

The following content was supplied by the authors as supporting material and has not been copy-edited or verified by JBJS.

Appendix 1: List of billing descriptions for opioid medications analyzed.

Medication	Description
Acetaminophen/codeine	ACETAMIN/CAFF/BUT, FIORICET/COD CAP 325/40/50/30MG
	ACETAMIN/COD, PHENAPHEN #2 CAP 325/15MG
	ACETAMIN/COD, PHENAPHEN #3 CAP 325/30MG
	ACETAMIN/COD, PHENAPHEN #4 CAP 325/60MG
	ACETAMIN/COD, TYLENOL #2 TAB 300/15MG
	ACETAMIN/COD, TYLENOL #3 TAB 300/30MG
	ACETAMIN/COD, TYLENOL #4 TAB 300/60MG
	ACETAMIN/COD, TYLENOL/COD ELX 10ML
	ACETAMIN/COD, TYLENOL/COD ELX 12.5ML
	ACETAMIN/COD, TYLENOL/COD ELX 120ML
	ACETAMIN/COD, TYLENOL/COD ELX 15ML
	ACETAMIN/COD, TYLENOL/COD ELX 30ML
	ACETAMIN/COD, TYLENOL/COD ELX 5ML
	ACETAMIN/COD, TYLENOL/COD ELX 60ML
	ASPIRIN/CAFF/BUT/COD, FIORINAL/COD #3 CAP
Aspirin/codeine	ASPIRIN/COD, EMPIRIN/COD #3 TAB 30/325MG
	ASPIRIN/COD, EMPIRIN/COD #4 TAB 60/325MG
Buprenorphine	BUPRENORPHINE, BUPRENEX AMP 0.3MG/ML 1ML
	BUPRENORPHINE, SUBUTEX TAB SL 2MG
	BUPRENORPHINE, SUBUTEX TAB SL 8MG
	BUPRENORPHINE, BUTRANS PATCH 5MCG/HR
	BUPRENORPHINE, BUTRANS PATCH 10MCG/HR
	BUPRENORPHINE, BUTRANS PATCH 20MCG/HR
	BUPRENORPHINE, BUPRENEX AMP 0.1MG
	BUPRENORPHINE, BUTRANS PATCH 7.5MCG/HR
	BUPRENORPHINE, BUTRANS PATCH 15MCG/HR
	BUPRENORPHINE, SUBUTEX TAB SL 1MG

	BUPRENORPHINE, BELBUCA BUCCAL 75MCG BUPRENORPHINE, BELBUCA BUCCAL 150MCG BUPRENORPHINE, BELBUCA BUCCAL 300MCG BUPRENORPHINE, BELBUCA BUCCAL 450MCG BUPRENORPHINE, BELBUCA BUCCAL 600MCG BUPRENORPHINE, BELBUCA BUCCAL 750MCG BUPRENORPHINE, BELBUCA BUCCAL 900MCG BUPRENORPHINE, SUBLOCADE INJ 100MG/0.5ML BUPRENORPHINE, SUBLOCADE INJ 300MG/1.5ML	
Codeine phosphate	CODEINE PHOS INJ 30MG/ML 1ML CODEINE PHOS INJ 30MG/ML 2ML CODEINE PHOS SOL 15MG/5ML 5ML CODEINE PHOS TAB 30MG CODEINE PHOS TAB 60MG CODEINE PHOS VL 30MG/ML 1ML CODEINE PHOS VL 60MG/ML 1ML CODEINE SULF TAB 15MG CODEINE SULF TAB 30MG CODEINE SULF TAB 60MG CODEINE PHOS SOL 15MG/5ML 120ML	
Dihydrocodeine/aspirin/caffeine	DIHYDROCODEINE/ASA/CAFF, SYNALGOS-DC CAP	
Fentanyl	FENTANYL, FENTANYL ORALET LOZ 100MCG FENTANYL, FENTANYL ORALET LOZ 200MCG FENTANYL, FENTANYL ORALET LOZ 300MCG FENTANYL, FENTANYL ORALET LOZ 400MCG FENTANYL, ACTIQ LOZ/STICK 200MCG FENTANYL, ACTIQ LOZ/STICK 400MCG FENTANYL, ACTIQ LOZ/STICK 600MCG	

