ORIGINAL RESEARCH

Discharge Before Noon: An Achievable Hospital Goal

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BACKGROUND: Late afternoon hospital discharges are thought to contribute to admission bottlenecks, overcrowding, and increased length of stay (LOS). In January 2012, the discharge before noon (DBN) percentage on 2 medical units was 7%, below the organizational goal of 30%.

OBJECTIVE: To sustainably achieve a DBN rate of 30% and to evaluate the effect of this intervention on observed-to-expected (O/E) LOS and 30-day readmission rate.

DESIGN: Pre-/post-intervention retrospective analysis.

SETTING: Two acute care inpatient medical units in an urban, academic medical center.

PATIENTS: All inpatients discharged from the units.

INTERVENTION: All staff helped create a checklist of daily responsibilities at a DBN kickoff event. We initiated afternoon interdisciplinary rounds to identify next-day DBNs and created a website for enhanced communication. We pro-

vided daily feedback on the DBN percentage, rewards for success, and real-time opportunities for case review.

MEASUREMENTS: Calendar month DBN percentage, O/E LOS, and 30-day readmission rate.

RESULTS: The DBN percentage increased from 11% in the 8-month baseline period to an average of 38% over the 13-month intervention ($P = 0.0002$). The average discharge time moved 1 hour and 31 minutes earlier in the day. The O/E LOS declined from 1.06 to 0.96 ($P = 0.0001$), and the 30-day readmission rate declined from 14.3% to 13.1% ($P = 0.1902$).

CONCLUSIONS: Our study demonstrates that increased DBN is an achievable and sustainable goal for hospitals. Future work will allow for better understanding of the full effects of such an intervention on patient outcomes and hospital metrics. *Journal of Hospital Medicine* 2014;9:210–214. © 2014 Society of Hospital Medicine

Late afternoon hospital discharges are thought to create admission bottlenecks in the emergency department (ED).[1] ED overcrowding increases the length of stay (LOS) of patients[2] and is a major dissatisfier for both patients and staff.[3] In our medical center, ED patients who are admitted after 1:00 PM have a 0.6-day longer risk-adjusted LOS than those admitted before 1:00 PM (M. Radford, MD, written communication, March 2012).

Many potential barriers to discharging patients early in the day exist.[4] However, comprehensive discharge planning favorably impacts discharge times.[5] There are limited published data regarding discharging patients early in the day. Studies have focused on improved discharge care coordination,[6,7] in-room display of planned discharge time,[8] and a discharge brunch.[9] In January 2012, the calendar month dis-

charge before noon (DBN) percentage for 2 inpatient medicine units in our institution was approximately 7%, well below the organizational goal of 30%. We describe an intervention to sustainably increase the DBN percentage.

METHODS

Setting
The intervention took place on the 17th floor of New York University (NYU) Langone Medical Center's Tisch Hospital, an urban, academic medical center. All patients on the 17th floor received the intervention.

The 17th floor is composed of 2 acute care inpatient medical units—17E and 17W. Each unit has 35 medical beds including a 16-bed medical step down unit (SDU). Medical teams on the floor consist of 4 housestaff teams, a nurse practitioner (NP) team, and an SDU team. Each housestaff and NP team is led by a hospitalist, who is the attending of record for the majority of patients, though some patients on these teams are cared for by private attendings. Medical teams admit patients to any unit based upon bed availability. Nurses are assigned patients by acuity, not by medical team.

Intervention
Kick-Off Event, Definition of Responsibilities, and Checklist
All stakeholders and front-line staff were invited to a kickoff event on March 5, 2012. This event included education and discussion about the importance of a

TABLE 1. Interdisciplinary Discharge Before Noon Checklist

Discharge Task	Responsible Team Member
MD discharge summary and medication reconciliation	Resident or NP
Discharge order	Resident or NP
Prescription(s)	Resident or NP
Communicate discharge date and time to patient/family	Resident/hospitalist/NP
Patient education	Nurse
RN discharge summary	Nurse
Patient belongings/clothing	Nurse
Patient education/teaching	Nurse
Final labs/tests	Nurse
Assess Foley catheter need and remove	Nurse
Transportation	Social worker and care manager
At-home services (HHA/HA/private hire)	Social worker and care manager
Equipment/supplies (DME, O₂, ostomy supplies)	Social worker and care manager

NOTE: Abbreviations: DME, durable medical equipment; HA, home attendant; HHA, home health aide; MD, medical doctor; NP, nurse practitioner; O_2, oxygen; RN, registered nurse.

safe and early discharge from the patient and staff perspective. Roles in the discharge process were clearly defined and a corresponding checklist was created (Table 1). The checklist was used at least once per day during afternoon interdisciplinary in preparation for next-day DBNs. Discharge date and time are communicated by the medical team to individual patients and families on the day a patient is identified for DBN. Patients and families did not receive additional orientation to the DBN initiative.

