The Perioperative Surgical Home: A New Role for the Acute Pain Service

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SIGNIFICANCE OF PERIOPERATIVE PAIN MANAGEMENT

Management of acute postoperative pain and its morbid transition to chronic postsurgical pain (CPSP) continue to be major health care challenges. CPSP is defined as pain that develops after surgery and persists for at least 2 months, with exclusion of other causes and preexisting problems.[1] Recent surveys indicate that postoperative pain remains inadequately treated[2]; this being especially true in procedure- and condition-specific at-risk populations.[3,4] Inadequate postsurgical analgesia may predispose patients to a number of postsurgical complications with subsequent increases in negative perioperative outcomes and unnecessary costs.[3] A patient's pain experience has also been reported as the second most important factor in his or her recommendation of an institution.[5]

Of the approximately 80 million annual inpatient and outpatient surgical procedures currently performed in the United States,[6] it is estimated that between 10% and 70% of patients will develop some degree of CPSP depending on the type of surgery performed (Table 1),[1,7] and up to 5% will develop severe CPSP with chronic functional disability and psychosocial distress.[8] Therefore, CPSP is the second largest group of patients presenting to chronic pain treatment centers[9] and represents a significant portion of the United States estimated approximately $635 billion chronic pain-related health care costs.[10]

Furthermore, surgical patients with preexisting chronic pain and opioid tolerance are a challenging and growing population who not uncommonly experience negative perioperative outcomes with associated increased costs.[3] There are no published data on the prevalence of such surgical patients. However, an internal audit of our preoperative evaluation clinic noted 15% to have preexisting chronic pain and opioid tolerance.

Effective surgical pain management is a widely recognized fundamental human right and ethical principle[11] and an important health care quality metric. Perioperative pain management in the United States is currently substandard and is criticized due to its variable and fragmented care, high costs, and low value.[6,12] Postoperative pain should not simply be reactively addressed as a byproduct of surgery, it should be cohesively and proactively managed throughout the entire perioperative experience.

In this Open Mind article, we describe how a comprehensive perioperative pain service (PPS) can be integrated into a Perioperative Surgical Home (PSH) model, thereby improving outcomes and reducing costs in surgical patients at risk for poorly controlled postoperative pain and CPSP. We also discuss how the specialty of anesthesiology may contribute to and benefit from this new practice model. Lastly, we present a viable financial model for such a PSH-integrated PPS.

AT-RISK POPULATIONS

Identification, assessment, and management of cohorts at risk of moderate to severe postoperative pain are challenging. A better understanding of associated ("predictive") factors will help to identify patients likely to benefit from additional care. Current evidence suggests that preoperative pain,[3,13] increased pain sensitivity,[8] and vulnerable psychosocial[3,8] (anxiety, depression, catastrophization, and stress symptoms), physical[3,8,14] (younger adults, female gender, obesity, and deconditioning), and genetic features[8] are considered important factors associated with acute postoperative pain. In turn, acute postoperative pain and its associated factors, along with the type of surgical procedure being performed, are generally considered important factors associated with CPSP.[3,15] A recent review of procedure-specific CPSP demonstrated that the prevalence of CPSP after surgeries (Table 1)[1,7] performed in the thoracic and breast area approximates 30%–35%; that of bone and joint surgeries

Table 1. Incidence of CPSP After Various Surgeries[1,7]

Limb amputation: 30%–80%
Total hip arthroplasty: 30%
Hysterectomy: 5%–30%
Cesarean delivery: 10%
Breast surgery 20%–50%
Groin hernia surgery: 10%
Sternotomy: 20%
Thoracotomy: 25%–60%

Abbreviation: CPSP, chronic postsurgical pain.

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Accepted for publication March 27, 2017.

Funding: None.

The authors declare no conflicts of interest.

Reprints will not be available from the authors.

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DOI: 10.1213/ANE.0000000000002165

approximates 20%; and that of surgeries on abdominal visceral structures approximates 10%–14%,[16,17] with a reported 10% overall rate of severe CPSP 1 year after surgery.[7] The complexity of the sensory and emotional aspects of pain makes it highly unlikely that one single measure could predict all aspects of acute or more persistent postoperative pain, and accordingly, multivariate prediction models may prove valuable. One such analysis showed a sensitivity of 60% and a specificity of 83% based on 5 multivariate predictors: capacity overload, preoperative pain in the operating field, other chronic preoperative pain, postsurgical acute pain, and comorbid stress symptoms.[1] There exists a real and sizeable proportion of patients presenting for surgery with condition-specific and/or procedure-specific risk factors who could benefit from a comprehensive PPS model.

