Analyzing Opioid Prescriptions in Medicare Part D: Issues, Tools, and Techniques

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Disclaimers

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Learning objectives

- Summarize the process for linking National Drug Codes (NDCs) to RxNorm in the Medicare Part D data set
- List issues in identifying opioid drugs in drug classification systems, such as ATC
- Demonstrate how to calculate the daily dose and morphine equivalents for oral and other dosage forms
Self-Assessment Question 1

Which type of information can be found in claims data, such as Medicare Part D dataset?

- A. Patient name and address
- B. ATC class (from the Anatomical Therapeutic Chemical drug classification)
- C. “NDC codes” (from the National Drug Code directory)
- D. Days supply
- E. Quantity dispensed
Self-Assessment Question 2

• TRUE/FALSE: Medications can belong to only one ATC class?
  – A. True
  – B. False
Self-Assessment Question 3

• Conversion to oral morphine milligram equivalent
  – A. Enables comparison between daily doses of opioid drugs
  – B. Can be done by multiplying the unit strength by a factor, regardless of the dose form
  – C. Is required for characterizing the global evolution of opioid doses over time
  – D. Is required for characterizing differences in opioid doses dispensed across geographic areas
  – E. All of the above
Outline

• Introduction
  – RxNorm and the Medicare Part D dataset
  – Use case (analysis of opioid prescriptions)
    – Follow-along activity with RxNav
• How to link NDCs to RxNorm and ATC?
  – Identifying opioid drugs from a drug class – ATC
  – How to handle obsolete NDCs
    – Follow-along activity with RxClass
• Calculating the daily dose in oral morphine milligram equivalent
• Discussion of results from larger-scale analysis
Introduction
RxNorm

- Standard drug terminology
- Developed by the National Library of Medicine
- Integrates 13 drug vocabularies (interoperability)
- Scope
  - Prescription drugs (U.S. market)
  - Only terminology (not a drug knowledge base)
- Updated monthly
- Use cases
  - E-prescribing
  - Information exchange
  - Formulary development
  - Reference value sets
  - Analytics

https://www.nlm.nih.gov/research/umls/rxnorm/
## Normalization Lexical level

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<thead>
<tr>
<th>Name</th>
<th>Code</th>
<th>Source</th>
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<tr>
<td>WARFARIN (COUMADIN) NA 1MG TAB</td>
<td>4005203</td>
<td>VANDF</td>
</tr>
<tr>
<td>warfarin 1 mg oral tablet</td>
<td>3617</td>
<td>MMSL</td>
</tr>
<tr>
<td>WARFARIN NA 1MG TAB,UD</td>
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<td>VANDF</td>
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<tr>
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<td>NDFRT</td>
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<td>WARFARIN SODIUM 1 mg ORAL TABLET</td>
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<td>NDDF</td>
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<td>MTHSPL</td>
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<td>MMX</td>
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<td>WARFARIN SODIUM 1 mg ORAL TABLET</td>
<td>63629-4017</td>
<td>MTHSPL</td>
</tr>
<tr>
<td>WARFARIN SODIUM 1 mg ORAL TABLET [Warfarin Sodium]</td>
<td>53808-0985</td>
<td>MTHSPL</td>
</tr>
<tr>
<td>Warfarin Sodium 1 MILLIGRAM In 1 TABLET ORAL TABLET</td>
<td>15330-100</td>
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<td>GS</td>
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<td>Warfarin sodium 1mg tablet (product)</td>
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<td>SNOMEDCT_US</td>
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<td>MDDB</td>
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<tr>
<td>Warfarin Sodium, 1 mg oral tablet</td>
<td>3617</td>
<td>MMSL</td>
</tr>
<tr>
<td>WARFARIN SODIUM@1 mg@ORAL@TABLET</td>
<td>14198</td>
<td>NDDF</td>
</tr>
</tbody>
</table>