Interdisciplinary Rounds and DBN Website
In the past, interdisciplinary rounds, attended by each unit's charge nurse (CN), the medical resident or NP, the hospitalist, the team-based social work (SW), and care management (CM) occurred in the morning between 9:00 AM and 10:00 AM. With the DBN initiative, additional afternoon interdisciplinary rounds were held at 3:00 PM. These rounds were designed to identify the next day's DBNs. Multidisciplinary team members were asked to complete the checklist responsibilities the same day that DBNs were identified rather than waiting until the day of discharge. A DBN website was created, and CMs were asked to log anticipated DBNs on this site after 3:00 PM rounds. The website generates a daily automated email at 4:30 PM to the DBN listserv with a list of the next day's anticipated DBNs. The listserv includes all hospitalists, residents, NPs, CNs, nurse managers (NM), medical directors, bed management, building services, SWs, and CMs. Additional departments were subsequently added as the DBN initiative became standard of care.

Assistant NMs update the DBN website overnight, adding patients identified by nursing staff as a possible DBN and highlighting changes in the condition of previously identified patients. At 7:00 AM, an automated update email is sent by the website to the listserv. The automated emails include the DBN checklist, key phone numbers, and useful links.

Daily Leadership Meeting, Ongoing Process Improvement, and Real-Time Feedback
Weekdays at 11:00 AM, an interdisciplinary leadership meeting occurs with the medical directors, assistant NMs, CNs, and representatives from SW, CM, and hospital administration. At this meeting, all discharges from the previous day are reviewed to identify areas for improvement and trends in barriers to DBN. The current day's expected DBNs are also reviewed to address discharge bottlenecks in real time. Daily feedback was provided via a poster displayed in staff areas with daily DBN statistics.

Reward and Recognition
At the kickoff, a prize system was announced for the conclusion of the first month of the intervention if DBN thresholds were met. Rewards included a pizza party and raffle gift certificates. To hardwire the process, these rewards were repeated at the conclusion of each of the first 3 months of the intervention.

Changes to the Floor
There were notable changes to the floor during the time of this intervention. From October 25, 2012 until January 1, 2013, the hospital was closed after evacuation due to Hurricane Sandy. Units 17E and 17W reopened on January 14, 2013. The NP team was not restarted with the reopening. All other floor processes, including the DBN interventions, were restarted. The time period of floor closure was excluded in this analysis. The initial medical center goal was 30% DBNs. During the intervention period, the goal increased to 40%.

Data Collection and Analysis
Primary Outcome: Calendar Month DBN Percentage
The date and time of discharge are recorded by the discharging nurse or patient unit assistant in our electronic medical record (Epic, Madison WI) at the time the patient leaves the unit. Utilizing NYU's cost accounting system (Enterprise Performance Systems Inc., Chicago, IL), we obtained discharge date and time among inpatients discharged from units 17E and 17W between June 1, 2011 and March 4, 2012 (the baseline period) and March 5, 2012 and June 31, 2013 (the intervention period). Data from October 25, 2012 to the end of January 2013 were excluded due to hospital closure from Hurricane Sandy. The analysis includes 8 months of baseline data and 13 months of intervention data (not counting the excluded months from hospital closure), measuring the extent to which improvement was sustained. To match organizational criteria for DBN, we excluded patients on the units in the patient class "observation," deaths, and inpatient hospice.

Patients were identified as DBNs if the discharge time was before 12:01 PM, in accordance with our medical center administration's definition of DBN. Calendar month DBN percentage was calculated by

dividing the number of DBN patients during the calendar month by the total number of discharged patients during the calendar month. The proportion of DBNs in the baseline population was compared to the proportion of DBNs in the intervention population. Statistical significance for the change in DBN was evaluated by use of a 2-tailed z test.

Secondary Outcomes: Observed-to-Expected LOS and 30-Day Readmission Rate

Expected LOS was provided by the University Health Consortium (UHC). UHC calculates a risk-adjusted LOS for each patient by assigning a severity of illness, selection of a patient population to serve as a basis of the model, and use of statistical regression to assign an expected LOS in days. Observed-to-expected (O/E) LOS for each patient is calculated by dividing the expected LOS in days by the observed (actual) LOS in days. The average of the O/E LOS for all patients in the baseline period was compared to the average O/E LOS for all patients in the intervention period. This average was calculated by summing the O/E LOS of all patients in each time period and dividing by the total number of patients. In accordance with our medical center administration's reporting standards, we report the mean of the O/E LOS. For statistical evaluation of this non-normally distributed continuous variable, we also report the median of the O/E LOS for the baseline and intervention time period and use the Wilcoxon rank sum test to evaluate for statistical significance.