THE FRAGMENTED PERIOPERATIVE PAIN EXPERIENCE AND BARRIERS TO THE CURRENT ACUTE PAIN SERVICE MODEL

Perioperative care in the United States is criticized due to its variable and fragmented care, high costs, and low value,[6,12] paralleling recent data seen from acute pain service (APS) reviews.[5,18] Current APS teams vary widely in structure and function across institutions. Most provide care in the postoperative phase and primarily focus on management of epidural and peripheral nerve catheters, with a few services offering assistance in the intradischarge and postdischarge phases.[5] As a result, the majority of postsurgical pain, even for at-risk patients, is typically managed by surgeons who commonly use only single-agent therapy such as intravenous patient-controlled analgesia.

The current pain service model neglects many components of optimal perisurgical pain control, beginning in the preoperative phase, a critical phase ideal for identification and implementation of standardized assessment and patient-centered management plans for at-risk populations. The intraoperative phase is another area in which patient-centered decisions are often not discussed, and pain management guidelines or protocols are not followed due to disorganization and/or disengaged APS teams. Without a postdischarge phase, much needed follow-up assessments and services cannot be provided. Lastly, without an APS encompassing the full perioperative pain experience, effective measurement of pain-related health care metrics is difficult, and the ability to provide proactive, comprehensive, individually tailored care is significantly hindered.

Despite major health care measures and generally agreed-upon provisions of a dedicated pain service, APS teams continue to face obstacles.[19] Reasons for this vary between organizations; nonetheless, the general census remains that pain services are encumbered with significant fiscal and operational barriers. For instance, postoperative and postdischarge analgesia in the United States is traditionally managed by the surgical team and is the present-day model largely because this care service is included in its global professional fee. This is relevant because within this existing payment system, it makes it fiscally problematic for an expert team to provide postoperative pain management to at-risk patients. Further compounding the issue is that despite the benefits of a dedicated postoperative pain service, recent systematic reviews have demonstrated insufficient evidence to suggest its cost-effectiveness or ability to impact outcomes.[8,18] Explanations for this suggest that the variability in structure and function of pain services across facilities make it difficult to draw unequivocal conclusions,[5] and that most studies are limited by partial economic analyses.[19]

There are many conflicting elements involved in the development, implementation, and operational management of APS teams, and given the expenses of such a service, what are the incentives for hospitals and anesthesiologists to participate? Whether an APS is cost-effective likely depends on multiple factors, such as procedure- and condition-specific populations,[5,20] and the achievability of an integrated, comprehensive, standardized, rehabilitation pain program[21] that involves all phases of perioperative care.

THE SOLUTION: A PERIOPERATIVE PAIN SERVICE?

Effective surgical pain management is a fundamental human right and ethical principle.[11] Current views of postoperative pain must change from being an afterthought of surgery to a proactive, integral component of the entire perisurgical episode, beginning with the decision to operate. Role expansion of the APS into the preoperative and postdischarge phases, so as to embrace the entire perioperative episode, can provide patients at risk for postoperative pain with comprehensive and continuous perioperative pain management. This new proactive PPS model attempts to provide patient-centered, value-based health care and may improve health outcomes and produce cost savings for at-risk populations. This is similar to what has occurred in terms of reducing perioperative infections by surgeons now focusing on prevention rather than treatment after the fact.

Rationalistic data in support of a PPS are paralleled in recent reviews from the Patient-Centered Medical Home (PCMH),[22] integrated care pathways (ICPs, ie, enhanced recovery after surgery),[23] and standardized clinical assessment and management plan (SCAMP)[24] models. Collectively, these care delivery models have demonstrated better outcomes and improved health care value than traditional methods. Furthermore, the implementation of a PPS within the PSH is in alignment with the Institute of Healthcare Improvement Triple Aim for surgical health care reform, which comprises (1) improving the individual experience of care, (2) improving the health of populations, and (3) reducing per capita costs of care.[6]

THE SALIENT ELEMENTS OF A PERIOPERATIVE PAIN SERVICE

By harnessing the anesthesiologist-led PSH as the platform, an APS can fulfill the transition to becoming an all-encompassing PPS (Figure 1). Akin to the PSH, a PPS emphasizes continuity, coordination, and integration of perioperative care, with a greater focus on patient-centeredness and shared decision making, ultimately aiming to improve health care quality and cost outcomes. As such, many of the benefits recognized within the PSH will likely be applicable to a PPS model. Also, by having a PSH platform for pain services, at any time in a patient's surgical episode should they be experiencing inadequate pain relief with standard surgical ward measures, the PPS team can systematically

