



# The Flexible Care Pathway: An Alternative Paradigm for Post-Operative Care

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## Abstract

**Introduction** Telehealth has demonstrated reduced cost and increased satisfaction post-operatively compared to Conventional Follow-up (CFU). However, a Flexible Care Pathway (FCP), which involves only “as-needed” follow-up, has never been formally evaluated. We hypothesize that the FCP is a safe and satisfactory for patients who undergo carpal (CTR)/ cubital tunnel release (CuTR).

**Materials and Methods** Preoperatively, veterans were given the option to enroll in the FCP, in which post-operative follow-up visits were “as-needed” only. Patients who chose CFU were evaluated within 2 weeks post-operatively. Preoperatively, detailed post-operative instructions were given to both groups. Both groups were contacted by phone 30 days post-operatively with a questionnaire. The main outcomes were the number of FCP to CFU conversions, complications, time and distance of patient travel, and patient satisfaction.

**Results** 105 patients were enrolled in the study, 60.2% chose FCP. One quarter (23.7%) of patients in the FCP group returned for in-person clinic evaluation. On average, the CFU group travelled a roundtrip distance of 102.9 miles and expended 3.51 h for their follow-up visits. CFU patients ranked their satisfaction at an average of 8.6/10, FCP patients ranked an average of 9.5/10 ( $p < 0.05$ ).

**Conclusions** The FCP can be used in ambulatory hand surgeries with a high degree of safety and satisfaction, studied up to 30 days post-operatively. The FCP demonstrated higher patient satisfaction and a decrease in patient travel than CFU. This is particularly relevant in geographically broad areas, in populations with less access to specialty care, and in a pandemic where contact is limited.

**Keywords** Surgery · Health care quality · Quality improvement · Surgical innovation · Flexible care

## Introduction

Compared to conventional follow-up (CFU), telehealth methods (including mobile applications) have been shown to be more cost-effective while maintaining or

even improving patient satisfaction after surgery [1–3]. However, these methods may still be time consuming for patients and providers when follow-up may be unnecessary. With increased demand for healthcare access, surgeons and administrators seek new ways to expand capacity while maintaining high quality care. Expanded capacity is often limited by physician time and clinical space, which utilizes healthcare system resources. In addition, unnecessary clinical visits are a potential inefficiency for patients as in person visits can require an investment of time and travel, lost productivity from work, thus incurring expense [4]. As carpal tunnel and cubital tunnel release are performed frequently, we designed a post-operative pathway to eliminate unnecessary visits by providing detailed instructions (verbal and written) pre-operatively and allowing patients to choose as-needed follow-up after surgery.

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As-needed follow-up is not a new concept. In fact, patients are routinely scheduled pro re nata (PRN) towards the end of their post-operative course. However, immediate PRN follow-up has not been previously described or studied for post-operative care. We designed this quality-assurance study to investigate the safety, efficacy and impact of providing patients the option of as-needed follow-up after elective hand surgery, which we designate as the Flexible Care Pathway (FCP). The FCP was inspired by our veteran population in the Southeastern United States, who frequently travel hundreds of miles for their specialty healthcare.

## Methods

A Notice of Determination form stating that the project did not meet the federal definition of research was obtained after review by the Tennessee Valley Healthcare System (TVHS) Institutional Review Board. All Veterans Affairs (VA) patients  $\geq 18$  years of age who underwent an elective carpal tunnel release (CTR), cubital tunnel release (CuTR), or both simultaneously were eligible for the FCP. During their pre-operative visit, patients were given the choice of either CFU or Flexible Care Pathway for their post-operative care. The patients who chose CFU were scheduled to return to clinic for a post-operative visit within two weeks after the procedure. The patients who chose FCP were not scheduled to come back to clinic, but had the option to call or schedule an appointment should any concerns arise (Fig. 1).

Preoperatively, a detailed post-operative care packet was reviewed with and given to patients irrespective of the follow-up path chosen. This packet included photos of the typical healing progression, written information about details of the post-operative course (e.g., pain, incision care, activity, diet, and warning signs), as well as clinic and on-call contact

information. The packet had a Flesh-Kincaid Grade Level of 7.3, (a level of 7.0 indicates that a U.S. seventh grader can understand the document). This packet was discussed with the clinician and the patient thoroughly at both the initial consultation and enrollment, as well as in the preoperative area before surgery.

