Multimodal Analgesia: Concepts and Strategies to Reduce Opioid Use

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Why Should We Care?

Epidemic!

- "Prescription drug overdose is an epidemic in the United States. All to often, in far too many communities, *the treatment is becoming the problem*"

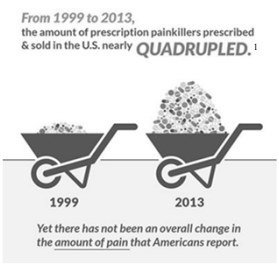
Tom Frieden
Former Director, CDC

August 10, 2017

- White House declared that the United States was in a state of national emergency over the opioid crisis

President Donald J. Trump Directs Administration to Use All Appropriate Authority to Respond to Opioid Emergency [press release]. Washington, DC, August 20, 2017.

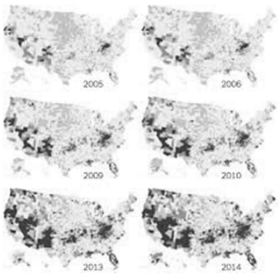
How Big Is the Pain Problem?



- **80%** of patients experience acute pain after surgery
- **75%** of U.S. patients report surgical pain rated 7 or higher (scale of 1–10)
- **59%** of patients are concerned about postoperative pain

US Centers for Disease Control and Prevention. Injury prevention & control: prescription drug overdose. 2015. http://www.cdc.gov.
Apfelbaum JL et al. *Anesth Analg.* 2003;97:534-540.
Joshi GP et al. *Am Surg.* 2014;80:219-228.
Joshi GP et al. *Br J Surg.* 2012;99:168-185.

Opioid Epidemic!



- U.S. contains 4.6% of the world's total population, but consumes 2/3 of the world opioid supply
- 12.5 million people, or 4.7% of the American population, aberrantly used prescription opioids in 2015
- 1% of the U.S. population is addicted to opioids

Surgeon General's Report [Internet]. Available from: https://addiction.surgeongeneral.gov/
Manchikanti L, Singh A. Therapeutic opioids: a ten-year perspective on the complexities and complications of the escalating use, abuse, and nonmedical use of opioids. Pain Physician. 2008;11(2 Suppl):S63–S88.
Center for Behavioral Health Statistics and Quality. (2016). 2015 National Survey on Drug Use and Health: Detailed Tables. Substance Abuse and Mental Health Services Administration, Rockville, MD.;

North American Problem, not just U.S.!

- The issue is especially severe in the US and Canada due to pharmaceutical advertising and opioid prescription practices

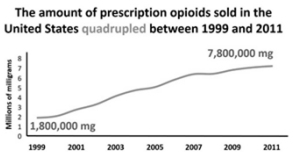
United Nations. Report of the International Narcotics Control Board for 2016. Vienna, Austria 2016.
Humphreys K. Avoiding globalisation of the prescription opioid epidemic. Lancet. 2017;390(10093):437-439.
Vashishtha D, Mittal ML, Werb D. The North American opioid epidemic: current challenges and a call for treatment as prevention. Harm Reduct J. 2017;14(1):7.

Opioid Epidemic

- **1996-2006**: Rate of prescription opioid use disorder increased by 167%
  - Rates continued to rise
- Resurgence of heroin
  - Cheaper
  - Inappropriate weaning strategies from prescription opioids

Dart RC, Surratt HL, Cicero TJ, Parrino MW, Severtson SG, Bucher-Bartelson B, et al. Trends in Opioid Analgesic Abuse and Mortality in the United States. N Engl J Med. 2015 Jan 15;372(3):241–8.

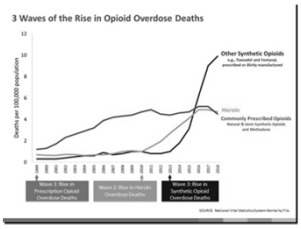
National Data



- **1990-2010** - Prescription rate increased by 1000%
- **2015** - 28,647 people died in the U.S. due to prescription opioid overdose
- **2016** - 2,458 people died in Canada, representing an increase of approximately 200% from the previous year
- Prescription opioid use disorder is estimated to cost the American economy $53.4 billion/year

Okie S. A flood of opioids, a rising tide of deaths. N Engl J Med. 2010;363(21):1981–1985.
Calcaterra S, Glanz J, Binswanger IA. National trends in pharmaceutical opioid related overdose deaths compared to other substance related overdose deaths: 1999–2009. Drug Alcohol Depend. 2013 Aug;131(3):263–70.
Paulozzi LJ, Budnitz DS, Xi Y. Increasing deaths from opioid analgesics in the United States. Pharmacoepidemiol Drug Saf. 2006 Sep;15(9):618–27.
Government of Canada. National report: apparent opioid-related deaths (2016). Ottawa, Ontario 2016.

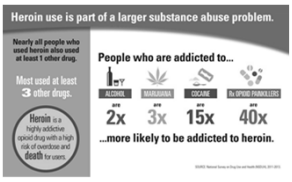
Prescribing Patterns and Deaths



- In patients with opioid prescriptions that overdose, the mortality rate increases with escalating dose
- Unfortunately ↑ in opioid prescription rate not resulted in improvement in patient disability or health outcome
  - Addictive
  - Low therapeutic ratio
  - Lack of documented effectiveness in chronic pain treatment

Bohnert AS, Valenstein M, Bair MJ, Ganoczy D, McCarthy JF, Ilgen MA, et al. Association between opioid prescribing patterns and opioid overdose-related deaths. Jama. 2011;305(13):1315–1321.
Sites BD, Beach ML, Davis MA. Increases in the Use of Prescription Opioid Analgesics and the Lack of Improvement in Disability Metrics Among Users: Req Anesth Pain Med. 2014;39(1):6–12.
Frieden TR, Houry D. Reducing the risks of relief - The CDC opioid-prescribing guideline. N Engl J Med. 2016;374(16):1501–1504.
https://siepr.stanford.edu/research/publications/opioid-crisis. Accessed 9.25.20.