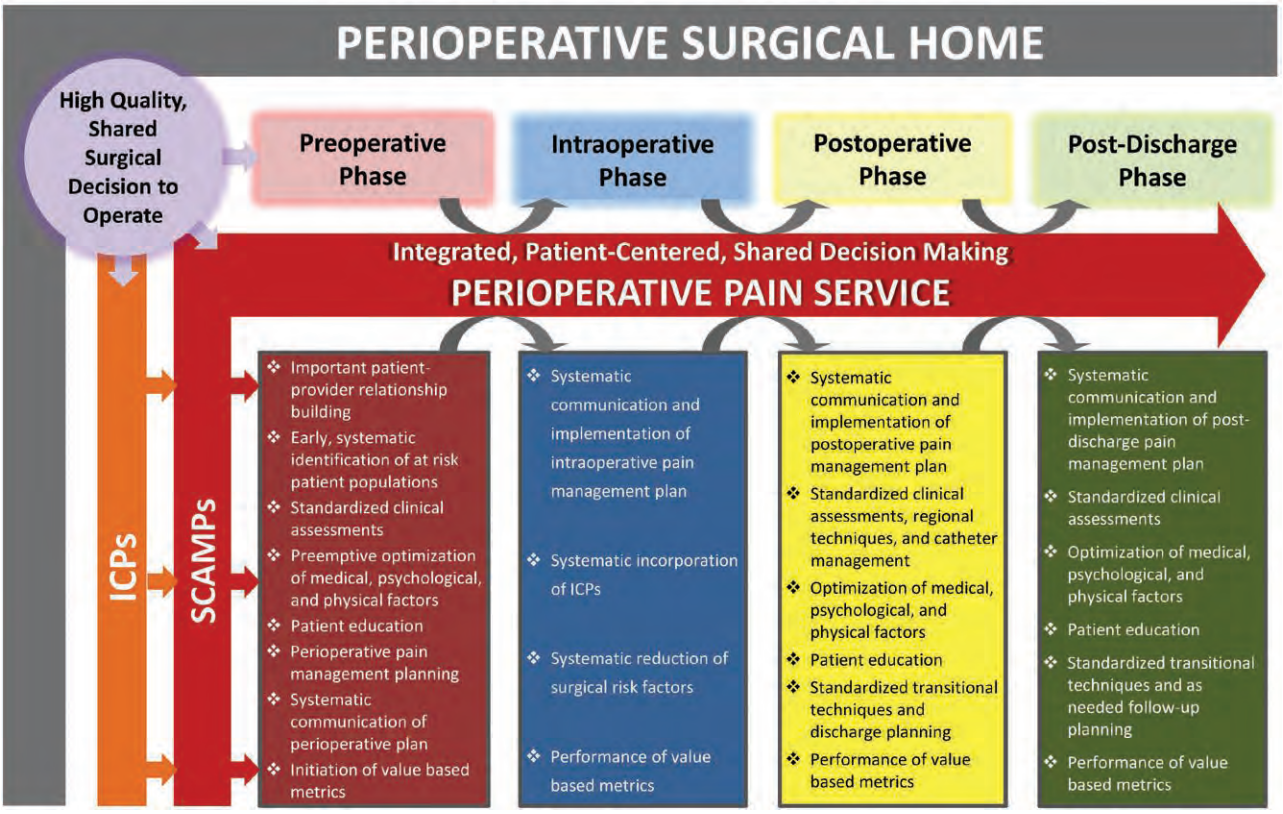

Figure 1. Keeping in line with the Personalized Care Matrix from Vetter et al,[6] this figure depicts how a perioperative pain service can harness the Perioperative Surgical Home model and serves as the management integrator for both condition-specific standardized clinical assessment and management plans (SCAMPs) and procedural-specific integrated care pathways (ICPs) across the entire perioperative episode for at-risk postoperative and persistent postsurgical pain patients.

assimilate this patient into their standardized management care structure. In doing so, a PPS will inherently address the postoperative management phase of the PSH, a challenging phase based on our current care model. Lastly, as does the PSH, a PPS will further enhance the visibility and value of the anesthesiology department within a hospital. This is becoming increasingly relevant in today's mounting health care-wide financial pressure, evolving hospital-physician economic collaborations and changing payment paradigm.

