Ambulatory Intensive, Multidisciplinary Telehealth for High-Risk Discharges: Program Development, Implementation, and Early Impact

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ABSTRACT

Introduction: Creating and implementing programs aimed at reducing readmissions for high-risk patients is critical to demonstrate quality and avoid financial penalties. Intensive, multidisciplinary interventions providing care to high-risk patients utilizing telehealth have not been explored in the literature. This study seeks to explain the quality improvement process, structure, intervention, lessons learned, and early outcomes of such a program.

Methods: Patients were identified prior to discharge with a multicomponent risk score. The enrolled population was managed intensively for 30 days after discharge through a suite of services, including weekly video visits with an advanced practice provider, pharmacist, and home nurse; regular lab monitoring; telemonitoring of vital signs; and intensive home health visits. The process was iterative, including a successful pilot phase followed by an expanded health system-wide intervention analyzing multiple outcomes, including satisfaction with video visits, self-rated improvement in health, and readmissions compared to matched populations.

Results: The expanded program resulted in improvements in self-reported health (68.9% reported health was some or greatly improved) and high satisfaction with video visits (89% rated satisfaction with video visits 8-10 on a scale of 0-10). Thirty-day readmissions were reduced compared to individuals with similar readmission risk scores discharged from the same hospital (18.3% vs 26.4%) and individuals who declined to participate in the program (18.3% vs 31.1%).

Conclusions: This novel model using telehealth to provide intensive, multidisciplinary care to high-risk patients has been successfully developed and deployed. Key areas for growth and exploration include developing an intervention that captures a greater percentage of discharged high-risk patients, including non-homebound patients, improving the electronic interface with home health care, and reducing costs while serving more patients. Data show that the intervention results in high patient satisfaction and improvements in self-reported health, with preliminary data showing reductions in readmission rates.

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INTRODUCTION

Reducing the number of readmissions to acute care hospitals within 30 days has been an area of focus nationally since the Patient Protection and Affordable Care Act of 2010, which, through Medicare, penalized excessive readmission rates. After the Patient Protection and Affordable Care Act, many efforts to reduce readmissions have focused on the transition of care from hospital discharge back to the primary care setting. It is known that a small number of individuals account for a disproportionate rate of readmission and of health care spending in the United States.[1] Focusing efforts on this small but frequently readmitted population may be key to sustainable and valuable interventions that improve outcomes and reduce readmissions.

Several effective models to reduce readmissions for hospitalized patients have been developed utilizing a bundle of interventions, including structured hand-offs, medication reconciliation, and utilization of discharge coaches/advocates.[2-6] However, the literature is less robust surrounding specific tactics to reduce readmissions for high-risk discharges. Longitudinal intensive management programs have been studied and found to have positive effects on patient access and engagement[7] and experience[8] but variable effects on long-term health care utilization.[9,10] A transitional care program providing intensive in-person management has shown particular success,[11] but in a randomized trial, a care program aimed at utilizing care

plans and intensive interdisciplinary management for high-risk patients did not show benefit.[12]

Programs providing intensive management for high-risk patients through telehealth after discharge have not been described in the literature and may provide a unique ability to serve this population, which often suffers from significant physical limitations to attend office-based visits. In support of this method of care, it has been found that in-person home-based primary care[13] and home-based extender care[14] can have positive benefits on health care utilization. Furthermore, preliminary evidence shows that telehealth can be a useful and effective modality of care in all-risk care transitions[15] and with the elderly.[16,17] However, specifics of programs serving high-risk patients on discharge with telehealth have not been described in the literature.

We aim to describe the piloting and development, feasibility, and observational impact of an intensive management program for high-risk discharges using a multidisciplinary team connecting to patients through telehealth facilitated by a home health registered nurse (RN). This paper describes the details of how this program was developed, structured, implemented, and iterated and the key lessons learned so that others can use the principles identified to develop programming for high-risk discharges. Analysis of outcomes outlined in the Results section aims to support understanding of the program.

