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## PAIN TOPICS

### Converting Opioid Analgesics, Part II: Review of Equianalgesic Conversion Calculators 2<sup>nd</sup> Revised Version

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In [Part I](#) of "Converting Opioid Analgesics" we discussed and practiced using equianalgesic tables. As noted there however, even when consistently using an equianalgesic table and simple formulae you still have to "do the math." In Part II we review the available equianalgesic conversion calculators.

There are six calculators currently available via the World Wide Web; I am unaware of any other sources. There are dramatic differences in cost, quality, complexity, and features among the 6. For example, 4 of the 6 provide for transdermal fentanyl conversions; only one provides for intrathecal conversions; one permits the user to choose the equianalgesic table upon which calculations are based; one calculates dose conversions with or without a reduction for incomplete cross tolerance; four are available for Palm operating system (Palm OS) handhelds, but only one for the Pocket PC; three display the actual conversion table. None of the calculators have all of these features, and all of them miss a few that seem important to me.

1. [MedCalc](#) (*this product is unchanged from the original in 2002*).

This calculator is the least clinically useful of those reviewed.

- ↓ Inconsistent use of generic and brand names.
- ↓ Dangerously confusing when the brand name for fentanyl is listed as Duragesic, yet the duration of analgesia is listed as 1- 2 hours, route is IV/IM and dosing is only available in mg, and not mcg. There is a similar mislabeling problem with oxycodone/Oxycontin.
- ↓ Another safety issue is that you can calculate an equianalgesic dose, then change the "Convert to:" drug, but the value of the previous "Convert to:" continues to be displayed until the 'Calculate' is clicked again.
- ↓ Only one drug may be converted at a time, so that if the patient is on more than one opioid, calculation by hand is still required.
- ↓ No other information or warnings are included—this is just a calculator.
- ↓↑ Opioids not commonly used in cancer or chronic pain management, such as opioid agonists/antagonists are included in the drug list, but combination products are not acknowledged.
- The morphine IV:PO ratio is 1:6, appropriate for opioid naïve patients, but other calculators use 1:3, more appropriate for prolonged use.
- ↑ Content source is listed: Tarascon Pocket Pharmacopoeia.
- ↑ When a drug is selected only appropriate routes are displayed.
- ↑ Cost: Can be used free on the web.

2. [PainSTAT](#) (*this product is unchanged from the original in 2002*).

This calculator was designed for the Palm OS. It is available for download from the Palm web site. There is no PC-based version. The calculator is easy to use but is very limited in drug and dose selection. The calculator is reviewed on the End of Life Physician Education Resource Center ([EPERC](#)) web site (free registration required): Register on the site, enter PainStat in the Search window, then click the PainStat title.

- ↓ Percocet and Tylenol #3 are considered as the same drug for purposes of calculation—not an egregious error, but sloppy programming. It should have been easy to enter another line or two of code for the second drug. More importantly, the calculator has not kept up with the fact that there are now 4 dose levels of Percocet available.

- ↓ Only a handful of drugs and formulations are available in the calculator. For example, the only oral morphine is MS Contin, there is no oral Dilaudid or hydrocodone, and parenteral morphine and Dilaudid are only offered as continuous infusion.
- ↓ Only brand names are used (except for morphine).
- ↓ Only one drug may be converted at a time, so that if the patient is on more than one opioid, calculations by hand are still required.
- ↑ Helpful information about management is included with the calculation. For example, there is a warning not to use Demerol chronically, and breakthrough doses are recommended.
- ↓ Content source is not listed.
- ↑ Cost: Shareware--\$20 after a free trial period

### 3. [GlobalRPh](#) (updated 26 Jan 2004)

There are 3 related products for opioid conversions: a free [web-based calculator](#); an inexpensive [Windows PC-based version](#); and an inexpensive [Palm OS/Pocket PC PDA \(handheld\) version](#). There is no bundled price for buying both the Windows and a PDA version. This is the only product currently available with both PC and PDA, and the only product with PDA versions for both the Palm and Pocket PC operating systems. The previously separate transdermal fentanyl calculator has been incorporated into the Windows and PDA versions.

