12-2017

Discharge readiness: Summary

Children's Mercy Kansas City

Office of Evidence Based Practice (EBP) – Critically Appraised Topic: Discharge Interventions

Specific Care Question

For pediatric patients, are there nursing interventions that improve the timeliness of hospital discharge?

Recommendations Based on Current Literature (Best Evidence) Only

No recommendation can be made on which countermeasure to implement to increase the rate of hospital discharge by a defined time. The certainty of evidence is very low. However, this review of current literature by the Department of EBP focuses on describing countermeasures employed by other hospitals to improve the efficiency of hospital discharge. When there is a lack of scientific evidence, standard work should be developed, implemented, and monitored. See Table 1 for a list of countermeasures employed by various institutions.

Literature Summary

Background. Capacity management is an overarching term that defines how patients flow through a hospital system ("Managing capacity to improve care", 2019). According to the Institute for Healthcare Improvement (IHI) there are three major domains of patient flow (a) flow into the hospital, (b) flow within the hospital, and (c) flow out of the hospital or discharges (IHI, 2017). Inefficient discharges prolong hospital stays and may cause back up in the other domains. It can increase the likelihood for patients to be boarded, to not be transferred to an appropriate acuity level, or to incur treatment delays (IHI, 2017). Further, the IHI (2017) states understanding constraints, bottlenecks, and causes of variation in the hospital discharge process so they can be removed, will have great effects on the hospital system. This analysis will take a detailed look at programs developed by hospitals to either discharge patients by a specific time, such as by 11 a.m., or within a range of time, such as within 2 hours of meeting discharge criteria.

Study characteristics. The search for suitable studies was completed on November 12, 2019. B. Hunter, BSN, RN, CPN reviewed the 73 titles and/or abstracts found in the search and identified 22 single studies believed to answer the question. After an in-depth review of the remaining articles, six answered the question. Mallipudi et al. (2019) and Mathews, Corso, Bacon, and Jenq (2015) were pre-post intervention papers that evaluated interventions to assure hospital discharge occurred by 11:00 a.m. The remaining four papers (Patel, Morduchowicz, & Mourad, 2017; Rochester et al., 2018; Statile et al., 2016; White et al., 2014), were reports of Quality Improvement initiatives that implemented interventions to assure discharge by a specific time (either 11:00 a.m. or Noon) or within a range of hours of being ready for discharge (see Figure 1).

Summary of Studies

Mallipudi et al. (2019). The study was a pre/post cohort study performed on patients admitted to an internal medicine residency teaching service at a community hospital from November 2017 to September 2018 (N = 1,402). For the pre-intervention group, data was collected for the month of October 2017 (n = 381), and for the intervention group, data was collected for 11 months (n = 1021). The pre-intervention group received usual care, while the intervention group received a pre-discharge order in the EMR the day before the planned day of discharge. The goal of the pre-discharge order was to notify the Nursing and Allied Health staff that tasks were to be completed by 11:00 a.m. on the day of discharge. The percent of patients discharged before 11 a.m. increased to 22% from 5% in the intervention group. The Discharge processing time decreased from 145 minutes in the pre-intervention group to 77 minutes in the intervention group. A limitation of this study included inconsistent placement of the pre-discharge order in the medical record. Although pre-discharge orders were to be placed the day prior to discharge, rounds frequently started at or after 11 a.m. the day of discharge. Therefore, patients could not be assessed by the medical team to be discharged at the goal time of 11 a.m.

Mathews et al. (2015). In the fiscal year 2007, a Red/Yellow/Green (RYG) Discharge tool was developed to identify the likelihood of adult patient's scheduled for discharge the following day at an urban US Hospital (Yale-New Haven Hospital). At inception, the designation signaled the initiation of discharge tasks and paperwork for patients identified as Yellow or Green, and 7 a.m. huddles were started to target patients with Green designations. Finally, daily patient rounds began with those with Green designations. In 2009, a quality improvement project was implemented to improve the performance of the tool. The countermeasure changed the placement of the tool from the sign-out note to the daily progress note. Overall, patients with RGY assignments were more likely to be discharged by 11 a.m. 19.3% vs. 16.4%, p = .006. The length of stay was lower for those with RYG

designations (p = .013). The 30-day hospital readmission rate was not different in those with and those without RYG designations. A limitation is the inability to differentiate the effect of moving the location of the RYG designation versus the presence of other process improvement interventions which occurred at the same time, such as leadership review of cases where the discharge process was not timely.

Patel et al. (2017). This was a quality improvement initiative at a large urban US hospital (University of California, San Francisco Medical Center). The goal was to discharge by noon (DBN) adult patients the following day. After extensive pre-work of completing a needs assessment, identifying modifiable and non-modifiable barriers to timely discharge, the improvement plan focused on three domains. First, an education plan ensued to share the quality gap. Second, implemented process changes to improve performance around the modifiable barriers. Finally, a mechanism for audit and feedback on the process changes occurred. Specific process changes included: (a) education on the patient safety goals that supported the DBN initiative; (b) teams began to prioritize patients on morning rounds to first take care of decompensating patients, then to those ready for discharge; (c) complete discharge orders by 10:00 a.m.; (d) restructured daily multidisciplinary rounds (MDR) to allow Case Managers to lead the MDR; (e) create and implement a discharge planning list; (f) audit team performance, spread best practices and (g) learn from obstacles identified.

