DAY OF DISCHARGE PLANNING UTILIZING THE N-BY-T STRATEGY

by

Michelle Fichter

Under Supervision of

Dr. Bridgitte Gourley

Second Reader

Dr. Shari Simone

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Abstract

Background: Hospital discharges are a complex process that can directly impact a patient's length of stay and decrease the quality of care that the patients receive. An ineffective discharge process increases the number of unplanned readmissions, which are costly to hospitals and affect patients negatively.

Local Problem: The medical providers on the General Surgery Unit at a Maryland hospital recognized the need for a discharge process that would increase the number of before-noon discharges. The unit experienced many late-day discharges which would contribute to increased night shift admissions. The unit also experienced higher than average readmission rates when compared to the rest of the organization.

Interventions: The purpose of this Doctor of Nursing Practice project was to implement and evaluate the n-by-T strategy into the discharge process for the medical patients on a 30-bed general surgery unit starting October 1, 2018. The quality improvement project involved utilizing a discharge checklist with the n-by-T strategy during morning rounds to safely schedule a number of patients (n) for same day discharge by a goal time (T). The medical director set a daily goal of two patients discharged by noon. Pre-implementation data was collected from September 1-30, 2018. Post-implementation data was collected from October 1, 2018 through November 30, 2018. Data collection included the use of the discharge checklist Monday through Friday during discharge rounds, the average time of discharges, the average length of the discharge process, and the unit's 7-day and 30-day readmission rates.

Results: Pre-implementation data collected in September 2018 showed an average time of discharge of 15:30, the average speed of the discharge process was 2.80 hours, the 7-day readmission rate for the unit was 7.27%, and the 30-day readmission rate for the unit was 21.82%. The average discharge time post-implementation was 15:26 and the average discharge process time was 2.99 hours. The 7-day readmission was 2.22% and 4.91% for October 2018 and November 2018, respectively. The 30-day readmission rate was 6.22% and 10.27% for October 2018 and November 2018, respectively. The discharge checklist was completed 38 out of 45 days, with an 84% completion rate

Conclusions: There was no statistically significant change in the average discharge time or the average length of the discharge process. The readmission rates showed statistically significant improvement in 7-day and 30-day rates post-implementation. Post-implementation provider feedback was positive from the providers for placing an emphasis on prioritizing patients for earlier same-day discharges. The process of this quality improvement project was successful, though sustainability at the project site was dependent on a re-evaluation of the discharge checklist due to the time burden associated with it. Future projects are recommended to assess other methods, besides an independent discharge checklist, in assessing patient readiness for before-noon same-day discharges. Future projects also include implementation on other inpatient units within the organization or to outpatient settings, such as subacute rehabilitation facilities.

Background

Hospital discharges involve a complex process, with a multitude of challenges that are not easily simplified when there are more than 35 million discharges occurring annually in the United States (Alper, O'Malley, & Greenwald, 2017). An ineffective hospital discharge process may increase a patient's length of stay (LOS), which contributes to a decrease in the quality of care, as well as an increase in costs by the hospital and the patient (Da Silva, Valacio, Botelho, & Amaral, 2014). A large cost associated with increased LOS is unplanned readmissions. Approximately one in five Medicare patients will have an unplanned readmission within 30 days of hospital discharge, accounting for $15 billion annually (Steiner, 2015). The groups of patients most affected by 30-day hospital readmissions are patients who were originally admitted with a diagnosis of heart attack, heart failure, pneumonia, chronic obstructive pulmonary disease, hip or knee replacement, or coronary artery bypass graft surgery (Agency for Healthcare Research and Quality, 2018). One of the interventions listed through the Agency for Healthcare Research and Quality (AHRQ) to improve outcomes with these high-risk patients is to improve discharge planning (2018).

The lack of an efficient discharge process with the medical patients on the general surgery unit (GSU) at a suburban Maryland hospital was identified as a cause for a delay in the speed of discharge, defined as the time the discharge order is placed in electronic health record (EHR) to when the patient is removed from the bed in the EHR. The GSU is a 30-bed unit, with patient population consisting of post-operative patients from abdominal or other surgeries. The patient population may also include overflow patients from medical-surgical units and non-surgical units. The average length of stay for the majority of scheduled surgical patients is 2 to 4 days. The average number of discharges and admissions per day is 8-9, though the range is 3-18.

The intervention to address the speed of the discharge process was the implementation of the n-by-T strategy, with an emphasis on 2-by-12. The n-by-T strategy, where "n" represents a number of patients and "T" represents the goal time of discharge, is a target discharge strategy that focuses on improving discharge process efficiency (Parikh, Ballester, Ramsey, Kong, & Pook, 2017). The n-by-T strategy promotes scheduling the patient discharge, with the use of multidisciplinary rounds, based on patient acuity and discharge needs. Utilizing targeted discharge strategies can reduce discharge process delays and excessive discharges in the afternoon or evening (Parikh et al., 2017). Refer to Appendix A for evidence supporting the implementation of n-by-T and discharges before noon.

The purpose of this Doctor of Nursing Practice (DNP) project was to implement and evaluate the n-by-T strategy discharge process on a GSU starting September 4, 2018. The short-term goals of the DNP project that were scheduled to be met by November 30, 2018 included 50% of patients would have a discharge checklist, 50% of patient discharge planning would utilize the n-by-T strategy, and there would be an increase in the number of patients that were discharged before noon. The long-term goals of the DNP project to be met by September 1, 2019 included 100% of patient discharge planning utilizing the n-by-T strategy, there would be an increase in the speed of the discharge process, an increase in the number of discharges before noon, and a decrease in the GSU 7-day and 30-day readmission rates.

Theoretical Framework

The theoretical framework that underlies this DNP project was the Plan-Do-Study-Act (PDSA) Model. The PDSA Model is a cyclical tool that was designed to assist in quality improvement (AHRQ, 2013). There are four steps that define the PDSA model. During the first step, the "Plan" step, the test or observation and its objective are determined. The desired data,

the methods of data collection, and any predictions that the data may present are also determined during the first step. The second step, the "Do" step, involved implementing the test or observation on a small scale, as well collecting data and observations about the test. The third step, the "Study" step, involved analyzing the data that was collected and comparing the data to the initial predictions determined during the "Plan" step. During the "Study" step, the impact of the intervention that was implemented was determined. The fourth step, the "Act" step, changes were made to the intervention based on the results from the small-scale test. During the final step, planning began for the next test, allowing entrance back into the "Plan" step of a new cycle (Institute for Healthcare Improvement, 2018).

