Opioid Conversion Algorithm

Equianalgesic doses are approximate, and should be used only as a guideline. Dosing must be titrated to individual response. Response may vary depending on tolerance, age, renal and hepatic function, other conditions, drug interactions, and genetics. Also consider pain control at time of switch. Below is a stepwise guide for estimating opioid dose conversions.\(^1\sim4\)

1. Add up current total daily opioid dose (scheduled and “as-needed” doses).
2. Conversion involves a noninjectable fentanyl product (e.g., transdermal, transmucosal, etc), methadone, extended-release hydromorphone (Exalgo, Jurnista [Canada]), tramadol (e.g., Ultram, Ralivia [Canada]) or tapentadol (e.g., Nucynta).
3. Both opioid products involved in conversion are one of the following: morphine, oxycodone, oxymorphone, hydromorphone (not extended-release), fentanyl (not transdermal, oral transmucosal, buccal, sublingual, nasal).
4. Use equianalgesic dosing chart to calculate equivalent total daily dose of new opioid.
5. Reduce dose by 50% to help offset incomplete cross-tolerance.
6. Reduce dose further if appropriate based on age, liver function, renal function, drug interactions, baseline pain control, etc.
7. Divide daily dose based on drug/dosage form.
8. For long-acting products, prescribe short-acting product for breakthrough pain (10% to 15% of total daily dose every 1 to 2 h as needed).

**Instruct patient/caregiver:**

1. Follow instructions exactly. Do not increase dose without calling prescriber.
2. Do not use alcohol or take sedatives unless approved by prescriber.
3. Hold dose and seek medical help in the event of confusion, respiratory depression, or excessive sedation.

**Pharmacist will dispense MedGuide (U.S.) with long-acting products, methadone, and fentanyl patch and oral transmucosal, buccal, sublingual, and nasal products.**

More...
Example 1

M.K. is a 78-year-old female with severe rheumatoid arthritis and renal insufficiency (CrCl 20 mL/min). She has been taking OxyContin 120 mg twice daily for the past six months, methotrexate, and carbamazepine. Her new insurance plan will not cover OxyContin, but it will cover MS Contin. To how much MS Contin should she be switched?

1. Calculate total oxycodone dose: 120 mg x 2 = 240 mg daily.
2. Convert oxycodone to morphine using equianalgesic chart:
   \[
   \frac{\text{morphine} 30 \text{ mg}}{\text{oxycodone} 20 \text{ mg}} = \frac{\text{morphine} \times \text{mg}}{\text{oxycodone} 240 \text{ mg}}
   \]
   \[X = 360 \text{ mg morphine}\]
3. Reduce dose by 50%: 360 mg/2 = 180 mg total daily morphine dose.
   The 50% dose reduction helps account for incomplete cross tolerance, and in M.K.’s case, also renal insufficiency (morphine has a renally eliminated metabolite), age, and carbamazepine use (carbamazepine reduces oxycodone levels, but not morphine levels).
4. Divide dose as appropriate based on drug/dosage form: 90 mg every 12 hours.
5. Monitor M.K.’s response. Provide immediate-release product for breakthrough pain. Advise patient to hold dose and seek medical help in the event of sedation or confusion, and to seek emergency help in the event of respiratory depression.

*NOTE*: a conversion factor of 30 mg oxycodone=30 mg morphine could be used to arrive at an even more conservative estimate.


1. Reduce current opioid by 10% to 30%: Oxycodone 120 mg twice daily reduced by 10% to 30% = 84 to 108 mg twice daily (practically, based on available table strengths, 80 to 100 mg twice daily).
2. Start new opioid at initial dose for opioid-naïve patient or at lowest available dose: MS Contin 15 mg twice daily.
3. Patient will be on MS Contin 15 mg twice daily AND OxyContin 80 or 100 mg twice daily.
4. Reduce dose of original opioid (i.e., OxyContin) by about 10% to 25% each week, while increasing dose of new opioid (i.e., MS Contin) by about 10% to 20%, per efficacy/tolerability. Switch can be completed in 3 to 4 weeks.
5. Provide immediate-release dosage form for breakthrough pain.
What if M.K.’s prescriber had opted to switch her to *Hydromorph Contin* (Canada)?

