Systematic Identification and Management of Barriers to Vascular Surgery Patient Discharge Time of Day

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Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School

Date: 19 February 2018

Student Name: Danny Wong, BA

Scholarly Report Title: Systematic identification and management of barriers to vascular surgery patient discharge time of day

Mentor Name(s) and Affiliations: C. Keith Ozaki, MD, Dept of Surgery, Brigham and Women’s Hospital

Collaborators, with Affiliations: Gaurav Sharma, MD; Dean J. Arnaoutakis, MD, MBA; Samir K. Shah, MD; Alice O’Brien, MS, RN; Stanley W. Ashley, MD, Dept of Surgery, Brigham and Women’s Hospital
Abstract:

Title: Systematic identification and management of barriers to vascular surgery patient discharge time of day.


Purpose: Length of stay fails to completely capture the clinical and economic effects of patient progression through the phases of inpatient care, such as admission, room placement, procedures, and discharge. Delayed hospital throughput has been linked to increased time spent in the emergency department and postanesthesia care unit, delayed time to treatment, increased in-hospital mortality, decreased patient satisfaction, and lost hospital revenue. We identified barriers to vascular surgery inpatient care progression and instituted defined measures to positively impact standardized metrics.

Methods: The study was divided into three periods: preintervention, “wash-in,” and postintervention. During the preintervention phase, barriers to patient flow were quantified by an interdisciplinary team. Suboptimal provider communication emerged as the key barrier. An enhanced communication intervention consisting of face-to-face and mobile application-based education on key patient flow metrics, explicit discussion of individual patient barriers to progression at rounds and interdisciplinary huddles, and communication of projected discharge and potential barriers via e-mail was developed with input from all stakeholders. Following a 4-week wash-in implementation phase, data collection was repeated.

Results: The pre- and postintervention patient cohorts accounted for 244.3 and 238.1 inpatient days, respectively. Both groups had similar baseline demographic, clinical characteristics, and procedures performed during hospitalization. The postintervention group was discharged 78 minutes earlier (14:00:32 vs 15:18:37; P = .03) with a trend toward increased discharge by noon (94% vs 88%; P = .09). Readmission rates did not differ (P = .44).

Conclusions: Implementation of a focused, interdisciplinary, frontline provider-driven, enhanced communication program can be feasibly incorporated into existing specialty surgical workflow. The program resulted in improved timeliness of discharge and projected cost savings, without increasing readmission rates.
Personal Contribution:

I worked closely with Gaurav Sharma, a general surgery resident at Brigham and Women’s Hospital (BWH), throughout the course of this project. I attended initial meetings between the vascular surgery department and Stanley Ashley, the Chief Medical Officer of BWH, to learn more about the hospital’s initiative to improve patient care metrics and the role of this study in reaching the institution’s goals. During the preintervention period, I attended several interdisciplinary team rounds to gain more insight into the discussions that were taking place regarding patient care and discharge. I also worked with Dr. Sharma to analyze the barriers to patient flow that were being identified, and once we found that primary team communication was the most commonly cited issue, I helped with brainstorming interventions that could reasonably be implemented. Following the wash-in and postintervention periods, I assisted with collecting data from patient charts (e.g. baseline characteristics, readmissions following discharge) and reviewing the results with Dr. Sharma to discuss their significance. For the manuscript, I contributed by doing literature searches and summarizing relevant papers for our introduction/conclusion, and by editing Dr. Sharma’s drafts. I had the opportunity to present our study to Elliot Chaikof, the Surgeon-in-Chief at the Beth Israel Deaconess Medical Center, at BWH’s Mannick Visiting Professor Event.

Significance of Project:

As all facets of society continue to evolve, it is important to innovate methods through which we can improve our healthcare system. For example, in 2004, Young et al described how industrial processes and theories that have worked in the manufacturing sector can be applied to patient care. In particular, they expand on the theory of constraints, a perspective that emphasizes the importance of identifying the bottleneck in a system and determining means through which it can be refined given that it will govern system throughput.\(^1\) In line with this approach, we designed our project such that we would pinpoint the most common barriers to patient care progression in our system for us to target with our interventions.