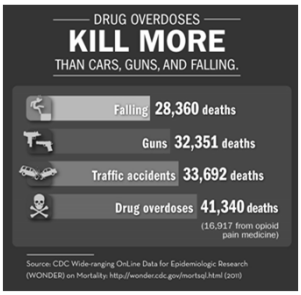
Trends and Costs



- 4/5 heroin users report their initial exposure to opioids was to prescription opioids
- **2007** - Prescription opioid overdose responsible for *more deaths than heroin and cocaine combined*

Kolodny A, Courtwright DT, Hwang CS, Kreiner P, Eadie JL, Clark TW, et al. The Prescription Opioid and Heroin Crisis: A Public Health Approach to an Epidemic of Addiction. Annu Rev Public Health. 2015 Mar 18;36(1):559–74.
Manchikanti L, Kaye AM, Kaye AD. Current State of Opioid Therapy and Abuse. Curr Pain Headache Rep [Internet]. 2016 May [cited 2016 Nov 16];20(5). Available from: http://link.springer.com/10.1007/s11916-016-0564-x

Shocking Statistics



- **Accidental deaths/year in U.S.:**
  - #1 - Drug poisoning
    - 40% of drug poisonings are due to opioid overdose
  - #2 – Automobile accidents
- **Exceeds deaths from HIV at the peak of the 1995 epidemic**

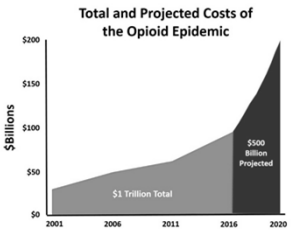
Warner M, Chen LH, Makuc DM, Anderson RN, Miniño AM. Drug Poisoning Deaths in the United States, 1980-2008. [cited 2016 Nov 16]; Available from: https://stacks.cdc.gov/view/cdc/13332/cdc_13332_DS1.pdf
Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in Drug and Opioid Overdose Deaths — United States, 2000–2014. In: Centers for Disease Control and Prevention, ed2016.
Gawande AA. It's time to adopt electronic prescriptions for opioids. Ann Surg. 2017;265(4):693-694.
https://www.nature.com/articles/d41586-019-02682-6. Accessed 9.25.20.

US Commission on Combating Drug Addiction and the Opioid Crisis

- *"With approximately 142 Americans dying every day [from the opioid crisis], America is enduring a death toll equal to September 11th every three weeks."*

Christie C, Baker C, Cooper R, Kennedy PJ, Madras B. Interim Report In: Commission on Combating Drug Addiction and the Opioid Crisis, ed. Washington, DC: Office of National Drug Policy 2017.

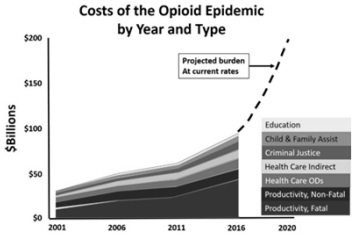
Costs



- **Estimates:** >$1 trillion from 2001 to 2017
- **Projections:** +$500 billion by end 2020

Altarum Study, February 13th, 2018.

Costs



- **Sources:**
  - Lost wages
  - Lost productivity
  - Lost taxes
  - ER visits
  - EMS
  - Treatment
  - Prevention

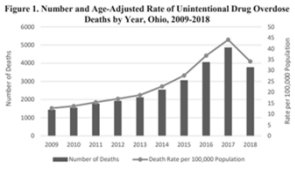
Altarum Study, https://altarum.org/news/economic-toll-opioid-crisis-us-exceeded-1-trillion-2001. Accessed 9.25.20.

Starting Young

- **U.S.** - 5.4% of grade 12 high school students aberrantly used prescription opioids within the last year
  - 40% stated that these drugs were easy to get
- **Canada** - 20.6% of high school seniors aberrantly used opioid medication in the last year
  - 70% of them obtaining the medications from their own homes

Johnston L, O'Malley P, Miech R, Bachman J, Schulenberg J. Monitoring the Future national survey results on drug use, 1975-2015: Overview, key findings on adolescent drug use. 2016.
Brands B, Paglia-Boak A, Sproule BA, Leslie K, Adlaf EM. Nonmedical use of opioid analgesics among Ontario students. Can Fam Physician Med Fam Can. 2010 Mar;56(3):256–62.

Ohio Data



Ohio Department of Health:
2018 Ohio Drug Overdose Data

- In 2017, Ohio led the nation in:
  - Opioid overdose deaths
  - Heroin-related deaths
    - 1 in 9 heroin deaths in the U.S. occur in Ohio
  - Synthetic opioid-related deaths
    - 1 in 14 synthetic opioid-related deaths occur in Ohio
- Higher than CA (2nd) and NY (3rd)

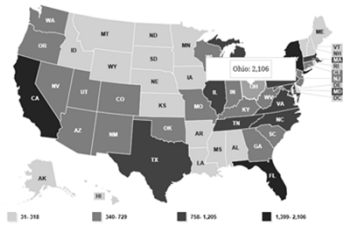
http://kff.org/other/state-indicator/opioid-overdose-deaths/?currentTimeframe=0. Accessed September 25, 2020.