The PDSA model was used to implement the n-by-T strategy in the discharge process on the GSU. Utilizing a cyclical model was important in the implementation of the n-by-T strategy to determine realistic goals for "n" and "T". During the "Plan" stage it was determined that the initial test would be implemented only with the medical patients on the GSU. During this step there was a checklist created that was used during multidisciplinary rounds (Appendix B). The checklist included the patient's acuity, readiness for discharge, discharge placement, and discharge needs (Gabriel et al., 2017). Pre-implementation data was collected with audits, which were completed by the DNP student, evaluating the average discharge time and the average speed of the discharge process of medical patients on the GSU. During the Plan stage the staff was trained about the n-by-T strategy and their role expectations. The staff included in the training were unit management, bedside nurses, unit physicians and nurse practitioners, and unit-based case managers and social workers. The training emphasized the goal was to implement 2-by-12, which was successful in the original study, revealing a reduction in boarding time by

26.1% (Parikh et al., 2017). The n-by-T strategy was flexible and adapted daily based on the unit census and patient acuity.

During the second step, "Do", the discharge process went live with multidisciplinary rounds utilizing the discharge readiness checklist, and the n-by-T strategy. Any observations by the nurses, physicians, and social workers were appreciated, and an initial analysis of discharge trends was examined. Adjustments to the process were made as needed. During the third step, "Study", the post-implementation data was collected and analyzed. The dates and times of discharges were analyzed to see if the trends changed from pre-implementation to post-implementation. The length of the discharge process had a pre- and post-implementation comparison. The 7-day and 30-day readmission rates from pre-implementation were collected and compared to one-month post-implementation and two months post-implementation. The discharge checklists were collected and assessed for compliance. During the fourth step, "Act", changes were suggested to the n-by-T strategy based on the data collected. The goal of 2-by-12 had not been met by the end of "Do" step and remained the discharge goal, with recommendations presented for sustainability and success.

Literature Review

The need for the n-by-T strategy to improve the discharge process time, with an emphasis on hospital discharges occurring before noon, was the focus of the evidence in this literature review. The review began by examining the n-by-T strategy. This discussion is followed by a review of scheduling patient discharges with a focus on early in the day discharges, particularly discharges before noon. Finally, the review concludes with the use of multidisciplinary teams and a discharge checklist to increase the number of discharges occurring earlier in the day and improve the discharge process time.

The n-by-T strategy was examined in a study completed by Parikh, Ballester, Ramsey, Kong and Pook (2017). The study consisted of two phases, a simulation phase and a pilot study, to examine the effects of the n-by-T strategy on the discharge process at a single setting, inpatient trauma unit. Due to a single site setting, a weakness was generalizability. The lack of staff compliance was another weakness, attributed due to the semi-structured manner of the study. However, increased external validity was noted through varying occupancy rates and patient acuities on the studied unit. Through the implementation of the n-by-T strategy, there was targeted discharge planning, resulting in providers writing discharge orders earlier in the day and a decrease in the discharge process time.

Planning discharge times serves as an effective strategy to make the discharge process more efficient. Khanna, Sier, Boyle and Zietz (2016) tried to identify the ideal time for patient discharge that would benefit hospital crowding, throughput, and staff workload. It was a retrospective, observational study that randomly assigned patient records to a simulation study with multiple scenarios. The results showed that the scenario where 80% of the patients discharged before 11am had the best overall performance. There was limited generalizability due to a single site setting and simulation-based methodology. However, the findings were consistent with other research interventions designed to increase the number of discharge orders before noon. Mehta, Nair, Rao, and Shukla (2015) completed a cross-sectional study, which found that planned discharges reduced the discharge process time. The study lacks generalizability due to sample size. However, the study examined the effects of the intervention across multiple determinants, such as patient type, discharge type, and discharge time, improving external validity and relevance to the general surgery unit that has many types of patients. Khana et al.

(2016) and Mehta et al. (2015) findings support scheduling discharge times to increase the number of discharges before noon and improve the discharge process.

The use of multidisciplinary teams also improves the discharge process, while increasing the number of discharges before noon. Patel, Morduchowicz, and Mourad (2017) focused on the use of multidisciplinary rounds with the implementation of a Tee Time, specific meeting time for discharge rounds, at a single inpatient site. The study implemented the PDSA model and allowed for improvements to be made with the process increasing the applicability to other sites. The findings showed that the intervention improved discharges before noon, regardless of discharge destination. Artenstein et al. (2017) implemented a multidisciplinary approach with "Right patient, Right bed, Right time" and an Interdisciplinary Plan-of-Care (IPOC) team. The results were statistically significant for discharge order entry prior to 10am, while LOS saw a decrease as a result of discharge rounds with the IPOC team. The study was a performance improvement project at an academic hospital setting which may weaken generalizability, however there was a large sample size of adult admissions. Bardes, Khan, Cornell, and Wilson (2017) examined the effects of discharge rounds with a multidisciplinary team. Due to the retrospective approach in this study there were limitations in the data collected. There were significant increases in discharges before noon post-implementation of discharge rounds, that were supported by a study completed at another trauma center, increasing the external validity. Ryan, Scott, and Fields (2017) also utilized multidisciplinary discharge rounds to determine the effects on the discharge process. The limitations of the study included the risk of generalizability to inpatient units since the study setting was an observation unit. Utilizing multidisciplinary teams in the discharge process allows the staff to better determine a patient's readiness for discharge, while determining the resources that need to be available for the discharge to take place and be successful.

Multidisciplinary rounds increase the number of patients discharged before noon and decrease boarding times (Patel et al., 2017; Bardes et al., 2017; Ryan et al., 2017).

Wertheimer, Jacobs, Iturrate, Bailey, and Hochman (2015) implemented a discharge checklist during multidisciplinary rounding to determine patient readiness for discharge before noon. This study was a single site setting and had other interventions implemented at the study site to improve throughput. The researchers noted that by increasing discharges before noon, the units were able to accept emergency department (ED) admissions earlier, improving ED and upstream throughput. Durvasula et al. (2015) noted an improvement in the number of patients discharged before noon utilizing a discharge checklist with multidisciplinary rounds, which also resulted in an improvement in the 30-day readmission rates. The outcomes may have been affected by other hospital interventions that coincided with the study interventions which would threaten the reliability. Overall, the findings from these studies support the use of a discharge checklist with multidisciplinary rounds. The checklist allows the multidisciplinary team to assess for patient readiness using a standardized form. Implementing a discharge checklist with multidisciplinary rounds allows providers to safely plan and discharge patients appropriately (Wertheimer et al., 2015; Durvasula et al., 2015). Refer to Appendix A for specific study details.