When evaluating throughput in healthcare, one common metric that has been used is length of stay (LOS). For instance, in a 1993 publication, Kominski et al explored the impact of Medicare’s prospective payment system on our nation’s medical system and chose LOS as their primary assessment tool.\(^2\) However, LOS has its shortcomings as it is unable to capture the
nuances of patient care progression that take place over the course of a day. For example, the
time at which a bed opens up following a discharge can affect the flow of patients through the
emergency department (ED) and dictate whether a patient is admitted during the day when there
are more resources available or at night when there are fewer. Metrics that are better suited to
assess these nuances include discharge by noon and specific discharge time of day. Wertheimer
et al investigated the importance of optimizing such metrics and demonstrated that increasing
rates of discharge by noon shifted the median arrival time of ED admissions to an hour earlier
and decreased high-frequency admission peaks from the ED – allowing for a steadier stream of
admissions. 3

The significance of improving patient care progression lies in the many negative
consequences associated with inefficient flow. Fee et al showed that ED crowding leads to
delays in administering essential therapies to patients; their analysis revealed that patients
presenting with community-acquired pneumonia were less likely to receive antibiotics within
four hours as the number of patients increased within the ED. 4 Chalfin et al indicated that
suboptimal patient care progression can result in increased mortality; their research demonstrated
that critically ill patients who remained in the ED for more than six hours prior to being
transferred to the intensive care unit (ICU) had higher ICU (10.7% vs 8.4%) and in-hospital
(17.4% vs 12.9%) mortality rates compared to those with shorter ED boarding times. 5 In addition
to these two highlighted ramifications, inefficient flow has also been associated with increased
adverse events and errors and decreased patient satisfaction, among other findings. 6,7

Patient throughput and care progression also have an impact on healthcare spending and
hospital revenue. Krochmal et al focused on the effects of ED overcrowding and found that
patients who were admitted through the ED but remained in the ED for more than a day had a
10-13% increase in total hospital LOS compared to those who were transferred from the ED
within a day. For the 490-bed hospital being studied, the authors estimated that ED overcrowding
had resulted in approximately $6.8 million in extra costs over a three-year period – 1988-1990. 8
Furthermore, Falvo et al analyzed the consequences of delays in transferring admitted patients
from the ED to an inpatient floor for a 450-bed hospital over a one-year span. They estimated
that if transfers had occurred within 120 minutes, the hospital would have been able to
accommodate 3,175 additional patients and generate $3.96 million more in net revenue. 9 Such
consideration of revenues and costs is becoming increasingly important as more patients are
gaining access to healthcare and the government is enforcing tighter limits on reimbursement rates – thus placing the pressure on hospitals to become more efficient.  

There have been a number of previous interventions implemented to improve patient care progression. Wariyapola et al instituted weekly multidisciplinary team meetings to discuss each patient’s care and expected date of discharge. The authors found that 64% of delays were due to preventable causes (e.g. waiting for a bed, waiting for social services), and that the meetings helped refine the discharge planning process by closing the distance between expected and actual discharge times. Wertheimer et al also put into practice a set of frontline provider-driven interventions for the purposes of enhancing patient throughput and increasing the number of discharges by noon. The interventions included creating a checklist of daily responsibilities, holding afternoon interdisciplinary rounds to pinpoint next-day discharges, and launching a website to promote communication, among others. The authors ultimately demonstrated that these measures were able to increase the percentage of discharges by noon from 11% to 38% and shift the average discharge time of day to 91 minutes earlier.

While keeping themes from these prior studies in mind, we aimed to systematically identify barriers to efficient patient care progression and institute corresponding measures to improve throughput in BWH’s vascular surgery division. We first used multidisciplinary rounds to categorize and quantify barriers to patient discharge – along the lines of what Wariyapola et al had done. After finding primary team communication to be the most cited issue, we created an intervention similar to what Wertheimer et al had implemented by establishing a multifaceted, frontline provider-driven set of measures to target that barrier. Furthermore, we used both older (e.g. LOS) and newer (e.g. discharge time of day, discharge by noon) metrics of patient care progression for our analysis. By incorporating insight gained from previous endeavors, we were ultimately able to show that a focused and enhanced communication program can be integrated into the vascular surgery workflow and improve patient throughput. However, further research must be carried out to assess its impact on other important metrics, including clinical outcomes and hospital revenues and costs.