1. Calculate total oxycodone dose: 120 mg x 2 times daily = 240 mg.
2. Convert oxycodone to hydromorphone CR using equianalgesic chart:

\[
\frac{\text{hydromorphone} \text{ 7.5 mg}}{\text{oxycodone} \text{ 20 mg}*} = \frac{\text{hydromorphone} \text{ X mg}}{\text{oxycodone} \text{ 240 mg}}
\]

\[X = 90 \text{ mg hydromorphone}\]

3. Reduce dose by 50% = 45 mg hydromorphone.
4. Divide dose as appropriate based on drug/dosage form = 24 mg q 12 hrs.

*NOTE*: a conversion factor of 30 mg oxycodone=7.5 mg hydromorphone CR could be used to arrive at an even more conservative estimate.

**Example 2**

J.J. is a 43-year-old male who has just been admitted to the rehab hospital after being released from an acute care facility for treatment of two broken legs and a broken pelvis after a motorcycle accident. He has been prescribed oxycodone 5 mg/acetaminophen 325 mg, two tablets every four hours as needed. He has been taking the maximum dose. The admitting physician is concerned about J.J.’s acetaminophen use because of his long history of alcohol abuse. Plus, the physician would like to be able to give J.J. an extra dose of pain medication before and/or after physical therapy if needed. He can’t escalate the dose of the acetaminophen combination product due to the risk of acetaminophen toxicity. Therefore, he would like to switch J.J. to immediate-release hydromorphone. How much hydromorphone should be prescribed for J.J.?

1. Calculate total oxycodone dose: 5 mg x 2 tablets x 6 times daily = 60 mg daily.
2. Convert oxycodone to hydromorphone using equianalgesic chart:

\[
\frac{\text{hydromorphone} \text{ 7.5 to 8 mg}}{\text{oxycodone} \text{ 20 mg}*} = \frac{\text{hydromorphone} \text{ X mg}}{\text{oxycodone} \text{ 60 mg}}
\]

\[X = 22.5 \text{ to } 24 \text{ mg hydromorphone}\]

3. Reduce dose by 50%: 12 mg.
   The 50% dose reduction helps account for incomplete cross tolerance.

4. Divide dose as appropriate based on drug/dosage form: 2 mg every 4 hours as needed.

5. Monitor J.J.’s response. Advise nurse to hold dose and call prescriber/on-call physician in the event of confusion, respiratory depression, or excessive sedation.

*NOTE*: a conversion factor of 30 mg oxycodone=7.5 to 8 mg hydromorphone IR could be used to arrive at an even more conservative estimate.
Users of this PL Detail-Document are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.

**Project Leader in preparation of this PL Detail-Document:** Melanie Cupp, Pharm.D., BCPS

**References**


Equianalgesic Dosing of Opioids for Pain Management

Equianalgesic doses contained in this chart are approximate, and should be used only as a guideline. Dosing must be titrated to individual response. There is often incomplete cross-tolerance among these drugs. It is, therefore, recommended to begin with a 50% lower dose than the equianalgesic dose when changing drugs and then titrate to a safe/effective response. Dosing adjustments for renal or hepatic insufficiency, cytochrome P450 drug interactions, genetics, and other conditions or medications that affect drug metabolism, kinetics, or response may also be necessary. Also consider pain control at time of switch. In general, use cautious dosing for elderly or debilitated patients, and patients with renal or hepatic impairment. Some products have specific dosing recommendations for these populations (see footnotes). See our Opioid Conversion Algorithm for instructions on converting from one opioid to another.