Project Implementation

A quality improvement (QI) project focused on the n-by-T discharge strategy was implemented on the general surgery unit of a large suburban hospital in Maryland. Inclusion criteria for the patients were patients who are age 18 years or older, medical team patients, and were being discharged from the GSU. Patients were not excluded based on race, gender, diagnoses, or discharge destination. The GSU is a 30-bed unit with an average of 8-9 discharges and admissions daily. The estimated sample size was 560 patients.

A project description was submitted to the Institutional Review Board (IRB) for a Non-Human Subjects Research (NHSR) determination at the University of Maryland Baltimore (UMB) and the local suburban hospital where the project was implemented. Human subjects were protected during this project since it did not have a direct impact on patient care and did not interfere with admissions or discharges. Privacy of patients was maintained, since there was no collection of data related to age, sex, race, or diagnoses and procedures during hospitalization.

The QI project occurred over a 13-week period. The first week was dedicated to training the core members of the DNP project, as well as the unit-appointed champions. A champion or core team member was to be present at every shift so that questions may be answered when the DNP student was unavailable. The training occurred as a 10-minute, informal, one-on-one presentation, during which the project was explained and written educational material was provided (Appendix C). The training session was centered around a lesson plan which included education in reference to the n-by-T strategy, the discharge checklist, the role of multidisciplinary rounds, how these components come together as a discharge process, and how to schedule the patients for a goal time of discharge (Appendix D). The discharge checklist was reviewed in detail during the training, including the columns, how to fill it out on a patient-by-patient basis, and how to evaluate it to schedule patient discharge times. At the end of the session, the participants were able to demonstrate teach back of all of the components of the lesson plan. The second and third week were dedicated to training the remaining team members during an informal 15-minute huddle and one-on-one sessions. These trainings included bedside nurses, case management, physicians, and APRNs and PAs who participated in the discharge process on the GSU. It is estimated approximately 40 people received the training. All participants signed in on the Discharge Process Utilizing the n-by-T Strategy Sign In sheet

(Appendix E). The sign in sheets were in the n-by-T Discharge Process binder that was left on the unit, in addition to the discharge checklists, and educational material for participants who may have a question about the process.

The project was implemented from weeks 4-12 and occurred Monday-Friday. The unit held multidisciplinary rounds at 10:30am and the discharge checklist was used during these rounds to determine patient needs, while planning for same-day discharges. During rounds, any patients who could be scheduled for discharge before noon were noted on the discharge checklist. The discharge checklists were organized by week in the n-by-T Discharge Process binder, which was kept in the office of the Clinical Nurse Leader on the unit. During week 4 the DNP student made several visits to assess implementation, barriers, and made adjustments to the process. During weeks 5-12, the DNP student made weekly contact with the unit to answer questions, address concerns, and assess for sustainability. The discharge checklists were assessed weekly to determine compliance. Compliance was measured by counting the number of completed discharge checklists in the Discharge Checklist folder versus the number of days that multidisciplinary rounds occurred. The final data was collected during week 13.

The data was collected 10-week post-implementation. The data collected, via audit, included the discharge checklists, the dates and times of actual discharges, and the speed of the discharge process. The audits were completed by the DNP leader, with assistance from the Clinical Supervisor. The 7-day and 30-day readmission rates were collected by the project host through hospital-based reports. The date and times of discharges were put into Excel spreadsheets to determine weekly means, as well as a post-implementation mean. The speed of the discharge process, from time the discharge order was signed by a provider to the time the

patient was discharged from the bed in the EMR, were calculated into a post-implementation average.

This project had many factors that increased its likelihood for sustainability after the implementation period. The director of the hospitalist group recognized the need for a discharge process that focused on efficiency for the GSU. There was stakeholder buy-in and the inclusion of champions to facilitate the change and continue the discharge process. The financial burden was minimal since the only expense was printed copies of the discharge checklist. The project was implemented using the PDSA model, which allowed for adjustments to be made by team members to ensure success. The n-by-T strategy was flexible, with daily discharge goals being made by team members included in the discharge process and may be implemented in any inpatient setting.

Results

The implementation of this project included the use of a discharge readiness checklist and the prioritization of patients who were ready for an early, same-day discharge. The setting already had multidisciplinary rounds in place, with all participants contributing to the completion of the discharge checklist. The charge nurse completed the checklist during rounds and assigned a goal time of discharge for patients who were deemed safe and appropriate for same-day discharge.

The data analyzed included audit results pre-implementation of the n-by-T strategy and post-implementation of the n-by-T strategy. The data analyzed included the average time of discharges and the average speed of the discharge process. Analysis was conducted using Excel. The discharge time and speed of the discharge process data was initially analyzed using the f-Test Two-Sample for Variances. The f-Test Two-Sample for Variances supported equal

variances and the data was then analyzed t-Test: Two Sample Assuming Equal Variances. The pre-implementation average time of discharge was 3:30pm and decreased to 3:26pm post-implementation (Figure 1). The results were not statistically significant ($P>0.05$). The average speed of the discharge process pre-implementation was 2.80 hours and was 2.99 hours post-implementation (Figure 2). The results were not statistically significant ($P>0.05$).

The readmission rates were collected by the clinical site host via unit-specific reports through the hospital database. The 7-day readmission rate in the month prior to implementation was 7.27, decreased to 2.22 in the first month post-implementation and 4.91 in the second month post-implementation (Figure 3). The data was analyzed using the z-Test: Two Sample for Means in Excel. The 7-day readmission rate results were statistically significant comparing one month and two-month post-implementation to the pre-implementation data ($P<0.001$). The 30-day readmission rate in the month prior to implementation was 21.82, decreased to 6.22 in the first month post-implementation and 10.27 in the second month post-implementation (Figure 4). The 30-day readmission rate results were statistically significant when comparing one month and two-month post-implementation to the pre-implementation data ($P<0.001$).