Rochester et al. (2018). This was a quality improvement initiative completed at a well newborn nursery within a community teaching hospital (Silver Spring, Maryland). The first intervention was to develop a discharge checklist so that infants who met discharge criteria could be discharged earlier in the day. Intern physicians completed the discharge checklist. After initiation of the checklist, the rate of discharges by 11:00 a.m. increased from 25% to 34%. A second intervention, identifying barriers to discharge prior to morning rounds was instituted. The workflow was modified to prioritize potential discharges. With both the checklists and the change in workflow, the discharge rate by 11:00 a.m. has been maintained at 43%. Information is reported without knowing the daily census on the unit. High census may be associated with discharge delays.

Statile et al. (2016). Hospital discharge of children with medical complexity, or who are technology dependent are the subjects in this quality improvement report, that was completed at an urban free-standing Children's Hospital (Cincinnati Children's Hospital Medical Center). The aim of the project was to increase the percent of medically complex patients discharged within 2 hours of meeting discharge goals from 50% to 80%. To achieve this aim the following was implemented: (a) the admission orders for children who are medically complex were changed to include considerations for discharge; (b) additional allied health staff was hired to improve care for this group of patients; (c) the complex care order set migrated to the EMR; (d) multi-disciplinary care coordination rounds were started; (e) a discharge needs assessment tool was created to standardize the care coordination rounds, and tool migrated to the EMR. Prior to the quality project, 50% of patients were discharged within 2 hours of being medically ready. After the implementation, 88% of medically complex patients were discharged within 2 hours of being medically ready to go home. This outcome was sustained for 6 months. Length of stay did not change (p = .67).

White et al. (2014). The goal of this quality improvement project was to increase the percentage of pediatric Hospital Medicine patients with common diagnoses such as gastroenteritis who were discharged within two hours of being medically ready from 42% to 80%. The pre-intervention group included patients from July 2010 to April 2011 (n = 3677) and no interventions occurred to improve discharge time. The intervention group included patients discharged from July 2012 to April 2013 (n = 2372). The following interventions occurred for the latter group: (a) discharge criteria were standardized, (b) discharge criteria were incorporated to the EMR, (c) the resident physician was included in discharge tasks, (d) discharge outcome measures were incorporated into nursing annual performance measures, (e) redesigned the out-patient pharmacy process, (f) prioritized consults and testing based on potential for discharge, and (g) shared performance measures with staff in a transparent manner. After the implementation of the above items, patients discharged within two hours of being discharge ready increased from 42% to 80%. Mean length of stay decreased from 1.56 to 1.4 days (p = .01). Readmission rates were similar between the two groups (p = .24). Finally, there was no change in patient/ family satisfaction rating. For both time periods it was 10 on a scale of 0-10, with higher being better.

Certainty of the evidence for discharge interventions. The certainty of the body of evidence was very low based on study type. Although pre/post cohort studies are low quality evidence and quality improvement reports are not included in the GRADE approach of assessing the quality of evidence, these types of papers are useful to describe interventions that may be employed in other quality initiatives.

Identification of Studies

Search Strategy and Results (see Figure 1)

Date	Database
Tuesday, November 12, 2019 2:38:13 PM	CINAHL

#	Query	Limiters/Expanders	Last Run Via	Results
S7	S1 AND S2	Limiters - Published Date: 20140101-20191231 Expanders - Apply equivalent subjects Narrow by SubjectAge: - all child Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	68
S6	S4 AND S5	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	146
S5	(MH "Inpatients") OR (MH "Adolescent,	Expanders - Apply equivalent subjects	Interface - EBSCOhost Research Databases	98,053

	Hospitalized") OR (MH "Child, Hospitalized") OR (MH "Infant, Hospitalized") OR (MH "Patient Bedside") OR (MH "Pediatric Nursing+") OR (MH "Pediatric Nurse Practitioners+")	Search modes - Boolean/Phrase	Search Screen - Advanced Search

Records identified through database searching *n* = 68
Additional records identified through other sources *n* = 5

Studies Included in this Review

Citation	Study Type
Mallipudi et al. (2019)	Cohort
Mathews et al. (2015)	Cohort
Patel et al. (2017)	Cohort
Rochester et al. (2018)	QI study
Statile et al. (2016)	QI study
White et al. (2014)	QI study

Studies Not Included in this Review with Exclusion Rationale

Citation	Reason for exclusion
Canary and Wilkins (2017)	Describes the ideal discharge, no metrics
Crespo et al. (2015)	Foreign language
Domínguez et al. (2015)	Foreign language
Driscoll and Gurka (2015)	Does not answer the question, assesses providers activities, not nursing
Dror et al. (2015)	Reintegration program for patients with eating disorders
Goldman, MacMillan, Kitto, Wu, and Reeves (2018)	Does not answer the question, work to include nursing at bedside rounds
Guerrero (2017)	Narrative review of one case
Holland et al. (2014)	Pilot work to design a discharge planning tool
Ingram, Johnson, and Fleming (2016)	Created education materials for ICN discharge

Jacobs-Wingo, Cook, and Lang (2018)	Addresses bed utilization during a mass causality incident
Lemyre, Jefferies, and O'Flaherty (2018)	Narrative review
New (2015)	Barriers to discharge in a specific population – adult spinal cord injury
Ougrin, Zundel, Corrigall, Padmore, and Loh (2014)	Establish community support after discharge for children with mental health diagnoses
Prince, Allen, Chittenden, Misuraca, and Hockenberry (2019)	Does not address discharge time, rather follow up appointments
Schuh et al. (2016)	Does not address discharge time, rather challenges faced at home
Weiss et al. (2019)	Does not address discharge time, rather re-admission rates

Methods Used for Appraisal and Synthesis

[a]Rayyan is a web-based software used for the initial screening of titles and / or abstracts for this analysis (Ouzzani, Hammady, Fedorowicz & Elmagarmid, 2017).

