Published in final edited form as:

Ann Surg Oncol. 2018 July ; 25(7): 1843–1851. doi:10.1245/s10434-018-6466-x.

Opioid Prescribing after Curative-Intent Surgery: A Qualitative Study Using the Theoretical Domains Framework

Jay S. Lee, MD¹, Vartika Parashar¹, Jacquelyn B. Miller, MA², Samantha M. Bremmer¹, Joceline V. Vu, MD¹, Jennifer F. Waljee, MD, MPH, MS³, and Lesly A. Dossett, MD, MPH¹

¹Department of Surgery, Division of Surgical Oncology, University of Michigan Comprehensive Cancer Center, Ann Arbor, Michigan

²Center for Bioethics and Social Sciences in Medicine, University of Michigan, Ann Arbor, Michigan

³Department of Surgery, Section of Plastic Surgery, University of Michigan, Ann Arbor, Michigan

Abstract

Background—Excessive opioid prescribing is common after curative-intent surgery, but little is known about what factors influence prescribing behaviors among surgeons. To identify targets for intervention, we performed a qualitative study of opioid prescribing after curative-intent surgery using the Theoretical Domains Framework – a well-established implementation science method for identifying factors influencing healthcare provider behavior.

Methods—Prior to data collection, we constructed a semi-structured interview guide to explore decision-making for opioid prescribing. We then conducted interviews with surgical oncology providers at a single Comprehensive Cancer Center. Interviews were recorded, transcribed verbatim, then independently coded by two investigators using the Theoretical Domains Framework to identify theoretical domains relevant to opioid prescribing. Relevant domains were then linked to behavior models to select targeted interventions likely to improve opioid prescribing.

Results—Twenty-one subjects were interviewed from November 2016 – May 2017, including attending surgeons, resident surgeons, physician assistants, and nurses. Five theoretical domains emerged as relevant to opioid prescribing: *Environmental context and resources*; *Social influences*; *Beliefs about consequences*; *Social/professional role and identity*; and *Goals*. Using these domains, three interventions were identified as likely to change opioid prescribing behavior: 1) *Enablement* (deploy nurses during preoperative visits to counsel patients on opioid use); 2) *Environmental restructuring* (provide on-screen prompts with normative data on the quantity of opioid prescribed); and 3) *Education* (provide prescribing guidelines).

Conclusions—Key determinants of opioid prescribing behavior after curative-intent surgery include environmental and social factors. Interventions targeting these factors are likely to improve opioid prescribing in surgical oncology.

INTRODUCTION

Prescription opioid misuse and abuse remains a national public health crisis. In 2015, deaths attributable to opioids continued to increase with over 33,000 fatalities from opioid overdoses.¹ Surgeons play a crucial role in this epidemic, providing 10% of opioid prescriptions in the United States.² In fact, 6% of previously opioid-naïve patients who undergo surgery subsequently transition to new persistent opioid use after surgery.³ Patients with cancer are at even higher risk, with 10% developing new persistent opioid use after curative-intent surgery.⁴

Opioid prescribing after curative-intent surgery is complex due to multiple potential sources of pain, including invasive procedures and side effects of chemotherapy.^{5–9} Patients with cancer also report high levels of psychological distress,^{10,11} which is associated with increased postoperative opioid consumption.^{12,13} The need for multidisciplinary cancer care also creates the potential for uncoordinated prescribing from multiple physicians.¹⁴ Given these factors, it is not surprising that excessive opioid prescribing is common after surgical oncology procedures. For example, over 70% of prescribed opioids remain unused after partial mastectomy with sentinel lymph node biopsy.¹⁵ Unfortunately, little is known regarding the factors that influence opioid prescribing after curative-intent surgery.

To better understand the key determinants of prescribing behavior and identify targets for behavior change interventions, we performed a qualitative study of opioid prescribing after curative-intent surgery using the Theoretical Domains Framework – a well-established implementation science method for identifying factors influencing healthcare provider behavior.^{16–18} We specifically identified factors influencing decision-making for the initial opioid prescription, counseling patients on safe opioid use, management of opioid misuse, and how a cancer diagnosis affects opioid prescribing.