[...]
RxNorm drug model

Generic drug entities

- Ingredient
  - Azithromycin

Branded drug entities

- Brand Name
  - Zithromax

C. Drug Comp.
- Azithromycin 250 MG
C. Drug Form
- Azithromycin Oral Tablet
B. Drug Comp.
- Azithromycin 250 MG
B. Drug Form
- Azithromycin Oral Tablet [Zithromax]

C. Drug
- Azithromycin 250 MG Oral Tablet

B. Drug
- Zithromax 250 MG Oral Tablet

G. Pack
- {6 (Azithromycin 250 MG Oral Tablet)} Pack
B. Pack
- Z-PAK

Definitional features
- Ingredient/Brand name
- [Navigational entities]
  - Drug Comp. = Ingredient + strength
  - Drug Form = Ingredient + dose form
- [Drug products (individual)]
  - Ingredient + strength + dose form (+ optionally Quantity Factor and Quality Distinction)
- [Drug products (collective)]
  - Collections of generic/branded drugs
### Azithromycin [RxCUI = 18631]

**IN/INN**
- **Ingredient (1)**
  - H R x S Azithromycin

**Precise Ingredient**
- Rx S AZITHROMYCIN ANHYDROUS
- Rx S Azithromycin Dihydrate
- Rx S Azithromycin Monohydrate

**BN**
- **Brand Name (3)**
  - H R x S AzaSite
  - H R x S Zithromax
  - H R x S Zmax

**Clinical Drug Component**
- **Clinical Drug Component (8)**
  - H R x S Azithromycin 10 MG/ML
  - H R x S Azithromycin 1000 MG
  - H R x S Azithromycin 20 MG/ML
  - H R x S Azithromycin 250 MG
  - H R x S Azithromycin 33.3 MG/ML

**Branded Drug Component**
- **Branded Drug Component (8)**
  - H R x S Azithromycin 10 MG/ML [AzaSite]
  - H R x S Azithromycin 1000 MG [Zithromax]
  - H R x S Azithromycin 20 MG/ML [Zithromax]
  - H R x S Azithromycin 250 MG [Zithromax]
  - H R x S Azithromycin 33.3 MG [Zmax]

**Clinical Drug or Pack**
- **Clinical Drug or Pack (14)**
  - H R x S Azithromycin 10 MG/ML Ophthalmic Solution
  - H R x S Azithromycin 1000 MG Powder for Oral Suspension
  - H R x S Azithromycin 20 MG/ML Oral Suspension
  - H R x S Azithromycin 250 MG Oral Capsule
  - H R x S Azithromycin 250 MG Oral Tablet

**Branded Drug or Pack**
- **Branded Drug or Pack (11)**
  - H R x S AzaSite 1 % Ophthalmic Solution
  - H R x S TRI-PAK
  - H R x S TRI-PAK
  - H R x S Zithromax 1 GM Powder for Oral Suspension
  - H R x S Zithromax 20 MG/ML Oral Suspension

**Clinical Dose Form Group**
- **Clinical Dose Form Group (6)**
  - H R x S Azithromycin Injectable Product
  - H R x S Azithromycin Ophthalmic Product
  - H R x S Azithromycin Oral Liquid Product
  - H R x S Azithromycin Oral Powder Product
  - H R x S Azithromycin Oral Product

**Dose Form Group**
- **Dose Form Group (6)**
  - H R x S Injectable Product
  - H R x S Ophthalmic Product
  - H R x S Oral Liquid Product
  - H R x S Oral Powder Product
  - H R x S Oral Product

**Branded Dose Form Group**
- **Branded Dose Form Group (8)**
  - H R x S AzaSite Ophthalmic Product
  - H R x S Zithromax Injectable Product
  - H R x S Zithromax Oral Liquid Product
  - H R x S Zithromax Oral Powder Product
  - H R x S Zithromax Oral Product
RxNav

• Browser for RxNorm
  – Graph: various types of drug entities in RxNorm for a given drug
  – Properties: names and codes (from non-proprietary sources)
  – NDC (only for clinical and branded drugs and packs)

• Additional information
  – Pill images (from the NLM C3PI collection)
  – Class view (link to drug classification systems)
  – Drug-drug interactions
  – Status (information about active and obsolete drugs)

Not in scope for RxNorm, but handled by RxNav
Center for Medicare and Medicaid (CMS)

Medicare covers:
- people age 65 or older,
- people under age 65 with certain disabilities, and
- people of all ages with End-Stage Renal Disease.