The principal goal of a PPS model will be to reduce variability, an overarching element of many innovative health care reforms. As in the PSH model, a PPS will be responsible for the integrative management of both condition-specific SCAMPs and procedural-specific ICPs, often times concurrently for each patient. With this level of organization, patients can be stratified into low-variability, high-throughput, protocol-based systems that optimizes resource utilization while improving patient care.[23,24] Key to variability reduction will be early intervention by the PPS, particularly in the preoperative phase (Table 2). This is a crucial phase where predictive risk factors of acute postoperative pain and its morbid transition to CPSP can be better understood and at-risk patients identified and assessed in a standardized fashion. Additionally, important patient-provider relationship building, education, expectation setting, and preemptive optimization of medical, psychological, and physical factors begin in the phase, as well as perioperative pain management planning, including discussion on intraoperative regional and neuraxial techniques.

Additional phases of care unique and essential to an all-encompassing PPS, and that are especially important for patients showing increased and prolonged postsurgical pain, are the postoperative transition planning and postdischarge follow-up phases. At these key junctures, integrative, patient-centered care-coordinated provisions are made with outpatient teams, pain medication regimens are optimized with appropriate tapering strategies, and where applicable, referrals to chronic pain medicine specialists are made available. Particularly, there is increasing evidence that majority of surgical patients do not utilize most of the opioid prescriptions provided by surgeons for postdischarge pain management. In addition, exposure to opioids during postoperative pain management is the first step for many patients who end up getting dependent on or abusing this group of medications.[25,26] Therefore, an anesthesiologist-led PPS is ideally positioned to help reduce the rampant opioid abuse/diversion epidemic in the United States by taking the lead in managing (or advising surgeons on) postoperative analgesic regimens.

Another vital function of the PPS model will be in its capacity to effectively administer and measure pain-relevant health care metrics, thus embracing a key element of a learning health care system. In doing so, perhaps a PPS could at last statistically demonstrate cost-effectiveness and enhanced value while improving outcomes through comparative effectiveness research (CER). As with the PSH, CER within the PPS

Table 2. Essential Tools/Interventions for a PPS to Reduce Severe Acute and Chronic Postsurgical Pain and Perioperative Opioid Utilization

Tool/Intervention		Advantages and Limitations
Anesthetic considerations		Currently, no evidence exists between anesthetic medications and an increased risk of developing CPSP. The choice of anesthetic medication and modality (ie, RA, GA, or both) may play a role in reducing CPSP.
	RA	Overall, the literature regarding RA for the prevention of CPSP is limited, and further studies are needed. Epidural anesthesia may reduce the risk of developing chronic pain after thoracotomy. Paravertebral block may reduce the risk of chronic pain after breast cancer surgery. Multimodal analgesia with axillary nerve block may reduce the risk of chronic postmastectomy pain.
	GA	Overall, the literature regarding GA for the prevention of CPSP is limited, and further studies are needed. There may exist a lower incidence of CPSP with propofol induction and maintenance when compared to induction with propofol and maintenance with sevoflurane.
	Multimodal analgesia	Cornerstone of CPSP prevention management. Utilize different classes of medication and/or RA to target different peripheral and CNS mechanisms to reduce postsurgical acute and chronic pain, opioid analgesic requirements, and improve opioid-related side effects. Evidence exists that preventative multimodal analgesic regimens can reduce the incidence of CPSP; however, better defined multimodal analgesic protocols are needed for procedure- and condition-specific at-risk populations.
Surgical considerations		Neural injury may lead to nerve dysfunction; therefore, surgical technique targeted at avoiding nerve injury has been proposed to decrease the incidence of CPSP; further research is needed.
	Incision	Postoperative pain after hysterectomies appears less with Pfannenstiel incisions versus midline. Thoracotomy by the anterolateral approach may result in less nerve damage and CPSP than the posterolateral approach.
	Tissue	Suturing through ribs has been shown to avoid direct nerve compression and may decrease CPSP. Ironically, elective division of the ilioinguinal nerve during hernia repair does not appear to lead to development of CPSP.
	Laparoscopic versus open	Laparoscopic herniotomy may reduce CPSP when compared to open herniotomy. There appears to be increased incidence of CPSP in open cholecystectomies versus laparoscopic.
	Duration	Surgery of more than 3 hours may increase risk of developing CPSP.
	Experience	Development of CPSP may be more common in hospitals with lower volume for breast procedures and less experienced staff.