METHODS

Study design

The University of Michigan Institutional Review Board approved this study. This was a qualitative study using semi-structured one-on-one interviews based on the Theoretical Domains Framework. The Theoretical Domains Framework was developed from a synthesis of psychological theories to help apply theoretical approaches to interventions aimed at behavior change.^{17,18} It is commonly used in implementation science research, and has previously been used to study physician decisions in a number of settings.^{19–24} Figure 1 illustrates how this method is used to study healthcare provider behavior. In this approach, healthcare providers are interviewed and asked about a target behavior. Interview transcripts are then reviewed to identify relevant theoretical domains. Theoretical domains represent types of factors that can influence healthcare behavior, including cognitive, social, and environmental factors.¹⁶ Relevant theoretical domains are then linked to behavior models to select targeted interventions likely to change behavior.^{16,18,25,26}

Setting and population

Within a single National Cancer Institute-designated Comprehensive Cancer Center, we recruited providers whose primary clinical responsibilities included the care of cancer patients undergoing curative-intent surgery for colorectal cancer, breast cancer, melanoma, and hepato-pancreato-biliary cancer. We used purposive sampling to ensure subjects were diverse with respect to age and position. Resident surgeons were purposively oversampled because internal data at our institution demonstrates resident surgeons account for 85% of opioid prescriptions provided to surgical patients.

Data collection

Prior to data collection, a semi-structured interview guide (Appendix 1) was constructed with questions focusing on four topics: 1) decision-making for the initial postoperative opioid prescription, 2) counseling patients on safe opioid use, 3) management of opioid misuse, and 4) how a cancer diagnosis affects opioid prescribing. Members of the research team then contacted providers to schedule in-person interviews. During interviews, the semi-structured interview guide was used to explore the subject's decision-making for opioid prescribing. Each interview was recorded, and audio files were transcribed verbatim and anonymized.

Coding interview transcripts

Each interview transcript was coded by two investigators (J.L., J.M.) using the Theoretical Domains Framework to identify theoretical domains and constructs relevant to opioid prescribing. Domains were judged to be relevant if they contained specific beliefs that might be potential barriers for changing opioid prescribing, and fulfilled one of the following criteria: 1) relatively high frequency of specific beliefs, 2) presence of conflicting beliefs, and 3) evidence of strong beliefs that may impact opioid prescribing. Differences in coding were resolved through discussion and reconciliation. Validity was established through investigator triangulation (J.L., J.M., L.D.). Using previously validated methods, theoretical domains identified from interviews were linked to behavior models to select targeted interventions likely to change behavior.^{16,26} NVivo 11 software (QSR International, Doncaster, Victoria) was used to assist with storage, searching, and coding of data.

RESULTS

We sampled eligible subjects between November 2016 and May 2017 until saturation of themes was met (n=21). All subjects who were asked to participate agreed to be interviewed and were included in the study. Subjects included four attending surgeons (2 male; 2 female), eleven resident surgeons (7 male; 4 female), four physician assistants (all female), and two clinic nurses (both female). Years of experience in patient care ranged from 2-33 years. After coding interview transcripts, five theoretical domains were judged to be relevant to opioid prescribing in surgical oncology: *Environmental context and resources*; *Social influences*; *Beliefs about consequences*; *Social/professional role and identity*; and *Goals*. Table 1 shows specific beliefs and sample quotes for each of these theoretical domains. Additional sample quotes are provided in Appendix 2.

Environmental context and resources

For all subjects, *Environmental context and resources* were identified as a key domain influencing opioid prescribing in surgical oncology. This domain is defined by circumstances or environments affecting the development of skills and abilities, independence, social competence, and adaptive behavior.¹⁷ Within this domain, four specific beliefs were identified:

- Resources: the limited ability of clinic staff to address patient complaints about pain management due to under-prescribing opioids.
“Some patients will call every day, multiple times a day. If their needs are straining the availability of the providers, they’re going to feel like their needs aren’t being met.”
- Barriers and facilitators: the inherent difficulty of managing a patient’s subjective experience of pain.
“Pain is so subjective. After major surgery, some patients might not have any pain, while others constantly struggle with pain.”
- Organizational culture/climate: the perceived culture over-emphasizing pain control.
“There is this focus on pain from the minute you get into PACU and throughout the hospital. Every single person asks you about pain. I think most patients don’t know they’ll have some pain.”