#### **Web-based version:**

- ↓ Only one drug may be converted at a time, so that if the patient is on more than one opioid, calculations by hand are still required.
- ↓↑ The equianalgesic table upon which calculations are based is displayed
- ↑ A unique feature is the inclusion of half-life in the table.
- ↓ Has propoxyphene in the table, but not the calculator.
- ↓ Cannot convert to or from transdermal fentanyl.
- All dosing is in 24 hour equivalents.
- ↑ Cost: Can be used free on the web

#### **PC version:**

- ↑ Up to 3 concurrent opioids can be converted to a single alternative agent
- ↑ All calculations display the oral morphine equivalent of the selected drug and dose
- ↑ The equianalgesic table upon which calculations are based is not only available for every calculation, but can be modified by the user.
- ↑ Calculations can be made with or without a reduction to account for incomplete cross-tolerance; the user can choose the percentage reduction from a drop-down list.
- ↑ For conversions to methadone, the user may choose either of 2 options for calculating a dose conversion and clinical management method. ↓ The instructions for use can be confusing for a clinician not experienced in methadone conversions.
- ↑ ↓ After completing the calculation, the user can click a “View Summary” button that opens a separate window to a printable page summarizing the transaction. The “Back” button on the window does not work. If you close the View Summary window, an identical window behind it is revealed on which the “Back” button is functional. However, the page to which you are “returned” has none of the values previously entered—so you had better print the summary page, or lose your work. Interestingly, the Summary window does not display the calculated oral morphine equivalents.
- Transdermal fentanyl dose is automatically calculated and displayed for every opioid conversion (when guidelines for such a conversion have been published).
- ↓ There are no warnings provided about excessive meperidine dosing
- ↓ Propoxyphene, available in the previous version, has been removed from the calculator.
- ↓ Levorphanol, available in the previous version, has been removed from the calculator.
- ↑ Conversions based on acute (or opioid naïve) vs chronic use of morphine and methadone may be specified.

- ↴ No consideration or warning related to use of combination products (e.g., oxycodone 5mg/acetaminophen 650) is included.

**PDA versions** (same features as PC version, except):

- ↴↕ Cannot perform a direct conversion to or from transdermal fentanyl (transdermal fentanyl does not appear in the drug selection drop-down windows), although a morphine – transdermal fentanyl table is available. The equivalent transdermal fentanyl dose can be determined indirectly by selecting any other drug to ‘convert to:’ transdermal fentanyl is automatically calculated and displayed for every drug conversion (when guidelines for such a conversion have been published).
- No printable summary available.

#### 4. [Talaria](#) (updated 26 Jan 2004)

Talaria is the oldest of the web-based calculators. Version 2.0 is reviewed here, though the [first version](#) is still available. It was originally designed to support the AHCPR cancer pain guidelines. It has since added the American Pain Society equianalgesic table, which is slightly different. The management of the site has moved from the University of Washington to the University of Utah. As of this writing in late January 2004, the site appears to be live, but the calculator is non-functioning, so the following is based on the July 2003 review.

- ↕ Lets the user specify the AHCPR or APS table for use in calculations.
- Until a different drug is selected all conversions default to the equianalgesic dose of parenteral morphine.
- ↴↕ Contains a table showing the dose ratio of all drugs to the equianalgesic dose of morphine. This should be useful, but the ratios in some cases are carried to 8 decimal places. Those that don't have multiple decimal places inexplicably have a trailing zero to the right of the decimal. This is considered poor practice in today's environment of error prevention.
- ↴↕ For new users, a “calculator tour” is available, but it doesn't work very well.
- ↴ A confusing feature is that the current drug (the one that is to be converted) is referred to as the “proposed drug” and the drug selection window instructs you to “select a new drug.”
- ↕ Several concurrent opioids can be entered for conversion to a single alternative agent.
- ↕ Current PRN medications can be included, but the estimated 24 hour intake must be entered.
- ↕ Cost: can be used free on the web.