References:


ABSTRACT

Objective: Length of stay fails to completely capture the clinical and economic effects of patient progression through the phases of inpatient care, such as admission, room placement, procedures, and discharge. Delayed hospital throughput has been linked to increased time spent in the emergency department and postanesthesia care unit, delayed time to treatment, increased in-hospital mortality, decreased patient satisfaction, and lost hospital revenue. We identified barriers to vascular surgery inpatient care progression and instituted defined measures to positively impact standardized metrics.

Methods: The study was divided into three periods: preintervention, “wash-in,” and postintervention. During the preintervention phase, barriers to patient flow were quantified by an interdisciplinary team. Suboptimal provider communication emerged as the key barrier. An enhanced communication intervention consisting of face-to-face and mobile application-based education on key patient flow metrics, explicit discussion of individual patient barriers to progression at rounds and interdisciplinary huddles, and communication of projected discharge and potential barriers via e-mail was developed with input from all stakeholders. Following a 4-week wash-in implementation phase, data collection was repeated.

Results: The pre- and postintervention patient cohorts accounted for 244.3 and 238.1 inpatient days, respectively. Both groups had similar baseline demographic, clinical characteristics, and procedures performed during hospitalization. The postintervention group was discharged 78 minutes earlier (14:00:32 vs 15:18:37; P = .03) with a trend toward increased discharge by noon (94% vs 88%; P = .09). Readmission rates did not differ (P = .44).

Conclusions: Implementation of a focused, interdisciplinary, frontline provider-driven, enhanced communication program can be feasibly incorporated into existing specialty surgical workflow. The program resulted in improved timeliness of discharge and projected cost savings, without increasing readmission rates. (J Vasc Surg 2017;65:172-8.)

A key concept in health systems management is “throughput,” or the number of patients served per unit of time. For over 2 decades, length of stay (LOS) has been one of the primary target metrics to optimize throughput. However, further gains in LOS reduction may be challenging to achieve given (1) intense reduction efforts to date, as well as (2) penalties for avoidable hospital readmissions that may result from premature discharge. LOS also lacks the granularity to capture nuances of inpatient hospital admission patient flow, which have implications for patient outcomes and staff work burden. For example, a delay in discharge time from 11:00 AM to 7:00 PM does not cause an appreciable increase in the LOS. However, by decreasing bed availability, delays of this nature increase postanesthesia care unit and emergency department boarding times.

There is now an extensive body of literature demonstrating the negative consequences of suboptimal patient flow. Outcomes that have been tied to impaired patient flow include delays in receipt of essential therapies, increased adverse events and medical errors, increased in-hospital mortality, and reduced patient satisfaction. In addition, compromised patient flow contributes to broader societal concerns regarding access to care and emergency-preparedness. Finally, suboptimal throughput is associated with increased healthcare system costs and lost hospital revenue.

Interest in optimizing patient flow processes is expected to intensify because of the financial impacts of impaired throughput in conjunction with (1) the increasing number of Americans who will obtain access to health insurance through the Affordable Care Act, (2) efforts to link traditional clinical and patient-centered outcomes with payment, and (3) impending constraints on hospital reimbursement and expansion of capacity. Hospitals are likely to pass these pressures off to surgical service lines. Elective procedures have been shown to be a major contributor to unpredictable and inefficient patient flow. This, in turn, has been
associated with ineffective healthcare resource allocation, manifested by both waste from low overall hospital bed occupancy and insufficient access to essential services.5,29,30

In 2015, our institution launched a frontline provider-driven pilot program as a broader hospital-wide initiative to optimize bed utilization by streamlining patient flow and improving timeliness of discharge. This initiative focused on newer metrics of throughput, such as specific time of discharge and discharge by noon.7,31,32 Here we discuss how the vascular surgery division at our academic medical center used a systematic approach to identify barriers to efficient patient throughput and successfully implemented a patient flow intervention.