Ohio Data - Trends

- In 2018, 22.5% decrease in deaths (vs. 2017)
- In 2018, 72.6% of deaths involved illicit fentanyl or fentanyl analogs
- Deaths related to natural and semisynthetic opioids (e.g. oxycodone, hydrocodone) decreased by 42.0% from 2017 to 2018

http://kff.org/other/state-indicator/opioid-overdose-deaths/?currentTimeframe=0. Accessed September 25, 2020.
https://odh.ohio.gov/wps/wcm/connect/gov/d9ee6d3b-bf62-4b4f-8978-d7c6d11348f/2018_OhioDrugOverdoseReport.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDM3000-d9ee6d3b-bf62-4b4f-8978-d7c6d11348f-mXhFqNO. Accessed September 25, 2020.

Ohio Data - Trends

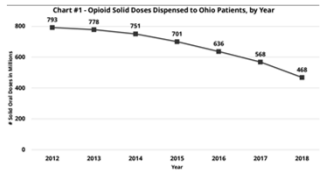


Location	Opioid Overdose Deaths
Ohio	2,106

- In 2018, 22.5% decrease in deaths (vs. 2017)
- In 2018, 72.6% of deaths involved illicit fentanyl or fentanyl analogs
- Deaths related to natural and semisynthetic opioids (e.g. oxycodone, hydrocodone) decreased by 42.0% from 2017 to 2018

http://kff.org/other/state-indicator/opioid-overdose-deaths/?currentTimeframe=0. Accessed September 25, 2020.
https://odh.ohio.gov/wps/wcm/connect/gov/d9ee6d3b-bf62-4b4f-8978-d7c6d11348f/2018_OhioDrugOverdoseReport.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDM3000-d9ee6d3b-bf62-4b4f-8978-d7c6d11348f-mXhFqNO. Accessed September 25, 2020.

Ohio Data - Trends



- 2018 – 468M doses
- 2017 – 569M doses
- 2016 – 631M doses
- 2012 – 793M doses

- Change in 6 years: ↓ 37%!
- Decrease of 325M doses!

https://www.ohiopmp.gov/documents/Annual%20Report%20(2018).pdf -accessed 9.25.20

So Where Do These Opioids Come From?

Diversion

- Illicitly obtained prescription opioids are often obtained from friends or family
- 40% of Medicaid patients with opioid prescriptions had indicators of aberrant use or diversion

Mack KA, Zhang K, Paulozzi L, Jones C. Prescription Practices involving Opioid Analgesics among Americans with Medicaid, 2010. J Health Care Poor Underserved. 2015;26(1):182–98.
Nosyk B, Marshall BDL, Fischer B, Montaner JSG, Wood E, Kerr T. Increases in the availability of prescribed opioids in a Canadian setting. Drug Alcohol Depend. 2012 Nov;126(1–2):7–12.

Surgeon's Role

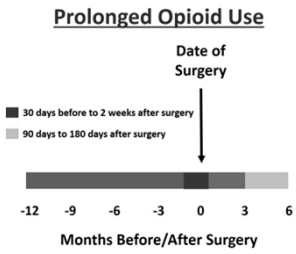
Specialty	Opioid Prescriptions (millions)	Total Prescriptions (millions)	Opioid:Total Prescriptions (percent)
Family Medicine	53	947	5.6%
Internal Medicine	44	914	4.8%
Non-Physician	32	431	7.2%
General Practice	32	431	7.5%
Surgery	28	77	36.5%
Dentistry	19	64	29.0%
Pain Medicine	15	30	48.6%
Emergency Medicine	13	61	20.7%
Physical Medicine	9	26	35.5%
All Others	45	1251	3.6%
TOTAL	289	4249	6.8%

- Surgeons responsible for 9.8% of the total opioid prescriptions in the U.S.
- Rates of opioid prescriptions to opioid naïve patients after minor surgery increased between 2004 -2012

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 Sep;49(3):409–13.
Wunsch H, Wijeysundera DN, Passarella MA, Neuman MD. Opioids Prescribed After Low- Risk Surgical Procedures in the United States, 2004-2012. JAMA. 2016 Apr 19;315(15):1654–7.

Surgeons may play a significant role in propagating the addiction crisis by exposing patients to potentially harmful and addictive opioid medications and contributing to the street supply of opioids

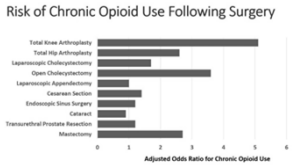
Opioids and Surgery



- A 2016 study of 59,725 elective hand surgery patients showed 13% were still taking opioids 90 days after surgery
- Another study found that 3.1% were still taking opioids at 90 days after major surgery

Johnson SP, Chung KC, Zhong L, Shauver MJ, Engelsbe MJ, Brummett C, et al. Risk of Prolonged Opioid Use Among Opioid-Naïve Patients Following Common Hand Surgery Procedures. J Hand Surg. 2016 Oct;41(10):947–957.e3.
Clarke H, Soneji N, Ko DT, Yun L, Wijeysundera DN. Rates and risk factors for prolonged opioid use after major surgery: population based cohort study. BMJ. 2014 Feb 11;348(feb11 3):g1251–g1251.

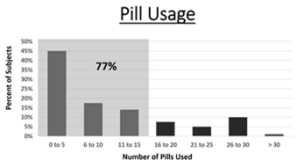
Opioids and Surgery



- **Total knee arthroplasty** - 1.4% chance of still taking opioids one year after surgery
  - Odds ratio of 5:1 when compared to non-operated controls
- Another study found that older patients (>66 y.o.) following low-risk surgery have a 44% increased likelihood of chronic use at one year compared with controls

Sun EC, Darnall BD, Baker LC, Mackey S. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid-Naive Patients in the Postoperative Period. JAMA Intern Med. 2016 Sep 1;176(9):1286.
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.