METHODS

Population Characteristics
An academic tertiary care hospital and 2 community hospitals with an extensive network of 40 health clinics that employ 1700 physicians comprise our health system. Patients were recruited only from those hospitalized at the academic tertiary care hospital and included those with internal or external primary care clinicians.

Prior to this program implementation, multiple readmission reduction tactics had been deployed, including high-risk discharge huddles, pharmacist medication reconciliation, expedited scheduling in primary care, and transitional care management calls. Despite implementation of these measures, a review of patients readmitted to the academic hospital from primary care practices affiliated with the system revealed that the majority had complex illness with a 36% readmission rate. This population required more effective monitoring, including the ability to rapidly intervene when issues arose.

Population Identification
In order to identify risk to appropriately target the intervention, an internal risk score was developed—the Hospital Admission Readmission Risk Discriminator (HARRD), which used multiple components described in the readmission literature, including polypharmacy, previous readmissions or emergency department (ED) visits, high-risk chronic conditions, and age (Table 1). The components of this score could be obtained directly from

Table 1. Components of the Hospital Admission Readmission Risk Discriminator Score

Component	Weight
ED visits ≥ 3 in past 6 months or ≥1 inpatient readmission(s) within the last 90 days	2 points
≥ 2 chronic diseases: diabetes, congestive heart failure, COPD, liver disease, dementia, connective tissue disease, HIV, stroke, peripheral vascular disease, cancer, psychiatric diagnosis (bipolar, schizophrenia, depression)	1 point
Age >65 years	1 point
>10 medications	1 point

Abbreviations: ED, emergency department; COPD, chronic obstructive pulmonary disease.

the electronic health record on admission and expedited recruitment during the hospital stay. This score had been retrospectively validated on discharges from within our system and found to outperform the LACE index[18] in predicting readmissions with a continuous receiver operating characteristic curve of 0.86 (Table 1). Prior to the start of the program, a HARRD score of 4 or 5 was found to correlate with a readmission rate of up to 36% or above. Individuals with a HARRD score of 4 or 5 and who qualified for home health care were the target population for this program. Patients were excluded if they were receiving chemotherapy, discharged to a nursing facility, part of the advanced heart failure program, within 2 years of any solid organ transplant, in hospice, or were admitted for congestive heart failure, sickle cell disease, or a myocardial infarction, as the health system had existing outreach programs for these patient populations. Patients were recruited in person by a staff member prior to discharge and consented to program participation.

Pilot Program
A pilot project was developed to test the hypothesis that the proposed program could reduce readmissions. The project focused on patients admitted from a single internal medicine clinic affiliated with the hospital. Eligible patients were interviewed using a standard tool addressing social, financial, disease knowledge, self-care ability, medication, and transportation issues. The inpatient team contacted a nurse practitioner in the clinic prior to discharge to initiate the handoff process. A home care referral was initiated to one hospital-affiliated home care agency, and the patient was seen at home within 24 hours by an RN and social worker. The patient was scheduled in clinic within 72 hours, evaluated by the primary care clinician or advanced practice nurse prescriber (APNP) and met with a pharmacist to review medications. A weekly huddle was held with the APNP, home health nurse, and RN care coordinator. The patient also received a weekly phone call from the RN care coordinator. After hours, if any problems arose, patients were instructed to call the home care nurse who, in turn, would contact the on-call physician. Analysis demonstrated a reduction in readmissions for patients of the study clinic with a HARRD score of 3,

