

COST OF DELIVERING INTRAVENEOUS OPIOID ANALGESIA IN EMERGENCY DEPARTMENTS IN THE UNITED STATES

Pamela Palmer, MD, PhD¹, Brenda Lemus, MD¹, Karen DiDonato, MSN, RN¹, John House, MS²

¹AcelRx Pharmaceuticals, Inc, Redwood City, CA, USA; ²Premier, Inc, Charlotte, NC, USA

Abstract

OBJECTIVES

Evaluation of the cost of delivering IV opioids in the emergency department (ED) for the treatment of acute pain has been limited to date. This study estimates the cost of delivering an initial dose of an IV opioid to ED patients.

METHODS

Descriptive analyses using the Premier database (2013-2014) of > 600 US hospital EDs were conducted on the cost of starting an IV and delivering an initial dose of an IV opioid in EDs. Average costs of each component were aggregated for total costs. Direct acquisition and indirect cost (labor, pharmacy, etc.) were included.

RESULTS

Over 24 months, 7,327,299 patients received IV opioids in 614 EDs in the US (approximately one-tenth of EDs in the US). Of these patients, 58% were not admitted to the hospital. Morphine (56%), hydromorphone (45%) and fentanyl (25%) were the most frequently administered IV opioids. Average [median; interquartile range] costs include initiating an IV (\$62 [\$62; \$60-66]), IV catheter (\$4 [\$3; \$2-3]), infusion pump tubing (\$15 [\$18; \$8-21]), infusion pump to maintain IV patency (\$37 [\$26; \$23-64]), 250 mL saline bag (\$15 [\$13; \$9-19]), 2% lidocaine for local anesthesia for line placement (\$5 [\$4; \$3-6]) and the cost of a single dose of morphine 5 mg (\$6 [\$4; \$2-7]), hydromorphone 1 mg (\$7 [\$5; \$3-9]) or fentanyl 100 mcg (\$7 [\$6; \$4-10]). Aggregated mean IV opioid total costs per patient for a single standard dose of opioid were \$143 (morphine), \$144 (hydromorphone) and \$145 (fentanyl).

CONCLUSIONS

The cost of setting up an IV line to administer an opioid is substantial. Since the majority of patients receiving IV opioids are discharged from the ED, the ultimate use for this IV line is limited. The development of a rapid-acting, non-invasive analgesic for ED use could be advantageous from both a cost and patient-benefit standpoint.

Introduction

The majority of ED patients require treatment for painful medical conditions or injuries.¹ Often these patients are suffering from moderate-to-severe pain, have long delays in the ED before obtaining pain relief, and are often discharged in a significant degree of pain. One study of over 800 patients treated in 20 EDs documented an average entering pain score of 8 out of 10, a median delay of 90 minutes to receive an analgesic with only 60% of these patients receiving any analgesic at all, and three-quarters of the patients were discharged in moderate-to-severe pain.²

The lack of appropriate pain management in the emergency room setting has been a longstanding issue and led to the term ED "oligoanalgesia" in 1989.³ There are many factors, whether justified or not, that lead to this phenomenon including fear that patients are drug-seeking and concern over masking the patient's underlying condition, thereby making the diagnosis more difficult. However, another important and relevant factor that may influence the undertreatment of patients in pain is the time and cost to set-up and administer intravenous (IV) opioids in the ED setting.

While IV opioids have been utilized for decades to rapidly treat moderate-to-severe pain in the ED, very little data exists regarding the costs of administering a typical dose of IV opioid in this setting. This study analyzed the current costs to administer a single dose of commonly utilized IV opioids in EDs throughout the US.

Methods

Descriptive analyses using the Premier database (2013-2014) of > 600 US hospital EDs were conducted on the cost of starting an IV and delivering an initial dose of an IV opioid in EDs. Average costs of each component were aggregated for total costs. Direct acquisition and indirect cost (labor, pharmacy, etc.) were included.

Cost included in the analysis:

- Direct acquisition cost
- Indirect cost (labor, pharmacy, etc.)
- Costs related to initiating an IV infusion, IV equipment (catheter, tubing, saline, pump, etc) and the dose of a standard initial IV opioid were included. Lidocaine 2% for local anesthesia prior to catheter insertion was also included.

Database cost entries were analyzed across all hospital EDs and mean, median and range are reported.

Methods (cont.)

Patient demographic data, payor data, as well as hospital descriptive data (location, size, type of hospital; see **Table 1**) were also collected. A comparison between patients who were ultimately admitted as inpatients versus the patients who were discharged from the ED was also performed.

Table 1. Premier Database Hospital Description Data

Premier Database	TOTAL	
	N	
# of Unique Hospitals	614	
Provider Region (n, %)		
Midwest	130	(21.2%)
Northeast	82	(13.4%)
South	283	(46.1%)
West	119	(19.4%)
Population Served (n, %)		
Rural	160	(26.1%)
Urban	454	(73.9%)
Teaching Hospital (n, %)	169 (27.5%)	
Hospital Size (# of beds) (n, %)		
< 100	148	(24.1%)
100-199	128	(20.8%)
200-299	120	(19.5%)
300-399	85	(13.8%)
400-499	56	(9.1%)
>500	77	(12.5%)

Results

- Over 24 months, 7,327,299 patients received IV opioids in 614 EDs in the US (approximately one-tenth of EDs in the US).
- Of these patients, 3,055,611 (58%) were not admitted to the hospital and were discharged to home from the ED.
- The average age of ED patients receiving IV opioids was 51 years old; see **Table 2** for demographic data