3 parts:
- Part A Hospital Insurance
- Part B Medical Insurance
- Part D Prescription Drug Coverage

CMS covers 100 million people...
Center for Medicare and Medicaid (CMS) data

• Available through the CMS Virtual Research Data Center (VRDC)
  – At a cost
  – Cloud-based environment – data cannot be downloaded
• Longitudinal data available
  – From 1999 for demographics, hospitalization and ambulatory data
  – From 2006 from drug coverage

https://www.resdac.org/cms-data
Medicare Part D dataset

- Main variables in the Drug Event File
  - Beneficiary information (ID and demographics)
  - Date on which the prescription was filled
  - Drug: identified by NDC (11-digit format)
  - Quantity Dispensed
  - Days Supply
  - Cost information

- Related information for the NDC (provided by First Databank)
  - Brand name, generic name, strength, dosage form code, and dosage form description

Use case: Analysis of opioid prescriptions

• Identify prescriptions corresponding to opioids in the Medicare part D dataset
• For each opioid drug, calculate the trend of dispensation over time (“number of prescriptions”)
• For all opioids, calculate the trend of total (or daily) dose dispensed in oral morphine milligram equivalents
• Out of scope for this tutorial
  – Analyze differences by prescriber
  – Analyze comorbidities (e.g., depression, anxiety)
  – Analyze adverse effects (e.g., emergency room visit for opioid overdose)
In practice: Analysis of opioid prescriptions

- Identify drugs of interest
  - Find Opioid class
  - Get drug members (with RxNorm identifiers)
  - Get NDCs for RxNorm drugs
    - Get active NDCs
    - Get historical NDCs
  - Extract strength information for these drugs
- Extract dispensation information for these NDCs
  - Quantity dispensed
  - Days supply
- Calculate oral morphine milligram equivalent for each prescription
RxNav follow-along activity

- Search for **oxycodone**
- Explore branded drugs
  - Select **12 HR OxyCONTIN 10 MG Extended Release Oral Tablet**
  - Click on the NDC tab to explore NDCs
- Go back to the Graph tab
  - Select **oxycodone** again
  - Check ATC classes under the Class View tab
- Click on **Natural opium alkaloids** to go to RxClass

https://mor.nlm.nih.gov/RxNav/
<table>
<thead>
<tr>
<th>Clinical Drug or Pack (71)</th>
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<tbody>
<tr>
<td>H Rx S 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet</td>
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<tr>
<td>H Rx S 12 HR OxyCONTIN 15 MG Extended Release Oral Tablet</td>
</tr>
<tr>
<td>H Rx S 12 HR OxyCONTIN 20 MG Extended Release Oral Tablet</td>
</tr>
</tbody>
</table>

**Branded Drug or Pack (44)**

| H Rx S 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet |
| H Rx S 12 HR OxyCONTIN 15 MG Extended Release Oral Tablet |
| H Rx S 12 HR OxyCONTIN 20 MG Extended Release Oral Tablet |
### 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet

#### RxNCEI: 1049504

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<th>PIN</th>
<th>Precise Ingredient (1)</th>
<th>BN</th>
<th>Brand Name (1)</th>
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<tr>
<td></td>
<td>H RX S</td>
<td>oxyCODONE</td>
<td>H RX S</td>
<td>oxyCODONE Hydrochloride</td>
<td>H RX S</td>
<td>OxyCONTIN</td>
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<tr>
<td>SCDC</td>
<td>Clinical Drug Component (1)</td>
<td>H RX S</td>
<td>oxyCODONE Hydrochloride 10 MG</td>
<td>H RX S</td>
<td>oxyCODONE Hydrochloride 10 MG [OxyCONTIN]</td>
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<tr>
<td>SCD/GPCK</td>
<td>Clinical Drug or Pack (1)</td>
<td>H RX S</td>
<td>Abuse-Deterrent 12 HR oxyCODONE Hydrochloride 10 MG Extended Release Oral Tablet</td>
<td>H RX S</td>
<td>12 HR OxyCONTIN 10 MG Extended Release Oral Tablet</td>
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<tr>
<td>SCDG</td>
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<td>Pill</td>
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<td>SBDG</td>
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<td>NDC10</td>
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<td>NDC9 PROPERTIES</td>
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<td>PD-Rx Pharmaceuticals, Inc.</td>
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<td>59011041010</td>
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<td>59011-410-20</td>
<td>bffefe35-d717-4855-a3c8-a13d26dade6</td>
<td>Purdue Pharma LP</td>
<td>10 in 1 BLISTER PACK:2 in 1 CARTON</td>
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</tr>
</tbody>
</table>

**Attention Dispenser:** Accompanying Medication Guide must be provided to the patient upon dispensing.

**NDC 59011-410-10**

OxyContin® (oxycodone hydrochloride) extended-release tablets

10 mg

100 Tablets

Rx Only

Purdue Pharma LP, Stamford, CT 06901-3431 30297-00
### oxyCODONE [RxCUI = 7804]

#### IN/MIN
- oxyCODONE (6)
- Acetaminophen / oxyCODONE (5)
- Aspirin / oxyCODONE (4)
- Ibuprofen / oxyCODONE (4)
- Naloxone / oxyCODONE (4)

#### PIN
- Precise Ingredient (2)
  - oxyCODONE Hydrochloride (2)
  - oxyCODONE terephthalate (2)

#### BN
- Endocet (1)
- Endodan Reformulated May 2009 (1)
- Oxydo (1)
- Oxecta (1)
- OxyCONTIN (1)

#### SCDC
- Clinical Drug Component (27)
  - oxyCODONE 10 MG (3)
  - oxyCODONE 13 MG (2)
  - oxyCODONE 18 MG (2)
  - oxyCODONE 20 MG (2)
  - oxyCODONE 27 MG (2)

#### SBD/DPCK
- Branded Drug Component (44)
  - Acetaminophen 300 MG / oxyCODONE Hydrochloride 10 MG (3)
  - Acetaminophen 300 MG / oxyCODONE Hydrochloride 5 MG (3)
  - Acetaminophen 300 MG / oxyCODONE Hydrochloride 20 MG (3)

#### SCD/PCK
- Clinical Drug or Pack (71)
  - 12 HR Acetaminophen 325 MG / oxyCODONE Hydrochloride 7.5 MG Extended Release Oral Tablet (4)
  - 12 HR Naloxone Hydrochloride 10 MG / oxyCODONE Hydrochloride 20 MG Extended Release Oral Tablet (4)

#### SCD/GPCK
- Clinical Dose Form Group (16)
  - Acetaminophen / oxyCODONE Oral Liquid Product (3)
  - Acetaminophen / oxyCODONE Oral Product (3)

#### DFG
- Dose Form Group (5)
  - Injectable Product (4)
  - Oral Liquid Product (4)
  - Oral Product (4)
  - Pill (4)
  - Rectal Product (4)

#### SBDG
- Branded Dose Form Group (36)
  - Endocet Oral Product (4)
  - Endocet Pill (4)
  - Endodan Reformulated May 2009 Oral Product (4)
How to link NDCs to RxNorm and ATC?
Linkages among drug entities

- oxycodone [N02AA05]
- oxyCODONE [7804]
- Abuse-Deterrent 12 HR oxycodone Hydrochloride 10 MG Extended Release Oral Tablet [1860157]
- 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet [1049504]
- N NERVOUS SYSTEM
  N02 ANALGESICS
  N02A OPIOIDS
  N02AA Natural opium alkaloids