Table 2. Details of Team Member Roles in the Hospital Discharge Care Program

Team Member	Credentials	Role	FTE
Medical director	MD or DO	Daily patient care huddles with team, after hours oncall coverage, program development and direction	0.2
Advanced practice provider (APP)	APNP, DNP, PA-C	Video visits with patients, monitor lab results and tele-monitoring results, coordinate with Home RNs, coordination with ED and inpatient teams when patients admitted, work directly with medical director	1.0
Registered nurse coordinator	BSN	Patient recruitment and initial biopsychosocial screening, triage, coordination with home RNs, durable medical equipment, support to APP or medical director as assigned	1.0
Home RN	BSN	Home-based program intake within 24 hours of discharge, patient assessment vitals, and basic physical exam, facilitate video visits, wound care, medication reconciliation and adherence counseling, home safety evaluation, frequent visits with patient as defined by need and directed by APP	1.0 split among multiple RNs
Pharmacist	PharmD	Initial extensive medication reconciliation, weekly patient video visits, between-visit availability for APP and home RN	0.7
Scheduler	HS degree or more	Assistance with patient recruitment, processing of paperwork, coordinate schedule for home visits, supplies and equipment for the team, and other duties as assigned	1.0

Abbreviations: FTE, full-time equivalent; MD, medical doctor; DO, doctor of osteopathic medicine; APNP, advanced practice nurse prescriber; DNP, doctor of nursing practice; PA-C, physician assisstant, certified; RN, registered nurse; ED, emergency department; BSN, bachelor of science in nursing, PharmD, doctor of pharmacy; HS, high school.

4, or 5 from 34.9% during the 7 months prior to the intervention (January 1-July 31) to 11.9% during the 7 months following the intervention (August 1–February 2) and a decrease in total cost per patient from $6860 to $3839. Total costs factored in costs to the health system, including outpatient, ED, and inpatient visits but did not include program costs; the reduction in costs of care was driven largely by reductions in inpatient care and ED visits versus an increase in outpatient visits. Patients discharged with HARRD scores of 3, 4, or 5 at 2 comparison clinics without intervention were followed in real time, showing respective readmission rates during the study period of 20.5% and 21.6% in one clinic and 34.5% and 27.1% in the other clinic.

Full Program

Based on the positive results of the pilot study, an expanded program called the Hospital Discharge Care Program (HDCP) was developed to manage all discharged patients at very high risk for readmission (HARRD scores 4 or 5), regardless of location of primary care clinician.

New programmatic adjustments relative to the pilot program were the use of video visits with the program's advanced practice provider (APP) and the addition of a pharmacist to each video visit, which was facilitated by the home health nurse. The video visits replaced scheduled clinic visits, allowing patients to recover in the comfort of their home while undergoing intensive monitoring by the team.

Multiple team members were involved in patient care, including a medical director responsible for overall program direction and clinical supervision; an APP responsible for the daily intensive patient care; a clinic-based RN responsible for recruitment, initial assessments, and triage; a home health RN responsible for intake assessments, weekly assessments, facilitating video visits, and many other duties as required in the home; a pharmacist responsible for medication reconciliation and follow-up; and a scheduler responsible for the program's day- to-day operational efficiencies. Details of these roles are listed in Table 2.

Patients were seen within 24 hours by the home health nurse; then video visits facilitated by that nurse with the APP and pharmacist were held within 72 hours of discharge and weekly thereafter for 30 days. All care was provided in the home as feasible, and those with acute issues requiring in-person care were brought to the clinic to be seen by the APP or physician. Telemonitoring, including daily blood pressure, pulse, oxygen saturation, and weight, was deployed for select patients, such as individuals with congestive heart failure, renal disease, or other disease states that would necessitate this monitoring. Telemonitoring data were communicated in real time to the APP for close monitoring of the patients' condition and titration of medications. Labs were completed in the home by the home health agency and transmitted to the APP. Video visits were utilized to assess and communicate with the patient and their caregivers. To minimize work for the patient, maximize enrollment and benefit from the program, and to avoid the known disparities that exist in access to telehealth technology, the home health nurse managed all of the technological aspects of care to connect via video visits. Home palliative care providing home-based visits by an APP frequently was ordered for individuals struggling with end-of-life decisions or symptoms. A discharge document was prepared for the primary care clinician upon completion of the program for continuity of care purposes.