Social influences

Social influences were also identified as an important factor for all subjects. *Social influences* are defined as interpersonal processes that cause individuals to change their thoughts, feelings, or behaviors.¹⁷ Three specific beliefs were identified within this domain:

- Group norms: a belief that the amount of opioid prescribed was similar to others.
“I think it’s fairly similar in talking to other residents. I would hope anyway because I wouldn’t want to be an outlier.”
- Power: residents and mid-level providers believe their opioid prescribing is influenced by attending surgeon preferences.
“I’ve been told to give them enough because the attending surgeons don’t want the patients calling.”
- Modelling: attributing current opioid prescribing practices to observing the behavior of more senior residents.
“A lot of that probably came from what I saw older residents prescribing when I was an intern.”

Beliefs about consequences

Beliefs about consequences was also a key factor for all subjects. *Beliefs about consequences* is defined as acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation.¹⁷ Within this domain, two specific beliefs were judged to be relevant:

- Consequences: previous experience with calls for refills influences current prescribing practices.
 “I definitely prescribe more than I think they will consume. It just became very painful for me to get paged in the middle of a procedure to refill scripts.”
- Beliefs: a belief that the opioid epidemic was unrelated to opioid prescribing by surgeons.
 “I think a lot of the opioid epidemic isn’t driven by surgeons, but more from chronic back pain.”

Social/professional role and identity

For all subjects, *Social/professional role and identity* was also as a key factor. This domain is defined as a coherent set of behaviors and displayed personal qualities of an individual in a social or work setting.¹⁷ In this domain, *Professional role* was judged to be the only relevant specific belief. For example, one subject described how prescribers with different levels of training have different opioid prescribing practices.

“It’s very heterogeneous among providers with different levels of training. There’s interns, chief residents, attendings, NPs, PAs, and clinic nurses. There are a lot of players, but no set standard or protocol.”

Goals

Goals was an important domain for opioid prescribing in nearly all subjects. This domain is defined as mental representations of outcomes or end states that an individual wants to achieve.¹⁷ Within this domain, two specific beliefs were judged to be relevant:

- Goal and target setting: deciding how much to prescribe based on the amount of time until the patient’s follow-up appointment.
 “100 pills will usually get them to their 2-week appointment, and they won’t have to call in a refill.”
- Priority: providers choose to discuss more pressing issues with patients instead of opioid use.
 “Am I going to figure this out for them when they’ve been told that they have rectal cancer, or that they need a colostomy?”

Selection of interventions targeting opioid prescribing in surgical oncology

Of the five theoretical domains judged as relevant for opioid prescribing in surgical oncology, the three domains identified most frequently were *Environmental context and resources*; *Social influences*; and *Goals*. We selected these domains as most likely to change opioid prescribing if targeted with behavior change interventions. Using previously validated methods,^{16,26} these domains were linked to behavioral models associated with targeted interventions. Figure 2 illustrates how these theoretical domains were linked to targeted interventions, and provides example interventions for surgical oncology. For *Environmental context and resources*, Enablement interventions are often effective. For example, subjects reported difficulty addressing pain management adequately during preoperative visits. To improve this, surgeons could deploy nurses during preoperative visits to specifically counsel patients on opioid use and pain management. For *Social influences*, Environmental restructuring interventions are effective. For example, because subjects report evaluating how much they prescribe compared to their peers, prescribers could receive on-screen prompts with normative data showing how much opioid their peers prescribe for the same operation. Finally, for *Goals*, Education interventions are effective for changing behavior. This could include providing clinicians with prescribing guidelines based on actual opioid consumption data.

DISCUSSION

This study has two key findings. First, opioid prescribing after curative-intent cancer surgery is influenced by five theoretical domains: *Environmental context and resources*; *Social influences*; *Beliefs about consequences*; *Social/professional role and identity*; and *Goals*. Second, specific interventions targeting these domains are likely to change opioid prescribing in this setting. These include Enablement interventions (deploy nurses trained to discuss opioid use at preoperative visits), Environmental restructuring interventions (provide on-screen prompts with normative data on the quantity of opioid prescribed), and Education interventions (provide prescribing guidelines based on opioid consumption data).