[b]Review Manager (Higgins & Green, 2011) is a Cochrane Collaborative computer program used to assess the study characteristics as well as the risk of bias and create the forest plots found in this analysis.

[c]The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram depicts the process in which literature is searched, screened, and eligibility criteria is applied (Moher, Liberati, Tetzlaff, & Altman, 2009).

[a]Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan-a web and mobile app for systematic reviews. *Systematic Reviews, 5*(1), 210. doi:10.1186/s13643-016-0384-4

[b]Higgins, J. P. T., & Green, S. e. (2011). *Cochrane Handbook for Systematic Reviews of Interventions [updated March 2011]* (Version 5.1.0 ed.): The Cochrane Collaboration, 2011.

[c]Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097 **For more information, visit www.prisma-statement.org.**

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Acronyms Used in this Document

Acronym	Explanation
DBN	Discharge by Noon
EBP	Evidence Based Practice
EMR	Electronic Medical Record
FY	Fiscal Year
IHI	Institute for Healthcare Improvement
LCD	Liquid Crystal Display
MDR	Multidisciplinary Daily Rounds
RYG	Red, Yellow, Green

Date Developed/Updated

12/2019

Table 1.
Interventions Employed by Included Studies

Intervention	Study	Countermeasure
Order set/PowerPlan/EMR presence	Mallipudi (2019)	Medical resident places a pre-discharge order the day before anticipated discharge to alert Nursing, Pharmacy, Care Managers, and Social Workers.
	Mathews (2015)	Developed a discharge tool that was placed in the daily progress note of the resident physician or Hospitalist
	Statile (2016)	Admission orders in the EMR included discharge goals
	White (2014)	Embed discharge criteria into discharge order sets
Huddles/ discharge meetings etc.	Matthews (2015)	7:00 a.m. huddles to target discharges for that day
	Patel (2017)	Multidisciplinary rounds led by Case Managers to prioritize patients nearing discharge
	Patel (2017)	Afternoon "Tee Time" to tee up patients who had potential for discharge the next day.
	Statile (2016)	Multidisciplinary rounds to discuss discharge tasks
Change order patients in which patients are rounded upon	Patel (2017)	Round on patients who are decompensating first, then those with potential discharge that day
Audit and feedback	Patel (2017)	Visible feedback on progress
Checklists/ Discharge criteria	Rochester (2018)	Discharge checklist completed by medical interns
	White (2014)	Standardized discharge criteria
Modify workflow	Rochester (2018)	If rounds start at 10:00 a.m. difficult to have discharges by 11:00 a.m. Work to modify rounding time.
	White (2014)	Prioritize consults and tests based on predicted discharge
Medication pathway	Statile (2016)	Smooth communication among medical & nursing, pharmacists, and patient/family