METHODS

Study participants. The study included all patients discharged from the vascular surgery service (no hospitalists) at a single academic, tertiary care medical center during pre- and postintervention periods, each spanning 3 weeks. The study protocol was approved by the Partners Human Research Committee Institutional Review Board, who determined that patients’ informed consent to participate was not required.

Identification of barriers to patient flow and timely discharge. During the preintervention phase, daily, 15- to 30-minute interdisciplinary “huddle” meetings consisting of house officers, nurses, allied health professionals, social workers, as well as a care coordinator and utilization review nurse assigned to the regionalized vascular surgery inpatient ward were held to discuss barriers to patient flow and discharge. The vascular nurse manager ran the meeting. Furthermore, because the focus of these weekday huddles was patient progression and not medical issues, the group was able to hold discussion on each patient to 1-2 minutes, minimizing impact on the stakeholders’ workdays. The group identified modifiable barriers and classified them in the following categories: (1) “primary team communication” for gaps in patient progression and discharge plan related to communication among members of the vascular surgery physician and physician extender team, as well as with other care providers, (2) “awaiting consultant recommendations” for clinical recommendations or interventions by medical, surgical, and allied health consulting services, (3) “laboratory/imaging diagnostics pending” for pending studies excluding those falling into the subsequent category, (4) “weekend-related” for barriers specifically related to weekend resource availability (eg, diagnostic testing or interventions not performed on weekends because of lack of availability of specialized personnel), (5) “patient/family social” for those driven by patient or family member concerns with the proposed care plan or inability to provide transport or housing at the planned time of discharge, (6) “payer” for barriers related to insurance authorization and related issues, and (7) “postacute care facility” for barriers, such as lack of availability of beds at postacute care facilities or pending acceptance of patients to such facilities. The care coordinator and utilization review nurse recorded the daily barriers identified for each patient by the multidisciplinary team. The utilization review nurse played an observational role and determined which barriers constituted delays in discharge (same individual pre- and postintervention). In keeping with the key features of patient safety and quality improvement culture endorsed by the Agency for Healthcare Research and Quality and others,33-35 the interdisciplinary meetings were set out as blame-free reporting environments. There were no punitive measures associated with identification of barriers. The focus was to identify processes, not individuals, which might require improvement.

Development of quality improvement interventions to address barriers. Based on the identification of suboptimal communication among members of the primary surgical team (Fig and Results section), a meeting of all involved stakeholders was convened to devise a strategic approach. An enhanced communication package consisting of several interventions was developed (Table I). In each case, communication processes were mapped and the stakeholders accountable for execution of each intervention were clearly identified to ensure loop closure. A senior attending vascular surgeon and a vascular nurse administrator worked in conjunction to

<table>
<thead>
<tr>
<th>Table I. Components of enhanced care team communication program</th>
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<tbody>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>1. Face-to-face meetings with all care providers to educate them on key patient flow metrics</td>
</tr>
<tr>
<td>2. Development of a mobile application-based reference book outlining patient flow metrics and procedures</td>
</tr>
<tr>
<td>3. Explicit discussion of each individual patient’s barriers to care progression and discharge at twice daily house officer rounds</td>
</tr>
<tr>
<td>4. Explicit discussion of each individual patient’s barriers to care progression and discharge at once daily attending surgeon rounds</td>
</tr>
<tr>
<td>5. Explicit discussion of each individual patient’s barriers to care progression and discharge at once daily interdisciplinary huddles</td>
</tr>
<tr>
<td>6. Identification of admission and postprocedure barriers to care progression by group emails</td>
</tr>
<tr>
<td>7. Reporting of anticipated discharge dates to unit coordinators to facilitate bed utilization planning daily</td>
</tr>
</tbody>
</table>

...
serve as champions of the program and the nexus points for feedback, escalation of issues, and reform. Sustainability of the interventions, particularly in the face of team member turnover, was achieved using a mobile application-based reference book outlining patient flow metrics and procedures (AgileMD, www.agilemd.com/home).