Previous research has focused on quantitative assessment of opioid prescribing and postoperative opioid use. This includes studies describing the risk of new persistent opioid use after cancer⁴ and non-cancer surgery,^{3,27–29} evaluating the association between postoperative opioid prescribing and patient satisfaction scores,³⁰ and comparing the amount of opioid prescribed and consumed by surgical patients.^{15,31–36} Although these studies have identified excessive opioid prescribing as a key issue for surgical patients, it is uncertain which interventions would be most effective for reducing excessive opioid prescriptions. Our study uses the Theoretical Domains Framework to evaluate behavioral factors influencing opioid prescribing after curative-intent surgery, and identifies interventions likely to change this behavior. This approach is ideal to address opioid prescribing because it specifically focuses on identifying the critical factors linked to prescriber behavior, which can be then applied toward actionable change. Moreover, the Theoretical Domains Framework has been used in other diverse settings of care to identify potential interventions to change physician behavior including blood transfusions,¹⁹ implementation of sepsis care bundles,³⁷ antibiotic use in pediatric respiratory tract infections,²⁴ and routine preoperative testing in low-risk

patients.²³ Applying this approach to identify potential interventions to reduce opioid prescribing, however, has not been previously reported.

The interventions identified in this study could be implemented to improve opioid prescribing after curative-intent surgery. For example, Education interventions were identified in this study as likely to reduce opioid prescribing. This could be implemented as prescribing guidelines based on opioid consumption data. In fact, two recent studies have shown that implementing this intervention is associated with reductions in excessive postoperative opioid prescribing.^{38,39} Our findings also identified Enablement and Environmental restructuring interventions as likely to change opioid prescribing behavior. Although no studies have reported implementing these types of interventions to reduce opioid prescribing for patients with cancer, both Enablement and Environmental restructuring interventions have been used to improve compliance with evidence-based guidelines for managing sepsis.^{40,41} These interventions are particularly well-suited for surgical patients with cancer. For example, patients with cancer report high levels of psychological distress,^{10,11} and surgeons in our study reported difficulty adequately counseling patients on safe opioid use because patients are distracted by coping with a new cancer diagnosis. Enablement interventions (deploying nurses during preoperative visits to counsel patients on opioid use) could help address this problem. These interventions could be effective for all surgical patients, and future studies will focus on comparing opioid prescribing behavior for surgical patients with and without cancer.

This study has several key limitations. First, study subjects were limited to a single academic teaching hospital. Because of this, our findings may not be generalizable to other institutions, particularly private practice and non-teaching hospitals. For example, resident surgeons prescribe the majority of opioids at teaching hospitals. In this setting, Power was an important determinant of prescribing behavior, but this may not be true in non-teaching hospitals. Future work will focus on validating these findings across multiple institutions and settings of care. Nevertheless, we expect our findings will be helpful in designing interventions for other academic teaching hospitals. In fact, one other academic teaching hospital has successfully reduced opioid prescribing after curative-intent operations using one of the interventions identified in our study.³⁸ Another limitation is that we did not conduct a survey, which would have allowed for statistical analyses and potentially generalizable results. Nevertheless, our findings are consistent with a recent survey of surgical residents demonstrating that opioid prescribing is influenced by attending surgeon preferences and concerns for patient satisfaction.⁴² Furthermore, using qualitative interviews provided much more granular data compared to a survey. In addition, qualitative methods are uniquely well-suited to exploring prescribing behaviors in this setting given the lack of existing knowledge on the barriers and facilitators to opioid prescribing for patients with cancer. In future work, we will apply these findings to survey-based quantitative work to compare the effect of interventions focused on opioid prescribing.

In conclusion, we identified several key factors influencing opioid prescribing after curative-intent surgery. These factors could be targeted with specific interventions likely to change prescribing behavior, such as opioid prescribing guidelines or providing prescribers with normative data on opioid prescribing. With recent studies showing high rates of

overprescribing¹⁵ and new persistent opioid use⁴ in cancer patients undergoing curative-intent surgery, it is crucial to develop and implement these interventions to reduce excessive opioid prescribing and improve the quality of care for cancer survivors.