Tool/intervention		Features	Advantages and limitations
Risk stratification methods	Multivariate prediction models	Uses algorithms that combine patient characteristics to predict a prognosis.	This method has not been compared or combined with quantitative sensory testing assessments.
	Kalkman et al[13]	Predicts severe acute pain (NRS >7) within the first hour postoperatively. Uses 7 predictors: sex, age, preoperative pain, type of surgery, incision size, preoperative anxiety, and preoperative "need for information."	Showed a sensitivity of 74% and a specificity of 61%. Requires information only from preoperative phase.
	Althaus et al[1]	Predicts CPSP 6 months after surgery. Uses 5 multivariate predictors: capacity overload, preoperative pain in the operating field, other chronic preoperative pain, postsurgical acute pain, and comorbid stress symptoms.	Showed a sensitivity of 60% and a specificity of 83%. Requires information from preoperative-, intraoperative, and postoperative phases.
	Quantitative sensory testing	Uses mechanical, thermal, or electrical stimuli to predict pain thresholds. Electrical pain threshold testing demonstrates greater predictive power.	May predict up to 54% of the variation in postoperative pain response to surgical stimulation.[22] The predictive strength is higher than any single factor.

(*Continued*)

Table 2. Continued

Tool/Intervention		Features	Advantages and Limitations
	Institution-specific criteria list	These include but are not limited to: A current/previous history of chronic pain; Previous/current drug misuse or abuse; Patients with previous/current psychosocial comorbidities; Current/previous opioid therapy for pain; Patients on methadone or buprenorphine; Patients consuming excessive amounts of postoperative opioids; and Any patient referred by an attending surgeon.	Goal is to target patients at risk for the development of acute and CPSP, as well as prevent the development of persistent opioid use after surgery.
Perioperative optimization concepts	Education	Aims to improve knowledge, perspectives, and health behaviors. Involves discussion on anesthetic and analgesic options during preoperative, intraoperative, and postoperative phases, also includes neuroscience education, pain and rehabilitation expectations, and discharge planning. Education may involve one-to-one verbal communication, group sessions, video, or reading booklets.	May help set expectations, reduce postoperative pain levels, health care expenditures, and improve patients' view of their surgical experience, particularly useful in at-risk patient populations.
	Medications	Introduction/modification of medications to serve as preventative CPSP multimodal analgesics. Opioid management (including complex dosing for dependent patients, patients on methadone and buprenorphine, IV to oral conversion, and opioid weaning strategy). Management of neuraxial and peripheral catheters (including relevant anticoagulation).	See pharmacotherapy and anesthetic consideration sections for detailed information. Preoperative opioids may increase the risk of: more intense and longer duration of postoperative pain, poorer management. and outcomes, larger and increased duration of opioid requirements, leaving the hospital on more opioids than preoperatively.
	Psychosocial	Preoperative anxiety, catastrophization, and negative psychosocial situations are factors regularly reported in the history of patients experiencing invalidating CPSP. Typical perioperative psychosocial interventions include CBT, such as ACT. Other coping strategies including imagery, relaxation, and music therapy.	Psychosocial intervention is promising in terms of outcomes in the acute postsurgical time period; further evidence is needed. The impact of psychological intervention on the prevention of CPSP is yet to be demonstrated.
	Physical	Prehabilitation—enhance systemic musculoskeletal and cardiovascular conditioning prior to surgery, as well as reduce kinesiophobia to improve postoperative rehabilitation. Perioperative nutrition care—enhance physical conditioning, as well as decrease nausea and vomiting, improve appetite recovery, enhance immunity, support normoglycemia, and provide sufficient protein intake.	Prehabilitation may improve postoperative pain, length of stay, and physical function. Nutrition optimization may improve perioperative functional capacity.
Perioperative pharmacotherapy	Opioids	Interact with one or more subtypes of opioid receptors (ie, mu, kappa, delta) at supraspinal, spinal, and peripheral sites to produce analgesia and a multitude of other effects.	Cornerstone of postoperative analgesia—used to alleviate primary hyperalgesia. Opioids may counterintuitively produce hyperalgesia, increasing postoperative pain and opioid requirements.
	NSAIDs	Inhibit the synthesis of prostaglandins by inhibiting the activity of COX-1 and COX-2. COX-2 isoform appears to be the enzyme responsible for inflammation and pain.	Appears to reduce acute postoperative pain and opioid use. Available literature has not demonstrated a significant impact on reduction of CPSP.