**Implementation of interventions.** Following development of the package of interventions, there was a 4-week, implementation “wash-in” phase. During this period, the interventions were open for refinement based on the experience of all stakeholders in the process.

**Outcome measures.** The primary goal of the timely discharge initiative was to facilitate earlier discharge times to increase bed availability. Secondary outcomes included discharge by noon (arbitrary target set by hospital management that has no impact on reimbursement), length of inpatient hospital stay, discharge disposition, and estimated discharge date accuracy. In addition, barriers to discharge were again measured during postintervention period using identical methodology as during the preintervention period (previously described). All outcome data were prospectively collected for the pre- and postintervention intervals.

### Table II. Baseline patient characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Preintervention (n = 40, No. (%))</th>
<th>Postintervention (n = 34, No. (%))</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age, years [Q1,Q3]</td>
<td>71 [56, 80]</td>
<td>72 [66, 77]</td>
<td>.46</td>
</tr>
<tr>
<td>Female</td>
<td>22 (55)</td>
<td>13 (38)</td>
<td>.17</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td>.12</td>
</tr>
<tr>
<td>White</td>
<td>30 (75)</td>
<td>31 (91)</td>
<td></td>
</tr>
<tr>
<td>Latin American</td>
<td>3 (7.5)</td>
<td>2 (6)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>7 (17.5)</td>
<td>1 (3)</td>
<td></td>
</tr>
<tr>
<td>Mean BMI (SD)</td>
<td>24.8 (5.5)</td>
<td>29.3 (6.1)</td>
<td>.003</td>
</tr>
<tr>
<td>Hypertension</td>
<td>34 (85)</td>
<td>31 (91)</td>
<td>.49</td>
</tr>
<tr>
<td>DM</td>
<td>18 (45)</td>
<td>14 (41)</td>
<td>.82</td>
</tr>
<tr>
<td>CKD</td>
<td>12 (30)</td>
<td>10 (29)</td>
<td>.90</td>
</tr>
<tr>
<td>COPD</td>
<td>9 (22)</td>
<td>8 (24)</td>
<td>&gt;.99</td>
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<tr>
<td>CHF</td>
<td>6 (15)</td>
<td>7 (21)</td>
<td>.56</td>
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<tr>
<td>Reason for admissionb</td>
<td></td>
<td></td>
<td>.95</td>
</tr>
<tr>
<td>Planned procedure</td>
<td>25 (62.5)</td>
<td>19 (56)</td>
<td></td>
</tr>
<tr>
<td>Unplanned procedure</td>
<td>12 (35)</td>
<td>12 (35)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3 (7.5)</td>
<td>3 (9)</td>
<td></td>
</tr>
<tr>
<td>Procedures</td>
<td></td>
<td></td>
<td>.22</td>
</tr>
<tr>
<td>CEA</td>
<td>2 (5)</td>
<td>6 (18)</td>
<td></td>
</tr>
<tr>
<td>Infrainguinal revascularization</td>
<td>10 (25)</td>
<td>7 (21)</td>
<td></td>
</tr>
<tr>
<td>Aortoiliac revascularization</td>
<td>2 (5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EVAR/TEVAR</td>
<td>3 (7.5)</td>
<td>2 (6)</td>
<td></td>
</tr>
<tr>
<td>Open AAA/TAAA repair</td>
<td>1 (2.5)</td>
<td>5 (15)</td>
<td></td>
</tr>
<tr>
<td>Upper extremity/great vessel revascularization</td>
<td>2 (5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dialysis access</td>
<td>7 (17.5)</td>
<td>3 (9)</td>
<td></td>
</tr>
<tr>
<td>Amputation</td>
<td>4 (10)</td>
<td>6 (18)</td>
<td></td>
</tr>
<tr>
<td>Visceral revascularization</td>
<td>3 (7.5)</td>
<td>1 (3)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3 (7.5)</td>
<td>1 (3)</td>
<td></td>
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<tr>
<td>Primary insurance coverage</td>
<td></td>
<td></td>
<td>.43</td>
</tr>
<tr>
<td>Medicare</td>
<td>23 (58)</td>
<td>20 (59)</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>14 (35)</td>
<td>14 (41)</td>
<td></td>
</tr>
<tr>
<td>State-sponsored</td>
<td>2 (5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Military/VA</td>
<td>1 (2.5)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