	FENTANYL, ACTIQ LOZ/STICK 800MCG	
	FENTANYL, ACTIQ LOZ/STICK 1200MCG	
	FENTANYL, ACTIQ LOZ/STICK 1600MCG	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 10ML	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 1ML	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 20ML	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 2ML	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 40ML	
	FENTANYL, SUBLIMAZE AMP 0.05MG/ML 5ML	
	FENTANYL, SUBLIMAZE EPIDURAL 250ML	
	FENTANYL, SUBLIMAZE PCA 0.05MG/ML 30ML	
	FENTANYL, SUBLIMAZE PCA 0.05MG/ML 60ML	
	FENTANYL, SUBLIMAZE VL 0.05MG/ML 30ML	
	FENTANYL, SUBLIMAZE VL 0.05MG/ML 50ML	
	FENTANYL/DROPERIDOL, INNOVAR AMP 2ML	
	FENTANYL/DROPERIDOL, INNOVAR AMP 5ML	
	FENTANYL, SUBLIMAZE PCA 0.05MG/ML 100ML	
Hydrocodone	HYDROCOD/ACETAMIN, LORTAB LIQ 60ML	
	HYDROCOD/IBUPROF, VICOPROFEN TAB 7.5/200MG	
	HYDROCOD/ACETAMIN, LORCET PLUS TAB 7.5/650MG	
	HYDROCOD/ACETAMIN, LORCET TAB 10/650MG	
	HYDROCOD/ACETAMIN, LORTAB LIQ 15ML	
	HYDROCOD/ACETAMIN, LORTAB LIQ 30ML	
	HYDROCOD/ACETAMIN, LORTAB LIQ 5ML	
	HYDROCOD/ACETAMIN, LORTAB TAB 2.5/500MG	
	HYDROCOD/ACETAMIN, LORTAB TAB 5/500MG	
	HYDROCOD/ACETAMIN, LORTAB TAB 7.5/500MG	
	HYDROCOD/ACETAMIN, VICODIN ES TAB 7.5/750MG	
	HYDROCOD/ASA, LORTAB ASA TAB 5/500MG	
	HYDROCOD/ACETAMIN, LORTAB TAB 10/500MG	

	HYDROCOD/ACETAMIN, NORCO TAB 10/325MG	
	HYDROCOD/ACETAMIN TAB 5/325MG	
	HYDROCOD/ACETAMIN TAB 7.5/325MG	
	HYDROCOD/IBUPROF, IBUDONE TAB 5/200MG	
	HYDROCOD/IBUPROF, IBUDONE TAB 10/200MG	
	HYDROCOD/IBUPROF, IBUDONE TAB 2.5/200MG	
	HYDROCODONE, HYSINGLA ER TAB 20MG	
	HYDROCODONE, HYSINGLA ER TAB 30MG	
	HYDROCODONE, HYSINGLA ER TAB 40MG	
	HYDROCODONE, HYSINGLA ER TAB 60MG	
	HYDROCODONE, HYSINGLA ER TAB 80MG	
	HYDROCODONE, HYSINGLA ER TAB 100MG	
	HYDROCODONE, HYSINGLA ER TAB 120MG	
	HYDROCODONE, ZOHYDRO ER TAB 10MG	
	HYDROCODONE, ZOHYDRO ER TAB 15MG	
	HYDROCODONE, ZOHYDRO ER TAB 20MG	
	HYDROCODONE, ZOHYDRO ER TAB 30MG	
	HYDROCODONE, ZOHYDRO ER TAB 40MG	
	HYDROCODONE, ZOHYDRO ER TAB 50MG	

Hydromorphone	*HYDROMORPHONE, DILAUDID AMP 1MG/ML 1ML	
	*HYDROMORPHONE, DILAUDID AMP 4MG/ML 1ML	
	HYDROMORPHONE, DILAUDID EPIDURAL 250ML	
	HYDROMORPHONE, DILAUDID HP AMP 10MG/ML 1ML	
	HYDROMORPHONE, DILAUDID HP AMP 10MG/ML 5ML	
	HYDROMORPHONE, DILAUDID INJ 1MG/ML 1ML	
	HYDROMORPHONE, DILAUDID INJ 2MG/ML 1ML	
	HYDROMORPHONE, DILAUDID INJ 3MG/ML 1ML	
	HYDROMORPHONE, DILAUDID INJ 4MG/ML 1ML	
	HYDROMORPHONE, DILAUDID LIQ 1MG/ML 30ML	