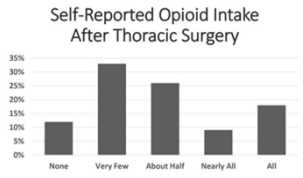
Leftovers and Disposal



- Elective hand surgery study (2012) - 95% received opioids with average 30 doses
- 19 doses leftover after acute pain resolution

Rodgers J, Cunningham K, Fitzgerald K, Finnerty E. Opioid Consumption Following Outpatient Upper Extremity Surgery. J Hand Surg. 2012 Apr;37(4):645–50.

Leftovers and Disposal



- **Urology** - 92% received no instructions on how to dispose of leftover opioids after surgery
  - 67% had leftover opioids
  - 91% of the patients with leftovers went on to keep them in an unlocked medicine cabinet
- **Oral surgery and pediatric surgery** – similar to above
- **Thoracic and gynecologic surgery** - 83% had leftover opioid medication
  - 71-73% stored the leftovers unsafely

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 Feb;185(2):551–5.

Maughan BC, Hersh EV, Shofer FS, Wanner KJ, Archer E, Carrasco LR, et al. Unused opioid analgesics and drug disposal following outpatient dental surgery: A randomized controlled trial. Drug Alcohol Depend. 2016 Nov;168:328–34.

Abou-Karam M, Dubé S, Kvann HS, Mollica C, Racine D, Bussières J-F, et al. Parental Report of Morphine Use at Home after Pediatric Surgery. J Pediatr. 2015 Sep;167(3):599–604.e2.

Bartels K, Mayes LM, Dingmann C, Bullard KJ, Hopfer CJ, Binswanger IA. Opioid Use and Storage Patterns by Patients after Hospital Discharge following Surgery. Costigan M, editor. PLOS ONE. 2016 Jan 29;11(1):e0147972.

Don't Eat the Leftovers!

- **Bicket *et al.*** - Systematic review to quantify unused postoperative prescription opioids
  - 6 studies
  - 810 patients
- 67- 92% of patients reported unfilled opioid prescriptions
- Even if filled, 42-71% of all opioid tablets obtained by patients remained unused
- <9% of patients with extra opioid tablets followed proper disposal methods

Bicket MC, Long JJ, Pronovost PJ, Alexander GC, Wu CL. Prescription Opioid Analgesics Commonly Unused After Surgery: A Systematic Review. JAMA Surg. 2017.

We Are Part of the Problem!

Since most people with prescription opioid use disorder get them from friends and family, it is reasonable to conclude that *our postoperative analgesia prescription practices are making a significant contribution to the supply of illicit opioids*

Take Home – Surgery Is A Risk Factor

Risk of persistent opioid use following exposure to opioid medications in the perioperative period, *even in opioid naïve patients*

Surgery and Addiction

Time-to-Cessation of Postoperative Opioids: A Population-Level Analysis of the Veterans Affairs Health Care System

Mudumbai SC, et al. Pain Med 2016; 17:1732-43

- 60% of patients received preoperative opioids
- Greater preoperative levels of opioid use were associated with progressively longer time-to-cessation postoperatively

- Patients who were opioid naïve before surgery shown to have a significant chance of persistent postoperative opioid use

  Many patients continue to receive opioids chronically after initially receiving them for post-operative pain control

- Patients taking opioids chronically prior to surgery have an increased chance of still taking them one year later when compared with controls

Mudumbai SC, Oliva EM, Lewis ET, Trafton J, Posner D, Mariano ER, et al. Time-to- Cessation of Postoperative Opioids: A Population-Level Analysis of the Veterans Affairs Health Care System. Pain Med. 2016 Sep;17(9):1732–43.

Wide Variability in Prescribing Practices

Discharge prescription patterns of opioid and nonopioid analgesics after common surgical procedures

Nooromid MJ, et al. Pain Rep 2018; 3:e637

- 95% of patients received a discharge opioid prescription
- Only 16% of patients received a non-opioid analgesic prescription
- There was a wide variation of the amount of opioids prescribed for each procedure

- **Hill et al.** - Wide variation in the number of opioid tablets prescribed
  - Even for patients undergoing the same outpatient general surgery procedure (n=642)
- **Thiels et al.** - Examined prescribing practices of 138 common elective procedures between 3 medical centers and reached similar conclusions (n=7,651).

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.

Thiels CA, Anderson SS, Ubl DS, et al. Wide variation and overprescription of opioids after elective surgery. Ann Surg. 2017.

Prescribing Practices Need to Change

- Opioid needs of patients could be met with much lower prescriptions
- May ↓ risk of diversion
- Post-operative opioid usage among surgeons is inconsistent
  - Benefit of more clinician opioid management training

"See One, Do One"

SEE ONE

DO ONE

TEACH ONE

- Post-operative pain management teaching is lacking in many surgical residency programs
- Trainees are heavily influenced by their superiors in post-operative prescribing patterns
  - Often prescribe opioids to excessive amounts
  - Do not receive formal opioid use training

Chiu AS, Healy JM, DeWane 441 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.