Acknowledgments

Dr. Lee is a National Research Service Award postdoctoral fellow supported by the National Cancer Institute (5T32 CA009672-23). Dr. Waljee receives funding from the Michigan Department of Health and Human Services, the National Institute on Drug Abuse (RO1 DA042859), and the Agency for Healthcare Research and Quality (1K08 HS023313-01). The content of this study is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Michigan Department of Health and Human Services.

Appendix 1: Semi-structured Interview Guide

Decision-making for the Initial Postoperative Opioid Prescription

- 1 We are going to discuss your practice for prescribing opioids to cancer patients. How do you decide what pain medication to use and how much to prescribe (dose, quantity of pills, refills)?
- 2 How did you come up with the above strategy?
- 3 How much do you prescribe relative to how much you think the patient will actually consume?
 - If applicable: why do you prescribe more than they need? What are the possible risks of this unused medication?
- 4 What do you think other surgeons do with regards to prescribing opioids?
- 5 What would consider ideal practice for prescribing opioids?
- 6 What are the barriers to prescribing less opioid medication?

Counseling Patients on Safe Opioid Use

- 7 Now we are going to discuss counseling patients on opioid use. What key factors do you address when counseling patients on opioid use?
 - If applicable – why do you not discuss the following factors: risk of abuse, risk of diversion, safe disposal of medication
- 8 Describe how counseling on opioid use is typically delivered to your patients (who provides it, who receives it, when is it given, written vs oral)?
- 9 What do you think other physicians do for counseling patients?
- 10 What would you consider ideal practice?
- 11 What are the barriers to achieving this?

Management of Opioid Misuse

- 12 After discharge, who most commonly answers questions from patients regarding opioid use and pain management?
- 13 How do you determine if a patient is inappropriately using opioid?
- 14 What do you do for these patients?
- 15 How do you think other physicians identify and manage inappropriate opioid use?
- 16 What would you consider to be ideal practice for identifying and managing inappropriate opioid use?
- 17 What are the barriers to achieving this?

How a Cancer Diagnosis Affects Opioid Prescribing

- 18 How does a patient's diagnosis of cancer affect your practice for prescribing opioids, counseling, and managing postoperative opioid use?
- 19 Anything else you would like to add?

Appendix 2: Additional sample quotes for theoretical domains and specific constructs for opioid prescribing

Theoretical domains	Specific beliefs	Sample quote
Environmental context and resources	Resources	"You could refer patients to pain specialists, but it can take up to six months to get an appointment."
	Barriers and facilitators	"Another barrier is the system for refilling opioid prescriptions. If that was somehow a less burdensome pathway, it could be easier to prescribe less."
	Organizational culture/climate	"To change practice, everybody on the team has to be on board. It can't just be a PA or resident thing. There has to be a standard protocol from the top down. We all have to agree that for these patients, this is how we're going to prescribe opioids."
Social influences	Group norms	"We talk about it a lot amongst each other. For convenience and speed of getting off the phone, a lot of people do give into the temptation of just refilling a patient's narcotic prescriptions."
	Power	"One reason we're motivated to prescribe more is because we get flak from our superiors if we don't give enough, because they're the ones dealing with the phone calls. We don't want to disappoint our bosses, so we send patients home with an ample number of pills."
	Modelling	"I asked a senior resident how much they generally prescribe, then just did what they did."
Beliefs about consequences	Consequents	"I think I prescribe less than what they need, and that's based solely on my impression that patients call in for refills all the time."
	Beliefs	"It'd be great if there was a way to standardize opioid prescribing, but I don't think it can be"

Theoretical domains	Specific beliefs	Sample quote
		standardized. It's hard to address directly to the patient without completely losing their trust in your care."
Social/professional role and identity	Professional role	"I don't want to make chronic pain a surgical problem because we're not the experts. We know how to treat acute pain, but we're not pain specialists."
Goals	Goal and target setting	"My practice is that I will calculate out that three or four days of dosing, and I will send them home with that full amount with the assumption that they will taper that down so it won't just last them that three days, it will last them five or six days."
	Priority	"We're pretty busy as residents, and I think it's nice to have an extended conversation about opioids, but usually people are waking up from anesthesia and there are barriers to circling back because the next case is already going."