AAA, Abdominal aortic aneurysm; BMI, body mass index; CEA, carotid endarterectomy; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; EVAR, endovascular aneurysm repair; Q1, 25th percentile; Q3, 75th percentile; SD, standard deviation; TAAA, thoraco-abdominal aortic aneurysm; TEVAR, thoracic endovascular aortic repair; VA, Veterans Affairs.

*Wilcoxon-rank sum test performed based on non-Gaussian distribution.

*Planned procedures, admission for scheduled, elective procedures; Unplanned procedures, admission for any procedure that was not scheduled prior to their admission, including urgent and emergent procedures; Other, admission for non-surgical, nonendovascular, diagnostic and therapeutic interventions (eg, antibiotic therapy).
There was a trend in decreased length of stay (LOS) in the postintervention group when compared with the cohort preceding the intervention (Table III). Reasons for readmissions in both groups ranged from planned readmission for vascular surgical procedures, surgical complications, such as surgical site infection and wound dehiscence, as well as medical complications such as non-ST elevation myocardial infarction, respiratory failure, gastrointestinal bleeding, acute pancreatitis, and seizure.

RESULTS

The pre- and postintervention cohorts consisted of 40 and 34 patients accounting for 244.3 and 238.1 inpatient days, respectively. Although mean body mass index was higher in the postintervention group, the two cohorts were similar in other baseline demographic and clinical characteristics, as well as primary insurance carrier (Table II). There were no statistically significant differences in indication for admission or procedures performed during hospitalization (Table II).

In total, 40 modifiable barriers to patient flow were identified. Gaps in communication among attending surgeons, vascular surgery fellows, residents, and physician assistants, as well as between these members and the remainder of the care team were cited as the most frequent modifiable barriers to patient flow and the major contributor to discharge delays in the multidisciplinary huddles (Fig).

Following implementation and “wash-in” of the enhanced communication intervention, the gaps in communication among the primary team decreased from 14 to 8, and the total number of modifiable barriers to care progression decreased to 26 ($P = .04$). Median discharge time was 78 minutes earlier in the postintervention group when compared with the cohort preceding the intervention (Table III). There was a trend toward increased discharge by noon (Table III). The intervention did not result in increased LOS, discharge to postacute care facility, or readmission at 30 days (Table III). Reasons for readmissions in both groups ranged from planned readmission for vascular surgical procedures, surgical complications, such as surgical site infection and wound dehiscence, as well as medical complications such as non-ST elevation myocardial infarction, respiratory failure, gastrointestinal bleeding, acute pancreatitis, and seizure.

DISCUSSION

Efforts to optimize hospital throughput are intensifying as the number of patients with access to care increases, even as hospital reimbursement and expansion are constrained.5 Vascular surgery providers are likely to face increasing pressure from hospitals to optimize throughput given the current contribution of surgical services to variability in patient flow.5,29,30 Here we identified specific barriers to patient care progression in a specialty surgical inpatient unit, then demonstrate that implementation of a focused, interdisciplinary, frontline provider-driven enhanced communication program can be feasibly incorporated into existing vascular surgical workflow. The program resulted in improved timeliness of discharge without increasing readmission rates and, thus, is estimated to have yielded cost savings.

