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TRANSITIONAL CARE PROGRAM

Screening and Referral of High Risk Liver Transplant Patients to a Transitional Care
Coordination Program to Reduce Hospital Readmission

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Background and Overview

Recent estimates indicate that one-fifth of patients with Medicare are readmitted to the hospital within 30 days of discharge, resulting in an annual cost of \$17.4 billion (Boulding, Glickman, Manary, Schulman, & Staelin, 2011). According to McAdams-DeMarco et al. (2012), early hospital readmission is linked with increased morbidity, healthcare errors, and costs. In 2013, the Centers for Medicare and Medicaid Services (CMS) initiated a program to decrease reimbursements to hospitals with excess readmission rates (McAdams-DeMarco, Grams, Hall, Coresh, & Segev, 2012).

Transplant patient populations can be considered high risk for readmission since they face many surgical and medical complications, including immunosuppression therapy. Immunosuppression can lead to increased vulnerability to infections, malignancy, nephrotoxicity, hepatotoxicity, hyperkalemia, hypertension, tremor, gum overgrowth, and bone marrow suppression (Min & Monaco, 1991). McAdams-DeMarco et al. (2012) reported that approximately one-third of transplant recipients are readmitted within 30 days of discharge. McAdams-DeMarco et al. suggested that patients who are at increased risk of readmission would benefit from effective transition of care and coordination at organ transplantation discharge. Moreover, some care management techniques (frequent outpatient follow-up) and coordination (teamwork and communication) may decrease complications, post-transplant mortality rate, and the cost of transplantation.

The care management approach can reduce preventable readmissions by improving care-coordination and transitions among high-risk patient populations (McCarthy, Cohen, & Johnson,

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2013). The large tertiary care urban medical center, which is the focus of this scholarly project, also faces growing readmission rates and diminishing reimbursement by CMS. Readmissions cost over \$656 million annually for the State of Maryland (Maryland Health Services Cost Review Commission, 2011). The inability to effectively identify patients who need closer management and could benefit from referral to a care coordination program is a challenging problem at the medical center. Therefore, a method is needed to predict prior to discharge a transplant patient's risk of early hospital readmission. By adopting a risk assessment tool, The LACE Index, the liver transplant center should be able to distinguish at-risk patients at discharge and refer them to the Transitional Care Coordination (TCC) program for intensive follow-up care. The LACE Index is a validated screening tool for predicting patients at high-risk for hospital readmission within 30 days of discharge (Walraven, et al. 2012). LACE stands for, Length of stay, Acuity of the admission, Co-morbidities, and Emergency department visits in the previous 6 months (Appendix A).

The purpose of this quality improvement project is to utilize LACE and other specific clinical information to identify and refer inpatient liver transplant recipients at high risk for readmission into a TCC program. It is anticipated that this program will improve the quality of care, decrease readmission rates, and consequently decrease healthcare spending. Understanding the contributing risk factors associated with hospital readmissions and improving how patients are discharged from the hospital are essential for the future delivery of healthcare (Boulding et al., 2011).

Theoretical Framework: Donabedian's Theory

Donabedian's (2005) structure, process, and outcome model is a useful outline and

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framework for quality assessment within the program and explains the relationship between process and outcome. According to the model, information about quality of care can be drawn from three categories: structure, process, and outcomes. Structure refers to the care delivery site, including qualifications of care providers, adequate facilities, staffing and equipment, and operations of the program. The process refers to how care will be provided in terms of appropriateness, adequacy, completeness, or competency. Outcomes, or the final points of care, can represent improvements in the function or survival rates.

Donabedian's theory is an applicable foundation to use in the development of the transitional care coordination referral process. This theory is appropriate as it guides the user to understand the relationship between structure, process, and outcome; essentially, how to implement a process and effectively evaluate the outcome. The framework that Donabedian's theory provides is reflected in the relationship between the TCC program (structure and process), decreased readmission rates (outcome), and increased quality of care (outcome). For operationalization purposes, the outcome, which is the readmission rate, will be precisely measured.

Literature Review

Due to regulatory and policy changes, the current healthcare landscape has shifted to focus more on quality outcomes. Specifically, 30-day readmission rates have unofficially become a litmus test for hospital discharge and patient care quality. Over the last ten years, researchers have developed and instituted interventions in their hospital environments to reduce their readmission rates. The subsequent care coordination interventions have proven effective,

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however, it has been suggested that individual medical centers may need to modify these interventions to accommodate for their own environments.