References

- Rudd RA, Seth P, David F, Scholl L. Increases in Drug and Opioid-Involved Overdose Deaths - United States, 2010-2015. *MMWR Morbidity and mortality weekly report*. 2016; 65(5051):1445–1452. [PubMed: 28033313]
- Levy B, Paulozzi L, Mack KA, Jones CM. Trends in Opioid Analgesic-Prescribing Rates by Specialty, U.S., 2007-2012. *Am J Prev Med*. 2015; 49(3):409–413. [PubMed: 25896191]
- Brummett CM, Waljee JF, Goesling J, et al. New Persistent Opioid Use After Minor and Major Surgical Procedures in US Adults. *JAMA Surg*. 2017; 152(6):e170504. [PubMed: 28403427]
- Lee JS, Hu HM, Edelman AL, et al. New Persistent Opioid Use Among Patients With Cancer After Curative-Intent Surgery. *J Clin Oncol*. 2017; 35(36):4042–4049. [PubMed: 29048972]
- Jung BF, Herrmann D, Griggs J, Oaklander AL, Dworkin RH. Neuropathic pain associated with non-surgical treatment of breast cancer. *Pain*. 2005; 118(1–2):10–14. [PubMed: 16213086]
- Land SR, Kopec JA, Cecchini RS, et al. Neurotoxicity from oxaliplatin combined with weekly bolus fluorouracil and leucovorin as surgical adjuvant chemotherapy for stage II and III colon cancer: NSABP C-07. *J Clin Oncol*. 2007; 25(16):2205–2211. [PubMed: 17470850]
- Mols F, Beijers T, Lemmens V, van den Hurk CJ, Vreugdenhil G, van de Poll-Franse LV. Chemotherapy-induced neuropathy and its association with quality of life among 2- to 11-year colorectal cancer survivors: results from the population-based PROFILES registry. *J Clin Oncol*. 2013; 31(21):2699–2707. [PubMed: 23775951]
- Portenoy RK. Treatment of cancer pain. *Lancet*. 2011; 377(9784):2236–2247. [PubMed: 21704873]
- Swarm RA, Abernethy AP, Angelescu DL, et al. Adult cancer pain. *J Natl Compr Canc Netw*. 2013; 11(8):992–1022. [PubMed: 23946177]
- Fann JR, Ell K, Sharpe M. Integrating psychosocial care into cancer services. *J Clin Oncol*. 2012; 30(11):1178–1186. [PubMed: 22412139]
- Zabora J, BrintzenhofeSzoc K, Curbow B, Hooker C, Piantadosi S. The prevalence of psychological distress by cancer site. *Psychooncology*. 2001; 10(1):19–28. [PubMed: 11180574]
- Brummett CM, Janda AM, Schueller CM, et al. Survey criteria for fibromyalgia independently predict increased postoperative opioid consumption after lower-extremity joint arthroplasty: a prospective, observational cohort study. *Anesthesiology*. 2013; 119(6):1434–1443. [PubMed: 24343289]
- Janda AM, As-Sanie S, Rajala B, et al. Fibromyalgia survey criteria are associated with increased postoperative opioid consumption in women undergoing hysterectomy. *Anesthesiology*. 2015; 122(5):1103–1111. [PubMed: 25768860]
- Dreyer, T., Rontal, R., Gabriel, K., Udow-Phillips, M. Uncoordinated Prescription Opioid Use in Michigan. *Ann Arbor, MI: Center for Healthcare Research & Transformation; Dec, 2015*. 2015

<http://www.chrt.org/publication/uncoordinated-prescription-opioid-use-in-michigan/>. Accessed February 20, 2017