Observed associations revealed that the discharge checklist assisted the providers in prioritizing patients for early same-day discharge, though it did not correlate to a significant shift in the average time of discharge. The speed of the discharge process increased, as opposed to the expected decrease in speed. This was an unexpected outcome and it is uncertain if the n-by-T strategy, patient acuity, or the discharge setting affected the increase in speed of the discharge process. The use of the discharge checklist assisted with determining patient readiness for discharge and the time spent on it improved the quality of the discharges, which correlated with a significant decrease in 7-day and 30-day readmission rates.

The charge nurses, social worker, and medicine providers were great facilitators of this project implementation. The discharge checklist was completed 82% of the time, which was greater than the short-term goal of 50% completion. An unexpected barrier was the time commitment that the discharge checklist took during multidisciplinary rounds. The charge nurses had to complete their unit-specific discharge checklist during rounds on all unit patients, so the addition of the discharge checklist for the medicine patients was found to be time-consuming and a barrier to sustainability.

A confounding variable that occurred during the implementation of this project was the hospital implemented a hospital-wide patient discharge goal of two patients by noon on every unit. Nurse managers had to report daily on the number of patients who were discharged before noon from their unit. This may be beneficial in bringing down hospital-wide readmissions and costs. There were no unexpected costs identified with this project implementation.

Discussion

The n-by-T strategy with a discharge checklist was successfully implemented with the medical patients located on the GSU at a Maryland hospital. The implementation of the n-by-T strategy into discharge rounds on the GSU did not have a statically significant impact on average time of discharge or the average speed of the discharge process. These results differed from the anticipated outcomes and results found in other publications. Parikh et al. (2017) found the implementation of the n-by-T strategy shifted discharges to earlier in the day. The study revealed 4.16% of patients were discharged before noon pre-implementation, while post-implementation 29.78% of patients were discharged by noon (Parikh et al., 2017). Publications that examined the use of a discharge checklist also found an increase in the number of patient discharges before noon (Wertheimer et al., 2015; Durvasula et al., 2015). The results from this DNP project saw a

statistically significant decrease in the readmission rates at the site from pre-implementation to post-implementation. This is comparable to previous research which showed that planned discharges, multidisciplinary rounds, and the use of a discharge checklist improved 30-day readmission rates (Khana, Sier, Boyle, & Zietz, 2016; Mehta Nair, Rao, & Shukla, 2015; Wertheimer et al., 2015; Durvasula et al., 2015). These publications also linked the decreased readmission rates to improved patient discharge readiness and patient safety outcomes.

The average time of discharge and average speed of the discharge process results were not consistent with the findings in literature or the anticipated outcomes for this DNP project. The site of this DNP project was consistent with those in literature, an acute inpatient setting with high patient turnover. The results of this DNP project may have been influenced by patient acuity, which was not assessed for during implementation and data collection. The patient discharge settings were also not accounted for and may have contributed toward the findings. Patients who are discharged to an outpatient rehabilitation or long-term care setting may have higher discharge needs than patients who are discharged home. There was also inconsistency with providers who participated in the multidisciplinary rounds. Rounds with a different case manager than the unit-assigned case manager tended to have more challenges in determining estimated patient discharge times due to the case manager's experience with transferring patients to outpatient settings.

The strengths associated with the project included stakeholder buy-in, generalizability, and minimal financial burden. The stakeholders included the medical director, the medical providers, the unit nurse manager, the unit clinical supervisor, and case management. The unit nurse manager and clinical supervisor were not as invested as the other stakeholders; however, they did participate in the process. Many stakeholders, as well as bedside nurses and

pharmacists, participated in daily multidisciplinary discharge rounds Monday through Friday. The charge nurse or clinical supervisor completed the discharge checklist 38 out of the 45 days, which was an 84% compliance rate. Case management was prepared to discuss patient discharge readiness and patient discharge needs at rounds, which increased the ability to assign n-by-T values.

The patients on the unit had a variety of diagnoses, acuity levels, and discharge needs. These factors increased the generalizability of the n-by-T strategy to other inpatient settings. The n-by-T strategy was flexible, which also contributed to the generalizability of this DNP project. The strategy allowed for variance in values assigned to n and T, so inpatient settings that adopt this strategy into their discharge rounds have flexibility in their scheduled discharges. There was minimal financial burden associated with the implementation of this project, with the printed discharge checklist being the only added cost. Multidisciplinary rounds already occurred at the site and staffing was not impacted by the implementation of this DNP project.

The project site increased the generalizability of the n-by-T strategy, though it may have limited it as well. The project would be applicable to any inpatient setting; however, it would not be applicable to an observation unit or Emergency Department setting. Another limitation is the imprecision in the data collection. The pre-implementation data collected was from the one month prior to project implementation, while the implementation period occurred over two months. Another limitation was that compliance of discharge checklist completion varied with the assigned charge nurse. This was minimized by weekly audits of the discharge checklists and meetings with the clinical supervisor. The clinical supervisor reported that the discharge checklist was time consuming and that may cause some of the relief charge nurses to not be able to fill it out during rounds, in addition to the unit's patient status notes that also needed to be

updated during rounds. The final limitation was provider readiness for discharge rounds. Many providers felt they could not see all of the patients prior to discharge rounds. This was adjusted for by reaching out to the medical director, who improved communication about discharge readiness during patient handoff between providers.

Conclusion

Patient discharges are a complex process that can lead to increased costs for hospitals and patients. This DNP project was useful in improving the discharge process by planning discharges and assessing patient readiness with a discharge checklist. The project saw a statistically significant reduction in readmission rates, which has been shown to save hospitals unplanned costs.

The sustainability of this project was reduced due to the time burden associated with the discharge checklist. A sustainability suggestion made by the DNP student to the nurse manager and clinical supervisor post-implementation was to combine the discharge checklist with the unit's form that tracks patient status. The nurse manager felt encouraged to continue the process due to the significant impact of the project on the unit's readmission rates.

There is potential for other units within the organization where the project was implemented to adopt the discharge strategy, n-by-T. The organization implemented a hospital-wide goal of every unit discharging two patients by noon. While the GSU did not see a significant shift in earlier discharges, the literature supported the use of scheduling discharges and a discharge checklist to meet goals of discharging patient before noon.

Future QI projects may be done to apply the n-by-T strategy to other inpatient units or to outpatient settings. Units need to be educated that the discharge checklist is necessary to assess patient readiness for discharge, schedule patient discharges, and assign values to n and T.

Suggested next steps include the GSU incorporating the discharge checklist into their current forms they complete during rounds and a formal presentation to hospital administrators to demonstrate the potential the n-by-T strategy has if applied in all inpatient units.