New Opioid Prescribing Laws

For first opioid prescription for acute pain:

- Adults: 7 days
- Minors: 5 days
- Cannot exceed average of 30 OMEs per day (28 oxycodone 5 mg)

Exceptions:

- Specific reason (surgery) documented in medical record
- Cancer, palliative/hospice care, addiction treatment
- Inpatient prescriptions

Citation: https://med.ohio.gov/Portals/0/DNN/PDF-FOLDERS/Laws-Rules/Newly-Adopted-Rules/4731-11-13%2C%20eff%208-31-17.pdf

Surgeon's Role

- Simple education interventions for patients to explain how to safely store and dispose of opioid medications can make a significant impact
- Led by the surgeon and a written handout or referral to a website which explains proper opioid storage and disposal

McCauley JL, Back SE, Brady KT. Pilot of a brief, web-based educational intervention targeting safe storage and disposal of prescription opioids. Addict Behav. 2013 Jun;38(6):2230–5.

McCarthy DM, Wolf MS, McConnell R, Sears J, Chevrier A, Ahlstrom E, et al. Improving Patient Knowledge and Safe Use of Opioids: A Randomized Controlled Trial. Bird S, editor. Acad Emerg Med. 2015 Mar;22(3):331–9.

Rose P, Sakai J, Argue R, Froehlich K, Tang R. Opioid information pamphlet increases postoperative opioid disposal rates: a before versus after quality improvement study. Can J Anesth Can Anesth. 2016 Jan;63(1):31–7.

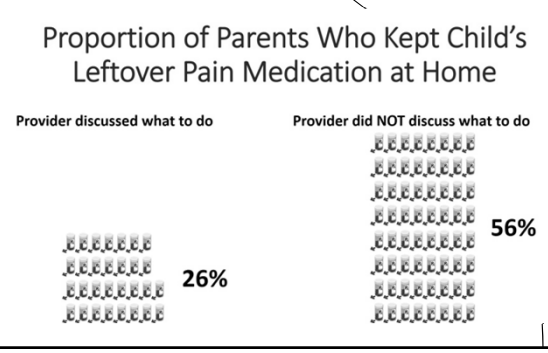
Herring ME, Shah SK, Shah SK, Gupta AK. Current regulations and modest proposals regarding disposal of unused opioids and other controlled substances. J Am Osteopath Assoc. 2008;108(7):338–343.

Seehusen DA, Edwards J. Patient practices and beliefs concerning disposal of medications. J Am Board Fam Med. 2006;19(6):542–547.

Proper Storage and Disposal

- Opioids should be stored in a locked cabinet
- All un-used medication should be returned to the pharmacy or destroyed once post-operative pain has resolved

Patient Education is Easy and it Works!



Patient Education is Easy and it Works!

⇧ Opioid disposal rate from 11% to 22%

Hasak et al. (2018) Empowering Post-Surgical Patients to Improve Opioid Disposal: A Before and After Quality Improvement Study. *Journal of the American College of Surgeons*

What Is The Clinical Impact of Ignorance of Ineffective Pain Control?

Impact of Inadequate Pain Management

- Undesirable physiologic and immunologic effects
- Associated with poor surgical outcomes
- ↑ probability of hospital readmission
- ↑ cost of care
- ↓ patient satisfaction

Joshi GP et al. *Am Surg.* 2014;80:219-228

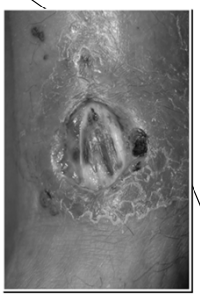
Clinical Impact of Poor Pain Control

- Uncontrolled postoperative pain:
  - Limits patient mobility
  - Decrease respiratory effort
  - Increase sympathetic discharge
- May decrease blood flow to healing tissues

Morrison RS, Magaziner J, McLaughlin MA *et al.* The impact of post-operative pain on outcomes following hip fracture. *Pain* 2003;103:303-311

Pain = Wound Healing Problems

- McGuire et al
- Post-surgical pain intensity was associated with delayed wound healing



McGuire L, Heffner K, Glaser R *et al*. Pain and wound healing in surgical patients. *Ann Behav Med* 2006;31:165-172.

Opioid Related Adverse Events

- Primary component of most postoperative multimodal pain management strategies
- Associated with unwanted and severe adverse events
  - Nausea and vomiting
  - Pruritus
  - Sedation and cognitive impairment
  - Urinary depression
  - Sleep disturbances
  - Respiratory depression

Dasta J et al. *Curr Med Res Opin*. 2012;28:1609-1615.

4

Getting Away from the "Cookie Cutter" Approach to Pain Management

- Common pain management protocols are opioid based
- Lack understanding of current literature
- Don't differentiate between acute and chronic pain
- Aren't customized to patients or surgical procedures

Janis JE and Joshi GP. *Plast Reconstr Surg*. 2014;134(4 Suppl 2):6S-7S.

4

Effective Strategies

- Pre-op
- Intra-op
- Post-op

Pre-op

Risk Factors for Opioid Abuse

Risk Factors for Chronic Opioid Use Following Surgery

Risk Factor	Odds Ratio	P-Value
Demographics		
Male	1.34	< 0.001
Age > 50 years	1.74	< 0.001
Preoperative Drug Use		
Benzodiazepines	1.82	< 0.001
Anti-Depressants	1.65	< 0.001
Anti-Psychotics	1.14	0.28
Medical Comorbidities		
Depression	1.15	0.03
Psychosis	1.03	0.89
Alcohol Abuse	1.83	< 0.001
Drug Abuse	3.15	< 0.001

- History of substance use disorder
- Co-morbid psychological health conditions (i.e. anxiety, depression)
- Male sex
- Low socioeconomic status