15. Hill MV, McMahon ML, Stucke RS, Barth RJ Jr. Wide Variation and Excessive Dosage of Opioid Prescriptions for Common General Surgical Procedures. *Ann Surg*. 2017; 265(4):709–714. [PubMed: 27631771]
16. Atkins L, Francis J, Islam R, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science*. 2017; 12(1): 77. [PubMed: 28637486]
17. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science: IS*. 2012; 7:37–37. [PubMed: 22530986]
18. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Quality and Safety in Health Care*. 2005; 14(1):26. [PubMed: 15692000]
19. Islam R, Tinmouth AT, Francis JJ, et al. A cross-country comparison of intensive care physicians' beliefs about their transfusion behaviour: a qualitative study using the Theoretical Domains Framework. *Implement Sci*. 2012; 7:93. [PubMed: 22999460]
20. Duncan EM, Francis JJ, Johnston M, et al. Learning curves, taking instructions, and patient safety: using a theoretical domains framework in an interview study to investigate prescribing errors among trainee doctors. *Implementation Science*. 2012; 7(1):86. [PubMed: 22967756]
21. McSherry LA, Dombrowski SU, Francis JJ, et al. 'It's a can of worms': understanding primary care practitioners' behaviours in relation to HPV using the theoretical domains framework. *Implementation Science*. 2012; 7(1):73. [PubMed: 22862968]
22. Michie S, Pilling S, Garety P, et al. Difficulties implementing a mental health guideline: an exploratory investigation using psychological theory. *Implementation Science*. 2007; 2:8–8. [PubMed: 17386102]
23. Patey AM, Islam R, Francis JJ, Bryson GL, Grimshaw JM. Anesthesiologists' and surgeons' perceptions about routine pre-operative testing in low-risk patients: application of the Theoretical Domains Framework (TDF) to identify factors that influence physicians' decisions to order pre-operative tests. *Implementation Science*. 2012; 7(1):52. [PubMed: 22682612]
24. Biezen R, Brijnath B, Grando D, Mazza D. Management of respiratory tract infections in young children—A qualitative study of primary care providers' perspectives. *NPJ Primary Care Respiratory Medicine*. 2017; 27:15.
25. Walker AE, Grimshaw J, Johnston M, Pitts N, Steen N, Eccles M. PRIME – PProcess modelling in ImpleMEntation research: selecting a theoretical basis for interventions to change clinical practice. *BMC Health Services Research*. 2003; 3(1):22. [PubMed: 14683530]
26. Michie S, van Stralen MM, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science: IS*. 2011; 6:42–42. [PubMed: 21513547]
27. Soneji N, Clarke HA, Ko DT, Wijesundera DN. Risks of Developing Persistent Opioid Use After Major Surgery. *JAMA Surg*. 2016; 151(11):1083–1084. [PubMed: 27533746]
28. Clarke H, Soneji N, Ko DT, Yun L, Wijesundera DN. Rates and risk factors for prolonged opioid use after major surgery: population based cohort study. *BMJ*. 2014; 348:g1251. [PubMed: 24519537]
29. Alam A, Gomes T, Zheng H, Mamdani MM, Juurlink DN, Bell CM. Long-term analgesic use after low-risk surgery: a retrospective cohort study. *Arch Intern Med*. 2012; 172(5):425–430. [PubMed: 22412106]
30. Lee JS, Hu HM, Brummett CM, et al. Postoperative Opioid Prescribing and the Pain Scores on Hospital Consumer Assessment of Healthcare Providers and Systems Survey. *JAMA*. 2017; 317(19):2013–2015. [PubMed: 28510669]
31. Bartels K, Mayes LM, Dingmann C, Bullard KJ, Hopfer CJ, Binswanger IA. Opioid Use and Storage Patterns by Patients after Hospital Discharge following Surgery. *PLoS ONE*. 2016; 11(1):e0147972. [PubMed: 26824844]