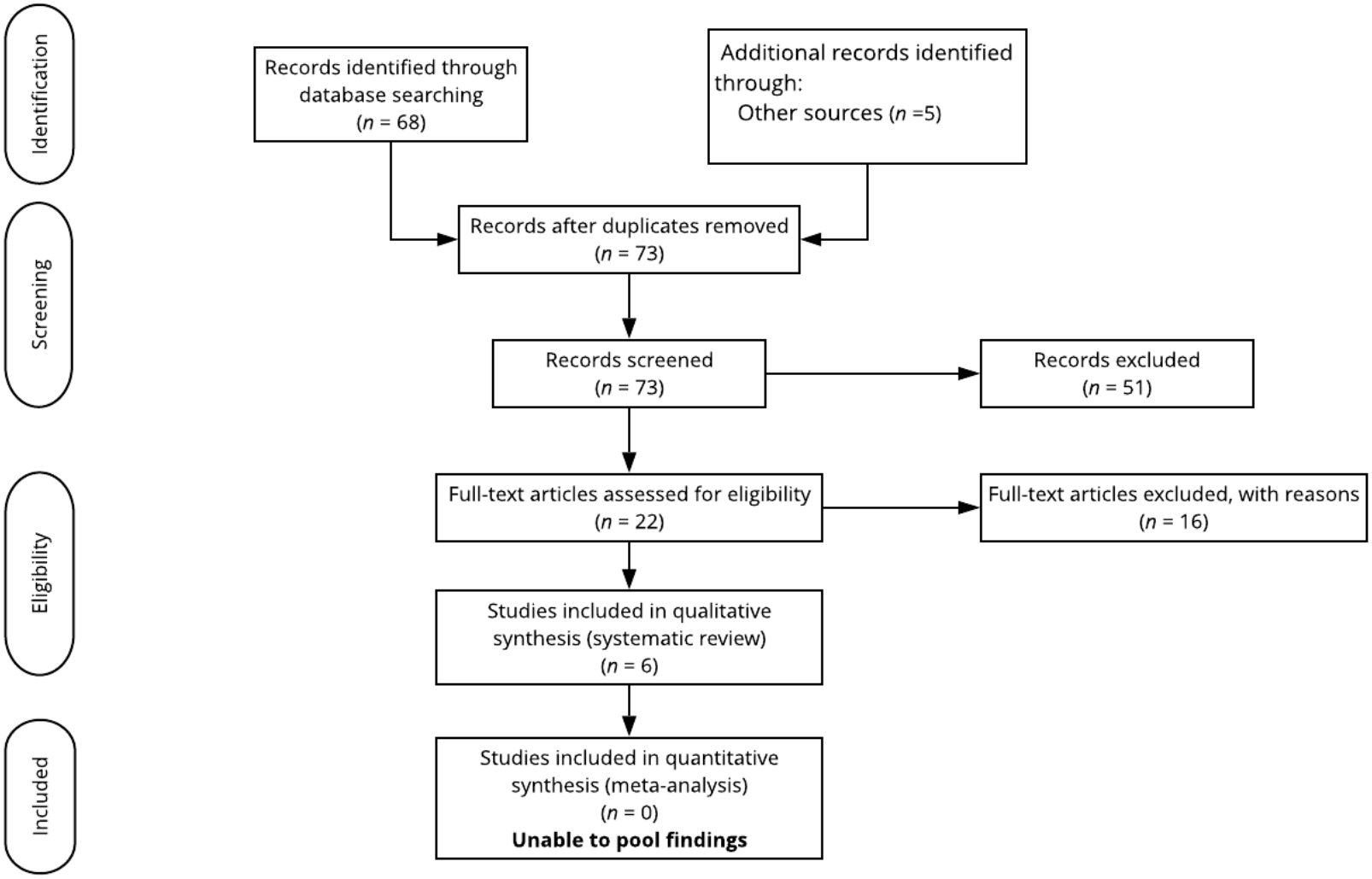

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA)[c]

Goldman, MacMillan, Kitto, Wu, and Reeves (2018)

Characteristics of Study	
Methods	Qualitative, Cohort, Interviews using "Ethnographic approach"
Participants	**Participants:** Bedside nurses and other healthcare professionals **Setting:** Canada, General Internal Medicine (GIM) unit, January 2012 to May 2013 **Number enrolled into study:** *N* = 23 interviews • Leadership nurses = 2 • Bedside nurses = 3 • Staff physicians = 3 • Medical residents = 2 • Social workers = 2 • Patient flow and utilization of care coordinators = 2 • Physiotherapist = 1 • Occupational therapist = 1 • Pharmacist = 1 • Speech-language pathologist = 1 • Community service case manager = 1 • Spiritual care worker = 1 One interview involved 2 people, there were three follow-up interviews **Gender, males:** Not reported **Race / ethnicity or nationality (as defined by researchers):** The study occurred in Canada. The authors did not identify race or ethnicity of the participants. **Age, mean / median in months / years, range / IQR:** Not reported **Inclusion criteria:** • Interview participants were selected based on their professional group from the staff directory and recommendations made by participants. • Researchers attempted to interview individuals representing each professional group working in GIM. **Exclusion criteria:** Not specified . **Covariates identified:** Not reported
Interventions	• One-to-one semi-structured interviews following an initial 3-month period of observations and then continuing during the study period • The interviews involved questions about: o Individuals' perceptions of their own and others' roles concerning discharge o The discharge processes o Interprofessional interactions during discharge

	o Organizational discharge policies.
Outcomes	1. Barriers 2. What role did the bedside nurse play during the discharge process?
Notes	**Results: Barriers** • Bedside nurses were not generally included in discharge planning meetings on this unit • Concerns about nursing information available to share in rounds, i.e., nursing management being unable to access data from patient records during discharge meetings • Information that was perceived to be valued during rounds was of variable quality • There was variability in opportunities for nursing input during rounds • Nurses felt that nursing issues were pushed to be talked of outside of rounds • Most information from rounds was communicated to nurses through the electronic whiteboard and talks with nursing leadership who had been present at rounds **Results: Role of nurses** • Observation showed that information shared by bedside nurses could often change a decision about a patient's discharge • Bedside nurses were not usually included at professional rounds • If nurses had concerns or questions about decisions made during rounds, there was limited opportunity for discussion

Holland et al. (2014)

Characteristics of Study	
Methods	Predictive correlation study - Mixed quantitative qualitative study design
Participants	**Participants:** Parents of children aged 1 month to 18 years **Setting:** USA, Children's Hospital in a large upper Midwest tertiary care hospital **Number enrolled into study:** *N* = 204 **Number completed the study**: *N* = 197· • **Group 1,** Early referral to hospital Discharge Planning (DP) resources *n* = 79 • **Group 2,** No early referral to hospital DP resources *n* = 118 **Gender, males: (as defined by researchers)** • **Group 1 / Group 2 (Only specified by study as a whole):** *n* = 55 (%) **Race / ethnicity or nationality (as defined by researchers):** • White: 89% • Hispanic/Latino: 8% • Black: 3% • Asian: 2% • Native Hawaiian/Other Pacific Islander: 1% • American Indian/Alaska Native 1% **Age, mean/years (SD) and median, (range)** • **Only specified by study as a whole:** mean 8.7 years (5.9); median 9; (1 month to 17 years) **Inclusion criteria:** • Children age 1 month to 18 years hospitalized for medical or surgical reasons • Admitted to one of three pediatric acute care nursing units • Had at least one parent/guardian 18 years old or older at the time of the study . **Exclusion criteria:** • Neonates • Patients admitted with a primary psychiatric diagnosis • Primary household language other than English . **Covariates identified:** Not reported
Interventions	• Twelve variables that were thought to predict if pediatric patients would require early referral to the discharge planning service were identified by searching the literature o A Study Coordinator assessed each patient using both record review and parent guardian interview to assess need for the early referral to the discharge planning service