Patients were enrolled from October 2018 to June 2019. Baseline demographic data were collected including age, gender, and comorbidities. Carpal tunnel and cubital tunnel releases were performed as a standard open approach, with no transpositions of the ulnar nerve in cubital tunnel releases. All patients in both groups were called on postoperative day 30 to obtain any additional demographic information, and conduct a post-operative survey. The patients in the CFU group were asked to estimate how much total time, in hours, they spent for their post-operative care including travel time and time spent at their postoperative visit. The patients in the FCP group were asked to estimate how much total time, in hours, they saved by forgoing the follow-up visit. This was designated as time of zero if the patient deviated from the FCP and returned to clinic for any reason. Roundtrip distance traveled was calculated based on input of their home address into Google Maps™ mapping service application. Gas expense for follow-up visits was calculated using IRS reimbursement rates and the equation: *roundtrip commute distance traveled (miles) \* \$0.58/mile transportation cost* [5]. Lastly, satisfaction survey scores were recorded for each group. (Appendix A).

All data was collected and entered into a VA REDCap secure survey instrument. Study data were collected and managed using REDCap electronic data capture tools hosted at VA Tennessee Valley Health Care System- Nashville Campus (TVHS) [6, 7]. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing 1) an

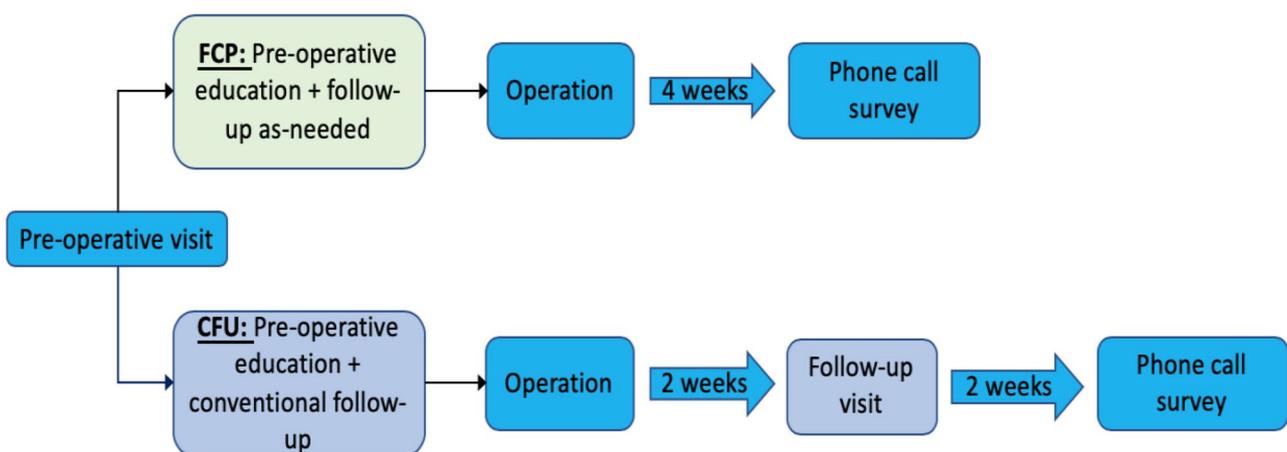


Fig. 1 Study design flow chart

intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.

The main outcomes measured were the number of FCP deviations, number of complications, patient time expended/saved, and patient satisfaction with their post-operative care. Deviation from FCP was defined as patients who came back to TVHS hand clinic for follow-up, patients who presented to their Primary Care Physician (PCP) with specific reason related to surgery, or patients who presented to the Emergency Department (ED) within 30 days of surgery for a complaint related to surgery. CFU group complications were identified and reported by the surgeon who saw the patient in clinic. FCP group complications were identified by either GP, ER physician, or the hand surgeon who saw the patient in clinic or ED. In addition, FCP complications were identified via phone survey.

Statistical analysis was performed using IBM SPSS Statistics 23.0 software (IBM Corporation, Armonk, NY). Unless otherwise noted, probability of type I error of 5% ( $P < 0.05$ ) was used to determine statistical significance.

## Results

One hundred and five patients enrolled in the study during the 9-month period. A total of 7 patients were excluded from the study; 1 from FCP group, 6 from CFU group. The patient from the FCU group was excluded as she had originally requested to be in the CFU group and then never returned; 5 excluded patients in the CFU group did not present to their follow-up appointment while 1 patient was excluded for extenuating circumstances due to unrelated medical illness/stressor. Six patients in the FCP group and 4 patients in the CFU group had no survey response, but were included for analysis for remaining variables; our survey response rate was 89.8%.