Readmission cases are identified by the clinical quality and effectiveness department at our medical center using the UHC definition of all patients who are readmitted to a hospital within 30 days of discharge from the index admission. The 30-day readmission rate is calculated by dividing the total number of cases identified as readmissions within 30 days by the total number of admissions over the same time period. This rate was obtained on a calendar-month basis for

patients discharged from the index admission before noon, after noon, and in total. These rates were averaged over the baseline and intervention period. The proportion of 30-day readmissions in the baseline population was compared to the proportion of 30-day readmissions in the intervention population. Statistical significance for the change in 30-day readmissions was evaluated by use of a 2-tailed z test.

RESULTS

Primary Outcome: Calendar Month DBN Percentage

The calendar month DBN percentage increased in the first month of the intervention, from 16% to 42% (Figure 1). This improvement was sustained throughout the intervention, with an average calendar month DBN percentage of 38% over the 13-month intervention period. Use of a 2-tailed z test to compare the pre-intervention proportion (11%) of patients who were DBN with the post-intervention proportion (38%) who were DBN showed a statistically significant change (z score -23.6, $P = 0.0002$). Units 17E and 17W had a combined 2536 total discharges in the baseline period, with 265 patients discharged before noon. In the intervention period, 3277 total discharges occurred, with 1236 patients discharged before noon. The average time of discharge moved 1 hour and 31 minutes, from 3:43 PM in the baseline period to 2:13 PM in the intervention period.

Secondary Outcomes: O/E LOS and 30-Day Readmission Rate

The average O/E LOS during the baseline period was 1.06, and this declined during the intervention period to 0.96 [Table 2]. Using the Wilcoxon rank sum test, we found a statistically significant difference between the O/E LOS in the baseline (median 0.82) and intervention (median 0.76) periods ($P = 0.0001$). The average 30-day readmission rate declined from 14.3% during the baseline to 13.1% during the intervention period. The change in 30-day readmission rate was not
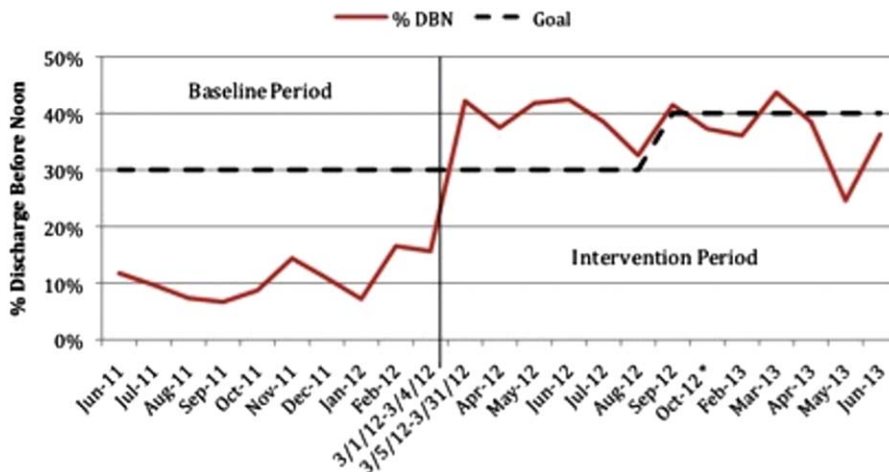

FIG. 1. Calendar month discharge before noon (DBN) percentage, units 17E and 17W combined. Goal is medical center DBN goal as defined by administration.
* - Hospital closure excluded from October 25, 2012 until January 31, 2013.

TABLE 2. O/E LOS and 30-Day Readmission Rate in the Baseline and Intervention Period for Units 17E and 17W

Units 17E and 17W	Baseline Period	Intervention Period	Change	*P* Value
O/E LOS, mean (median)	1.06 (0.82)	0.96 (0.76)	−10%	0.0001*
30-day readmission rate	14.3	13.1	−1.2%	0.1902

NOTE: **Abbreviations:** O/E LOS, observed-to-expected length of stay.