#### 5. [Cynergy Group](#) (updated 26 Jan 2004)

*There are no apparent changes to the software since the original review in 2002. However, in mid-2003, Cynergy Group ceased providing new subscriptions to any of the versions of the calculator. The Palm OS version is now available for online download through a 3<sup>rd</sup> party vendor, [CollectiveMed.com](#).*

This calculator is the most complete and the most professional looking of those reviewed. It was developed by Stuart DuPen, MD a well-known anesthesiologist and pain management specialist who invented the implanted DuPen epidural catheter. His wife, Anna DuPen, ARNP, a pain management nurse, collaborated in the development of the product. It has more features than the others reviewed, yet remains relatively easy to use. Web, PC, institutional network (“site”), and Palm OS versions have been produced (NOTE: as of this writing in January 2004, only the [Palm OS version](#) is currently available). The calculator is [reviewed](#) on the End of Life Physician Education Resource Center ([EPERC](#)) web site (free registration required). HINT: type “calculator” in the search window.

- ↕ Up to 5 opioids in the patient's current regimen can be converted in a single calculation.
- ↕ Current PRN medications can be included, but the estimated 24 hour intake must be entered.
- ↕ A preplanned titration schedule, based on percentage of current dose, can be calculated (not available on the Palm OS version).
- ↕ ↴ Displayed conversion values include a dose reduction to account for incomplete cross-tolerance; the user can choose a straight conversion without the recommended reduction. The user cannot adjust the percentage reduction.
- ↕ When a route is selected only appropriate drugs are displayed.
- ↕ Easy-to-follow written instructions for each version may be viewed on-screen or printed out.

- ⤴ All calculations display the oral morphine equivalent of the selected drug and dose
- ⤵⤴ References are listed in a bibliography
- ⤵ For the web version, there is an annoying time-out feature, the length of which is not controllable by the user.
- ⤴ The drug list includes a complete listing of combination products. It also contains oral transmucosal fentanyl, unique among opioid conversion calculators.
- ⤴ When acetaminophen-containing combination products are entered, daily acetaminophen doses are automatically calculated and displayed; high daily doses also produce a warning.
- ⤵⤴ There are warnings that meperidine and propoxyphene are not recommended for chronic use, but the calculator assumes chronic use and will not provide a conversion.
- ⤴ A well-organized report on each conversion may be printed out; in some settings this report could be entered into the patient record as partial documentation of the pain management regimen (not available on the Palm OS version).
- ⤴ Routes not specified by any of the other calculators are provided: epidural, intrathecal, rectal, transmucosal.
- ⤴ Having a PC and hand-held version of the same calculator is a significant advantage in a large practice or institutional setting. Not only does it address the differing hardware and style preferences of potential users, but should produce consistent results—a critical practice and safety element.
- ⤵⤴ Cost: Not bad for what you get, but significantly more expensive than competitors with less muscle: Palm OS \$99; one year subscription; includes updates during the subscription year.

6. [Hopkins Opioid Program](#) (*this product is unchanged since it was added in the April 2003 revision*).

This Palm OS opioid conversion calculator may be the oldest computer-based opioid calculator. The Hopkins Opioid Program (HOP) has been used on [Johns Hopkins Oncology Center](#) computers since 1984, and was marketed in the early 1990's as a DOS-based program by a medical publishing house. The Palm OS version was released in December 2002 and is available for free download. An upgraded Palm OS 5 version is scheduled for release in January 2004. A Windows platform version for desktop computers, and a Windows CE version for tablet computers, are in development.

- ⤴ Up to 3 opioids in the patient's current regimen can be converted in a single calculation.
- ⤴ ⤵ A scroll-through table displays the oral/parenteral relative potencies of the major opioids. The table is labeled "Opioid Equivalency Table"
- ⤴ Clinical warnings are available for all drug combinations.
- ⤴ ⤵ A scroll-through table of commercially available formulations of major opioids is provided. However, the Palm OS "scroll" is actually an incremental jumping down a page. This may result in jumping to a part of the screen that displays the dosage forms of one drug and the name of a different drug.
- ⤵ Hydrocodone does not appear in the Hopkins calculator
- ⤴ Limitations of equianalgesic studies and the use of standardized conversions are explained in the User's Manual.
- ⤴ References are provided in the User's Manual.
- ⤴ ⤵ Guidelines are provided in the Warning for breakthrough (rescue) doses and for dose reduction to account for incomplete cross-tolerance, but these calculations are not available within the program.
- ⤴ The mathematical equation and conversion factor is available for each calculation
- ⤴ The "Parenteral Morphine Equivalent" of all drug doses is always displayed, making explicit that morphine is the reference drug for all opioid equivalents.
- ⤵ Combination products (e.g., hydrocodone/ibuprofen; oxycodone/acetaminophen) are not included.
- ⤵ Not all handhelds use the Palm OS system, and not all practitioners use a handheld. The anticipated Windows version will be a welcome addition.