Table 2. Demographics of Patients Receiving IV Opioids in the ED

Age	51.2 ± 18.9
Age	
≤40	2373634 (32.4%)
41-49	1159217 (15.8%)
50-59	1364037 (18.6%)
60-69	1030544 (14.1%)
70-79	738193 (10.1%)
80 +	661674 (9.0%)
Gender	
Female	4319350 (58.9%)
Male	3007845 (41.0%)
Unknown	104 (0.0%)
Race	
Caucasian	4929262 (67.3%)
African American	1212943 (16.6%)
Other	1181680 (16.1%)
Unknown	3414 (0.0%)
Ethnicity	
Hispanic or Latino	716806 (9.8%)
Not Hispanic or Latino	5443978 (74.3%)
Unknown	1166515 (15.9%)
Payor	
Commercial	2253848 (30.8%)
Medicaid	1361597 (18.6%)
Medicare	2524520 (34.5%)
Any Other Payor	1187334 (16.2%)

Relative to the overall demographic of patients receiving IV opioids in the ED, patients that were admitted to the hospital tended to be older (average age 59 vs 51). Slightly more male patients were admitted (46%) relative to those who received IV opioids (41%), however the majority still remained female. Consistent with the older age of admitted patients, relatively more Medicare patients were admitted (50%) relative to the percent of Medicare patients receiving IV opioids (35%).

Most frequently administered IV opioid drugs in the EDs are shown in **Table 3** below.

Table 3. IV Opioids Administered in the EDs

IV Opioid	# of Patients (%)
Morphine	4068629 (55.5%)
Hydromorphone	3262789 (44.5%)
Fentanyl	1856870 (25.3%)
Meperidine	258800 (3.5%)

Results (cont.)

In **Table 4**, the cost of each individual item was listed along with the mean, median and cost range. Standard initial dosages of the three most commonly administered IV opioids in the ED (morphine, hydromorphone and fentanyl) were included.

Table 4. Per Patient Total Cost of Setting up an IV, Equipment and Initial IV Opioid Dose

	Cost (\$)	
IV Start and Infusion	Mean (Std Dev)	62 ± 5
	Median (IQR)	62 (60, 66)
	Range	51 - 69
Morphine 5 mg/ml in 1 mL pre-filled disposable syringe	Mean (Std Dev)	6 ± 6
	Median (IQR)	4 (2, 7)
	Range	1 - 47
Hydromorphone 1 mg/ml in 1 mL pre-filled disposable syringe	Mean (Std Dev)	7 ± 5
	Median (IQR)	5 (3, 9)
	Range	1 - 25
Fentanyl 50 mcg/mL, 2 mL vial	Mean (Std Dev)	7 ± 5
	Median (IQR)	6 (4, 10)
	Range	2 - 26
IV Catheter	Mean (Std Dev)	4 ± 4
	Median (IQR)	3 (2, 3)
	Range	0.5 - 23
250ml Saline Bag	Mean (Std Dev)	15 ± 8
	Median (IQR)	13 (9, 19)
	Range	1 - 47
Pump Tubing	Mean (Std Dev)	15 ± 7
	Median (IQR)	18 (8, 21)
	Range	5 - 25
IV Infusion Pump	Mean (Std Dev)	37 ± 29
	Median (IQR)	26 (23, 64)
	Range	2 - 110
2% Lidocaine	Mean (Std Dev)	5 ± 3
	Median (IQR)	4 (3, 6)
	Range	0.7 - 24
Total Cost (with morphine)	Mean (Std Dev)	\$143 ± 71
	Mean (95% CI)	143 (138-149)
	Median (IQR)	115 (107, 185)
	Range	62 - 344
Total Cost (with hydromorphone)	Mean (Std Dev)	\$144 ± 65
	Mean (95% CI)	144 (139-149)
	Median (IQR)	116 (108, 187)
	Range	62 - 322
Total Cost (with fentanyl)	Mean (Std Dev)	\$145 ± 65
	Mean (95% CI)	145 (139-150)
	Median (IQR)	117 (108, 188)
	Range	62 - 323

The costs above are largely due to the nursing time and equipment costs to set-up and maintain an IV infusion in order to administer IV opioids as needed. The mean cost of each standard dose of IV opioid was not substantial (\$6 - \$7). Over a typical ED visit treatment time of 90 minutes,⁴ typical dosing of IV morphine would be approximately 0.15 mg/kg (or the equivalent of approximately 2 doses of the above standard IV opioids in a 70-kg patient).⁵ Therefore, adding the second dose of IV opioid, the total cost of IV opioid treatment in the ED would average \$149 - \$152.

Conclusions

- Patients present to the ER with high levels of pain and are often undertreated.
- The high cost, approximately \$150, to administer IV opioids may contribute to this "oligoanalgesia."
- In the current healthcare reimbursement environment, it would be optimal to have access to a rapid-onset analgesic for treatment of moderate-to-severe pain that does not require IV administration so as to reduce the overall cost of treatment.

References

1. American College of Emergency Physicians Board of Directors: Policy Statement: Pain management in the emergency department. *Ann Emerg Med* 44:198, 2004.
2. Todd KH, Ducharme J, Choiniere M, Crandall, CS, Fosnocht DE, Homel P, Tanabe P: Pain in the emergency department: Results of the pain and emergency medicine initiative (PEMI) multicenter study. *J Pain* 8:460-466, 2007.
3. Wilson JE, Pendleton JM. Oligoanalgesia in the emergency department. *Am J Emerg Med* 7:620-623, 1989.
4. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6319a8.htm>
5. Patanwala AE, Keim SM, Erstad BL. Intravenous opioids for severe acute pain in the emergency department. *Ann Pharmacother* 44:1800-1809, 2010.

Acknowledgements

Funding of the study was provided by AcclRx Pharmaceuticals, Inc.