*O/E LOS statistical comparison for this non-normally distributed continuous variable was done with the Wilcoxon rank sum test of the median value in the 2 time periods.
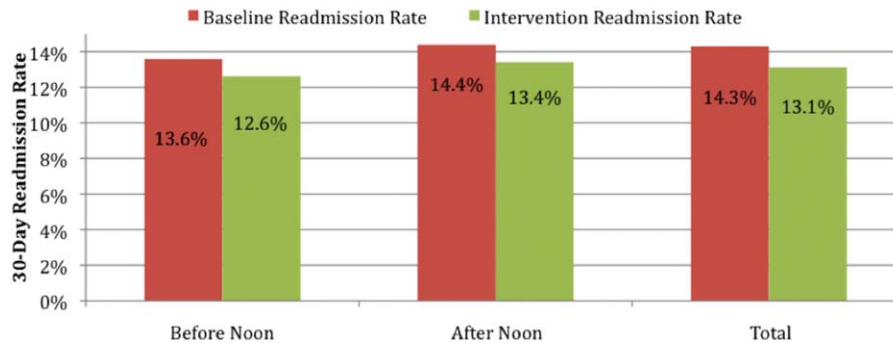

FIG. 2. Thirty-day readmission rate, units 17E and 17W combined. Before noon percentage is the average of all patients discharged before noon, after noon percentage is the average of all patients discharged after noon, and total percentage is the average of all patients.

statistically significant (z score = 1.3132, P = 0.1902). The change in readmission rate was similar and not statistically significant whether the patient was discharged before (13.6% baseline vs 12.6% intervention, P = 0.66) or after noon (14.4% baseline vs 13.4% intervention, P = 0.35) (Figure 2).

DISCUSSION

Throughput and discharges late in the day are challenges that face all medical centers. We demonstrate that successful and sustainable improvements in DBN are possible. We were able to increase the DBN percentage from 11% in the baseline period to an average of 38% in the 13 months after our intervention. Our success allowed us to surpass our medical center's initial goal of 30% DBN.

The intervention took place on 2 inpatient medical units at an urban, academic medical center. This intervention is likely generalizable to comparable medical centers. The study is limited by the implementation of multiple interventions as part of the DBN initiative at the same time. We are unable to isolate the effect of individual changes. If other medical centers wish to use a similar intervention, we believe the 3 most important parts of our intervention are: (1) kickoff event to engage all staff with a clear definition of roles; (2) daily real-time feedback, utilizing tools such as unit boards tracking the DBN percentage; and (3) a standardized form of communication for expected DBNs. In our experience, for a DBN to be successful, the team, patient, and family members must be alerted, and discharge plans must be initiated at least 1 day prior to the expected discharge. Attempting to discharge a patient before noon when they have been identified on the day of discharge is a losing proposition, both to achieve a coordinated, safe discharge and for staff and patient satisfaction.

The O/E LOS and 30-day readmission rate declined over the intervention period, suggesting that there is no negative effect on these metrics. There was concern that staff would choose to keep patients an extra night to allow for an extra DBN the following day. This was actively discouraged during the kickoff event and throughout the intervention period at interdisciplinary rounds and through informal communications. Based upon the decline in O/E LOS, this did not occur. There was also concern that the 30-day readmission rate may increase if patients are discharged earlier in the day than usual. We observed an actual but not statistically significant decline in 30-day readmission rate, potentially due to improved communication between team members and earlier identification of expected discharges at the prior day's afternoon DBN rounds. It is unknown if the decline in O/E LOS and 30-day readmission rate was effected by the DBN initiative. Many other initiatives were ongoing within the medical center that could be effecting these variables. More research is required to better understand the true effect of DBN on LOS and 30-day readmission rate.

There is limited literature on discharge early in the day. One previous study showed improvement in the DBN percentage on an obstetric floor through the institution of a discharge brunch.[9] Another report showed a modest increase (from 19.6% to 26%) in DBNs with the use of scheduled discharges.[6] This study was of unclear duration and was not specific to medical units. Another study focused on the use of in-room display boards to document the expected day

and time of patient discharge.[8] That report focused on the ability to schedule and achieve the scheduled discharge date and time. The authors describe a trend toward more discharges early in the day but provide no specific data on this effect. The only study looking specifically at discharge early in the day on a medical unit showed improvement in the discharge before 1:00 PM percentage, but was of small size (81 total patients) and short duration (1 month).[7] Our study is of larger size and longer duration, is focused on implementation of a medical service, and provides a comprehensive system that should be reproducible.

There are several next steps to our work. We will continue to monitor the DBN percentage and the ongoing sustainability of the project. We plan to investigate the effect of this rapid and notable increase in DBN percentage on a variety of patient outcomes and hospital metrics, including patient satisfaction, timeliness of ED admissions, intensive care unit transfers to the medical floor, and direct admissions.

Our study demonstrates that increased timely discharge is an achievable and sustainable goal for medical centers. Future work will allow for better understanding of the full effects of such an intervention on patient outcomes and hospital metrics.

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