	• Five pediatric direct care clinical or DP experts, without knowledge of the twelve variables, navigated the Electronic Health Record (EMR) of study patients and determined by consensus if the patient should receive an early referral to discharge planning. The reason for early referral was recorded. • After summarizing the associations, a regression model was developed to identify factors that were associated with an early referral to Discharge Planning and the outcomes of interest
Outcomes	1. Numbers referred to early discharge service 2. Agreement between the five expert assessors 3. How well the reasons the five experts gave for early referral agreed with the variables from the literature
Notes	**Results:** • Identified for early referral to discharge planning- 79/197 (40%) • There was poor to fair agreement between the five experts in the assignment of whether a discharge planning referral was necessary. Overall κ = .38 (Kappa statistic is used to measure inter-rater reliability). • Of the 12 variables, the five experts only reached consensus on "substantial post-acute care needs", *OR* = 46.55, $p < .001$ o Those not referred for discharge planning had substantial post-acute care needs selected 18% (4/118) while those referred for discharge planning had this variable selected 49/79 (62%) • "Substantial post-acute care needs" was a strong association, no other variables were associated with early referral to discharge planning. Therefore, "substantial post-acute care needs" was removed from the analysis to explore if other variables were predictive o Variables that were associated after removal of "substantial post-acute care needs" ▪ Involvement of community agencies prior to hospital admission

Mallipudi et al. (2019)

Characteristics of Study	
Methods	**Cohort**
Participants	**Participants:** All patients admitted on the fulltime internal medicine residency teaching service from Nov 2017-Sept 2018 were included **Setting:** 365 bed community hospital accredited by the Joint Commission **Number enrolled into study:** *N* = 1,402 · **Group 1:** *n* = 1021 · **Group 2:** *n* = 381 **Number completed:** *N* =381 · **Group 1:** *n* = 1,021 · **Group 2:** *n* = 381 **Gender, males: (as defined by researchers)** · Not reported **Race / ethnicity or nationality (as defined by researchers):** · Not reported **Age:** · Not reported **Inclusion criteria:** · For the pre-intervention group, all patients discharged over one month (October 2017) · For the intervention group, all patients on the resident teaching service under the care of the fulltime faculty (November 2017 to September 2018) **Exclusion criteria:** · Nonteaching hospitalist patients, private teaching patients, and private nonteaching patients. **Covariates identified:** · Covariates not reported · The time frame when data was collected differed. One month for the pre-intervention group, and 11 months for the intervention group
Interventions	**Both:** • **Group 1:** Usual care • **Group 2:** o Placement of a pre-discharge order in the EMR by the medical resident physician the day before anticipated discharge. Serves electronic notification of likely discharge to ▪ Nursing ▪ Pharmacy ▪ Social Work o The aim of the pre-discharge order is to have the work necessary for discharge to be complete and patient is ready for discharge If the patient is stable at 9 a.m., discharge can occur by 11:00 a.m.
Outcomes	**Primary outcome(s):**

	· Increase the percentage of daily discharges occurring before 11:00 a.m. to 40% from 5% **Secondary outcome(s)** · To reduce the mean discharge processing time defined as the time between placement of the discharge order to when the patient physically leaves their hospital room, to less than 145 minutes as observed in the preintervention group. **Safety outcome(s):** · Not reported
Notes	**Results:** **Time of discharge:** **Pre-intervention Group:** · Discharged before 11 a.m**.** (*n* = 49, 5%) · Discharged after 11 a.m**.** (*n* = 551, 54%) · Discharged 2 days later Did not separate out of discharge after 11 a.m. group · Discharged 3 days later Did not separate out of discharge after 11 a.m. group **Intervention Group** · Discharged before 11 a.m. (*n* = 83; 22%), · Discharged after 11 a.m. (*n* = 204; 54%), · Discharged 2 days later (*n* = 47: 12%) scharged 3 days later (*n* = 47; 12%). **Discharge Processing time:** (*p* < .001) · Preintervention Group: 145 minutes · Intervention Group: 77 minutes

Mathews, Corso, Bacon, and Jenq (2015)

Characteristics of Study	
Methods	Cohort
Participants	**Participants:** Adult medicine patients discharged in Oct-Dec 2009 & 2011 **Setting:** Hospital – Yale-New Haven, USA **Number enrolled into study:** *N* = 10,600 · **Pre-intervention period** · **Group 1,** RGY assigned, *n* = 8400 · **Group 2,** RGY not assigned**:** n = *2200* **Number completed:** *N* = 9218 · **Group 1:** *n = 7683* · **Group 2:** *n = 1535* **Gender, males: (as defined by researchers)** • **Group 1:** *n* = 3822 (49.7%) • **Group 2:** *n* = 744 (50%) **Race / ethnicity or nationality (as defined by researchers):** · The study occurred in the US. The authors did not identify race or ethnicity of the participants. **Age, mean, (SD)** • **Group 1:** 61.3, (±18.6) • **Group 2:** 59.9, (±18.8) **Inclusion criteria:** · Adult medicine patients discharged during study period **Exclusion criteria:** · Length of stay <1 day · Left against medical advice or expired during hospitalization **Covariates identified:** · Not reported
Interventions	Both Groups: • Developed the RYG Discharge Tool to identify patients with a high likelihood of being discharged the next day. • Patients labeled as Red (not likely), Yellow (Possibly), and Green (very likely) for next day discharge • Tool was implemented prior to the 2009 study period, but compliance was low. Quality work ensued to increase compliance Improvement activity