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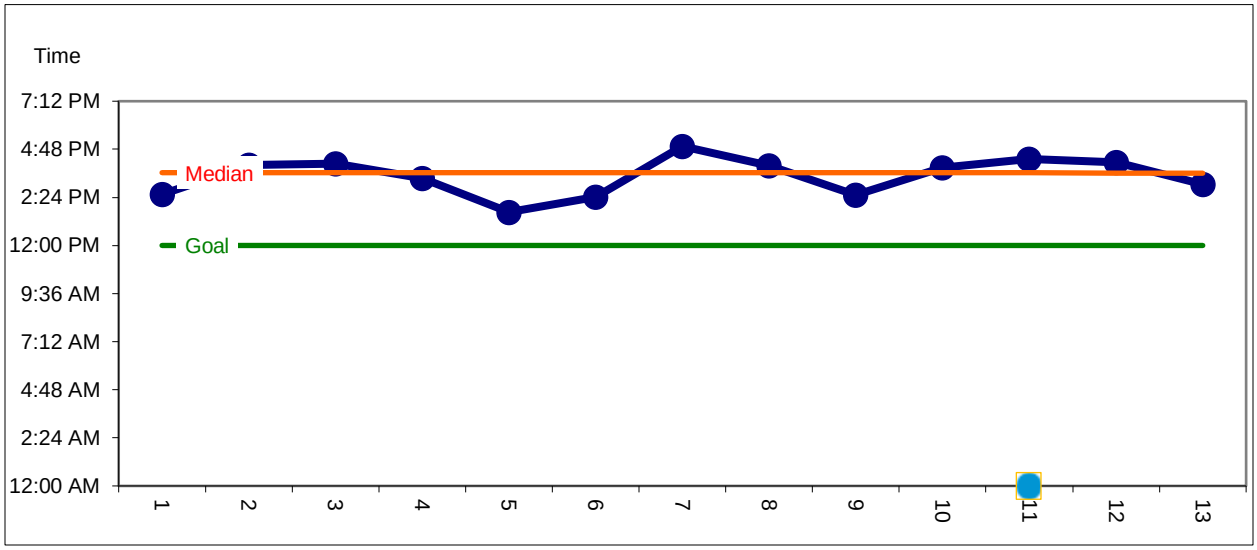

Figure 1. Average time of patient discharges.

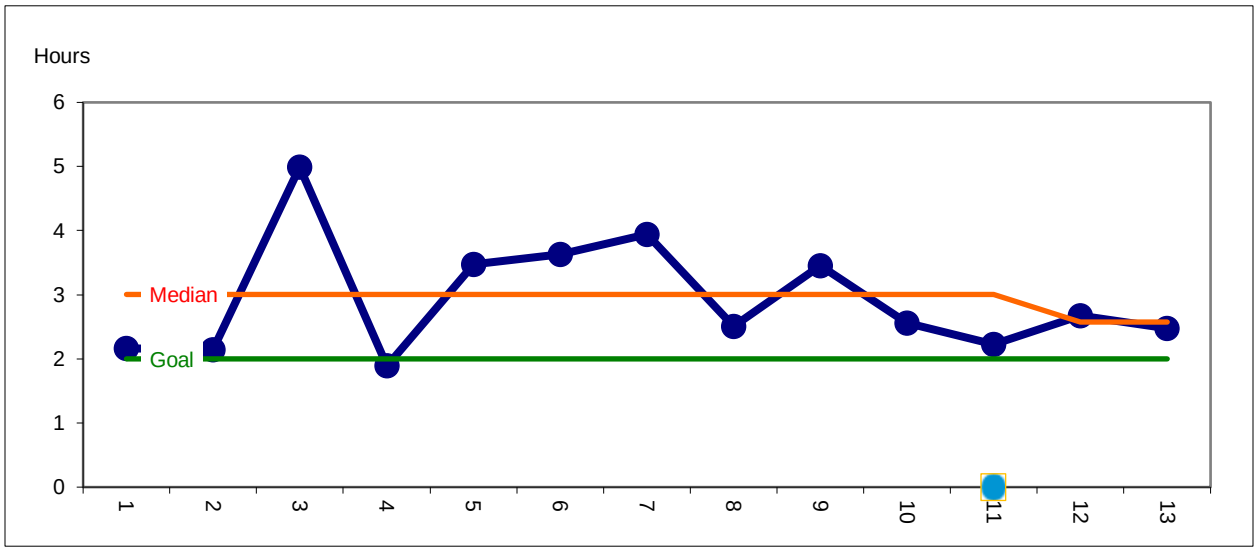

Figure 2. Average speed of the discharge process.

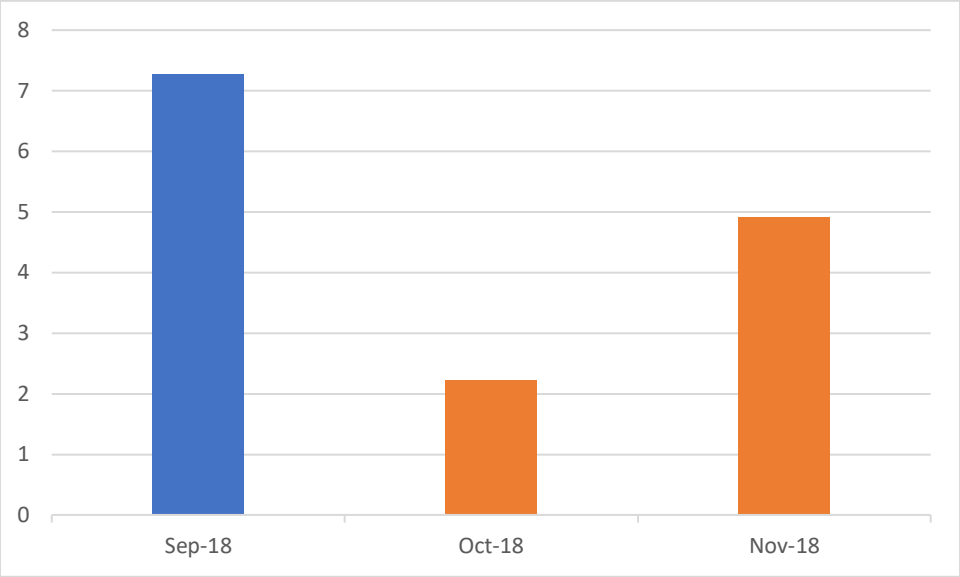

Figure 3. 7-day readmission rates.