	HYDROMORPHONE, DILAUDID LIQ 1MG/ML 5ML	
	HYDROMORPHONE, DILAUDID PCA 0.2MG/ML 30ML	
	HYDROMORPHONE, DILAUDID PCA 0.2MG/ML 60ML	
	HYDROMORPHONE, DILAUDID PWDR 0.972GM	
	HYDROMORPHONE, DILAUDID SUPP 3MG	
	HYDROMORPHONE, DILAUDID TAB 1MG	
	HYDROMORPHONE, DILAUDID TAB 2MG	
	HYDROMORPHONE, DILAUDID TAB 3MG	
	HYDROMORPHONE, DILAUDID TAB 4MG	
	HYDROMORPHONE, DILAUDID VL 10MG/ML 2ML	
	HYDROMORPHONE, DILAUDID VL 10MG/ML 50ML	
	*HYDROMORPHONE, DILAUDID VL 2MG/ML 1ML	
	HYDROMORPHONE, DILAUDID VL 2MG/ML 20ML	
	HYDROMORPHONE, DILAUDID LIQ 1MG/ML 60ML	
	HYDROMORPHONE, EXALGO TAB ER 8MG	
	HYDROMORPHONE, EXALGO TAB ER 12MG	
	HYDROMORPHONE, EXALGO TAB ER 16MG	
	HYDROMORPHONE, EXALGO TAB ER 32MG	
Levorphan	LEVORPHAN, LEVO DROMORAN AMP 2MG/ML 1ML	
	LEVORPHAN, LEVO DROMORAN TAB 2MG	
	LEVORPHAN, LEVO DROMORAN VL 2MG/ML 10ML	
Meperidine	*MEPERIDINE, DEMEROL AMP 100MG/ML 1ML	
	MEPERIDINE, DEMEROL AMP 25MG/ML 0.5ML	
	*MEPERIDINE, DEMEROL AMP 25MG/ML 1ML	
	*MEPERIDINE, DEMEROL AMP 50MG/ML 1ML	
	*MEPERIDINE, DEMEROL AMP 75MG/ML 1ML	
	MEPERIDINE, DEMEROL EPIDURAL 250ML	
	MEPERIDINE, DEMEROL INJ 100MG/ML 1ML	
	MEPERIDINE, DEMEROL INJ 10MG/ML 1ML	
	MEPERIDINE, DEMEROL INJ 25MG/ML 1ML	

	MEPERIDINE, DEMEROL INJ 50MG/ML 1ML	
	MEPERIDINE, DEMEROL INJ 50MG/ML 2ML	
	MEPERIDINE, DEMEROL INJ 75MG/ML 1ML	
	MEPERIDINE, DEMEROL PCA 10MG/ML 30ML	
	MEPERIDINE, DEMEROL PCA 10MG/ML 50ML	
	MEPERIDINE, DEMEROL PCA 10MG/ML 60ML	
	MEPERIDINE, DEMEROL SYRP 50MG/5ML 1ML	
	MEPERIDINE, DEMEROL SYRP 50MG/5ML 30ML	
	MEPERIDINE, DEMEROL SYRP 50MG/5ML 5ML	
	MEPERIDINE, DEMEROL TAB 100MG	
	MEPERIDINE, DEMEROL TAB 50MG	
	MEPERIDINE, DEMEROL VL 100MG/ML 20ML	
	MEPERIDINE, DEMEROL VL 10MG/ML 10ML	
	MEPERIDINE, DEMEROL VL 10MG/ML 30ML	
	MEPERIDINE, DEMEROL VL 10MG/ML 5ML	
	MEPERIDINE, DEMEROL VL 50MG/ML 30ML	
	MEPERIDINE/PROM, MEPERGAN FORTIS CAP	
	MEPERIDINE/PROM, MEPERGAN INJ 25MG/25MG 2ML	
	MEPERIDINE/PROM, MEPERGAN VL 25MG/25MG 10ML	
Methadone	METHADONE CONC 10MG/ML 30ML	
	METHADONE SOL 10MG/10ML 10ML	
	METHADONE SOL 10MG/5ML 5ML	
	METHADONE SOL 5MG/5ML 15ML	
	METHADONE SOL 5MG/5ML 1ML	
	METHADONE SOL 5MG/5ML 30ML	
	METHADONE SOL 5MG/5ML 5ML	
	METHADONE TAB 10MG	
	METHADONE TAB 40MG	
	METHADONE TAB 5MG	
	METHADONE VL 10MG/ML 1ML	