The effectiveness of a care transition intervention program in reducing readmission rates was demonstrated in a randomized control design study (Coleman, Parry, Chalmers, & Min, 2006). Interventions, such as a “transition coach,” that provides support pre and post-discharge, were utilized as methods to reduce readmission rates in the study. The researchers analyzed readmission rates at one, three, and six month intervals post-intervention, demonstrating decreased readmission rates in the intervention groups at every time point. The readmission rate at one-month post-intervention was 8.3% (intervention) and 11.9% (control), three months was 5.3% (intervention) and 9.8% (control), and six months 8.6% (intervention) and 13.9% (control). The results of this intervention indicated lower readmission rates at 30 days (8.3% vs 11.9%), 90 days (5.3% vs 9.8%), and 180 days (8.6% vs 13.9%) (Coleman et al., 2006). Another randomized controlled study was effective in reducing 30-day readmission rates (0.341 versus 0.451) by using a combination of several discharge and care coordination interventions (Jack et al., 2009). Koehler et al. (2009) also reported on the effectiveness of a post-discharge intervention bundle in lowering hospital and ER readmissions rates within 30 and 60 days.

Balaban, Samuel, and Woolhandler (2008) evaluated the impact of sending a discharge information form to the patient’s primary care provider and a follow-up call by their Registered Nurse upon arrival home. Although the researchers found no significant difference in readmissions and ER visits within 30 days between the experimental and control groups, the interventions reduced non-compliance with the post-discharge plan of care (11.5% versus 31.3%) and reduced the number of patients without primary care appointments within 21 days (14.9% versus 40.8%).

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There appears to be advantages to using multiple interventions over a single intervention strategy with the development of transitional care programs. Voss et al. (2011) recommended the Care Transitions Intervention (CTI) originally developed by Eric Coleman, which utilizes transition coaches to motivate the patient during their hospital stay and provides several post-discharge follow-up phone calls at specific time intervals. The purpose of Voss' study was to apply the intervention within multiple medical centers in order to answer questions of generalizability (2011). The investigators were able to successfully decrease 30-day readmission rates within the intervention group (12.8%) compared to the control group (30%).

Supporting a multiple intervention approach are two systematic reviews by Feltner et al. (2014) and Hansen et al. (2011). The researchers suggest that no single intervention is effective in all settings, and mention that the use of a combination of several interventions may improve effectiveness. Furthermore, Feltner et al. (2014) and Hansen et al. (2011) suggest that the variability in intervention effectiveness is likely related to the fact that hospital readmission causes are multifactorial and generally related to patient acuity, demographics, discharge procedures, and health literacy.

LACE Index: The Most Effective Referral Tool For TCC Program Eligibility

This scholarly project utilized the LACE Index to identify those patients who would benefit from referral to the TCC program. The LACE Index can be considered a numerical representation of four variables independently associated with unplanned readmissions within 30 days and/or death. LACE Index results range from 0 to 19, which corresponds to an expected risk of 2.0% to 43.7% respectively. According to Walraven et al. 2012, a score of 10 is

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associated with a 12.2% expected and observed probability of unplanned readmission or death within 30 days post-discharge. In this project, a LACE Index score of 10 or greater, as well as other specific laboratory data on the day of discharge, are associated with higher unplanned hospital readmission rates. The TCC program focused on transplant clinic attendance, lab-work compliance, follow up, medication management, and patient education.

In addition to using a LACE Index for screening, the patients were also screened for five other relevant factors to further categorize the severity of their illness. The five additional factors were the Model for End Stage Liver Disease (MELD) score, Serum Creatinine, Serum Bilirubin, White Blood Count, and Hematocrit. The presence of a (MELD) score equal or greater than 35 on the day of transplant or the presence of the following lab values on the day of discharge; 1) Serum Creatinine > 2 mg/dl, 2) Serum Bilirubin > 3 mg/dl, 3) White Blood Count < 2, or 4) Hematocrit < 21% have been associated with higher risk of readmissions. Therefore, the presence of any of the additional factors regardless of their LACE Index score will immediately qualify the patient for the TCC program and prompt a referral. The additional criteria for referral were developed by an expert team consisting of liver transplant surgeons, hepatobiliary physicians, hepatologists, and liver transplant nurse coordinators after review of the indications for readmission from the transplant center's cohort of 7/2012-7/2015.