A website with an equianalgesic dose calculator is available at http://www.hopweb.org

<table>
<thead>
<tr>
<th>Drug</th>
<th>Equianalgesic Doses (mg)</th>
<th>Approximate Equianalgesic 24 hr Dose (Assumes Around-the-Clock Dosing)</th>
<th>Usual Starting Dose (Opioid-Naïve Adults) (Doses NOT Equianalgesic)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parenteral</td>
<td>Oral</td>
<td>Parenteral</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphine (immediate-release tablets, oral solution)</td>
<td>10</td>
<td>30</td>
<td>3-4 mg q 4 h</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Controlled-release morphine (e.g., MS Contin, Kadian)</td>
<td>NA</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Extended-release morphine (Avinza [U.S.], Embeda [with naltrexone, U.S.])</td>
<td>NA</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Drug</td>
<td>Equianalgesic Doses (mg)</td>
<td>Approximate Equianalgesic 24 hr Dose (Assumes Around-the-Clock Dosing)</td>
<td>Usual Starting Dose (Opioid-Naïve Adults) (Doses NOT Equianalgesic)</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Parenteral</td>
<td>Oral</td>
<td>Parenteral</td>
</tr>
<tr>
<td>Hydromorphone (Dilaudid)</td>
<td>1.5-2</td>
<td>7.5-8</td>
<td>0.5-0.8 mg q 4 h</td>
</tr>
<tr>
<td>Controlled-release hydromorphone (Hydromorph Contin [Canada])</td>
<td>NA</td>
<td>7.5 mg</td>
<td>NA</td>
</tr>
<tr>
<td>Extended-release hydromorphone (Exalgo, Jurnista [Canada])</td>
<td>NA</td>
<td>See footnote b.</td>
<td>NA</td>
</tr>
<tr>
<td>Oxycodone (e.g., Roxicodone [U.S.], Oxecta [U.S.], Oxy IR [Canada], also in Percocet, others)</td>
<td>NA</td>
<td>20-30</td>
<td>NA</td>
</tr>
<tr>
<td>Controlled-release oxycodone (OxyContin [U.S.], OxyNeo [Canada])</td>
<td>NA</td>
<td>20-30</td>
<td>NA</td>
</tr>
<tr>
<td>Oxymorphone (Opana [U.S.])</td>
<td>1</td>
<td>10</td>
<td>0.3-0.4 mg q 4 h</td>
</tr>
<tr>
<td>Extended-release oxymorphone (Opana ER [U.S.])</td>
<td>NA</td>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>Hydrocodone (in Lortab [U.S.], Vicodin [U.S.], others)</td>
<td>NA</td>
<td>30-45</td>
<td>NA</td>
</tr>
<tr>
<td>Drug</td>
<td>Equianalgesic Doses (mg)</td>
<td>Approximate Equianalgesic 24 hr Dose (Assumes Around-the-Clock Dosing)</td>
<td>Usual Starting Dose (Opioid-Naïve Adults) (Doses NOT Equianalgesic)</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Parenteral</td>
<td>Oral</td>
<td>Parenteral</td>
</tr>
<tr>
<td>Codeine&lt;sup&gt;a&lt;/sup&gt;</td>
<td>100-130</td>
<td>200</td>
<td>30-50 mg q 4 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlled-release codeine (Codeine Contin [Canada])&lt;sup&gt;m,n&lt;/sup&gt;</td>
<td>NA</td>
<td>200</td>
<td>NA</td>
</tr>
<tr>
<td>Methadone (&lt;em&gt;Dolophine [U.S.], Metadol [Canada]&lt;/em&gt;)&lt;sup&gt;9&lt;/sup&gt;</td>
<td>Variable</td>
<td>Variable</td>
<td>For opioid-tolerant patients only.&lt;sup&gt;14&lt;/sup&gt; The conversion ratio of methadone is highly variable depending on factors such as patient tolerance, morphine dose, and length of dosing (short-term versus chronic dosing). Because the analgesic duration of action is shorter than the half-life, toxicity due to drug accumulation can occur with just a few doses.&lt;sup&gt;35&lt;/sup&gt; For conversion methods, see <a href="http://www.cancer.gov/cancertopics/pdq/supportivecare/pain/HealthProfessional/page3">http://www.cancer.gov/cancertopics/pdq/supportivecare/pain/HealthProfessional/page3</a>. Some experts recommend that only those with substantial experience with its use should prescribe methadone.&lt;sup&gt;39,55&lt;/sup&gt;</td>
</tr>
<tr>
<td>Meperidine (&lt;em&gt;Demerol&lt;/em&gt;)</td>
<td>75</td>
<td>300</td>
<td>Should be used for acute dosing only (short duration of action [2.5 to 3.5 hours]) and neurotoxic metabolite, normeperidine.&lt;sup&gt;1&lt;/sup&gt; Avoid in renal insufficiency and use caution in hepatic impairment and in the elderly (potential for toxicity due to accumulation of normeperidine).&lt;sup&gt;1,16-18&lt;/sup&gt; Seizures, myoclonus, tremor, confusion, and delirium may occur.&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Drug</td>
<td>Equianalgesic Doses (mg)</td>
<td>Approximate Equianalgesic 24 hr Dose (Assumes Around-the-Clock Dosing)</td>
<td>Usual Starting Dose (Opioid-Naive Adults) (Doses NOT Equianalgesic)</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>Parenteral</td>
<td>Oral</td>
<td>Parenteral</td>
<td>Oral/Other</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.1</td>
<td>NA</td>
<td>All noninjectable fentanyl products are for opioid-tolerant patients only. Do not convert mcg for mcg among fentanyl products (i.e., patch, transmucosal lozenge [Actiq (U.S.)], buccal tablet [Fentora (U.S.)], buccal film [Onsolis], nasal spray [Lazanda (U.S.)], sublingual tablet [Abstral]). See specific product labeling (U.S.: Drugs@FDA; Canada: Health Canada Drug Product Database) for dosing. Or, for U.S. products only, see our PL Chart, Fentanyl Products for Breakthrough Pain. Some experts use this conversion in cancer patients: oral morphine 60 mg total daily dose = 25 mcg/hr fentanyl patch. Round up or down based on patient factors and available patch sizes.</td>
</tr>
</tbody>
</table>