There was no significant difference in baseline characteristics of the participants (Table 1). 60.2% of patients selected FCP and 39.8% selected CFU. Of those selecting FCP, 23.7% presented to the TVHS hand clinic, to the ED, or to their PCP within 30 days of their procedures with a specific concern related to surgery. The other 76.3% did not return to clinic. After designating "0" as the distance traveled for patients who did not deviate from the FCP, the mean distance travelled in the FCP group was 27.5 miles, which was significantly less than the CFU group (102.7 miles). Assuming only one follow-up visit for our patient population, FCP patients estimated that they saved 5.3 h of travel and clinic visit time. The FCP patients would have travelled an average distance of 122.4 miles for their follow-up appointments,

estimated at an average cost of \$66.7 in travel expenses [5] (Table 2). The CFU group had more complications than the FCP group (Table 3).

There was no difference in satisfaction in post-operative care instructions. Patients in the FCP group were more likely to believe that follow-up was unnecessary compared to CFU group. Patients in the FCP group were more likely to recommend their chosen pathway to a friend and for themselves than CFU group recommending/choosing their pathway (Fig. 2). There was a statistically significant higher overall satisfaction in the FCP group compared to the CFU group (9.5 vs 8.6,  $p = < 0.05$ ).

## Discussion

Alternative forms of communication for outreach have the potential to improve patient access, avoid patient travel, and reduce health care costs. Postoperative care with telemedicine or specialized digital applications have been designed to reduce the onus on patients and providers [8, 9]. Telemedicine in upper extremity and hand surgery has been proven to mitigate travel burden, especially to those in remote or underserved areas. Similar to our study, Buvik et al. performed a randomized control trial of approximately 400 orthopedic consultations and found that video consultations were equivalent in safety, reduce travel associated with traditional clinic visits, and are superior in patient satisfaction [9]. Patient travel times and costs are a significant factor in our veteran population with a mean travel mileage of 115 miles. This would incur an estimated \$66.49 per patient in travel expenses. As distance of travel to Veteran Affairs (VA) hospitals has been shown to make it difficult for veterans to obtain specialty care, a method to reduce unnecessary travel while still receiving quality care in the veteran cohort is paramount [10, 11].

This study evaluated a Flexible Care Pathway in a Veteran population where, depending on disability level, typical co-pays range from zero to very little out of pocket expense to veterans and transportation costs are often reimbursed [12]. In a non-VA population, a flexible care option may be of even more value to the patient, who would likely pay a larger co-pay and incur full travel expenses. However, a non-VA patient may not be required to travel as far for their routine health care needs. The time saved by eliminating travel time and clinic visit time would likely be a benefit shared by all patient populations.

While there is an ongoing expansion of mobile technology with innovative use of videoconferencing, smart phone applications and telecommunications, especially in the Covid era, staffing and time is still required for such exchanges. There can also be a technological barrier and learning curve, as well as potential financial barriers, for

**Table 1** Baseline characteristics

Characteristic	FCP, n = 59 (%)	CFU, n = 39 (%)	p- value
Age (years)	57.4	56.6	0.29
Age Distribution (years)	24—79	33—78	
Male sex	49 (83.1)	31 (79.5)	0.66
In healthcare	5 (9.3)	3 (8.6)	0.91
<b>Educational Degree</b>			0.21
Professional	2 (3.8)	0 (0.0)	
Masters	5 (9.4)	4 (11.4)	
Bachelors	8 (15.1)	10 (28.6)	
Associates	9 (17.0)	1 (2.9)	
Some college	16 (30.2)	12 (34.3)	
High school	13 (24.5)	8 (22.9)	
<b>Income</b>			0.83
> 150,000	2 (4.9)	1 (3.8)	
100,000–149,999	3 (7.3)	0 (0.0)	
75,000- 99,999	4 (9.8)	2 (7.7)	
50,000- 74,999	8 (19.5)	6 (23.1)	
35,000- 49,999	9 (22.0)	6 (23.1)	
25,000- 34,999	6 (14.6)	6 (23.1)	
< 25,000	9 (22.0)	5 (19.2)	
<b>Coexisting conditions</b>			
AF	3 (5.1)	2 (5.1)	0.99
Arthritis	19 (32.2)	15 (38.5)	0.52
CAD	8 (13.6)	3 (7.7)	0.37
CHF	0 (0.0)	1 (2.6)	0.22
COPD	4 (6.8)	2 (5.1)	0.74
DM	16 (27.1)	12 (30.8)	0.70
HTN	36 (61.0)	21 (53.8)	0.48
HLD	36 (61.0)	25 (64.1)	0.76
GERD	27 (45.8)	15 (38.5)	0.48
OSA	12 (20.3)	8 (20.5)	0.98
PTSD	14 (23.7)	14 (35.9)	0.19
Tobacco use	12 (20.3)	12 (30.8)	0.24
<b>Procedure</b>			0.64
Unilateral CTR	19 (32.2)	14 (35.9)	
Bilateral CTR	15 (25.4)	6 (15.4)	
CuTR	4 (6.8)	2 (5.1)	
CTR + CUTR	21 (35.6)	17 (43.6)	
<b>Additional procedures</b>	4 (6.8)	6 (15.4)	0.17
Trigger finger release	0 (0.0)	3 (7.7)	
Ganglion excision	0 (0.0)	1 (2.6)	
Needle fasciotomy	1 (1.7)	0 (0.0)	
Thumb denervation	3 (5.1)	0 (0.0)	
Steroid injection	0 (0.0)	1 (2.6)	
1 <sup>st</sup> dorsal compartment release	0 (0.0)	1 (2.6)	