32. Bates C, Laciak R, Southwick A, Bishoff J. Overprescription of postoperative narcotics: a look at postoperative pain medication delivery, consumption and disposal in urological practice. *J Urol*. 2011; 185(2):551–555. [PubMed: 21168869]
33. Bicket MC, Long JJ, Pronovost PJ, Alexander GC, Wu CL. Prescription Opioid Analgesics Commonly Unused After Surgery: A Systematic Review. *JAMA Surg*. 2017
34. Harris K, Curtis J, Larsen B, et al. Opioid Pain Medication Use After Dermatologic Surgery A Prospective Observational Study of 212 Dermatologic Surgery Patients. *Jama Dermatology*. 2013; 149(3):317–321. [PubMed: 23682368]
35. Maughan BC, Hersh EV, Shofer FS, et al. Unused opioid analgesics and drug disposal following outpatient dental surgery: A randomized controlled trial. *Drug Alcohol Depend*. 2016; 168:328–334. 1879-0046 (Electronic). [PubMed: 27663358]
36. Rodgers J, Cunningham K, Fitzgerald K, Finnerty E. Opioid consumption following outpatient upper extremity surgery. *J Hand Surg Am*. 2012; 37(4):645–650. [PubMed: 22410178]
37. Steinmo SH, Michie S, Fuller C, Stanley S, Stapleton C, Stone SP. Bridging the gap between pragmatic intervention design and theory: using behavioural science tools to modify an existing quality improvement programme to implement “Sepsis Six”. *Implementation Science*. 2016; 11(1):14. [PubMed: 26841877]
38. Hill MV, Stucke RS, McMahon ML, Beeman JL, Barth RJ Jr. An Educational Intervention Decreases Opioid Prescribing After General Surgical Operations. *Ann Surg*. 2017
39. Howard RA, Waljee JF, Brummett CM, Englesbe MJ, Lee JS. Reduction in Opioid Prescribing Through Implementation of Evidence-Based Prescribing Guidelines. *JAMA Surg*. 2017 [Epub December 6, 2017].
40. Arabi YM, Al-Dorzi HM, Alamry A, et al. The impact of a multifaceted intervention including sepsis electronic alert system and sepsis response team on the outcomes of patients with sepsis and septic shock. *Annals of Intensive Care*. 2017; 7(1):57. [PubMed: 28560683]
41. Steinmo S, Fuller C, Stone SP, Michie S. Characterising an implementation intervention in terms of behaviour change techniques and theory: the ‘Sepsis Six’ clinical care bundle. *Implementation Science*. 2015; 10(1):111. [PubMed: 26253306]
42. Chiu AS, Healy JM, DeWane MP, Longo WE, Yoo PS. Trainees as Agents of Change in the Opioid Epidemic: Optimizing the Opioid Prescription Practices of Surgical Residents. *J Surg Educ*. 2017

SYNOPSIS

In this qualitative study, we evaluate behavioral determinants of opioid prescribing after curative-intent surgery, and identify targeted interventions to improve opioid prescribing in this setting.

Figure 1. Theoretical Domains Framework Methodology

Figure 1 illustrates how the Theoretical Domains Framework is used to study healthcare provider behavior. In this approach, healthcare providers are interviewed and asked about a target behavior. Interview transcripts are then reviewed to identify relevant theoretical domains. Theoretical domains represent types of factors that can influence healthcare behavior, including cognitive, social, and environmental factors. Relevant theoretical domains are then linked to behavior models to select targeted interventions likely to change behavior.

Figure 2. Interventions Targeting Opioid Prescribing Behavior in Surgical Oncology

Figure 2 shows three key theoretical domains identified from interviews as relevant to opioid prescribing in surgical oncology. Each domain was linked to targeted interventions likely to change behavior. Example interventions for opioid prescribing in surgical oncology are provided for each domain.

Table 1

Summary of theoretical domains and specific constructs for opioid prescribing

Theoretical domains	Specific beliefs	Sample quote
Environmental context and resources	Resources	"Some patients will call every day, multiple times a day. If their needs are straining the availability of the providers, they're going to feel like their needs aren't being met."
	Barriers and facilitators	"Pain is so subjective. After major surgery, some patients might not have any pain, while others constantly struggle with pain."
	Organizational culture/climate	"There is this focus on pain from the minute you get into PACU and throughout the hospital. Every single person asks you about pain. I think most patients don't know they'll have some pain."
Social influences	Group norms	"I think it's fairly similar in talking to other residents. I would hope anyway because I wouldn't want to be an outlier."
	Power	"I've been told to give them enough because the attending surgeons don't want the patients calling."
	Modelling	"A lot of that probably came from what I saw older residents prescribing when I was an intern."
Beliefs about consequences	Consequents	"I definitely prescribe more than I think they will consume. It just became very painful for me to get paged in the middle of a procedure to refill scripts."
	Beliefs	"I think a lot of the opioid epidemic isn't driven by surgeons, but more from chronic back pain."
Social/professional role and identity	Professional role	"It's very heterogeneous among providers with different levels of training. There's interns, chief residents, attendings, NPs, PAs, and clinic nurses. There are a lot of players, but no set standard or protocol."
Goals	Goal and target setting	"100 pills will usually get them to their 2-week appointment, and they won't have to call in a refill."
	Priority	"Am I going to figure this out for them when they've been told that they have rectal cancer, or that they need a colostomy?"