- Dementia. This 2017 realist review\textsuperscript{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\textsuperscript{26} will look at the impact of professional interpreters on outcomes for hospitalized children of parents with low English proficiency.

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<th>4. Impact of a New Evidence Review</th>
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<tr>
<td>There are many ways to potentially impact LOS, and the choice of strategy will depend on the priorities and resources of health systems.</td>
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<td>Some interventions have consistent evidence, such as ERAS.</td>
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<th>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)?</th>
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<td>There is likely diversity of approaches among different health systems.</td>
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<th>5. Primary Research</th>
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<td>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\textsuperscript{118-121}, rural\textsuperscript{122}, and vulnerable older adults\textsuperscript{123}. All studied different interventions. These included: advanced practice nurse-led team\textsuperscript{121}; geriatric liaison intervention\textsuperscript{119}; specialized care unit for frail elderly\textsuperscript{120}; and interprofessional team-based care\textsuperscript{9,123}.</td>
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<td>Study types were diverse and included:</td>
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<td>- RCT-1\textsuperscript{119}</td>
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<td>- Cluster randomized trial-1\textsuperscript{123}</td>
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<td>- Pre-post-2\textsuperscript{120,121}</td>
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<tr>
<td>- Case study-1\textsuperscript{118}</td>
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<td>- Cohort-1\textsuperscript{122}</td>
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<th>6. Value</th>
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<td>Yes, health systems are actively looking for ways to decrease delayed discharges.</td>
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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