AF Atrial Fibrillation, CAD Coronary Artery Disease, COPD Coronary Obstructive Pulmonary Disease, DM Diabetes Mellitus, HTN Hypertension, HLD Hyperlipidemia, GERD Gastroesophageal Reflux Disorder, OSA Obstructive Sleep Apnea, PTSD Posttraumatic Stress Disorder, CTR Carpal Tunnel Release, CuTR Cubital Tunnel Release

**Table 2** Patient outcomes

	FCP, n = 59 (%)	CFU, n = 39 (%)	p- value
Require follow-up (FCP) or additional follow-up (CFU)	14 (23.7)	10 (14.3)	-
Follow-up location			
VA clinic	8 (13.6)	39 (100)	
PCP	3 (5.1)	0 (0.0)	
ED	3 (5.1)	0 (0.0)	
Time saved in FCP group with no follow-up visit (hrs)	5.3	-	
Time spent for follow-up visits (hrs)	-	3.51	
Calculated roundtrip distance (miles)*	122.4	102.9	0.21
Distance actually traveled (miles)	27.5	102.9	<0.05
Estimated gas expense (\$)	15.0	56.1	<0.05
Overall satisfaction	9.4/10	8.6/10	<0.05

VA Veteran Affairs, PCP Primary Care Physician, ED Emergency Department

\*Roundtrip distance calculated using GoogleMaps™ between patients' home and Tennessee Valley Health Care System—Veterans Affairs Hospital

those without access or in the elderly population [13]. Preoperative education with optional follow-up is a further innovation in the delivery of post-surgical care. Although such flexible care is currently used in some outpatient surgery centers, there are no studies that document the benefits and safety of a flexible care pathway. Our quality assurance study comparing CFU to FCP is the first such evaluation.

Giving patients the option to follow-up reduces the utilization of time or resources of making follow-up visits, which this study effectively shows are unnecessary in 75% of this population. Since patients can choose their follow-up pathway, FCP gives patients greater autonomy to make healthcare better fit their needs, whether it is a flexible or conventional follow-up visit. FCP patients are encouraged to convert to CFU should they need it, thus patients still receive timely care for any postsurgical issues or questions that arise. This study gives patients a choice after informed consent and detailed preoperative education; and choice is not only a valued ethical principle but is also an important factor in patient satisfaction [14, 15]. We found that patients who chose the FCP pathway were significantly more satisfied with their care.

**Table 3** Complications

	FCP, n = 59 (%)	CFU, n = 39 (%)
<b>Complication</b>	8 (13.6)	13 (33.3)
Edema*	1 (1.7)	0 (0.0)
Pain*	1 (1.7)	3 (7.7)
Infection**	4 (6.8)	4 (10.3)
Dehiscence***	2 (3.4)	5 (8.4)
Seroma	0 (0.0)	1 (1.7)