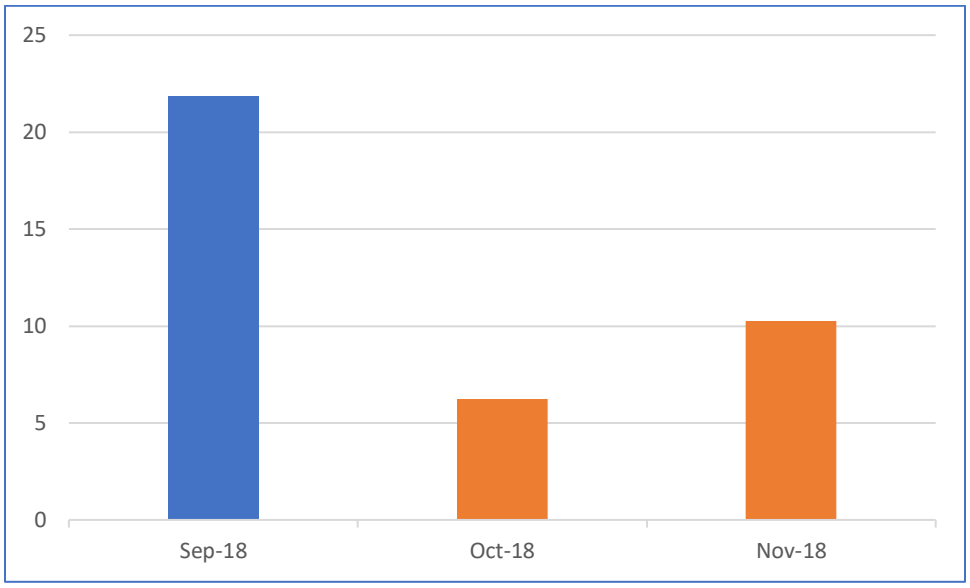

Figure 4. 30-day readmission rates.

Appendix A

Table 1

Evidence Review Table

Author, Year	Study objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	Level[a] and Quality Rating[b]
Artenstein, Rathlev, Neal, Townsend, Vemula, Goldlust, Schmidt, & Visintainer (2017)	To optimize a patient's progress throughout their hospitalization. The hospital implemented a multidisciplinary improvement project called the Baystate Patient Progress Initiative (BPPI). The project had multidisciplinary teams that were placed in the ED, called the "ED" team and the "Right patient, Right bed, Right time" (RRR) team, as well as an inpatient team that was referred to as the "Interdisciplinary Plan-of-Care" (IPOC) team.	QI project	Patients at a large teaching hospital in Massachusetts seen in the ED N=109111 and adult admissions (excluding psychiatric and obstetric admissions) N=26335	Volume of patients and walkouts from the ED, hours the patient was boarded in the ED, discharge orders entered before noon, interdisciplinary plan of care (IPOC), inpatient LOS	There are increasing volumes at this hospital but after the intervention there was a decrease in the number of patient walkouts from the ED. There was a decrease in the length of boarding time despite the increase in volume. The use the ED and RRR teams, saw improvement in early discharge order entry. There was early improvement in the goal of discharge order entry before noon. The goal of 10am discharge order entry was added and saw improvement of 123%. Inpatient units utilized IPOC rounds, which focused on patient progress through discharge, saw LOS decrease by 0.30 days overall.	6B
Bardes, Khan, Cornell, & Wilson, 2017	To assess the effectiveness of a standardized discharge team on a patient's LOS and discharged by noon. A multidisciplinary discharge team was	Retrospective pre- and post-intervention study	Patients at a university, level 1 trauma center in West Virginia: pre-intervention N=3053 patients and post-	Number of patients who are discharged by noon	The pre-implementation stage had 25.5% of patients discharged before noon, post-implementation saw 51.2% of patients discharged before noon. The mean LOS for patients decreased by 18%.	4B

	created from existing staff at a level 1 trauma center, in addition to the multidisciplinary team that completes morning rounds on the inpatient beds. The discharge team rounded on patients with the medical team to ensure they saw the patients very early in the morning so that same day discharges could be assessed, as well as rounding independently to determine patient's discharge needs.		intervention N=3801 patients			
Durvasula, Kayihan, Granich, Parker, Anawalt, & Staiger, 2015	To determine the impact on early morning discharges by implementing orders within the discharge process and medication reconciliation the night before the anticipated discharge. In addition, a discharge checklist was implemented that determined if a patient was appropriate for discharge.	Cross-sectional study, included pilot study and main study comparisons	A teaching hospital located in Washington that has more than 18000 inpatient admissions yearly, N=778	Number of patients discharged before 11am was the primary outcome and the mean of discharge time was the secondary outcome	During the pilot period 11% of patients were discharged before 11am, while after the main study period 29.7% of discharges were before 11am if orders and medication reconciliation were completed the night before. The average discharge time was 12:06pm. There was an improvement in the 30-day readmission rate, which decreased to 10.3%. There was no change to the mean LOS.	4C
Khanna, Sier, Boyle, & Zietz, 2016	To identify the best times to discharge patients and determine the effects on hospital crowding, emergency department (ED) throughput and staff workload. Seven scenarios were tested using the simulation pathways. Scenario 1: Discharge	Retrospective observational study with randomly picked patient record to be placed in the simulation pathways for ED patient and inpatient	15 months (October 2011-December 2012) of ED and inpatient hospital records at a teaching hospital in Australia that boasts 650 inpatient beds and 70,000 annual ED visits,	National Emergency Access Target (NEAT) which is an ED performance tool that is utilized in Australia, bed occupancy, length of stay	Scenario 1 and Scenario 4 had the most comparable outcomes. There was a 16% improvement in the NEAT performance, a 1.5% reduction in bed occupancy wait time, and a 25% reduction in inpatient bed wait time. Scenario 4 revealed a single discharge peak that is	4B