<table>
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<tr>
<th>ATC code</th>
<th>Name</th>
<th>DDD</th>
<th>U</th>
<th>Adm.R.</th>
<th>Note</th>
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<td>oxycodone</td>
<td>75</td>
<td>mg</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>30</td>
<td>mg</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>
Identifying opioid drugs from a drug class

- ATC – Anatomical Therapeutic Chemical drug classification system

- N02AA Natural opium alkaloids
  - ATC code N02AA01: morphine
  - ATC code N02AA02: opium
  - ATC code N02AA03: hydromorphone
  - ATC code N02AA04: nicomorphine
  - ATC code N02AA05: oxycodone
  - ATC code N02AA08: dihydrocodeine
  - ATC code N02AA10: papaveretum
  - ATC code N02AA51: morphine, combinations
  - ATC code N02AA53: hydromorphone and naltrexone
  - ATC code N02AA55: oxycodone and naltrexone
  - ATC code N02AA56: oxycodone and naltrexone
  - ATC code N02AA58: dihydrocodeine, combinations
  - ATC code N02AA59: codeine, combinations excl. psycholeptics
  - ATC code N02AA79: codeine, combinations with psycholeptics
Issues: Obsolete NDCs

- **oxycodone** [N02AA05]
- **oxyCODONE** [7804]
- Abuse-Deterrent 12 HR oxyCODONE Hydrochloride 10 MG Extended Release Oral Tablet [1860157]

12 HR OxyCONTIN 10 MG Extended Release Oral Tablet [1049504]

131 Obsolete NDCs

- 10544059120
- 10544059130
- 16590067710
- 16590067715
- 16590067720

4 Current NDCs

- 59011041010
- 43063035410
- 59011041020
- 43063035402

Obsolete NDCs can be queried under Historical NDCs in RxNav
Issues: Multiple ATC classes

CARDIOVASCULAR SYSTEM
BETA BLOCKING AGENTS
BETA BLOCKING AGENTS
Beta blocking agents, non-selective

SENSORY ORGANS
OPHTHALMOLOGICALS
ANTIGLAUCOMA PREPARATIONS AND MIOTICS
Beta blocking agents

timolol
RxClass follow-along activity

• Search for OPIOIDS in ATC
  – Navigate to the subclass Natural opium alkaloids (N02AA)
  – Explore the members of this class
• Click on Oxycodone to go to RxNav
  – Navigate to 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet
  – In the NDC tab, check Historical NDCs

https://mor.nlm.nih.gov/RxClass/
Class Browser

- Anatomical Therapeutic Chemical (ATC1-4)
- Established Pharmacologic Classes (EPC) [from DailyMed]
- MeSH Pharmacologic Actions (MESHPA)
- Disease
- Chemical Structure (Chem) [from DailyMed]
- Mechanism of Action (MoA) [from DailyMed]
- Physiologic Effect (PE) [from DailyMed]
- Pharmacokinetics (PK)
- VA Classes (VA)

Class Name

OPIODS

- Opioids in combination with antispasmodics
- Opioids in combination with non-opioid analgesics
- Other opioids

CHEM

- Receptors, Opioid (receptors, opioids)
- Receptors, Opioid, delta (receptors, delta opioids)
- Receptors, Opioid, kappa (receptors, kappa opioids)
- Receptors, Opioid, mu (receptors, mu opioids)
### 28 RxNorm generic drugs in ATC / similar classes