	METHADONE VL 10MG/ML 20ML	
Morphine	MORPHINE AMP 1MG/ML 2ML	
	MORPHINE AMP 1MG/ML 30ML	
	MORPHINE AMP 1MG/ML 60ML	
	*MORPHINE AMP 2MG/ML 1ML	
	MORPHINE INJ 10MG/ML 1ML	
	MORPHINE INJ 10MG/ML 2ML	
	MORPHINE INJ 15MG/ML 1ML	
	MORPHINE INJ 15MG/ML 2ML	
	MORPHINE INJ 25MG/ML 10ML	
	MORPHINE INJ 25MG/ML 20ML	
	MORPHINE INJ 25MG/ML 40ML	
	MORPHINE INJ 25MG/ML 4ML	
	MORPHINE INJ 2MG/ML 1ML	
	MORPHINE INJ 2MG/ML 2ML	
	MORPHINE INJ 4MG/ML 1ML	
	MORPHINE INJ 4MG/ML 2ML	
	MORPHINE INJ 50MG/ML 20ML	
	MORPHINE INJ 8MG/ML 1ML	
	MORPHINE INJ 8MG/ML 2ML	
	MORPHINE PCA 1MG/ML 100ML	
	MORPHINE PCA 1MG/ML 30ML	
	MORPHINE PCA 1MG/ML 50ML	
	MORPHINE PCA 1MG/ML 60ML	
	MORPHINE PCA 5MG/ML 30ML	
	*MORPHINE PCA BAG 250ML	
	MORPHINE TAB SOLUBLE 10MG	
	MORPHINE TAB SOLUBLE 15MG	
	MORPHINE TAB SOLUBLE 30MG	
	MORPHINE VL 10MG/ML 10ML	

	*MORPHINE VL 10MG/ML 1ML	
	*MORPHINE VL 15MG/ML 1ML	
	MORPHINE VL 15MG/ML 20ML	
	MORPHINE VL 1MG/ML 100ML	
	MORPHINE VL 2MG/ML 60ML	
	MORPHINE VL 3MG/ML 50ML	
	*MORPHINE VL 50MG/ML 20ML	
	MORPHINE VL 5MG/ML 1ML	
	MORPHINE VL 5MG/ML 30ML	
	*MORPHINE VL 8MG/ML 1ML	
	MORPHINE, DURAMORPH AMP 0.5MG/ML 10ML	
	MORPHINE, DURAMORPH AMP 0.5MG/ML 2ML	
	MORPHINE, DURAMORPH AMP 1MG/ML 10ML	
	MORPHINE AMP 10MG/ML 20ML	
	*MORPHINE AMP 25MG/ML 20ML	
	MORPHINE, MS CONTIN TAB SR 100MG	
	MORPHINE, MS CONTIN TAB SR 15MG	
	MORPHINE, MS CONTIN TAB SR 30MG	
	MORPHINE, MS CONTIN TAB SR 60MG	
	MORPHINE, MSIR SOL 10MG/5ML 10ML	
	MORPHINE, MSIR SOL 10MG/5ML 2.5ML	
	MORPHINE, MSIR SOL 10MG/5ML 5ML	
	MORPHINE, MSIR SOL 20MG/5ML 10ML	
	MORPHINE, MSIR SOL 20MG/5ML 25ML	
	MORPHINE, MSIR SOL 20MG/5ML 30ML	
	MORPHINE, MSIR SOL 20MG/5ML 5ML	
	MORPHINE TAB 15MG	
	MORPHINE TAB 30MG	
	MORPHINE, RMS SUPP 10MG	
	MORPHINE, RMS SUPP 20MG	
	MORPHINE, RMS SUPP 30MG	