(*Continued*)

Table 2. Continued

Tool/Intervention	Features	Advantages and Limitations
Acetaminophen	Mechanism of action remains unclear; it may inhibit central COX transcription.	Appears to reduce acute postoperative pain and opioid use. Evidence for prevention of CPSP is insufficient.
Glucocorticoids	Reduce proinflammatory cytokines and increase anti-inflammatory cytokines; this may reduce the development and maintenance of central sensitization and neuropathic pain associated with nerve injury.	Appears to reduce acute postoperative pain and opioid use. Evidence for prevention of CPSP is insufficient.
NMDA receptor antagonists	The NMDA receptor is important in both the induction and the maintenance of central sensitization and pathologic pain. Antagonism of this receptor is believed to reduce pain and analgesic consumption through the prevention of NMDA-mediated sensitization of spinal cord dorsal horn neurons. Shown to protect against opioid-induced hyperalgesia.	Ketamine: Appears to provide acute postoperative analgesia and opioid-sparing effects. Appears to be effective in preventing CPSP; however, results remain controversial due to the wide variability in clinical settings, dosing regimens, and reported outcomes. Memantine and amantadine: Current evidence for prevention of CPSP is insufficient.
Gabapentinoids	Interact with $\alpha 2\delta$ subunit on presynaptic voltage-gated calcium channels, which are often upregulated following nerve injury, thereby inhibiting calcium influx and the release of excitatory neurotransmitters.	Gabapentin: Appears to be effective in preventing CPSP; further evidence is needed. Lack of standardized doses may have contributed to study inconsistencies. Pregabalin: Appears to be effective in preventing CPSP; further evidence is needed. Heterogeneity of dosing regimens studied to date is problematic.
LA	Membrane-stabilizing drugs that decrease the rate of depolarization and repolarization of excitable membranes leading to what is probably a synergistic mixture of analgesic mechanisms. Delivery routes consist of oral, local, neuraxial, regional, and IV.	Plays a valuable role in multimodal analgesia. IV lidocaine may be effective in at-risk populations to reduce acute postoperative pain and opioid requirements; current evidence for prevention of CPSP is insufficient.
$\alpha 2$ Receptor agonist	Several central and peripheral pain pathways may reduce pain—primary pathway is likely via decreased release of norepinephrine at both central and peripheral adrenergic terminals. Delivery routes consist of oral, local, neuraxial, regional, and IV.	Clonidine: May prevent CPSP; further evidence is needed. Neuraxial administration and given before incision appears most effective. Dexmedetomidine: May prevent CPSP; further evidence is needed.
SNRIs	Inhibits neuronal reuptake of serotonin and norepinephrine leading to enhanced descending inhibition of centrally sensitized pain.	Evidence for the prevention of CPSP is promising; further studies are needed.
Vitamin C	Is a free radical scavenger that has decreased TNF-α and IL-6 in experimental models of inflammation.	Appears to reduce the risk of CPSP and chronic regional pain syndrome; further evidence is needed.

Abbreviations: ACT, acceptance and commitment therapy; CBT, cognitive behavioral therapy; CPSP, chronic postsurgical pain; COX, cyclooxygenase; GA, general anesthesia; IL, interleukin; IV, intravenous; LA, local anesthetic; NMDA, *N*-methyl-D-aspartate; NSAID, nonsteroidal anti-inflammatory drugs; NRS, numerical rating scale; PPS, perioperative pain service; RA, regional anesthesia; SNRI, selective norepinephrine and serotonin reuptake inhibitor; TNF, tumor necrosis factor.

model will aim to enhance patient-centered care, increase clinician adherence to evidence-based practice, improve patient quality and safety, and reduce overall costs. Ideally, a national PPS outcome database designed to measure risk-adjusted outcomes and CER of pain management interventions so as to compare results between institutions should be developed, much akin to the surgeon's National Surgical Quality Improvement Program.[27] Through envelopment of the entire perioperative process with a dedicated pain service, a faithful adaptation of a learning health care system with regard to perioperative pain management can be achieved.

DISSEMINATION AND IMPLEMENTATION OF A PERIOPERATIVE PAIN SERVICE

Dissemination and implementation of a PPS will not be without challenges. Foremost, considering the PSH is the ideal platform for anesthesiologist-led perioperative care, a variation of this surgical home model should either be in place or in parallel development with a PPS. As with the PSH model, dissemination and implementation of a PPS require a broad set of stakeholders who are willing to collaborate and push for this innovation[28]; this includes providers (anesthesiologists, surgeons, nurses, and pharmacists, with respective departmental fiscal officers), payers, and policymakers. Depending on institutional infrastructure and unforeseen external forces, there will likely be multiple effective variants of a PPS fashioned in an evolutionary-type manner with different institutions adopting different elements at different rates. Dissemination and implementation science should be incorporated throughout the process of creating a PPS; this includes efficacy and effectiveness trials followed by CER not only for validation and improvement but for economic and political leveraging capacity.[6]