Mudumbai SC, Oliva EM, Lewis ET, Trafton J, Posner D, Mariano ER, et al. Time-to- Cessation of Postoperative Opioids: A Population-Level Analysis of the Veterans Affairs Health Care System. Pain Med. 2016 Sep;17(9):1732–43. 24.
Johnson SP, Chung KC, Zhong L, Shauver MJ, Engelsbe MJ, Brummett C, et al. Risk of Prolonged Opioid Use Among Opioid-Naïve Patients Following Common Hand Surgery Procedures. J Hand Surg. 2016 Oct;41(10):947–957.e3.
Clarke H, Soneji N, Ko DT, Yun L, Wijeysunders DN. Rates and risk factors for prolonged opioid use after major surgery: population based cohort study. BMJ. 2014 Feb 11;348(feb11 3):g1251–g1251.
Sun EC, Darnall BD, Baker LC, Mackey S. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid-Naive Patients in the Postoperative Period. JAMA Intern Med. 2016 Sep 1;176(9):1286.

Risk Factors for Opioid Abuse

- Patients presenting for surgery with a chronic pain condition and on an opioid medication have greater morbidity and mortality, as well as increased health care costs following orthopedic and abdominal surgeries compared with controls

Preoperative Opioid Misuse is Associated With Increased Morbidity After Elective Orthopedic Surgery

	Opioid Naïve	Opioid Users
90-Day Costs	$24,263	$26,604
Length of Stay	5.2 days	5.9 days
Major Complications	16%	20%
Non-Home Discharge	11%	13%
Hospital Readmission	6%	10%

Zywiel MG, Stroh DA, Lee SY, Bonutti PM, Mont MA. Chronic Opioid Use Prior to Total Knee Arthroplasty: J Bone Jt Surg-Am Vol. 2011 Nov;93(21):1988–93.
Menendez ME, Ring D, Bateman BT. Preoperative Opioid Misuse is Associated With Increased Morbidity and Mortality After Elective Orthopaedic Surgery. Clin Orthop Relat Res. 2015 Jul;473(7):2402–12.
Cron DC, Englesbe MJ, Bolton CJ, Joseph MT, Carrier KL, Moser SE, et al. Preoperative Opioid Use is Independently Associated With Increased Costs and Worse Outcomes After Major Abdominal Surgery: Ann Surg. 2016 Jul;1.

Chronic Opioids

- It has been suggested that 5-25% of patients on a chronic opioid medication have an opioid use disorder

Additional clinical features of opioid dependence

- Taking a high dose or a rapidly escalating dose despite stable pain condition
- Past or strong family history of addiction
- Only one type of opioid works
- Deteriorating or poor social functioning
- Binging on opioids
- Reporting opioid withdrawal symptoms
- Acknowledging being addicted
- Currently addicted to other drugs (cocaine, benzodiazepines, cannabis, etc)
- Underlying mood or anxiety disorders not responsive to treatment
- Inconsistent urine drug screen results
- Concern expressed by family members

Kahan M, Srivastava A, Wilson L, Gourlay D, Midmer D. Misuse of and dependence on opioids: study of chronic pain patients. Can Fam Physician. 2006 Sep 1;52(9):1081–7.

Recommendations

- Patients with an established or suspected substance use disorder should be referred to an addiction specialist *pre-operatively if possible*
- Elective surgery in patients with established substance use disorders should not be performed until follow-up for substance use has been arranged

Risk Factors for Adverse Outcomes of Opioid Therapy and Opioid Misuse

	Overdose	Trauma	Opioid Use Disorder	Opioid Misuse
Opioid dose > 50 morphine equivalent (mg/day)	X	X		
Sedative-hypnotic use	X	X	X	
Alcohol or drug use history	X	X	X	X
Depression or other mental health disorder	X	X	X	X
Past incarceration or legal problems			X	X
Smoking			X	X
Higher reported pain severity			X	X
Younger age			X	X
Family history of substance abuse			X	

Thorson D, Biewen P, Bonte B, Epstein H, Haake B, Hansen C, et al. Acute pain assessment and opioid prescribing protocol. Inst Clin Syst Improv [Internet]. 2014 [cited 2016 Nov 16]; Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.678.4784&rep=rep1&type=pdf

Intra-Op

What is the Role of Intra-Op Narcotics?

Opioid Hyperalgesia

- Common misconception that tolerance to opioids is a slow process
- Opioid tolerance starts to develop within a matter of minutes
- So, patients who receive higher doses of narcotics intraoperatively require more narcotics postoperatively

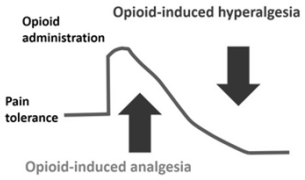
Vinik HR, Kissin I. Rapid development of tolerance to analgesia during remifentanil infusion in humans. Anesth Analg. 1998;86:1307–1311.

Opioid Hyperalgesia

Common Characteristics of Opioid-Induced Hyperalgesia

- Worsening pain over time in spite of and because of increases in opioid dose
- Nociceptive sensation
- Area of pain more diffuse
- Pain of lesser quality and harder to pinpoint

Opponent Process Theory

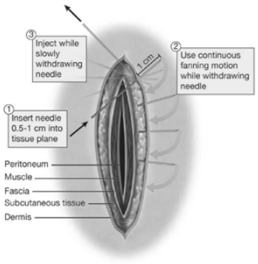


Other Intraop Strategies

Surgical Site Infiltration:
Best Clinical Practice

- **Solution**
  - Bupivacaine (150 mg) or Ropivacaine (300 mg)
    - Additives to prolong duration (e.g., clonidine 100 mcg, epinephrine 0.5 mg)
  - Liposomal bupivacaine
- **Volume**
  - 40-100 mL