To determine the applicability of the LACE Index for use with liver transplant patient population, the transplant center performed a three year (7/2012-7/2015) retrospective review of 30-day readmissions among liver transplant recipients (N= 321) prior to the implementation of this project. The LACE Index, MELD, discharge creatinine, white blood cell count, and demographic data were analyzed using multivariate analysis. Patients with a 30-day readmission (30%) had a higher mean LACE (11.6, range 7-17)) than those without (10.9, p=0.04). A LACE

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score ≥ 10 (sensitivity of 76% and specificity of 41%) indicates a higher risk of 30-day readmission ($p=0.01$). LACE positively correlates with recipient MELD at transplant (R coefficient= 0.4280, $p<0.0001$). Analysis further demonstrated that younger, female patients with a low WBC and elevated creatinine correlated with a significant risk of readmission.

The external validity of the LACE Index was demonstrated in the research done by Walraven et al. (2010). Walraven et al. (2010) collected additional data on unplanned readmission and death from 11 medical centers in Ontario, Canada to validate external validity. The study results indicated a significant positive correlation between LACE Index scores and the likelihood of unplanned readmission within the first month of hospital discharge.

Methods

This quality improvement project focused on studying 36 patients who received a liver transplant or who were discharged in an 8-week screening period during February and March 2016 from a 27-bed Intermediate Care (IMC) Abdominal Transplant Unit. Based on the LACE Index, 25 patients were categorized as high risk for hospital readmission and were referred to the TCC program. Out of the total sampled patients ($n=36$), seven patients did not meet the referral criteria and continued with the standard post discharge care. Those patients who did not qualify for the TCC program had a LACE score less than 10, as well as laboratory data that was considered within normal limits. The TCC and referral process' effectiveness were measured by retrospectively comparing the readmission rates from February and March 2015 with those from February and March 2016 who received the TCC program intervention. Four patients with a qualifying LACE score were not referred due to mortality or complications associated with other

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comorbidities. In total, 25 patients were referred to and completed the TCC program.

Procedures

The LACE Index score was calculated on the IMC transplant unit on the anticipated day of discharge. In order to accurately calculate the LACE Index, each patient was interviewed to obtain accurate data regarding any Emergency Room visits within the last six months, including those to outside hospitals. Additional inpatient visit(s) were occasionally required due to the patients' mental status (post-anesthesia state), the effects of pain medication, or post-operative complications that delayed transfer to the IMC. The patient's medical record was also reviewed to ascertain the additional lab values used to determine if a referral to the TCC program was warranted. All patients that were deemed eligible for this intervention received education about the TCC program and its benefits.

Eligible patients were referred to, and completed, the 90-day TCC program. Patients were followed by a designated transplant nurse coordinator who ensured that high-risk patients received appropriate care based on TCC guidelines (Appendix B). The nurse coordinators were the central point of contact for the patients, and assisted with coordinating care amongst the multidisciplinary transplant team. This provided consistency and continuity for the patient, promoted education and autonomy, and addressed additional issues that may impact adherence with the post-transplant regimen.

One focus of this program was to enhance post-liver transplant care through strategic coaching. The coaching aimed at providing adequate utilization of resources, consistent education, robust follow-up, and a consistent schedule to facilitate meeting the necessary

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transplant clinic and lab work appointments. Nurse coordinator or provider follow-up focused on educating the patient, providing support, and discussing topics to prevent medication errors and confusion.

The first 30-days (Month 1) of the TCC program included a total of four transplant clinic visits, one each week, twice weekly lab work (CBC w/differential, CMP, Tacrolimus Level) for trending, and a total of at least four phone calls made to the patient each week. These phone calls addressed areas of concern, facilitated adjustment of immunosuppression medications, and provided laboratory data results to the patients. In this first month, an NP or a PA, a surgeon, and a hepatologist were seeing patients. Additionally, a pharmacist and nutritionist saw the patient at one of their visits and a social worker was available as needed.

The second 30-days (Month 2), the patient was thought to be establishing a post-transplant routine by becoming more confident and independent with their medications, asking relevant questions, and utilizing resources provided by the transplant department as needed. During days 31-60, the patient visited the transplant clinic for a total of three visits, transitioned to weekly lab work, and received a minimum of three phone calls a week from the post-transplant nurse coordinator, NP, or PA, nutritionist, and pharmacist. In addition, the transplant pharmacists and social workers provided services specifically tailored to those patients with social, financial, or insurance issues that would likely have prevented them from obtaining their medications. Patients who demonstrated psychosocial risk factors that might further prohibit them in progressing with the TCC program, were also referred to the social worker at the liver clinic.