- ↑ Cost: Free download from the Hopkins Oncology web site. Free registration and a first-time use of a registration code are required.

### **PDA-Based Opioid Conversion Calculators**

The personal digital assistant (PDA) or handheld computer is enjoying steadily growing popularity among clinicians in all disciplines. Point-of-care reference works (such as drug libraries) and tools (such as medical calculators) are replacing some of the bulky handbooks and cards that have distorted the pockets of so many clinical jackets. It is not surprising therefore, that there are now 4 opioid conversion calculators available for the PDA, 3 of which may have broad clinical appeal.

The PDA cannot match the functionality of a computer with a mouse and keyboard, particularly when it comes to entering data. However, the available opioid conversion calculators for the PDA can be quite useful in clinical practice because of their portability. This convenient platform supports consistent (and therefore potentially safer) practice especially when clinicians in the same practice or institution use the same method for rotating opioids and calculating equianalgesic doses. There has been no research on the clinical impact of these tools. It would be very beneficial to have data on usability as well as impact on the delivery of care (issues such as time required to use the tool and promotion of the use of consistent guidelines) and patient outcomes. It is yet to be determined, for example, whether these tools are more useful for training or for daily clinical practice, or which health care disciplines will find them most useful.

There are three PDA opioid calculators available. As of this writing there is no opioid conversion calculator for Macintosh products. The GlobalRPh calculator (Table 1, page 8) is the only product currently available for both Windows PCs and a PDA, and the only one for both the Palm OS and the Pocket PC. A constant dilemma in software development is the determination of the minimum functionality needed to make a tool useful, and whether more (more features, more detail) is necessarily better. For example, the more you expect and instrument to do, the more data you are likely to need to input. If it is too simple however, additional calculations and decisions will need to be made “off line.” As with other software acquisition decisions, multiple factors must be considered in choosing an application for personal or institutional use. A side-by-side comparison of the available PDA calculators is provided in Table 1, page 8.

The Hopkins calculator is free; the GlobalRPh and Cynergy calculators have free trial periods. I strongly recommend testing all three before making a final choice.

### **Summary**

The Cynergy Group calculator may be the best of those reviewed, because of its comprehensiveness. It is easy to use, provides clinically relevant calculations for a large number of opioids, provides relevant warnings and information, and minimizes the mental and paper-pencil calculations that must be done. Not surprisingly, it is the most expensive of those surveyed. The Hopkins Oncology Program and GlobalRPh calculators are not as elegant or complete as the Cynergy Group calculator, but are very serviceable, easy to learn and use, and inexpensive (the Hopkins calculator is free).

What would make these (and future) opioid conversion calculators better?

- In an institutional setting, similar calculators should be integrated into prescriber order entry (POE) systems, rather than requiring that these computations be done with a separate software program. They should also be available in documentation software, to facilitate clinical planning.
- Short of that, a longitudinal computerized patient record of pain management prescriptions would be extremely useful when contemplating opioid rotation.
- Include all opioids and NSAIDs for which published conversions are available
- Make clear the source of all conversion factors.