	50% of patients by 10am, 80% by noon, and 100% by 2pm; Scenario 2: Discharge 35% of patients by 11am, 70% by 2pm, and 100% by 5pm; Scenario 3: Discharge 50% of patients by 11am, 70% by 2pm, and 100% by 5pm; Scenario 4: Discharge 80% of patients by 11am; Scenario 5: Discharge 40% of patients by 11am, 70% by 2pm, 90% by 5pm, and 100% by 10pm; Scenario 6: same discharge time goals as scenario 5 but only applying them to patients who were admitted from the ED, not patients who were admitted for elective procedures; Scenario 7: same discharge time goals as scenario 1 but only applying them to patients who were admitted to inpatient from the ED, not to patients admitted for elective reasons.		N= unknown ED records, N=48,385 inpatient records	(LOS) and inpatient wait times	double the baseline discharge peak, while Scenario 1 had two discharge peaks between 10am and 12pm. The best overall performance was noted in Scenario 4 in the simulation, though practitioners in the hospital did not believe it would be sustainable due to the current discharge target of 35%. The other scenarios tested did not perform as well and reinforced discharges before 11 am to ensure quality patient flow.	
Mehta, Nair, Rao, & Shukla, 2015	To determine the effect of discharge planning on the time of discharge.	Cross-sectional study, comparing pilot study to main study	Discharges completed at a multispecialty hospital, excluded discharges completed on Sundays and those that were considered emergency night	Mean discharge time for insured versus uninsured and planned versus unplanned discharges	Planned discharges were 20% in the pilot study and increased to 47% in the main study. Planned discharges saw a decrease in discharge time from 524 minutes in the pilot study to 85 minutes in the main study; discharge times for insured patients, 527 minutes, was statistically	4B

			time discharges, N=75		significant higher than in uninsured patients, 88 minutes.	
Patel, Morduchowicz, & Mourad, 2017.	To determine the effect of a multidisciplinary approach on increasing the percentage of patients discharged before noon. The study used the Plan-Do-Study-Act (PDSA) model to introduce small trials of change to the multidisciplinary rounding that included prioritizing and communicating about education needs for patients for DBN and utilizing a Tee Time when there would be additional communication meetings between the multidisciplinary team members in the afternoons. The Tee Time allowed providers to plan for early discharges the following day by discussing family and patient transportation needs, with vouchers available if private vehicle would not be accessible.	Quality Improvement (QI) initiative	Inpatient hospital discharges, pre-intervention July 2012 to June 2013 N= 6572, July 2013 to June 2014 N=6,179.	Number of patients who were discharged before noon (DBN)	The patients who were being discharged home, pre-intervention found 10.4% patients DBN while post-intervention there was 15.7% DBN in FY2014. The patients who were being returned to a skilled nursing facility saw an increase from 10.4% DBN pre-intervention, to a post-intervention of 27.4% in FY2014. Data was examined in the year after the intervention and noted the trends continued with 19.7% DBN to home, while 33.2% DBN to a skilled nursing facility.	6B
Parikh, Ballester, Ramsey, Kong, & Pook, 2017	To determine the effects of the n-by-T target discharge strategy on discharge completion times and the upstream boarding. During the pilot study the nurses would determine the patients	Two phase study: Phase 1 retrospective observational data applied to simulation model and Phase 2 pilot cross-sectional,	Phase 1: discharged patients from an inpatient trauma unit at a hospital in the Midwest in 2013, N= 1789 Phase 2: patients on pilot, inpatient unit	Time-based outcomes: discharge completion and upstream boarding times; capacity-based measures: annual	Phase 1: The n-by-T model was applied to the retrospective data, with 2-by-10 and 2-by-12 strategies being applied in the validated simulation model. The simulation revealed a decrease in the mean for total	4B

	eligible for early discharge by 7am, and the patients would then be assigned a discharge time at n-by-10 or n-by-12.	observational study at an inpatient trauma unit at a level 2 trauma center located in the Midwest United States	from June through December 2014, N=unavailable	inpatient and upstream bed hours	completion time of the discharge process, a decrease in the mean boarding times of patients, and an increase in the annual inpatient bed hours. The study found the little difference in the improvements if T=10 or T=12. The pilot study showed similar results to the simulation, with a decrease in boarding times and earlier discharge hours. In the pre-implementation stage of the pilot 4.16% of patients were discharged by noon, whereas post-implementation 29.78% of patients were discharged before noon when using the 2 by 12 strategy.	
Ryan, Scott, & Fields, 2017	To evaluate the effect of Rapid Rounds on nurse efficiency, interdisciplinary collaboration, and patient satisfaction with the discharge process.	Evidence based practice (EBP) project	Patients on a 55-bed observation unit at a community hospital, N=unavailable	Patient satisfaction with readiness for discharge, speed of the discharge process, and discharge instructions	After the implementation of multidisciplinary rounds there was a reduction in physician or pager communication, there was an increase in medication interventions, and improvement in the patient's readiness for discharge and the speed of the discharge process.	6B
Wertheimer, Jacobs, Iturrate, Bailey, & Hochman, 2015	To evaluate the effect of discharge-before-noon (DBN) on admission timing and load, and how well the DBN initiative completed in a prior study has been sustained. The intervention consisted of a discharge checklist that was utilized during	Pre- and post-retrospective analysis	Patients at urban teaching ED patients admitted to inpatient unit's pre-intervention N=2756 and post-intervention N=3810; transfer patients within the hospital unit's pre-	Admission arrival times, load of admissions, and sustainability of DBN	The ED admission to an inpatient unit median time went from 5pm to 4pm after the implementation of the intervention. Patient transfers also saw a change in the median arrival, from 5 pm to 4pm. The level load of admissions changed from 5pm to 10pm pre-	4B

	multidisciplinary rounding to determine patients who would be ready for discharge the following day before noon.		intervention N=310 and post-intervention N=513		intervention, to 3pm to 8pm post-intervention. The average DBN for inpatient units was sustained at 35% after the original implementation of DBN, 18 months prior. All results were found to be statistically significant and was found to be favorable for patient safety by moving admissions away from night shifts.	

[a]Level of Evidence, ranked 1-7: 1- Systematic reviews of randomized control trials (RCTs), 2- RCTs, 3- Well-designed controlled trials without randomization, 4- Case-control and cohort studies, 5- Systematic reviews of descriptive and qualitative studies, 6- Single descriptive or qualitative study, 7- Expert opinions. (University of Maryland, School of Nursing, n.d.)