	MORPHINE, RMS SUPP 5MG	
	MORPHINE, ROXANOL SOL 100MG/5ML 10ML	
	MORPHINE, ROXANOL SOL 100MG/5ML 240ML	
	MORPHINE, ROXANOL SOL 100MG/5ML 5ML	
	MORPHINE, ROXANOL SOL 20MG/ML 10ML	
	MORPHINE, ROXANOL SOL 20MG/ML 120ML	
	MORPHINE, ROXANOL SOL 20MG/ML 15ML	
	MORPHINE, ROXANOL SOL 20MG/ML 1ML	
	MORPHINE, ROXANOL SOL 20MG/ML 30ML	
	MORPHINE, DEPODUR VL 10MG/ML 2ML	
	MORPHINE, MS CONTIN TAB SR 200MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 20/0.8MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 30/1.2MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 50/2MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 60/2.4MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 80/3.2MG	
	MORPHINE/NALTREXONE, EMBEDA CAP 100/4MG	
	MORPHINE, AVINZA CAP 45MG	
	MORPHINE, AVINZA CAP 75MG	
	MORPHINE, AVINZA CAP 90MG	
	MORPHINE, AVINZA CAP 120MG	
	MORPHINE, KADIAN CAP 10MG	
	MORPHINE, KADIAN CAP 20MG	
	MORPHINE, KADIAN CAP 50MG	
	MORPHINE, KADIAN CAP 80MG	
Oxycodone	OXYCOD/ACETAMIN, PERCOCET TAB 5/325MG	
	OXYCOD/ACETAMIN, ROXICET SOL 30ML	
	OXYCOD/ACETAMIN, ROXICET SOL 5ML	
	OXYCOD/ACETAMIN, TYLOX CAP 5/500MG	

	OXYCOD/ASA, PERCODAN TAB 4.5/325MG	
	OXYCOD/ASA, PERCODAN-DEMI TAB 2.25/325MG	
	OXYCODONE, OXYCONTIN TAB CR 10MG	
	OXYCODONE, OXYCONTIN TAB CR 20MG	
	OXYCODONE, OXYCONTIN TAB CR 40MG	
	OXYCODONE, ROXICODONE SOL 20MG/ML 30ML	
	OXYCODONE, ROXICODONE SOL 5MG/5ML 5ML	
	OXYCODONE, ROXICODONE TAB 5MG	
	OXYCODONE, OXYCONTIN TAB CR 80MG	
	OXYCOD/ACETAMIN, PERCOCET TAB 7.5/500MG	
	OXYCOD/ACETAMIN, PERCOCET TAB 10/325MG	
	OXYCOD/ACETAMIN, PERCOCET TAB 2.5/325MG	
	OXYCOD/ACETAMIN, PERCOCET TAB 7.5/325MG	
	OXYCOD/ACETAMIN, PERCOCET TAB 10/650MG	
	OXYCODONE, ROXICODONE TAB 15MG	
	OXYCODONE, ROXICODONE TAB 30MG	
	OXYCODONE TAB 10MG	
	OXYCODONE TAB 20MG	
	OXYCODONE, OXYCONTIN TAB CR 15MG	
	OXYCODONE, OXYCONTIN TAB CR 30MG	
	OXYCODONE, OXYCONTIN TAB CR 60MG	
	OXYCODONE, OXYCONTIN TAB CR 160MG	
	OXYCODONE, XTAMPZA ER TAB 9MG	
	OXYCODONE, XTAMPZA ER TAB 13.5MG	
	OXYCODONE, XTAMPZA ER TAB 18MG	
	OXYCODONE, XTAMPZA ER TAB 27MG	
	OXYCODONE, XTAMPZA ER TAB 36MG	
	OXYCODONE, ROXICODONE SOL 20MG/ML 1ML	
	OXYCODONE, ROXICODONE SOL 20MG/ML 0.5ML	

	OXYCODONE, ROXICODONE SOL 20MG/ML 0.25ML	
Oxymorphone	OXYMORPHONE, NUMORPHAN AMP 1.5MG/ML 1ML	
	OXYMORPHONE, NUMORPHAN AMP 1MG/ML 1ML	
	OXYMORPHONE, NUMORPHAN SUPP 5MG	
	OXYMORPHONE, NUMORPHAN VL 1.5MG/ML 10ML	
	OXYMORPHONE, OPANA TAB 5MG	
	OXYMORPHONE, OPANA TAB 10MG	
	OXYMORPHONE, OPANA ER TAB 5MG	
	OXYMORPHONE, OPANA ER TAB 7.5MG	
	OXYMORPHONE, OPANA ER TAB 10MG	
	OXYMORPHONE, OPANA ER TAB 15MG	
	OXYMORPHONE, OPANA ER TAB 20MG	
	OXYMORPHONE, OPANA ER TAB 30MG	
	OXYMORPHONE, OPANA ER TAB 40MG	
Pentazocine	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE PARENTERAL	
	PENTAZOCINE/ACETAMIN ORAL	
	PENTAZOCINE/ACETAMIN ORAL	
	PENTAZOCINE/NALOXONE ORAL	
Propoxyphene	PROPOXYPHENE, DARVON CAP 32MG	
	PROPOXYPHENE, DARVON CAP 65MG	
	PROPOXY/ASA/CAFF, DARVON COMPD CAP 65MG	
	PROPOXYPHENE, DARVON-N SUSP 10MG/ML 30ML	
	PROPOXYPHENE, DARVON-N SUSP 10MG/ML 5ML	
	PROPOXYPHENE, DARVON-N TAB 100MG	