	• Designation made at medical team afternoon shift change o Changed placement of the tool from the sign-out note to the daily progress note o Designation displayed on centrally located LCD screen o Nursing and medical staff began discharge paperwork for yellow and green patients o Care coordinators prioritized facilitating transportation based on RYG labels o 7 a.m. huddles to target patients with a green designation o Daily rounds began with patients designated green • PDSA changes o Automated how changes in RYG status occurred on the LCD o RYG tool incorporated into progress note in EMR • **Group 1:** RGY assigned • **Group 2:** RGY non assigned
Outcomes	• **Primary outcome(s):** o 11:00 a.m. discharge rate * • **Secondary outcome(s)** o Any discharge assignment on the day before discharge o Prediction accuracy of assignment on the day before discharge o 30-day readmission rate • **Safety outcome(s):** o Not reported • * Of interest to the EBP Team
Notes	**Results:** • By study period: o The overall 11:00 a.m. discharge rate improved from 10.4% to 21.2% from 2007-2011 ($p < .001$) o 2007 to 2009 increased from 11.1% to 18.3% o 2009 to 2011 increased from 18.3% to 24.0% o Overall adherence with RYG Discharge Tool increased from 75.9% to 90.8% o Practitioners predicted discharge rate 75.1% in Study period 1 and decreased to 59% in Study period 2 • By assignment of RYG o For either study period, any assignment of RYG was associated with higher 11:00 a.m. discharges 19.3% vs. 16.4%, $p = .006$ o Patients with green assignment were more likely to be discharged by 11:00 a.m. in both study periods o The accuracy of discharge prediction went from 75.1%-59.1% for green patients and 34.5%-29.2% for yellow patients. o Patients with any RYG assignment who were also discharged before 11:00 a.m. ad shorter LOS than those without 4.31 ± 4.13 versus 5.02 ± 4.52, $p < .001$ o Hospital readmission rate was not different

Patel, Morduchowicz, and Mourad (2017)

Characteristics of Study	
Methods	Quality Improvement Study
Participants	**Participants:** Patients on Medicine teaching service **Setting:** University of California, San Francisco Medical Center (UCSFMC) from June 2013 to June 2014 **Intervention Groups:** • **Group 1** = Providers on the Medicine teaching service at UCSFMC • **Group 2** = No comparison group **Inclusion criteria** for reporting purposes: • Patients discharged from Medicine teaching service **Exclusion criteria** for reporting purposes: • Patients who died • Patients who left against medical advice (AMA) **Covariates identified:** Barriers to discharge were complex and multifactorial. Most commonly reported barrier was timely medical decision making, but this was not one of the areas targeted for improvement in this project.
Interventions	The Institute for Healthcare Improvement (IHI) Model for Improvement (MFI) was used as the framework to guide improvement strategies. A needs assessment was conducted by surveying multiple stakeholders: • A convenience sample of physicians was asked to provide reasons for late discharge from a prespecified list the day after discharge • A focus group of nurses and care managers was convened to provide input on challenges faced with early discharge Common modifiable barriers included: • Lack of communication between nurses, care managers, and teams about discharge planning • Obtaining home services, equipment, and oxygen early in the morning • Arranging transportation for facilities earlier in the day • Communicating discharge expectations with patients and family members Changes centered around three key domains: • Education-ensuring that providers know there is a quality gap and understand the implications of poor performance • Process changes-changing the workflow in care to create reliable and sustainable change • Audit and feedback-creating accountability and awareness of current performance and performance relative to others Specific changes: • Starting in July 2013 the study team began presenting educational material about patient safety goals underlying Discharge By Noon (DBN) efforts at monthly house staff and attending conferences. • Teams were encouraged to prioritize patients during morning rounds to first focus on decompensating patients, then any patients ready for discharge, then patients with diagnostic dilemmas. In addition, teams were encouraged to complete discharge orders before 10:00 AM.

	• Care Managers were given the role of leading Multi-Disciplinary Rounds (MDRs) to prioritize discussion of patients nearing discharge • An afternoon "Tee Time" was implemented to "tee up" potential early discharges for the following day. This consisted of a daily huddle at 3:00 PM between the senior resident and the care manager to review potential discharges and discuss standardized prompts for barriers to discharge, physical therapy recommendations, equipment and transportation needs, and discharge orders. • A multidisciplinary team of key stakeholders began meeting 30 minutes each week to perform audit and feedback. o Feedback was provided to teams via email with stats comparing the eight medicine teams to one another to foster accountability and competition o Attendings who achieved their goals were asked for strategies for success, while those who fell short were asked to share obstacles o Strategies for success were shared at month educational conference
Outcomes	**Primary outcome(s):** • Percent of inpatients discharged by noon (DBN) **Secondary outcome(s):** • Average Length of Stay (ALOS) • Length of Stay Index • Readmission Rates
Notes	**Primary Outcome Results:** • Baseline discharge time for July 2012 through June 2013 (fiscal year FY 2013), the academic year prior to the intervention, was 3:35P.M., with only 682 of 6,572 patients (10.4%) discharged prior to noon. • After a 12-month intervention, from July 2013 through June 2014 (FY 2014), the average discharge time fell to 3:18P.M., with 970 of 6,179 patients (15.7%) discharged before noon. • In the academic year following our intervention, July 2014 to June 2015 (FY 2015), our average discharge time was 2:56P.M., with an average DBN rate of 19.7%. o Discharges to skilled nursing facilities before noon specifically saw a more pronounced increase as a result of our interventions, with a baseline rate of 14.0% increasing to 27.4% in FY 2014 and 33.2% in FY 2015 (compared to 8.8%, 14.0%, and 17.5%, respectively, for discharges home) **Secondary Outcome Results:** • ALOS remained relatively stable: 5.88 in FY 2013, 5.85 in FY 2014, with a decrease to 5.60 in FY 2015 ($p<0.05$). • LOS index also stayed relatively constant from 1.16 in FY 2013 to 1.18 in FY 2014, but subsequently decreased to 1.10 in FY 2015 ($p<0.05$). • Readmission rates similarly were stable during the study period. The 30-Day All-Cause Readmission Rate per the Vizient, Inc. definition was 17.5% in FY 13, 17.4% in FY14, and 17.0% in FY 15. Limitations: • Adult population • Single site intervention at a major urban teaching hospital may limit generalizability of results • High percentage of improvement came from a single process change (discharge coordination to SNF) and would not apply to pediatric institutions