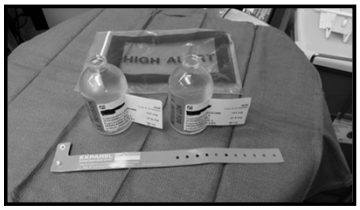
Surgical Site Infiltration:
Best Clinical Practice

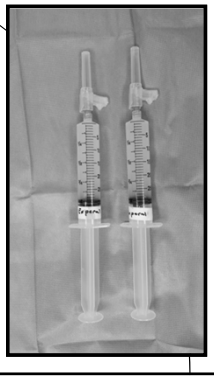


- Use a 22 gauge, 1.5-inch needle
- Use a fanning technique ("moving needle technique")
- Needle is inserted approximately 0.5-1 cm into the tissue plane and local anesthetic solution is injected while slowly withdrawing the needle (reduces the risk of intravascular injection)

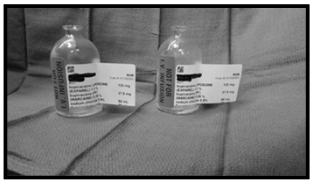
Joshi, G.P., Janis, J.E., Haas, E.M., Ramshaw, B.J., Nihira, M.A., and Dunkin, B.J. Surgical Site Infiltration for Abdominal Surgery: A Novel Neuroanatomical-based Approach. Plast Recon Surg – Global Open, 4: e1181, Dec 2016.

Liposomal Bupivacaine





Solution



- Liposomal bupivacaine 266mL 20mL
- 0.25% bupivacaine 30mL
- Sodium Chloride 0.9% 100mL
- Total volume 150mL

Liposomal Bupivacaine in Abdominal Wall Reconstruction

Cost Effective in Plastic Surgery?

- Queried Vizient Database on plastic surgery procedures
  - Cosmetic and recon
- Looked at LOS, readmission rates, direct and total costs

Little, A., Brower, K., Keller, D., Ramshaw, B. and Janis, J.E.. A Cost-Minimization Analysis Evaluating the Use of Liposomal Bupivacaine in Reconstructive Plastic Surgery Procedures.. Plast Reconstr Surg. 143(4): 1269-1274, 2019. PMID: 30730499

Cost Effective?

- 958 cases
  - Liposomal bupivacaine used in 25% (239 cases)
- ↓ LOS (5.8 vs. 9.2 days)
- ↓ Cost
  - Total: $28K vs. $39K
  - Direct: $18K vs. $24K
- Similar readmission rates

Little, A., Brower, K., Keller, D., Ramshaw, B. and Janis, J.E.. A Cost-Minimization Analysis Evaluating the Use of Liposomal Bupivacaine in Reconstructive Plastic Surgery Procedures.. Plast Reconstr Surg. 143(4): 1269-1274, 2019. PMID: 30730499

Post-Op Strategies

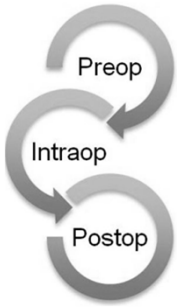
ERAS Background

- Initiated by Dr. Kehlet in the 1990s
- Also referred to as 'fast-track' surgery
- Official protocols exist for:
  - GI Surgeries
  - Radical cystectomy for bladder CA
  - Head and Neck Cancer
  - Gynecologic Oncology
  - Breast Reconstruction
  - Bariatric Surgery
  - Abdominal Wall Reconstruction

ERAS Background

- Embraced in American, European and Canadian Institutions
- Shown to:
  - Reduce length of stay
  - Decrease postoperative complications

Six Core Principles of ERAS



1. Patient and family engagement
2. Nutrition management
3. Perioperative fluid and hydration management
4. Perioperative early mobility and physical activity
5. Surgical best practices
6. Multi-modal opioid sparing analgesia

Multimodal Analgesia
The Basics

Multiple Organizations Have Urged a Shift Toward Non-Opioid Options for Pain Management

- **JCAHO**:
  - *"An individualized, multimodal treatment plan should be used to manage pain—upon assessment, the best approach may be to start with a non-narcotic"*[1]
- **CDC:**
  - *"Health care providers should only use opioids in carefully screened and monitored patients when non-opioid treatments are insufficient to manage pain"*[2]
- **ASA**:
  - *"A multimodal approach to pain management beginning with a local anesthetic where appropriate"*[3]

1. The Joint Commission. http://www.jointcommission.org/assets/1/23/jconline.
2. US Centers for Disease Control and Prevention. *Morb Mortal Wkly Rep*. 2011;60:1487-149.
3. American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology*. 2012;116:248-273.

7

How Can we Best Reduce Surgical Pain?

- Use clinically relevant outcome measures instead of pain score scales
- Avoid and/or limit opioid use
- Use multimodal anesthesia regimens
- Develop clinical pathways using a procedure-specific approach
  - PROSPECT Guidelines
- Avoid analgesic gaps

Joshi GP et al. *Am Surg*. 2014;80:219-228.

7

Analgesic Options For Multimodal Analgesia

- Regional analgesic techniques
  - Wound infiltration
  - Field blocks (TAP block)
  - Peripheral nerve and plexus blocks
  - Neuraxial blocks
- IV Lidocaine infusion
- Acetaminophen
- NSAIDs
- COX-2 inhibitors
- Dexamethasone
- Ketamine
- Gabapentin/pregabalin
- Opioids (as rescue)

Multimodal Pain Management

- Combines a variety of analgesic medication and techniques with nonpharmacological interventions
  - **Us**es drugs with complimentary mechanisms of action
  - Targets multiple sites of the nociceptive pathway
- Allows for lower doses of medications and potentially provides greater pain relief
- May result in fewer analgesic side effects
- May address patient differences in analgesic metabolism and pain sensitivity

Manworren RC. Multimodal pain management and the future of a personalized medicine approach to pain. AORN J. 2015;101(3):308-314.