*NA = not available.*

Most of the above oral opioids are available as generics. Exceptions (prices are AWP [U.S.]) include: Kadian ($6.63/30 mg cap), Avinza ($5.45/30 mg cap), Opana ($6.53/10 mg tab), Opana ER ($4.35/10 mg tab), OxyContin ($2.43/10 mg tab), Embeda ($4.98/20 mg cap), and Exalgo ($8.99/8 mg). As a comparison, generic morphine controlled-release = $1.69/30 mg tab.

a. Product labeling for hydromorphone recommends a starting dose of 0.2 mg to 1 mg IV every two to three hours (Canadian labeling: 2 mg IV every four to six hours) as needed, or 2 mg to 4 mg orally every four to six hours as needed. Some institutions use even lower doses of parenteral hydromorphone (e.g., 0.2 mg to 0.5 mg every two hours as needed). One regimen starts opioid-naive patients at 0.2 mg IV every two hours as needed for mild or moderate pain, with the option in moderate pain to give an extra 0.2 mg after 15 minutes if relief is inadequate after the first 0.2 mg dose. For severe pain, 0.5 mg IV every two hours as needed is used initially. In adults <65 years of age, the 0.5 mg dose can be repeated in 15 minutes if relief is inadequate, for a maximum of 1 mg in two hours.

b. Per the product labeling, convert to Exalgo 12 mg from oral codeine 200 mg, hydrocodone 30 mg, morphine 60 mg, oxycodone 30 mg, oxymorphone 20 mg, or transdermal fentanyl 25 mcg/hr. After 50% dose reduction for incomplete cross-tolerance, reduce dose again by 50% for moderate renal impairment, and by 75% for severe renal or moderate hepatic impairment. Not for use in severe hepatic impairment. The Jurnista product monograph recommends a 5:1 oral morphine:oral hydromorphone conversion ratio.