In the last month (Month3), the transplant patients began their transition from the TCC program to a medical center chosen hepatologist. It was critical to ensure that the patient had

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received the proper education and support needed to feel comfortable managing their medications and adhering to medication changes as they occurred. This was expected to be done with less preemptive coaching and follow-up as in the prior two months. Month three included bi-weekly transplant clinic visits, bi-weekly lab work (unless otherwise discussed by the provider), and a minimum of two phone calls a week from the nurse coordinator. Because of this increase in care coordination, the nurse was able to establish better patient/provider relationships, which thereby enhanced communication, independence, and provided an increased level of comfort with medication management.

The providers visited each patient in the transplant clinic a total of nine times. The patient had 13 sets of lab work (or more) drawn, and received a minimum of 36 phone calls from an NP, PA, or nurse coordinator during the full 90-days of the TCC program. Upon completion of the program, the patients were transitioned to a hepatologist to continue their post-transplant follow-up care, while maintaining access to their transplant nurse coordinator to facilitate continuity of care.

Results

The effectiveness of the referral process and TCC program were measured by retrospectively comparing the readmission rates from February and March 2015 to those in 2016, and after the TCC program intervention. The TCC screening process was 100%. Between the two time periods in 2015 and 2016, a total of 41 patients were eligible for the TCC program (16 in 2015 and 25 in 2016). Among the 25 patients referred to the TCC program in 2016, 5 (20%) were readmitted within 30 days of hospital discharge. The retrospective 2015 data showed a

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readmission rate of 37.5% among the 16 patient who would have been eligible for, but did not receive, the TCC program. There was a significant difference in readmission proportions between equally eligible patients who did and did not receive the TCC program (Pearson's chi-square $p = 0.01$). The analysis could not explore the potential effect of confounding variables due to the small number of patients, length of the prospective study, and use of a retrospective control group.

The reasons for readmission in an 8-week cohort from February and March, 2016 included: a) dehydration with hypotension secondary to diarrhea, b) bacteremia, c) anemia requiring transfusion, and d) falls resulting in fractures. According to the data collected, there were no readmissions with concern for, or resulting in, acute cellular rejection of the transplanted liver. In the prior cohort February and March, 2015, the reasons for readmission for patients who were potentially eligible for the TCC program, included: a) fever, b) infection, c) electrolyte imbalance, d) edema, f) shortness of breath, and g) hypotension. The comparison between the reasons for readmission in 2015 and 2016 indicates an overall improvement because of the implementation of the TCC program.

Discussion

For the prospective data, the readmission rate was 20% as five of 25 eligible TCC patients were readmitted within 30-days of hospital discharge. A readmission also occurred if the patient arrived at an outside hospital or the Transplant Center through direct admission, the Emergency Department, from a non-Transplant Center associated facility, or from home. The outside facilities included sub-acute rehabilitation centers, outside hospitals, and short- and long-term care facilities. Readmissions based on this data were validated through Transplant Center

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database and by the transplant surgeons. If at all possible, readmissions from the transplant clinic setting were avoided by utilizing outpatient resources, changes in medication regimen, or scheduling diagnostic procedures and interventions at an outpatient facility. Additionally, alternate treatment options were discussed with the outside facilities to encourage collaborative patient care management when acceptable to do so; there was no compromise in patient safety to this regard.

Although the LACE Index and the TCC program included multiple organized strategies and interventions to improve patient outcomes, the project still faced some barriers. These challenges included geographic factors, language barriers, transportation issues, and patient financial ability. The transplant referral and follow-up process was complicated in some cases, because several referring physicians wanted to resume primary care of their patient shortly after liver transplantation. However, per TCC guidelines patients were required to make visits to the transplant center for management. Considering these factors, for the next project, it is likely that in addition to providing extended and exceptional care to patients, the transplant center will be able to better address the patient's challenges along with the referring physician's expectations.