[b]Quality of Evidence: A- High: consistent results and recommendations, B- Good: reasonably consistent results and recommendations, C- Low/major flaw: Inconsistent results, unable to make recommendations (Newhouse, 2006)

Appendix B
Discharge Readiness Checklist

							Disposition							
							Home	Home Health			SNF			Goal
ROOM	Adfinitas?	Expected D / C?	Cleared by Specialty?	Medically Stable?	Order Written?	Pending Actions? Labs / Tests / Meds / Etc.	Self Care	Start of Care	F2F	MOLST	Summary Signed	MOLST	Transport	Time of D/C
560	Y / N	Y / N / T												
561	Y / N	Y / N / T												
562	Y / N	Y / N / T												
563	Y / N	Y / N / T												
564	Y / N	Y / N / T												
565	Y / N	Y / N / T												
566	Y / N	Y / N / T												
567	Y / N	Y / N / T												
568	Y / N	Y / N / T												
569	Y / N	Y / N / T												
570	Y / N	Y / N / T												
571	Y / N	Y / N / T												
572	Y / N	Y / N / T												
573	Y / N	Y / N / T												
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576	Y / N	Y / N / T												
577	Y / N	Y / N / T												
578	Y / N	Y / N / T												
579	Y / N	Y / N / T												
580	Y / N	Y / N / T												
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584	Y / N	Y / N / T												
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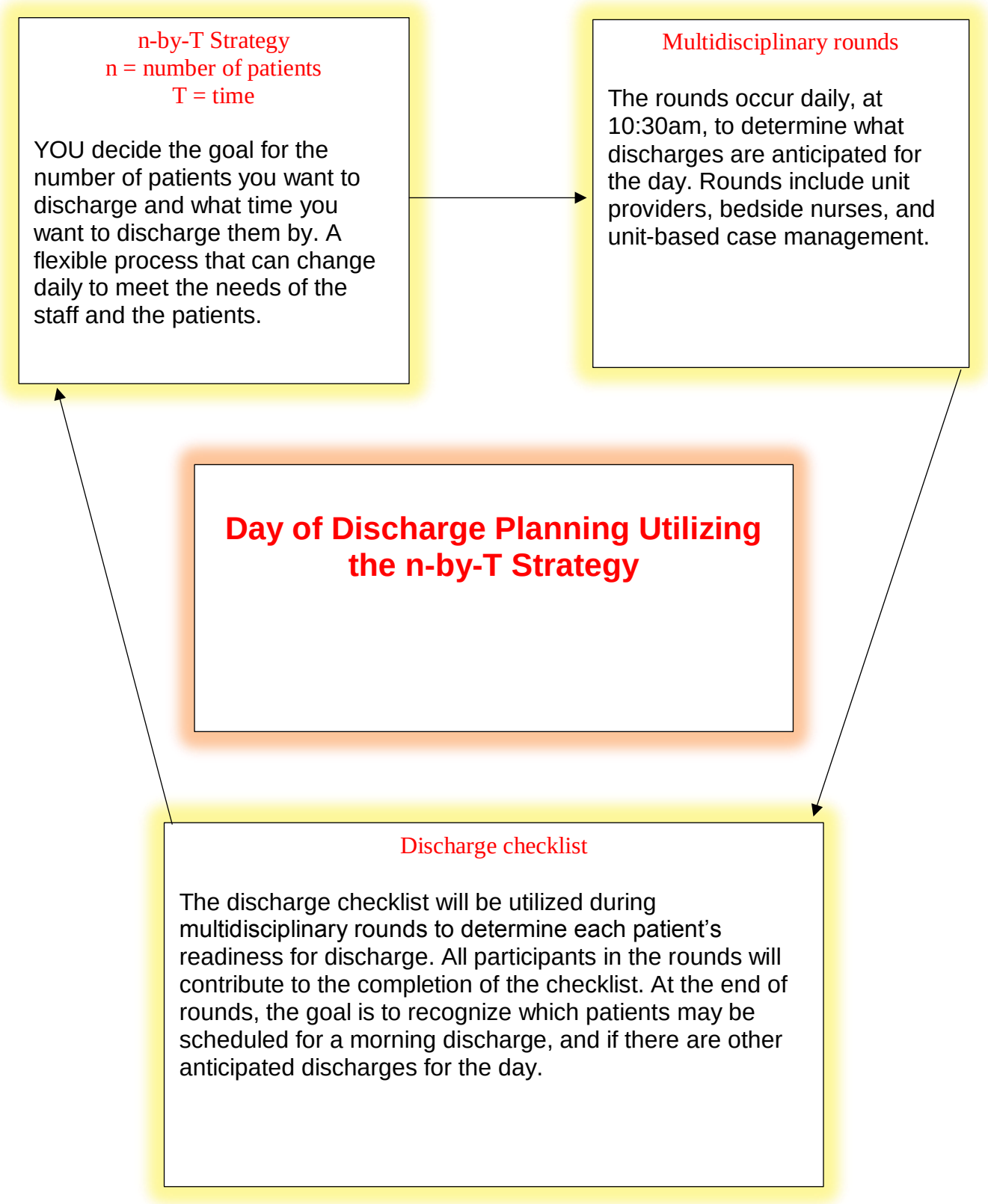
Appendix C
Educational Material



Appendix D
Lesson Plan

Learning Objectives	Content Outline	Method of Instruction	Time Spent	Method of Evaluation
Participants can verbalize understanding n-by-T strategy for the discharge process	• What is the n-by-T method? • Benefits of planning discharges with n-by-T • Reservation table • How using a reservation table will allow to plan for discharges more effectively	Informal huddle meeting with written supportive material	3	Teach back
Participants will understand how to utilize the discharge checklist to plan daily discharges	• Each patient will have an assigned row in the discharge checklist • All participants in daily rounds will assist in filling out the checklist • Considerations for each column and how to fill it out with information appropriate to patient's discharge needs	Informal huddle meeting with written supportive material	3	Teach back
Participants will understand how to incorporate multidisciplinary rounds into the discharge process	• Who is included • What are role expectations	Informal huddle meeting with written supportive material	3	Teach back
Participants will understand how to implement the discharge process into daily routine on the GSU	• What time will rounds be held • What are expectations of multidisciplinary rounds • Focus on the discharge checklist • Decide which patients may be implemented into n-by-T • Fill out the reservation table	Informal huddle meeting with written supportive material	3	Teach back
Participants will understand how to involve the patient into the discharge process	• Patients will be informed after rounds if they are an anticipated discharge for the day	Informal huddle meeting with written	3	Teach back

	and what their goal time of discharge is • Patients will be asked if they have questions/concerns and how to address them • Would it be beneficial for the patients to have a flyer explaining the discharge process?	supportive material		

Appendix E
Discharge Process Utilizing the n-by-T Strategy Sign-In

Print Name	Sign Name	Credentials	Date & Time of Attended Huddle