Key to dissemination and implementation of a PPS within the PSH will involve a multidisciplinary collaboration of health care providers. This is paramount considering the expanded perioperative care responsibilities that a PPS model will assume in addition to the subsequent expansion in patient volume with increased health care personnel and resource requirements. Not surprisingly, dissemination and implementation science will likely determine that the ideal PPS organizational structure will center on an integrative team of midlevel providers supervised by anesthesiologists. Midlevel providers can effectively apply highly efficient, evidence-based perioperative pain protocols and pathways, thereby enabling anesthesiologists to focus on a patient's evolving diagnoses and to tailor an individualized treatment plan.[29] Additionally, the task of developing local institutional perioperative pain SCAMP/ICP amalgamation pathways for at-risk acute postoperative pain and CPSP populations should also be accomplished by a multidisciplinary team of health care providers and performed similarly to previous descriptions in the literature using evidence-based guidelines and protocols.[24]

Highly important to the successful dissemination and implementation of a PPS includes adequate education and training among anesthesiologists and midlevel providers. Not only will they need to become clinically proficient in perioperative pain management, especially for at-risk postoperative pain populations, but they will need to educate themselves on the general dissemination and implementation process, including its science, team building, and change management,[12] in order to competently develop and implement a PPS with SCAMP/ICP amalgamation pathways. Just as importantly, continuous feedback and learning from CER will also be key to the successful dissemination and implementation and maintenance of a PPS. With the goal of creating a comprehensive proactive PPS with PSH-integrated clinical pathways, as suggested in the PSH literature,[12] residency programs should provide training that incorporates the perioperative encounter into a multiphase continuum.

PAYING FOR A PERIOPERATIVE PAIN SERVICE

In the current expensive health care system, funding a PPS integrated into a PSH presents significant financial barriers. The compensation structure of the US health care system is shifting away from the traditional, volume-based, fee-for-service model toward bundled payments that include performance and care coordination payments. In view of this, creation of an anesthesiology-led PPS will encourage important hospital-wide visibility and add expected cost-effective value to the global perisurgical arena, thereby helping to defend the undesirable outcome of anesthesia provisions being locked only into the intraoperative phase with commodity rate compensations.

Central questions yet to be adequately answered to achieving a PPS are: (1) how does one finance the dissemination and implementation of the service; and (2) how does one receive compensation for maintenance of the service? To help answer the first question, resource capacity utilization will need to be determined and patient selection criteria matched, that way patient volume will approach full resource capacity. Given that an anesthesiologist-led PSH will be the support structure of an overlying PPS, determination of initial cost will also vary depending on the PSH infrastructure already in place at a particular institution. Furthermore, an existing APS will help institutions offset the start-up cost. As described in the PSH literature,[6,12] financing a PSH-integrated PPS will require local institutional stakeholders to purchase the presumed value created by this care model. That said, the brunt of the initial investment may lie with anesthesiologists until the hospital and third-party payers appreciate the improved outcomes and added value of the service.

As described in the PCMH literature and used as a guide for the PSH, current health care initiatives depend on a combination of 4 basic compensation elements: fee-for-service, criteria-met bonus, pay-for-performance, and care coordination payments.[6] Local institutional APS and PSH compensation structures will serve as guides for a PPS.

At our institution, we trialed reimbursement payments during the dissemination and implementation of our PPS and discovered that anesthesiologists can receive compensation for seeing patients preoperatively who are at risk for postoperative pain and CPSP, collect in-hospital daily rounding fees, as well as receive payments for coordinating discharge plans and for a postdischarge follow-up visit. During the dissemination and implementation process, we used the time-driven activity-based costing method (Figure 2), work pioneered by Harvard Business School professors Michael Porter and Robert Kaplan, to design a perioperative care delivery process pathway for at-risk postoperative pain patients, predict the purchasing cost of implementing this