Benefits of Multimodal

- Improve postsurgical pain control
- Permit use of lower analgesic doses
- Reduce dependence on opioids for postsurgical pain management

Lovich-Sapola J et al. *Surg Clin North Am.* 2015;95:301-318.
Golembiewski J and Dasta J. *Clin Ther.* 2015. [Epub ahead of print]

Multimodal Regimen

- **PRIOR TO SURGERY**
  - 300 mg Gabapentin (Neurontin) by mouth
    - Only if no history of sleep apnea

Multimodal Regimen

- **Upon arrival to the surgery center or hospital**
  - **1500 mg acetominophen** by mouth liquid (2 hours prior to surgery time)
    - If no hypersensitivity, severe hepatic impairment or severe active liver disease
  - **300 mg Gabapentin** by mouth (2 hours prior to surgery time)
    - Only if no history of sleep apnea
  - **400 mg celecoxib** by mouth (20 minutes prior to surgery time)
    - Depends on assessment of individual patients risks (cardiovascular morbidity, gastroduodenal ulcer history, renal function and hepatic function)
  - **40 mg aprepitant** (Emend), 1 tablet by mouth, 2 hours before surgery*
    - *(Only if history of post op nausea and vomiting AND ONLY before operation, never post operation)

Sample Multimodal Regimen

- Intraoperative
  - **Multi-planar field block** with 0.25% Marcaine with epinephrine or liposomal bupivacaine
  - **Ketorolac IV** (15-30 mg)
    - Don't currently have IV acetaminophen or IV ibuprofen
  - **Dexamethasone IV** (8 mg)
    - Improves pain control, reduces PONV, anti-inflammatory
    - No significant effect on blood glucose

Timing of Perioperative Analgesia

- Timing of the block (pre- vs post-incision) does not appear to be clinically significant
- Nerve blocks improve postop analgesia
- Total dose, but not volume and concentration, of LA affects the efficiency

Barreveld A et al: Anesth Analg 2013; 116: 1141-61

Sample Regimen

- **Day of Surgery/POD#0**
  - **200 mg celecoxib** by mouth (12 hours after the morning dose)
  - **1000 mg acetominophen** tablet by mouth (every 6 hours, repeat 3 times)
  - **5 mg oxycodone** 1 tablet by mouth every 4 hours as needed for pain
  - **100 mg docusate (Colace)** 1 tablet by mouth 2 times a day as needed for constipation
  - **8 mg odansteron** sublingual 1 dissolvable tablet every 8 hours as needed for nausea

Sample Regimen

- **POD#1 and after**
  - **200 mg celecoxib** by mouth, 3 times a day for 10 days
  - **1000 mg acetominophen** tablet by mouth every 6 hours for 6 days (with no other APAP-containing meds!)
  - **5 mg oxycodone** 1 tablet by mouth every 4 hours as needed for pain
  - **100 mg docusate (Colace)** 1 tablet by mouth 2 times a day as needed for constipation for 4 days
  - **8 mg odansteron** sublingual 1 dissolvable tablet every 8 hours as needed for nausea

Gabapentinoids

- Beneficial when high probability of prolonged, persistent pain
- Reduce both pain and opioid requirements
- Can improve perioperative sleep and anxiety
- < 65 y.o.:
  - **Gabapentin 300 mg** by mouth 3 times a day for 7 days
- > 65 y.o.:
  - **Gabapentin 300 mg** by mouth, 2 times a day for 7 days
    - Need to adjust for renal function

Alternates

- If allergic to celecoxib or insurance won't cover, can use meloxicam 15 mg by mouth twice a day
- If cannot take celecoxib or meloxicam, use either ibuprofen 400 mg by mouth every 6 hours or Naprosyn 440 mg by mouth every 12 hours.
  - Do not use if patient with history of peptic ulcer disease. Do not take both, only one or other.

Summary

Surgeon's Responsibility

- If an opioid naive patient develops an opioid use disorder after surgery, that is a surgical complication
- Similarly, if members of our patients family (i.e. children, home care workers etc.) aberrantly use the medications we prescribe, we hold a level of responsibility for this
- *As surgeons we are in a unique position to lead practice change and create responsible perioperative prescribing practices*

Surgeon Suggestions

- *We can make a major contribution* by curbing opioid diversion in the perioperative period
- We can partner with our anesthesia/pain colleagues to identify at risk patients and prevent postoperative aberrant opioid use.

Summary – Patient Screening

- Substance Use Disorder - refer to addiction specialist perioperatively
- Risk Factors (mood disorder, family history of substance disorder, psycho social stressors)
  - Communicate risk non-judgementally to patient and primary care physician

Summary-Prescribing Practices

- Limit potency of prescribed opioids
- Limit total prescription to 20 doses unless specific reason otherwise
- Never prescribe long acting opioids for acute pain
- Use adjunctive non-opioid analgesics (NSAIDs, acetaminophen)

Summary – Patient Education

- Risk of opioid misuse and diversion in members of household
- Proper storage of opioids in a locked cabinet
- Proper disposal practices of unused opioid medications

PRS Pain Management Supplement

Janis JE, Joshi GP.

Introduction to "current concepts in pain management in plastic surgery."

Plast Reconstr Surg. 2014;134(4)(suppl 2):6S-7S