The initial program goal was to care for 20 patients per month; after approximately 1 year of operation, this goal was increased to 40 patients per month. This mark was difficult to obtain given a combination of factors, including the tightening of the home care requirements by the home health organization, loss of active referrals from inpatient case management, and an increasing number of discharges managed by the health system's telephonic-based care coordination programs. Given enrollment difficulties, some patients with HARRD 3 scores were included when requested by inpatient or program staff. Program enrollment was maintained at approximately 20 to 35 patients per month over this time.

Data Analysis

Although the program spanned multiple years, data for fiscal year 2018 were included in the final analysis. Process data were collected as the program was deployed, including enrollment, reasons for decline, and HARRD scores.

A telephone survey was offered to all program participants from fiscal year 2018 asking multiple questions, such as satisfaction with video visits and self-reported health improvement before and after program enrollment.

Thirty-day readmission data were retrospectively analyzed utilizing Vizient data on readmissions. Planned readmissions were excluded from analysis. The readmission rates for those enrolled in the program were compared to those who were eligible for the program but declined to participate or those for whom we were unable to offer enrollment (missed) due to staff shortage or an after-hours discharge. A second comparison population was created analyzing the readmission rates for HARRD scores 3, 4, and 5 versus HDCP patients with similar HARRD scores, as well as a total readmission rate that was weighted to the same population enrolled in HDCP (Table 3).

This project and analysis were approved for institutional review board exemption by the institution's department of medicine quality improvement exemption process.

RESULTS

For fiscal year 2018, 191 patients were enrolled in the program, and 161 were eligible but declined to participate (45.7%). The top 3 reasons cited for declining included the lack of desire to have home health care, not wanting to lose personal care services related to insurance requirements, and perceived lack of need for home health care services. All of the individuals who refused the program also refused home health care. Many of the enrolled patients had a HARRD score of 4 or 5 at the time of discharge. Some patients with lower scores on discharge (n = 23) were enrolled, as the HARRD score changed during admission as medications and problem lists were modified.

Forty-five patients responded to the telephone survey (23.5%). When asked to rate the video visits on a scale of 0 to 10 with 0 being the worst and 10 being the best, 82% of participants responded between 8 and 10 (Figure 1). At the end of the intervention, 68.9% of respondents reported improvement in their overall health (Figure 2).

Of the enrolled individuals, the readmission rate was 18.3%. For those who were eligible but declined or missed program enrollment, the overall readmission rate was 31.1%. Higher differences between the enrolled and declined population's rates were seen at a HARRD score of 3 or 4 compared to 5. Similarly, the weighted "all-hospital" discharge cohort had a readmission rate of 26.4%, with greater differences again seen at HARRD scores of 3 and 4 compared to 5 (Table 3).
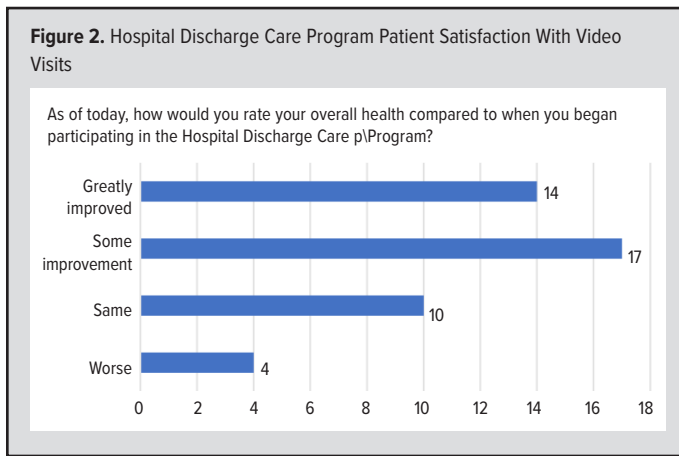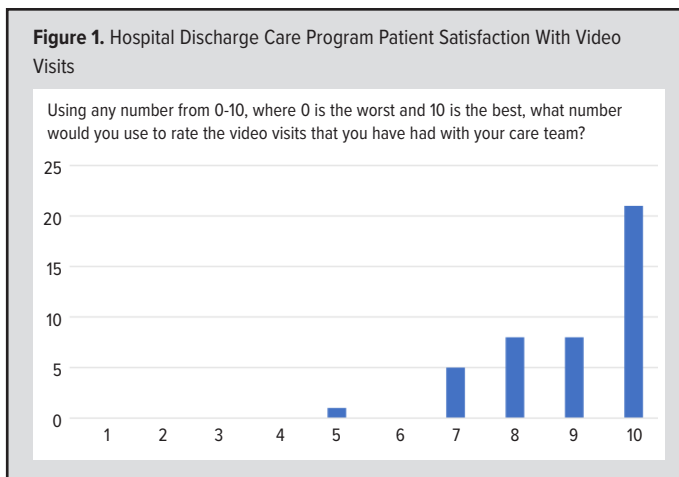
DISCUSSION