The Affordable Care Act is expected to provide 32 million additional Americans with health insurance by 2019.36 Changes that will limit Medicare hospital payment updates and utilize payment bundles that will span inpatient and postacute service care episodes are expected to amplify hospital administrations’ interest in increasing care efficiency.5 Previous reports have revealed that staff-led interventions can improve discharge times, and that timely discharge decreases emergency room and surgical boarding.31,37 Even though 78 minutes in isolation may not seem to be a meaningful improvement in discharge time, on a system level such modest, incremental gains have a substantial impact on patient flow through precious hospital resources.5

Our findings are consistent with and extend those of previous work in this area of investigation. The use of multidisciplinary teams has recently been reported to be an effective practice for targeting delays in discharge in vascular surgery patients. Wariyapola et al38 reported the experience of weekly vascular surgery ward discharge planning meetings by a multidisciplinary team with similar constituents as the one described in our study. Anticipated discharge accuracy was 65%, with 22% and 15% of patients being discharged later and earlier than expected, respectively.38 The most common avoidable factor cited for delayed discharge in their cohort was lack of postacute care bed availability.39 To our surprise, this was not a frequent cause of delays in our study when barriers to care progression and timely discharge were quantified in daily multidisciplinary huddles. This may reflect differences in the healthcare
Table III. Impact of enhanced communication intervention on patient progression metrics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Preintervention (n = 40), No. (%)</th>
<th>Postintervention (n = 34), No. (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median LOS, days [Q1,Q3]</td>
<td>4.54 [2.20,6.75]</td>
<td>5.58 [2,26,8.39]</td>
<td>.33</td>
</tr>
<tr>
<td>Discharge disposition</td>
<td></td>
<td></td>
<td>.52</td>
</tr>
<tr>
<td>Home</td>
<td>19 (46)</td>
<td>12 (35)</td>
<td></td>
</tr>
<tr>
<td>Home with services</td>
<td>10 (24)</td>
<td>11 (32)</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation center</td>
<td>4 (10)</td>
<td>5 (15)</td>
<td></td>
</tr>
<tr>
<td>Skilled nursing facility/long-term facility</td>
<td>8 (20)</td>
<td>6 (18)</td>
<td></td>
</tr>
<tr>
<td>Mean discharge time</td>
<td>3:18:37 PM</td>
<td>2:00:52 PM</td>
<td>.03</td>
</tr>
<tr>
<td>Discharge before noon</td>
<td>3 (7.3)</td>
<td>7 (21)</td>
<td>.09</td>
</tr>
<tr>
<td>Accurate estimated discharge date</td>
<td>36 (88)</td>
<td>32 (94)</td>
<td>.45</td>
</tr>
<tr>
<td>Readmissions within 30 days</td>
<td>10 (25)</td>
<td>6 (18)</td>
<td>.44</td>
</tr>
</tbody>
</table>

LOS, Length of stay; Q1, 25th percentile; Q3, 75th percentile.
*Wilcoxon-rank sum test performed based on non-Gaussian distribution.

environment of their United Kingdom hub center and our own US institution. Instead, we found that communication within and outside the complex primary care team was the major driver of delays. Enhanced communication programs have been shown to demonstrate success in achieving earlier discharge times in other fields.39 Frontline provider engagement may be a key component to improving patient flow by capitalizing on the complementary expertise of providers and administrators. Furthermore, it facilitates development of solutions that can be effectively integrated into the challenging workflow of already overextended providers—a key factor contributing to compliance and sustainability.

It is important that interventions employed to improve newer metrics related to patient throughput are kept in perspective. The use of a single, fixed discharge time target such as “discharge by noon” or “X% of discharges by 11:00 AM” is becoming increasingly prevalent. Rajkomar et al.7 recently reported a retrospective single institution review of discharge by noon, in which improvement in that metric was actually shown to be associated with increased acute care LOS. The authors concluded that focusing solely on a single metric alone was an insufficient approach. Similarly, other groups have called into question the superiority of fixed, single point discharge time targets vs approaches aiming for earlier discharge albeit distributed over wider time intervals.40 In addition, it is critical that short-term improvements in discharge timeliness do not increase readmission rates (which are associated with higher costs and poorer outcomes), or offload care from one phase (eg, inpatient acute care hospitalization) to another (eg, postacute care hospitalization), resulting in cost-shifting without any true improvement in the quality of care or total medical expense.41 In the current study, our enhanced communication intervention did not result in increased LOS or readmission rates, though the cohort is acknowledged as small. In this report, discharge time was only 78 minutes earlier. A dramatically larger scale study will be necessary to clearly demonstrate the actual impact on outcome measures, such as more effective bed utilization, and on costs and reimbursement.