\*Pain or edema typical of CTR/CuTR was counted as a complication

\*\*Suspected, reported, or confirmed cellulitis or deep space infection

\*\*\*includes partial and complete wound dehiscence

This study was conducted before the COVID-19 pandemic. However, particularly in the pandemic era of health-care, a follow-up system like the FCP could be particularly useful – and even essential. The pandemic has highlighted how innovations like the FCP can improve the operational efficiency of health care systems by elimination of unnecessary utilization. Patients in the pandemic era may view the opportunity for a flexible care follow-up pathway with more enthusiasm than in the past, as more hybrid and innovative care models become ubiquitous. In fact, many patients have endorsed higher satisfaction with telehealth compared to other types of visits such as face-to-face, websites, or telephone consultations [16]. While telemedicine implementation has increased secondary to critical demand during the pandemic, it still requires time from the patient and time from the surgeon. In addition, a telehealth visit requires access to technology and knowledge of how to use electronic devices properly for a successful telehealth encounter. However, digital literacy has been shown to decline with educational level and age, which may be a large barrier to successful telehealth visits in older and at-risk populations [17]. The Flexible Care Pathway steps beyond the telehealth realm into an optional follow-up system with as-needed support.

The main drawback of the FCP is the potential of loss to follow-up for a patient who should be seeking follow-up care but is unable to. However, with an open-door clinic policy and multiple access-points for patients, they are never denied access. Therefore, it is paramount to provide a list of phone numbers that would provide them access to someone 24/7 and instruct patients to call the listed number(s) without hesitancy. Our FCP education packet contained multiple access phone numbers, and patients were instructed to visit clinic should they feel the need to be seen, with primary, urgent and emergency care facilities acting as a safety net. Additionally, the packet details and pictures show typical

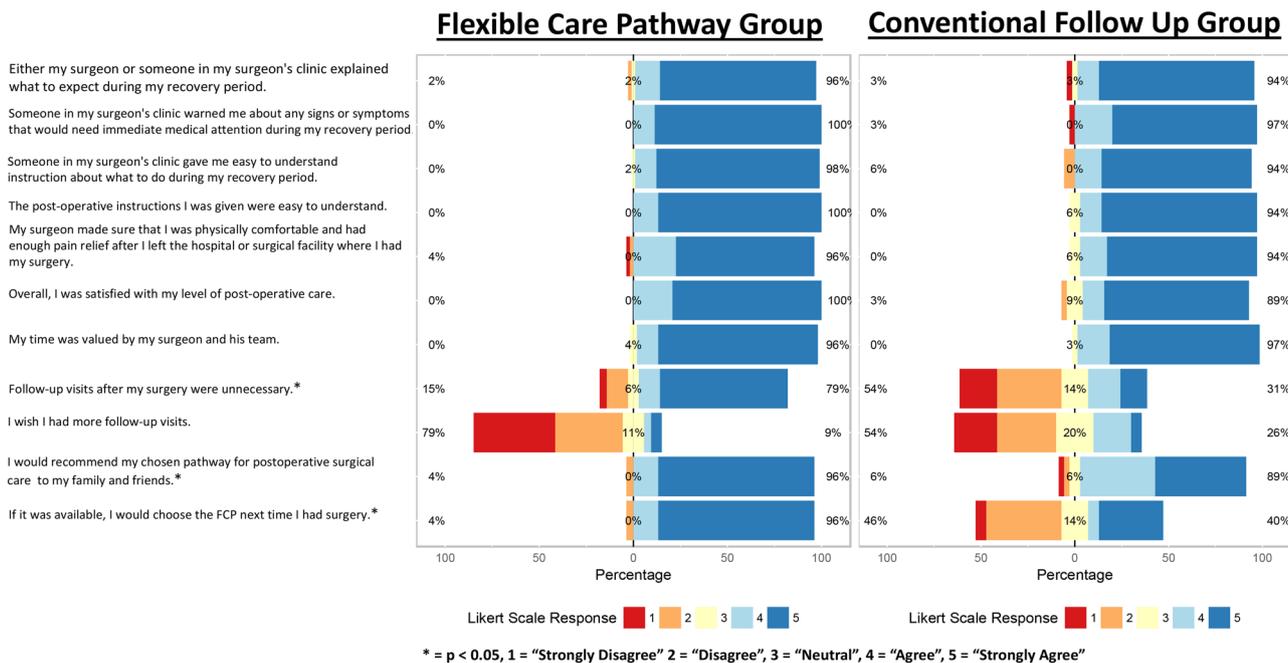


Fig. 2 Results of Patient Satisfaction Questionnaire

warning signs to monitor for, and emphasized that if post-operative recovery deviated from normal expected healing, patients were to promptly call. This would be essential to ensure safety of the FCP. We found that the FCP group in fact had a lower complication rate than the CFU group. We suspect that this is attributed to all complications not being captured for the FCP patients because the complication was minor enough (i.e. pain or minor dehiscence) that patients did not contact the surgeon. This study did not contact patients in each group to assess for long-term complications six months and one year after surgery (i.e. scar sensitivity, pillar pain, CRPS, stiffness, neuroma, etc.). Future investigation is warranted to compare long-term safety between each group, including comparison of DASH scores. In addition, occupational therapy (OT) requirements were not evaluated as they were likely a rare occurrence within the 30 day evaluation period.