Rochester et al. (2018)

Characteristics of Study	
Methods	Quality Improvement Study
Participants	**Participants**: Infants covered by hospitalist service (approximately 20% of newborns at this institution) **Setting**: 443-bed community teaching hospital in suburban Maryland, Holy Cross Hospital from July 1, 2010 to June 30, 2012 **Number Completed:** *N* = 5963 • **Group 1, Pre-interventions:** *n* = 3224 • **Group 2, Post-interventions:** *n* = 2739 **Gender**: • Not reported **Race / ethnicity or nationality:** • The study occurred in the United States. The authors did not identify race or ethnicity of the participants. **Inclusion criteria for reporting purposes:** • Well newborns discharged from hospitalist service **Exclusion criteria for reporting purposes:** • Newborns transferred to higher level of care (neonatal intensive care or pediatric inpatient unit) **Covariates identified:** N/A
Interventions	Focus groups and brainstorming sessions were conducted to identify key drivers and perceived barriers to timely newborn discharge. Representatives included hospital administration, nursing leadership, frontline nursing staff, pediatric interns, and pediatric hospitalists. Chart reviews were also conducted on a random sample of 120 newborns to further delineate barriers to timely discharge. Potential barriers included: • Maternal age • Parity • Insurance status • Primary language • Ethnicity • Gestational age • Delivery type • Day of the week • Holiday • Bilirubin check • Weight loss • Group B Streptococcus (GBS) exposure • Follow-up • Car seat test • Lactation consult **Plan-Do-Study-Act (PDSA) Cycle 1:**

	• Discharge checklists were developed by QI team and executed by pediatric interns
	  o Checklist was completed daily by the interns during pre-rounding and reviewed by the attending on arrival, with the goal of identifying issues preventing an 11:00 a.m. discharge order
	  o New interns had to be trained every 4 weeks as they rotated through service
	  o After 6 months it was determined that the rounding and attending workflow were not conducive to entering timely discharge orders
	PDSA Cycle 2:
	• Workflow was modified to prioritize potential discharges
	• Workflow was interrupted to follow up on outstanding barriers to discharge including phone calls to multidisciplinary team members with outstanding tasks
	• Core hospitalists were incentivized to fully participate in this project by including it in the group's annual faculty goals and tying results to performance-based bonus

Outcomes	**Primary outcome(s):**
	• Percent of newborns on the hospitalist service with a discharge order by 11:00 a.m.
	  o Data were compiled monthly
	Secondary outcome(s)
	• Reasons for discharge delays
	  o To analyze the causes for moderately delayed discharge orders, the core hospitalists performed retrospective chart reviews for all newborns with discharge orders after 12 pm during the study period.
	  o We identified all documented causes for delayed discharge orders by using a standardized data abstraction tool
	  o The primary source for data abstraction was the patient's discharge summary
	  o Additional information was obtained by reviewing orders and laboratory results when necessary
	  o All issues unresolved by 12 pm were counted as reasons for delayed discharge orders

Notes	**Primary Outcome Results:** • At baseline, 24% of 3224 newborns were discharged by 11:00 a.m. • During the first six months (checklist only intervention) an average of 34% of 775 discharge orders (monthly range 22%–40%) were entered by 11:00 a.m. • After the second PDSA cycle (checklist plus workflow improvements), an average of 43% of 1964 discharge orders (monthly range 27%–53%) were entered by 11:00 a.m. **Secondary Outcome Results:** • Most frequent cause of late discharge orders was in-hospital observation of newborns for maternal GBS colonization • Second most frequent cause was "missing data", a category assigned to infants discharged after 12pm whose names were inadvertently omitted from the discharge checklist or whose checklist was missing • Third most frequent cause was "other" which included a myriad of clinical issues not captured on the checklist • Percentage of patients with late discharge orders for "unknown" reasons declined from 22% in the first 6 months for 9% after the second PDSA cycle **Limitations:** • Daily census was not accounted for • Study only captured discharge ORDER time, not the time the patient physically left the unit

Statile et al. (2016)

Characteristics of Study	
Methods	**Methods:** Quality Improvement Study
Participants	**Participants:** • Children with medical complexity, defined as those with neurologic impairment, and/or • Children with technology dependence, defined as those requiring technology to live or maintain their current state of health **Setting:** Cincinnati Children's Hospital Medical Center, a free-standing children's hospital with 522 beds **Number of encounters in the study:** *N* = 385 **Number of unique patients seen within the study period:** *N* = 227 **Number completed:** *N* = 227 **Gender, males: (as defined by researchers)** = 54% **Race / ethnicity or nationality (as defined by researchers):** • White = 66.1% • Non-Hispanic = 92.9% **Age, median in months/years, range/IQR:** • Median = 5.3 years • IQR = 2.2 – 15.6 **Inclusion criteria:** • Patients admitted to two primary units for hospital medicine (HM) patients during the study period: July 2012 – May 2015) **Exclusion criteria:** • None identified **Covariates identified:** • Not reported
Interventions	**Interventions** Both: • Patients with medical complexity were grouped into one team supervised by 15 physicians for specialized care • Patients identified by RNs at time of admission for bed placement so decrease the spread of complex medical patients throughout the resident team • Additional staff were hired as an investment in improving care for chronic care (pharmacist, dietician, care manager and social worker) • September 2013: a complex care-specific admission order set was tested in the electronic hospital record (EMR) o Included medical discharge goal orders specific to the needs of complex patients. o Initial goals could then be modified as needed in the patient's treatment course. • October 2013: weekly multidisciplinary care coordination rounds were implemented during which discharge goals and tasks were discussed. o Results were then reviewed with families at bedside.