Our findings must be interpreted within the context of the study design. Our total patient sample was only 74 patients, divided between the pre- and postintervention periods, potentially contributing to type II error. The fact that there was no decrement in LOS postintervention may have related to variability in case mix (ie, trends toward more open aneurysm repairs and fewer dialysis access cases), although differences in the case mix profiles in the two time periods did not reach statistical significance. There was potential for observer or Hawthorne effect, which may have led providers to be more cognizant of discharge times and other patient flow metrics during the preintervention phase prior to formal implementation of the enhanced communication program; this would likely bias the results toward the null hypothesis of no impact of the intervention. Similarly, the durability of the intervention effect is not known. Furthermore, we were not able to adjust for overall hospital capacity during the pre- and postintervention periods. This may have biased results in either direction as increased capacity might impact availability of nursing, allied health, care coordination, transport, and other staff. Our calculation of savings does not consider revenue generation from backfill or savings from complications avoided by improved communication and, thus, may have underestimated the true value of the program. Finally, these results may not be generalizable to institutions with drastically different infrastructure and resources. This enhanced communication system stands on a resource-rich environment in a tertiary care hospital, and other, leaner strategies may need to be developed for smaller community hospital settings.
CONCLUSIONS
A focused, interdisciplinary, frontline provider-driven enhanced communication program can be feasibly incorporated into existing vascular surgical workflow. This intervention improved patient progression endpoints. Future directions include scaling the intervention to other services, and quantifying the impact on clinical outcomes, patient satisfaction, and hospital revenue generation.

AUTHOR CONTRIBUTIONS
Conception and design: GS, DA, SS, SA, CO
Analysis and interpretation: GS, DA, SS, AO, SA, CO
Data collection: GS, DW, AO
Writing the article: GS, DW, DA, SS
Critical revision of the article: GS, DW, DA, SS, AO, SA, CO
Final approval of the article: GS, DW, DA, SS, AO, SA, CO
Statistical analysis: GS
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 Overall responsibility: GS

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The authors are to be congratulated on performing this interesting study. Although they achieved only a modest decrease in the time of discharge (of 78 minutes earlier after implementation of the program), all would agree that earlier discharge of patients has many salutary downstream benefits, such as increasing the availability of hospital beds, thereby improving throughput, which is of interest to physicians and hospital administrators. The only facet of the study that is not adequately explained is how they arrived at a projected annual cost savings of over $84,000, because there was no decrease in the length of stay in the period after implementation.

The authors acknowledge that this program was implemented in a “resource-rich environment” with surgical residents, fellows, care coordinators, utilization nurses, social workers, etc. A surgical resident was available to participate in the huddles that occurred after morning rounds while, presumably, the fellows and attendings were in the operating room. Lastly, all of the patients had been admitted to the vascular service, which allowed them to better control the time of discharge.

Is this program, feasible in a community hospital where resident, fellows, utilization review nurses, etc may not be available? I think the answer is probably no—at least in the sense of following the model they describe. Most community-based surgeons make rounds early in the morning before going to the operating room and, therefore, a priori are not available for “huddles.” Some community-based surgeons operate in more than one hospital, thereby compounding the issues of huddles, emails, patient-flow metrics, etc. By necessity, community-based surgeons rely on physician extenders and hospitalists to assist in achieving efficient throughput. There is also the potential cost of the mobile application that the authors used in this study, which is likely not insignificant.

What is the take-home message of this study? To me the message is quite clear. Good communication is of paramount importance in achieving efficient throughput. Good communication can be achieved without necessarily requiring more personnel or financial resources. Finally, I am reminded of the wisdom of Dr Ward Griffen, my chairman at the University of Kentucky, who taught that discharge planning after an operation should begin the moment the last suture is placed. Discharge planning can also begin at the time the procedure is scheduled.