In 2014, over 11.4 million ambulatory surgeries were performed in the United States [18]. As previously mentioned, 60.2% of patients in our study elected to have flexible instead of conventional follow-up. Of those, nearly 77% did not return for follow-up. Assuming only one post-operative appointment, this eliminated 45% of total follow-up visits. A fair portion of ambulatory procedures could be designed with FCP, and potentially millions of clinic visits with tens of millions of miles and hours of travel saved in the United States alone. Reclaimed time with the FCP can be utilized to schedule new surgeries or allow surgeons to spend more time with complex patients.

Particularly in resource-limited settings, such as the only VA hand clinic for several hundred miles, this allows for additional patients to be treated and more time with other patients in need.

The primary barrier to implementation is the comfort level of the provider using as-needed follow-up. Surgery is a discipline built on tradition, and a workflow innovation like the FCP is bound to be controversial. Surgeons want to see their patients post-operatively, however this sentiment may often be for their own peace of mind. We should consider the cost to the patient when follow-up is done for the surgeon and not the patient.

An additional task is the effort needed to create a detailed educational packet for each procedure that the surgeon wishes to employ for flexible care. This must include photos of healing progression, written information about details of the post-operative course (e.g., pain, incision care, activity, and diet), as well as easy clinic and on-call contact information. It is also important to ensure comprehension by means of recall from the patient. Although many surgeons already have post-operative instructions, patients in the FCP need not only detailed educational materials but also committed time to teaching and answering questions before surgery. Integrating the FCP into clinic flow requires rearranging clinic follow-up schedules to allow for patients to make their choice of CFU or FCP, and for that choice to be honored in the system so that the patient receives appropriate care.

The Flexible Care Pathway appears to be a replicable system for many ambulatory surgeries. In surgeries with

well-defined complication rates and risks, it appears to provide good results, without compromise in care or patient satisfaction. We found that the FCP demonstrated a higher degree of patient satisfaction and a decrease in patient travel than CFU. This is particularly relevant in geographically broad areas or in a veteran population with less access to specialty care. The Flexible Care Pathway may be applicable to other types of ambulatory surgical procedures and warrants further investigation.

## Conclusions

The FCP can be used in some ambulatory procedures (e.g., CTR and CuTR) as a substitute for standard post-operative clinic visits with a high degree of patient satisfaction and patient safety, studied up to 30 days post-operatively. By eliminating unnecessary follow-up, flexible care is advantageous to both surgeons and the healthcare system. This approach to the delivery of post-operative care is in an early stage of development and warrants further study, especially of long-term outcomes, as it expands to more practices and procedures.

**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1007/s10916-022-01824-0>.

**Author's contributions** All authors confirm contribution to the paper in the following ways: study conception and design, data collection, analysis and interpretation of results, and draft manuscript preparation. All authors reviewed the results and approved the final version of the manuscript.

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**Availability of data and material** The datasets generated during and/or analyzed during the current study are available from the corresponding author, upon reasonable request.

**Code availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Ethics approval** A Notice of Determination form stating that the project did not meet the federal definition of research was obtained after review by the Tennessee Valley Healthcare System (TVHS) Institutional Review Board.

**Consent to participate** A Notice of Determination form stating that the project did not meet the federal definition of research was obtained after review by the Tennessee Valley Healthcare System (TVHS) Institutional Review Board. Patients were aware they were participating in a Quality Assurance/Quality Improvement activity to improve health care delivery.

**Consent for publication** A Notice of Determination form stating that the project did not meet the federal definition of research was obtained after review by the Tennessee Valley Healthcare System (TVHS) Institutional Review Board. Patients were aware they were participating in a Quality Assurance/Quality Improvement activity to improve health care delivery.

**Conflicts of interests/Competing interests** The authors have no relevant financial or non-financial interests to disclose.

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