This novel program managing high-risk patients discharged from an academic health system provided care through intensive telehealth with a multidisciplinary team (APP and pharmacist) in collaboration with a home health RN. Preliminary analysis shows high patient satisfaction and a reduction in the readmission rate for those who were enrolled versus other comparison populations. This effect could be due to the intervention; however, further studies are needed to verify these results.

The literature surrounding readmission reduction programs focused on high-risk patients is limited. A recent manuscript describing the Complex High Admission Management Program (CHAMP) outlining intensive non-telehealth management of high-risk patients has shown no benefit on readmissions or health care utilization.[12] The described intervention was successful in relation to a few key differences from CHAMP, including a virtual platform and telehealth care that was based in the home—two methods of care that have been proven in multiple areas of the literature to be effective in reducing health care utilization.[13-17]

In addition, literature describing the process of implementation, iteration, and structure are limited in the literature. This manuscript provides details necessary for health system leaders to consider when developing programs focused on patients with high risk of readmission.

The study also highlights the high satisfaction of high-risk patients with video visits and telemedicine care after hospital dis-

Table 3. Retrospective Readmission Rates (Excluding Planned Readmissions) for the Hospital Discharge Care Program Compared to Patients Who Declined the Program and Hospital Averages by Risk Score for Fiscal Year 2018

HARRD Score	HDCP Enrolled		HDCP Eligible But Declined/Missed		HDCP Enrolled vs Declined	Overall Hospital[a]	HDCP Enrolled vs Hospital
	n	Readmission Rate (%)	n	Readmission Rate (%)	Variance (%)	Readmission Rate (%)	Variance (%)
0	2	0	0	0			
1	2	0	0	0			
2	7	14.3	0	0	14.3		
3	12	0	3	33.3	-33.3	20.8	-20.8
4	93	19.4	117	35.9	-16.5	30.3	-10.9
5	75	21.3	41	17.1	4.3	24.9	-3.6
Total	191	18.3	161	31.1	-12.7	26.4[b]	-8.1

Abbreviations: HARRD, Hospital Admission Readmission Risk Discriminator; HDCP, Hospital Discharge Care Program.
[a]Excluding advanced heart failure and active oncology.
[b] Weighted to HDCP population distribution.

Figure 1. Hospital Discharge Care Program Patient Satisfaction With Video Visits

Using any number from 0-10, where 0 is the worst and 10 is the best, what number would you use to rate the video visits that you have had with your care team?

Figure 2. Hospital Discharge Care Program Patient Satisfaction With Video Visits

As of today, how would you rate your overall health compared to when you began participating in the Hospital Discharge Care p\Program?

charge. However, the population is likely self-selected, as those who declined to participate often cited the lack of desire to have individuals in the home or engaging virtually as reasons not to enroll. Regardless, options including telehealth for discharges are useful and effective strategies to reduce readmissions, in conjunction with other strategies to provide multiple options for high-risk patients.