Conclusion

In conclusion, the LACE Index may be a valuable asset to liver transplant programs for identifying patients who are at high-risk for readmission within the first 30-days of hospital discharge. Additionally, these identified patients are predicted to benefit from intense post-discharge care through organized care coordination. The results of this project demonstrate the effectiveness of the LACE Index in conjunction with the TCC program, in the identification of

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high risk liver transplant patients, and prevention of hospital readmission. However, any TCC program should be tailored to the specific needs of the patient population and the organization. The results of this project should serve as a guide in developing effective tools for determining high-risk readmission criteria. Consequently, the identification of readmission risk supports early referral to a transitional care program. It is hypothesized that the use of the LACE Index coupled with a TCC type intervention will reduce readmission rates, increase the quality of patient care and satisfaction, and aid in decreasing healthcare spending. Future studies will need to focus on the impact of this intervention on readmission rates at 60 and 90 day intervals post-discharge.

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Appendix A

MELD Score _____
 ABO _____
 Date of Transplant _____

LACE Index Scoring Tool

Step 1. Length of Stay

Length of stay (including day of admission and discharge): _____ days

Length of stay (days)	Score (circle as appropriate)
1	1
2	2
3	3
4-6	4
7-13	5
14 or more	7



L

Step 2. Acuity of Admission

Was the patient admitted to hospital via the emergency department/ transferred from other facilities/hospitals or admitted from home?

If yes, enter "3" in Box A, if admitted from home enter "0" in Box A

A

Step 3. Comorbidities

Condition (definitions and notes on reverse)	Score (circle as appropriate)
Previous myocardial infarction	+1
Cerebrovascular disease	+1
Peripheral vascular disease	+1
Diabetes without complications	+1
Congestive heart failure	+2
Diabetes with end organ damage	+2
Chronic pulmonary disease	+2
Mild liver or renal disease	+2
Any tumor (including lymphoma or leukemia)	+2
Dementia	+3
Connective tissue disease	+3
AIDS	+4
Moderate or severe liver or renal disease	+4
Metastatic solid tumor	+6
TOTAL	

If the TOTAL score is between 0 and 3 enter the score into Box C. If the score is 4 or higher, enter 5 into Box C

C

Step 4. Emergency department visits

How many times has the patient visited an emergency department or got admitted in the six months prior to admission (not including the emergency department visit immediately preceding the current admission)? _____

Enter this number or 4 (whichever is smaller) in Box E

E

Add numbers in Boxes L, A, C, and E to generate LACE score and enter into box below. If LACE score is ≥ 10 , refer the patient to the Transitional Care Coordination Program.

LACE

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Additional Screening Criteria:

If the patient receives a positive finding on any of the following lab parameters on the discharge day, then the patient will be referred to the Transitional Care Coordination Program regardless of the LACE score:

	Yes	No
• Serum Creatinine at the discharge > 2 mg/dl
• MELD Score at time of transplant ≥ 35
• Serum Bilirubin at the discharge > 3 mg/dl
• White Blood Count at the discharge < 2
• Hematocrit at the discharge < 21

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Appendix B

Transitional Care Coordination Program

Step 1. Patient referred to the Transitional Care Coordination program based on results from the LACE Index and additional screening criteria.

Patients will be required to be seen in clinic as described on the table below

Month 1 (First 30 Days)	1 visit weekly (Total of 4 visits)
Month 2 (Second 30 Days)	Total of 3 visit
Month 3 (Third 30 Days)	1 visit biweekly (Total of 2 visits)

The patient will be seen by the PA/ NP, Surgeon and Hepatologist for the first 2 visits. The NP/ PA will see the patient for the remaining visits. Additionally, a pharmacist and nutritionist will see the patient monthly.

Patients will be required to obtain lab works as described on the table below

Month 1 (2 times a week)	8 lab works
Month 2 (1 time a week)	4 lab works
Month 3 (Biweekly)	1 lab work biweekly (Total of 2 lab works)

Lab values that will be checked by the nurse coordinators and the NP/ PA are CBC and CMP and Tacrolimus level (immunosuppression level). Maintenance immunosuppressive therapy prevents acute and chronic rejection and the loss of transplanted organ. The phone call by the Nurse coordinator will be made to direct the patient to make the appropriate changes.

Patients will receive phone calls as described on the table below

Month 1	4 phone calls a week
Month 2	3 phone calls a week
Month 3	2 phone calls a week

The phone calls will be made by the nurse coordinator/ PA to either to direct the patient to change the immunosuppression medication dose or to inform them that the lab values were within normal limits. A constant education regarding signs and symptoms of rejection and infection will be provided to the patient while the phone call made. The Nurse Coordinator provides coaching and directions to patients on how to manage their own care. Patients will be referred to the social worker by the nurse coordinator if there is any psychosocial risk such as financial or insurance issues that prevent patients from purchasing their medication.