	PROPOXY/ACETAMIN, DARVOCET-N TAB 100/650MG	
	PROPOXY/ACETAMIN, DARVOCET-N TAB 50/325MG	
	PROPOXY/ACETAMIN, WYGESIC TAB 65/650MG	
Tramadol	TRAMADOL, ULTRAM TAB 50MG	
	TRAMADOL/ACETAMINOPHEN, ULTRACET TAB 37.5MG/325MG	
	TRAMADOL, ULTRAM ER TAB 100MG	
	TRAMADOL, ULTRAM ER TAB 200MG	
	TRAMADOL, ULTRAM ER TAB 300MG	
Tapentadol	TAPENTADOL, NUCYNTA TAB 50MG	
	TAPENTADOL, NUCYNTA TAB 75MG	
	TAPENTADOL, NUCYNTA TAB 100MG	
	TAPENTADOL, NUCYNTA TAB ER 50MG	
	TAPENTADOL, NUCYNTA TAB ER 100MG	
	TAPENTADOL, NUCYNTA TAB ER 150MG	
	TAPENTADOL, NUCYNTA TAB ER 200MG	
	TAPENTADOL, NUCYNTA TAB ER 250MG	

Appendix 2: Morphine Milligram Equivalent (MME) Dose Conversions

Medication	Dose Equivalent*
Alfentanil (IV)	0.5 mg
Buprenorphine (IV, SQ, IM)	0.3 mg
Buprenorphine (transdermal)	0.01 mg/hr
Codeine	200 mg
Fentanyl (PO)	0.1 mg
Fentanyl (IV, SQ, IM)	0.1 mg
Fentanyl (transdermal)	60mg/day (PO) = 25 mcg/hr (TD)
Hydromorphone (IV, SQ, IM)	1.5 mg
Hydromorphone (PO)	7.5 mg
Hydrocodone (PO)	30 mg
Levorphanol (IV, SQ, IM)	2 mg
Levorphanol (PO)	4 mg
Meperidine	300 mg
Methadone (IV, SQ, IM)	10 mg
Methadone (PO)	20 mg
Morphine (IV, SQ, IM)	10 mg
Morphine (PO)	30 mg
Nalbuphine	2.5 mg
Oxycodone (PO)	20 mg
Oxymorphone (IV, SQ, IM)	1 mg
Oxymorphone (PO)	15 mg
Oxymorphone (PR)	10 mg
Pentazocine	180 mg
Propoxyphene	65 mg
Tapentadol	75 mg
Tramadol	100 mg
Remifentanil (IV)	0.1 mg
Sufentanil (IV)	0.01 mg

*Calibrated to a standard reference dose of 10mg parenteral (intravenous, subcutaneous, or intramuscular) Morphine.

Dose Conversion Formulae:

I. In order to convert two formulations of the same drug but different route of administration:

Example: Convert 20mg BID of PO Oxymorphone to IV Oxymorphone

1. First, calculate the total amount of medication over a 24 hour period: (20mg BID = 40mg/ 24 hours)
2. Second, determine the equianalgesic ratio between the two routes of administration: (15mg PO Oxymorphone = 1mg IV Oxymorphone)
3. Finally, calculate the total dose using the ratio described above: (40mg PO Oxymorphone/24 hr) * (1mg IV Oxymorphone /15mg PO Oxymorphone) = 2.67 mg IV Oxymorphone / 24 hours

II. In order to convert two formulations of the same route of administration but different drug:

Example: Convert 90 mg BID of PO Morphine to PO Tramadol.