This intervention was more successful in individuals who had lower risk scores. Those with the highest risk score (5) did not experience much benefit from the program with regard to readmission reductions, while those with moderate risk scores (3-4) experienced the most benefit. There is no literature to guide the understanding of this phenomenon. It can be postulated that individuals at very high risk needed different types of services or were too medically complex or ill to respond to even this high level of care. Further studies should be completed to understand this phenomenon.

One of the limitations of the outcomes analysis is that the comparison groups were selected for convenience, but there are potential biases that could affect the interpretation of causality. However, the feasibility and successful deployment of this program has been clearly described. Furthermore, data on demographics of those enrolled, declined and missed, and the matched compari-

son populations are not available. Further work to understand the true impact of the program on readmissions, which populations the intervention may benefit most, and how this intervention can be scaled to serve non-homebound and moderate-risk patients is underway.

Key Successes
Video visits: This method of intensive video visit care facilitated by a home health RN has not been described in the literature. Compared to traditional telephonic transitional care, this care method allowed the care team to visualize the patient's condition; communicate effectively with the patient, RN, and family members; and form more trusting and therapeutic relationships with patients. Furthermore, patients recovered in the comfort of their home post discharge. Patients were seen rarely in the clinic or required to come to the lab for testing. This intervention may have increased the engagement of a very high-risk patient population with mobility challenges who otherwise may not have been able to engage with office-based primary care after discharge. Our satisfaction and health improvement ratings display that this method of care was well-received by this patient population.

Intensive patient management: Frequent touches and acute availability allowed the care team to catch health changes early before they led to an ED visit or hospitalization. Furthermore, the ability of the home health agency to deploy home vital sign monitoring and laboratory analysis allowed the APP and pharmacist team to closely monitor and treat these patients.

Collaborative care: Collaboration between home health RNs and a campus-based APP and pharmacist was important. This method of care allowed the home health RNs to have the needed support to manage complex patients with a clear connection to the discharging institution to ensure gaps were not missed in the discharge plan of care. Home health RNs emphasized the benefit of real-time communication versus leaving messages to be returned at the end of a clinic day.

Future Directions
Enrollment: The population of eligible patients declined with time due to two factors: (1) home care requirements became stricter; (2) the health system concurrently deployed multiple telephonic care coordination programs over time that excluded more patients from the intervention based on payor. Efforts to recruit more patients or consider other groups of patients who may benefit from this intervention are being explored, including those who are not eligible for home health care and those who would not prefer video visits. In addition, efforts to include the primary care clinician in management are being explored to improve patient trust and engagement.

Non-homebound patients: On average, 16 patients per month are ineligible due to the insurance requirement that patients be homebound to receive home care. Other interventions, including

use of telephonic outreach and community health worker-based programs are being explored to cover this gap. This method of care may not be feasible or effective for non-homebound patients.

Lack of electronic interface: The lack of an electronic interface between the home health agency electronic health record and the hospital electronic health record led to the need for frequent verbal and email-based communication. Furthermore, lab results relied on fax transmittal and often were delayed, leading to delays in care. An interface would facilitate care.

Scalability: The program is resource intensive, serving a small number of patients. Current work is being done to explore how this care can be deployed more cost-effectively and how to properly target the intervention to the population that may benefit from it the most.

CONCLUSIONS

This novel model using telehealth to provide intensive, multidisciplinary care to high-risk patients has been successfully developed and deployed. Key areas for growth and exploration include developing an intervention that captures a greater percentage of discharged high-risk patients, including non-homebound patients, improving the electronic interface with home health care, and reducing costs while serving more patients. Data show that the intervention results in high patient satisfaction and improvements in self-reported health, with preliminary data showing reductions in readmission rates.

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