	○ Additional interventions were implemented for shorter lengths of stay where the patient's admission did not coincide with the weekly meeting. • January 2014: creation of a needs assessment tool to assist in the structure of care coordination rounds and ensure appropriate discharge for patients with shorter admissions. ○ Eventually moved to the EMR as a modifiable document. ○ Assessment was initiated at admission with regular review during admission. • Medication pathway introduced to track changes to regimens and identify any barriers, overseen by team pharmacist who also worked with the families for home medication needs. • Descriptive statistics used to examine demographic and clinical characteristics: ○ Run chart for analysis of primary outcome measure ○ Secondary outcome analysis included Wilcoxon rank-sum test for median LOS and x^2 test for 30-day readmission rates
Outcomes	**Outcomes** Primary outcome(s): • Percentage of medically complex patients discharged within two hours of meeting medical discharge goals (admitted to two primary units for hospital medicine patients) Secondary outcome(s) • Median length of stay (LOS) Identified Balancing Measure: • 30-day readmission rate
Notes	**Results:** • Creation of multidisciplinary planning group comprised of attending physicians, RNs, care managers, pharmacists, residents, social workers and parents of children with medical complexity. This group identified the efficient discharge process and identified key drivers: ○ Optimization of team structure ○ Discharge goal identification ○ Anticipation of discharge care needs ○ Staff engagement in discharge preparedness ○ Care coordination • Baseline data before initiation of the complex care team included medically complex patients from July 2012 through June 2013. • Pre-intervention: 50% of patients were discharged within 2 hours of meeting medical discharge goals. • Post-intervention: 88% of medically complex patients were discharged within 2 hours of meeting medical discharge goals • Outcome was sustained for 6 months • In preintervention–postintervention comparison, median length of stay did not change (3.1 days [IQR, 1.8–7.0] vs 2.9 days [IQR, 1.7–6.1]; p = .67) • Median LOS remained the same and 30-day readmission rate was not impacted (30.7% vs 26.4%; *p* = .51). • Authors state that the following were most impactful in achieving the primary outcome: ○ Standardizing discharge planning processes

	○ Identifying discharge barriers earlier which allowed for better prediction of timing of discharge ○ Providers perceived a workload "decompression" as tasks were completed before the day of discharge when possible ○ The process allowed families to clearly identify home needs **Limitations:** • Study population did not include patients that typically have longer LOS, such as ventilator dependent patients which may have affected the ability to detect significant changes in LOS (the secondary measure) • The creation of the multidisciplinary team with varied expertise allowed for rapid improvement but may limit the generalizability of the study • The authors note that frontline providers need to be engaged in the process for success – standardization and use of the EMR may not be enough as the process is people dependent

White et al. (2014)

Characteristics of Study	
Methods	Quality Improvement Study
Participants	**Participants:** In-Patients with 11:00 a.m. discharge diagnoses being discharged from the hospital **Setting:** USA, Urban Pediatric Tertiary Care Hospital and Satellite Campus **Number Completed:** *N* = 6049 • **Group 1, Pre-interventions**: *n* = 3677 • **Group 2, Post-intervention:** *n = 2372* **Gender:** • The authors did not identify gender of the participants. **Race / ethnicity or nationality:** • The study occurred in the United States. The authors did not identify race or ethnicity of the participants. **Age, mean/median in months/years, range/IQR** • The authors did not identify age of the participants. **Inclusion criteria:** • Admitted to Hospital Medicine Service and discharged between July 2012 and April 2013. • In-patient with a discharge diagnosis of: asthma, bronchiolitis, cellulitis/abscess, constipation, croup, fever, gastroenteritis/dehydration, hyperbilirubinemia, osteomyelitis, pneumonia, or urinary tract infection. **Exclusion criteria:** • Not reported. **Covariates identified:** • Not reported.
Interventions	**Group 1:** • No interventions to improve discharge time **Group 2:** • Standardization of discharge criteria • Discharge criteria goals incorporated into EMR order sets and viewable to entire team • Resident physician inclusion in discharge tasks • Incorporate discharge outcome measures into nursing annual performance measures • Redesign of out-patient pharmacy process • Prioritizing consults and testing based on predicted discharge • Transparency of performance measures to all staff
Outcomes	**Primary outcome:** • Percentage of patients discharged within 2 hours of meeting criteria* **Secondary outcome(s)** • Length of Stay* • Average daily census* • Readmission rate* • Patient/Family satisfaction*

	Safety outcome(s): • Not reported *Outcomes of interest to the CMH CPG or CAT development team
Notes	**Results:** • Patients discharged in 2 hours of meeting goals increased from 42% to 80%. • Mean Length of Stay days decreased from 1.56 to 1.44 (p = .01). • Average daily census increased from 36.4 to 42.9%. • Readmission rates were similar between the two groups, (4.6% and 4.21%, p = .24). • No change in patient/family satisfaction rating of 10, on 0 to 10 scale is noted.

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