1. First, calculate the total amount of medication over a 24 hour period: (90mg BID = 180mg/ 24 hours)
2. Second, determine the equianalgesic ratio between the two routes of administration: (30mg PO Morphine = 100mg PO Tramadol)
3. Finally, calculate the total dose using the ratio described above: (180mg PO morphine /24 hr) * (100mg PO Tramadol/30mg PO Morphine) = 600mg PO Tramadol / 24 hours

Reference: Arnold R, Weissman DE. Calculating Opioid Dose Conversions, 2nd Edition. Fast Facts and Concepts. July 2005.

Available at: <http://links.lww.com/AAP/A258>

Appendix 3: Baseline hospital characteristics, in association with the 5 morphine milligram equivalent (MME) quintiles

	<54 MMEs (N = 305,323)	54-82 MMEs (N = 305,071)	82-116 MMEs (N = 305,197)	116-173 MMEs (N = 305,264)	>172 MMEs (N = 305,130)	P-Value
Bed Size (no. [%])						p< 0.0001
<100	92,429 (5.3)	84,946 (4.9)	80,018 (4.6)	78,356 (4.4)	76,940 (4.4)	
100-199	227,083 (12.9)	217,523 (12.5)	223,734 (12.9)	219,728 (12.3)	187,272 (10.7)	
200-299	372,083 (21.2)	363,585 (20.9)	330,415 (19.0)	353,369 (19.8)	326,883 (18.6)	
300-399	327,002 (18.6)	312,555 (18.0)	309,592 (17.8)	312,402 (17.5)	325,483 (18.5)	
400-499	273,904 (15.6)	303,888 (17.5)	308,839 (17.8)	319,156 (17.9)	319,566 (18.2)	
>500	465,020 (26.5)	455,863 (26.1)	486,751 (28.0)	501,416 (28.1)	522,028 (29.7)	
Urban vs. Rural						p< 0.0001
Rural	198,625 (11.3)	192,081 (11.1)	186,677 (10.7)	191,368 (10.7)	179,345 (10.2)	
Urban	1,558,895 (88.7)	1,544,280 (88.9)	1,552,671 (89.3)	1,593,059 (89.3)	1,578,826 (89.8)	
Teaching Status (no. [%])						p< 0.0001
Yes	128,032 (41.9)	125,729 (41.2)	127,164 (41.7)	130,905 (42.9)	133,339 (43.7)	
Region (no. [%])						p< 0.0001
Midwest	375,939 (21.3)	444,334 (25.6)	452,225 (26.0)	425,768 (23.9)	393,823 (22.4)	
Northeast	403,868 (23.0)	289,308 (16.7)	272,286 (15.7)	314,839 (17.6)	322,801 (18.4)	
South	551,935 (31.4)	604,139 (34.8)	639,918 (36.8)	660,942 (37.0)	679,398 (38.6)	
West	426,686 (24.3)	398,581 (23.0)	374,920 (21.6)	382,877 (21.5)	362,150 (20.6)	
Fiscal year (no. [%])						p< 0.0001
2004	113,298 (6.5)	101,708 (5.9)	105,462 (6.1)	125,858 (7.1)	125,573 (7.1)	
2005	126,262 (7.2)	116,772 (6.7)	119,916 (6.9)	145,771 (8.2)	137,227 (7.8)	
2006	130,130 (7.4)	128,897 (7.4)	134,306 (7.7)	150,325 (8.4)	152,187 (8.7)	
2007	150,029 (8.5)	143,168 (8.3)	142,076 (8.2)	154,764 (8.7)	154,564 (8.8)	
2008	157,408 (9.0)	156,456 (9.0)	157,527 (9.1)	164,065 (9.2)	162,310 (9.2)	
2009	172,136 (9.8)	167,975 (9.7)	168,392 (9.7)	170,231 (9.5)	179,832 (10.2)	
2010	176,460 (10.0)	166,078 (9.6)	166,524 (9.6)	170,402 (9.6)	178,886 (10.2)	
2011	165,374 (9.4)	172,468 (9.9)	171,347 (9.9)	164,843 (9.2)	166,762 (9.5)	
2012	171,551 (9.8)	180,072 (10.4)	178,358 (10.3)	172,669 (9.7)	173,409 (9.9)	
2013	181,460 (10.3)	192,904 (11.1)	193,958 (11.2)	181,827 (10.2)	165,626 (9.4)	
2014	213,412 (12.1)	209,864 (12.1)	201,483 (11.6)	183,672 (10.3)	161,797 (9.2)	