- Permit the user to substitute conversion factors that are more clinically relevant for a particular setting or patient, or as research refines the conversion process.
- Permit the user to adjust the dose for incomplete cross-tolerance, and to select the percent reduction.
- Permit the user to reduce screen clutter by “hiding” drugs that are not used in a particular practice.
- Some drugs (morphine, levorphanol, methadone) have different published equivalencies for acute vs chronic use. GlobalRPh is the only calculator that takes this into consideration in its drug tables, although the HOP program printed instructions (“User’s Manual”) and the software itself provide an explicit warning.
- When combination products are used, the total daily dose of acetaminophen, ibuprofen, or aspirin should be displayed with appropriate warnings. The Cynergy calculator automatically calculates acetaminophen dosing with combination products, but not ibuprofen or aspirin.
- Safety warnings should be automatically displayed. This is a controversial topic in the software development industry. Expert practitioners don’t like or need repeated warnings, but non-experts may not take the active step of clicking or scrolling to a warning.
  - Warnings should always be no more than a single click or scroll away, and the link should be obvious.
  - First time conversions of any drug combination should display the appropriate warnings associated with the particular drugs.
  - After that first warning display, the user should have the option to turn off automatic warnings for that combination. This puts the clinical judgment in the hands of the practitioner, not the software developer. If there are multiple users on the same computer or system, each user must be able to choose to view or not view the warnings.
- Recommend a drug and dose for breakthrough pain; permit the user to adjust the percentage by which breakthrough doses are calculated.
- Let the prescriber (not the software) decide if “not recommended” drugs will be used in a particular case.
- Consideration for pediatric dosing should be incorporated.
- Dose adjustment recommendations for those with impaired hepatic or renal function should be incorporated.
- Methadone conversions are particularly controversial and complex. All calculator designers should consider the GlobalRPh approach of providing optional conversion methods.
- Future products should work on the widest possible number of platforms
- An unsafe scenario for all of these calculators: I can enter a medication and dose (ex. oral hydrocodone 10mg), then realize that I have selected the wrong drug. When I change the drug name to, for example, hydromorphone, the same 10 mg dose is still displayed. This can potentially lead to an overdose. Safety feature: when a drug name is changed, all previously entered information (e.g., route, dose) should be cleared from their respective fields.S

A comment in the EPERC review of the PainSTAT calculator can be applied to all equianalgesic dosing tools: “a physician or nurse needs to have a good understanding of pain management and equianalgesic conversions before using this tool. This tool should not replace the need for education in the area of equianalgesic dosing.” On the other hand, I must take issue with the reviewer of the Cynergy Group calculator who suggested that “inexperienced users may not use this enough to justify the cost of the program, experienced users probably don’t need it.” David W. Bates, MD, of Brigham and Women’s Hospital, and others have provided ample evidence that POE increases the quality of care and decreases the risk of errors in medication prescribing and management. Even if these stand-alone calculators do not rise to the level of POE, they are a major conceptual step in the right direction and should be used even by experienced practitioners. Importantly, they promote standardization and consistency of practice within an institution or practice, and provide additional training opportunities for all clinicians as well as.

URL notes: **Hold your cursor over the link for a second to see the URL.** If you are reading this in hard copy or PDF, the PAIN TOPICS links are:

Part I of Converting Opioid Analgesics: [http://www.massgeneral.org/painrelief/prcvol1\\_6.PDF](http://www.massgeneral.org/painrelief/prcvol1_6.PDF)

MedCalc: <http://www.medcalc.com/narcotics.html>

PainSTAT: <http://www.palmgear.com/software/showsoftware.cfm?sid=66DF4DBD-9D3B-4B20-850FE3B3A1143361&prodID=12486>

PainSTAT review:

[http://www.eperc.mcw.edu/edmats/detail.cfm?matl\\_id=312&query\\_id=20474&srchType=resource&secSrchType=search&sessn\\_id=2649666808251339827346133](http://www.eperc.mcw.edu/edmats/detail.cfm?matl_id=312&query_id=20474&srchType=resource&secSrchType=search&sessn_id=2649666808251339827346133)

GlobalRPh: <http://www.globalrph.com/narcoticonv.htm>

Talaria (V2.0): <http://www.painresearch.utah.edu/cancerpain/calculatorJ20.html>

Talaria (V1.5): <http://www.talaria.org/calculatorJ15.html>

Cynergy Group PDA calculator, available through CollectiveMed.com: <http://www.collectivemed.com/jump/opioi.shtml>