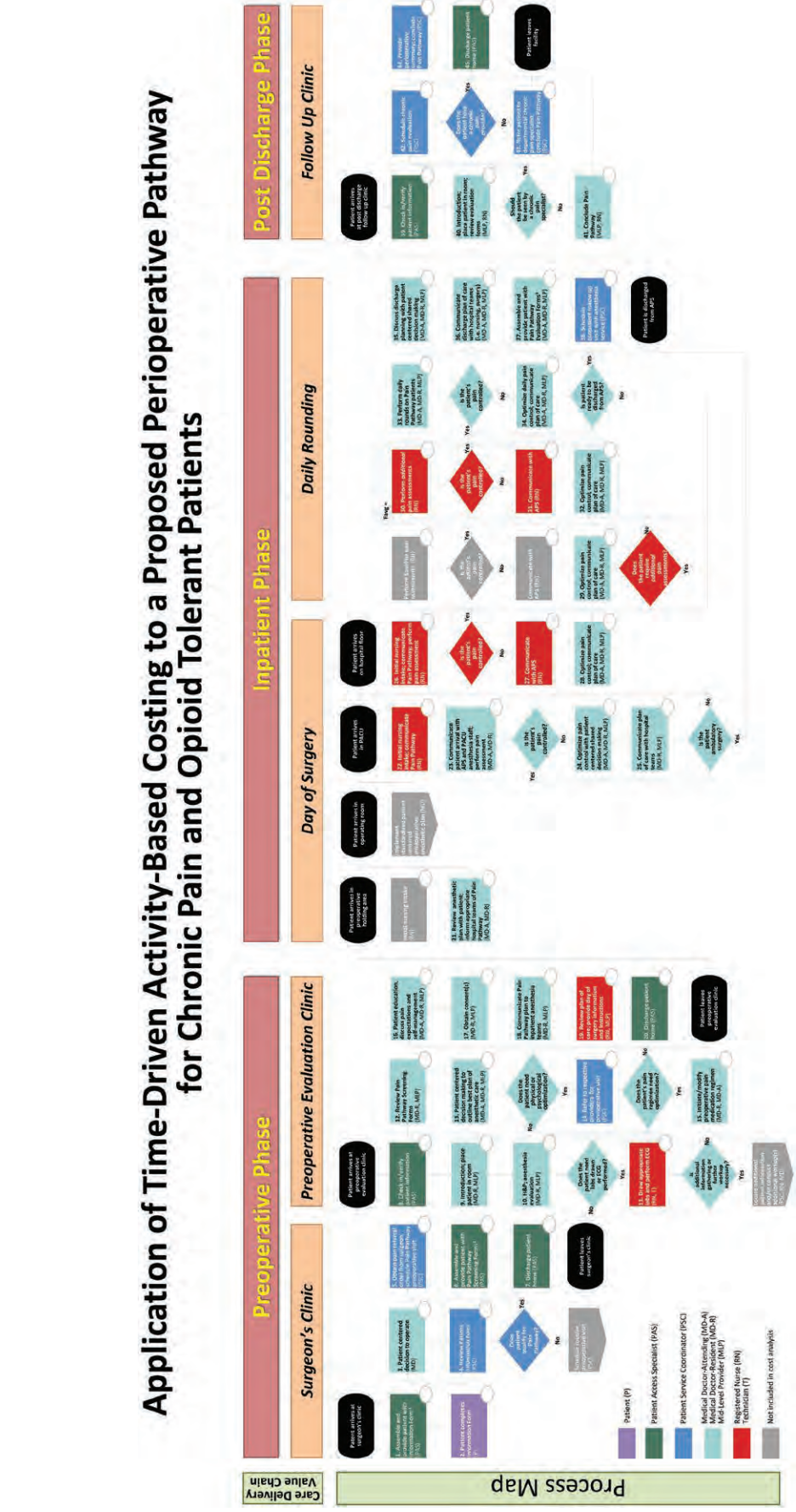

Figure 2. Using the time-driven activity-based costing (TDABC) method, work pioneered by Harvard Business School Professors Michael Porter and Robert Kaplan, this figure depicts an example of a perioperative care delivery process pathway for at-risk postoperative and persistent postsurgical pain (CPSP) patients.

service, and characterize opportunity to reduce perioperative cost for this group of patients. The time-driven activity-based costing method is a bottom-up approach of estimating health care delivery costs based on direct assessment of actual clinical and administrative processes. This method engaged health care providers at our institution in understanding the processes and costing activities of health care delivery and provided a unique platform to design and integrate a PPS in an optimized, cost-conscious manner.

CONCLUSIONS

Adequate management of iatrogenic surgical pain is a fundamental ethical principle, highly recognized by the medical profession and health authorities, and an important component of many measures of hospital quality. With the advent of the anesthesiologist-led PSH, the opportunity to create a proactive, comprehensive, and standardized PPS that embraces the entire perisurgical episode while serving as a learning health care system through CER may confirm improved health outcomes and cost savings, as paralleled in PCMH, ICP, and SCAMP care delivery models, for surgical patients at risk for increased acute postoperative pain and CPSP. The success of a PPS requires collaboration of health care providers, local institutions, and payers all functioning in alliance across the perioperative care continuum. We believe the specialty of anesthesiology will benefit from this practice model, and the implementation of a PPS will help meet the postoperative demands of the PSH and is adequately in alignment with the Institute of Healthcare Improvement Triple Aim for surgical health care reform.

DISCLOSURES

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