c. Per the product labeling, oral oxymorphone 10 mg ER is approximately equivalent to hydrocodone 20 mg or oxycodone 20 mg.

d. Dilaudid Canadian monograph recommends parenteral starting dose of 2 mg. See footnote “a” for additional information and precautions.
e. No initial dose for Exalgo. For opioid-tolerant patients only.\textsuperscript{13} Initial Jurnista dose (opioid-naïve or <40 mg daily oral morphine equivalents) is 4 to 8 mg q 24 h.\textsuperscript{19}

f. Tramadol (e.g., Ultram, Ralivia [Canada]), potency is about one-tenth that of morphine, similar to codeine.\textsuperscript{1} The maximum daily dose of tramadol is 300 mg to 400 mg, depending on the product.\textsuperscript{22-28,36,37} See product labeling for dosing in elderly, or in renal or hepatic dysfunction.

g. Examples of doses seen in clinical practice, taking into account available dosage strengths.

h. Labeling for some products (MS Contin [U.S.], Kadian, Jurnista [Canada]) recommends beginning treatment with an immediate-release formulation.\textsuperscript{6,19,21,29}

i. Tapentadol controlled-release (Nucynta CR, Canada) and oxycodone controlled-release exhibit comparable pain relief in a dose ratio of 5:1 (tapentadol:oxycodone).\textsuperscript{31} The maximum dose of tapentadol CR is 250 mg twice daily.\textsuperscript{31} No specific dose conversion is given for Nucynta (U.S.), Nucynta IR (Canada) and Nucynta ER (U.S.).\textsuperscript{32,33} Not for use in severe in renal or hepatic dysfunction.\textsuperscript{31-33,38}

j. Some experts do not recommend for chronic pain in opioid-naïve patients.\textsuperscript{14}

k. The initial dose of transdermal buprenorphine (Butrans) for patients taking less than 30 mg of oral morphine or equivalent per day is a 5 mcg/hr patch applied once weekly (Canada: start with 5 mcg/hr patch in opioid-naïve patients, and 5-10 mcg/hr patch in patients taking up to 80 mg oral morphine equivalents per day). U.S.: When converting from 30 to 80 mg of morphine equivalents daily dose, first taper to 30 mg oral morphine equivalents, then start with the 10 mcg/hr patch.\textsuperscript{34} The maximum dose is 20 mcg/hr patch once weekly.\textsuperscript{54,47}

L. Parenteral morphine 10 mg is approximately equal to parenteral pentazocine 60 mg, oral pentazocine 180 mg, parenteral butorphanol 2 mg, and parenteral nalbuphine 10 mg.\textsuperscript{49} For buprenorphine transdermal patch (Butrans), see footnote “k.” The analgesic efficacy of these drugs is limited by a dose ceiling. Furthermore, the mixed agonists-antagonists (i.e., pentazocine, butorphanol, nalbuphine) are contraindicated for use in patients receiving an opioid agonist because they can precipitate withdrawal and increase pain. They also pose a risk of psychotomimetic effects.\textsuperscript{1}

m. Reduce dose by 25% when switching from oral codeine phosphate to account for phosphate content of tablet.\textsuperscript{49}

n. Analgesic efficacy limited by a dose ceiling.\textsuperscript{56,49}

o. Relatively safe choice in renal or liver insufficiency.\textsuperscript{54,55}

p. Relatively safe choice in renal or liver insufficiency.\textsuperscript{55} Clearance reduced by uremia.\textsuperscript{54} Do not start with patch in renal or liver failure.\textsuperscript{54} Watch for delayed toxicity.\textsuperscript{54,55}

q. Opana ER has received a notice of compliance (June 2012) by Health Canada. At time of publication, it is not yet available on the Canadian market.

r. Start with an oral dose of 5 mg q 4-6 h for opioid-naïve elderly or opioid-naïve patients with renal or liver impairment.\textsuperscript{44}