Cynergy Group calculator review:

[http://www.eperc.mcw.edu/edmats/detail.cfm?matl\\_id=272&query\\_id=14249&srchType=resource&secSrchType=search&sessn\\_id=5411596935516430464187717](http://www.eperc.mcw.edu/edmats/detail.cfm?matl_id=272&query_id=14249&srchType=resource&secSrchType=search&sessn_id=5411596935516430464187717)

EPERC: <http://www.eperc.mcw.edu>

Hopkins Opioid Program:

<http://www.hopkinskimmelcancercenter.org/specialtycenters/hop.cfm?action=2&errorcheck=nobookmark>

Johns Hopkins Oncology Center: <http://www.hopkinskimmelcancercenter.org>

**Table 1: Comparison of PDA-based opioid conversion calculators**

	<u>Hopkins</u>	<u>GlobalRPh</u>	<u>Cynergy Group</u>
Morphine equivalents (ME) displayed	Parenteral ME	Oral ME	Oral ME
Conversion factor choice	No choice	User may edit table	No choice
Conversions for:			
transdermal fentanyl	Yes	Yes	Yes
transmucosal fentanyl	No	No	Yes
methadone	Yes	Yes	Yes
hydrocodone	No	Yes	Yes
levorphanol	Yes	No	Yes
combination products	No	No	Yes
meperidine	Yes	Yes	<u>Convert from</u> , only
propoxyphene	No	No	<u>Convert from</u> , only
<u>Convert to methadone method</u>	No choice	Choose 1 of 2 methods	No choice
Alternate routes (IT, EP, etc.) addressed	Oral, parenteral, transdermal, only	Oral, parenteral, transdermal, only	All
Available formulations addressed	No	No	Yes
List of opioids available for performing calculations	All-in-one drop down list	All-in-one drop down list	When route selected, only appropriate drugs displayed
Equianalgesic table displayed	No	Yes	No
Acute vs chronic dosing for morphine	No	Yes	No
methadone	No, but discussed in User's Manual	Yes	No, but discussed in instructions
Interface			
Dose entry	Tap in using application's virtual buttons	Use "graffiti;" or tap in using OS's virtual buttons	Use "graffiti;" or tap in using OS's virtual buttons; entry value limited to 3 digits
Drop-down windows	Large: minimal scrolling	Very small: lots of scrolling	All content visible: no scrolling required
Clinical alerts, reminders, limits			
meperidine	No	No	Yes; no <u>convert to</u> function
methadone	Yes (in User's Manual)	Yes	Yes
transdermal fentanyl	Yes (in User's Manual)	Yes	Yes
acetaminophen dose	No	No	Yes
cross-tolerance	No	Yes	Yes
breakthrough dose	No	Yes	No
Dose reduction for cross tolerance available	No	User chooses % reduction	Yes/No choice: if Yes, application chooses % reduction
References cited	Yes (User's Manual)	Yes (web site)	
Can convert concurrent opioids to a single alternative	Up to 3 different opioids	Up to 3 different opioids	Up to 5 different opioids
Instructions available	Yes (User's Manual)	Yes (in application & on website)	Yes (web site)
Platform	Palm OS only (others in development)	Web; Windows; Palm OS; Pocket PC	Palm OS only (web and Windows versions currently not available)
Cost	Free	14-day free demo Web (limited version): Free Windows: \$24.95 PDA: \$16.95	30-day free demo \$99/year
Other		Transdermal fentanyl conversion displayed for every calculation (when guidelines available)	User may choose drug list display: all drugs, generic only, trade only

Source:

Hopkins: <http://www.hopkinskimmeltcancercenter.org/specialtycenters/hop.cfm?action=2&errorcheck=nobookmark>

GlobalRPh (PDA version): [http://www.globalrph.com/narcotic\\_pda.htm](http://www.globalrph.com/narcotic_pda.htm)

GlobalRPh (Windows version): [http://www.globalrph.com/narcotic\\_converter.htm](http://www.globalrph.com/narcotic_converter.htm)

Cynergy: <http://www.collectivemed.com/jump/opioi.shtml>