<table>
<thead>
<tr>
<th>Type</th>
<th>RXCUI</th>
<th>RxNorm Name</th>
<th>Relation</th>
<th>All classes</th>
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<td>MIN</td>
<td>817579</td>
<td>Acetaminophen / Codeine</td>
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<td>Show</td>
</tr>
<tr>
<td>MIN</td>
<td>352362</td>
<td>Acetaminophen / Tramadol</td>
<td>INDIRECT</td>
<td>Show</td>
</tr>
<tr>
<td>MIN</td>
<td>135095</td>
<td>Aspirin / Codeine</td>
<td>INDIRECT</td>
<td>Show</td>
</tr>
<tr>
<td>IN</td>
<td>1819</td>
<td>Euprenorphine</td>
<td>INDIRECT</td>
<td>Show</td>
</tr>
<tr>
<td>IN</td>
<td>1841</td>
<td>Butorphanol</td>
<td>INDIRECT</td>
<td>Show</td>
</tr>
<tr>
<td>MIN</td>
<td>710303</td>
<td>Codeine / Ibuprofen</td>
<td>INDIRECT</td>
<td>Show</td>
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<td>Dextromoramide</td>
<td>INDIRECT</td>
<td>Show</td>
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<tr>
<td>IN</td>
<td>22713</td>
<td>dezocine</td>
<td>INDIRECT</td>
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</table>
class: Natural opium alkaloids / id: N02AA / class type: ATC1-4 / show context

<table>
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<th>Type</th>
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<th>Relation</th>
<th>All classes</th>
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<td>Hydromorphone</td>
<td>DIRECT</td>
<td>Show</td>
</tr>
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<td>7052</td>
<td>Morphine</td>
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<td>Naltrexone / Oxycodone</td>
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8 RxNorm generic drugs in ATC / similar classes

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<tr>
<th>Type</th>
<th>RXCUI</th>
<th>RxNorm Name</th>
<th>Source Id</th>
<th>Source Name</th>
<th>Relation</th>
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### Natural opium alkaloids

8 RxNorm generic drugs in ATC / similar classes

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</table>
### 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet

**IN/IN**
- *Ingredient:* oxycodone
- *Precise Ingredient:* oxycodone hydrochloride

**BN**
- *Brand Name:* oxyCONTIN

**SBDC**
- *Branded Drug Component:* oxycodone hydrochloride 10 MG

**SBD/BPCK**
- *Branded Drug or Pack:* 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet

**SBDG**
- *Branded Dose Form Group:* oxycodone oral product

**SCDG**
- *Clinical Dose Form Group:* oxycodone oral product

**SC/SC**
- *Clinical Drug Component:* oxycodone hydrochloride

**SC/SC/GPCK**
- *Clinical Drug or Pack:* 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet
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Calculating the daily dose in oral morphine milligram equivalent
Why converting to MME?

• Opioids have widely different potency levels
  – Fentanyl is about 100 times more potent than morphine

• Difficult to
  – Compare doses across drugs
  – Compare doses over time for multiple drugs
  – Aggregate results

• Reference: 1 mg of morphine administered orally

• Use case: How do these two drugs compare?
  – 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet (twice a day)
  – 72 HR fentaNYL 0.012 MG/HR Transdermal System
MME conversion factor

- Conversion factor for each drug
  - Available from CMS
  - Compiled from CDC data

---

### Opioid Oral Morphine Milligram Equivalent (MME) Conversion Factors

<table>
<thead>
<tr>
<th>Type of Opioid (strength units)</th>
<th>MME Conversion Factor</th>
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<tbody>
<tr>
<td>Buprenorphine film/tablet (mg)</td>
<td>30</td>
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<tr>
<td>Buprenorphine patch (mcg/hr)</td>
<td>12.6</td>
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<tr>
<td>Buprenorphine film (mcg)</td>
<td>0.03</td>
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<tr>
<td>Butorphanol (mg)</td>
<td>7</td>
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<tr>
<td>Codeine (mg)</td>
<td>0.15</td>
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<tr>
<td>Dihydrocodeine (mg)</td>
<td>0.25</td>
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<tr>
<td>Fentanyl buccal or SL tablets, or lozenge/troche (mcg)</td>
<td>0.13</td>
</tr>
<tr>
<td>Fentanyl film or oral spray (mcg)</td>
<td>0.18</td>
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<tr>
<td>Fentanyl nasal spray (mcg)</td>
<td>0.16</td>
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<tr>
<td>Fentanyl patch (mcg)</td>
<td>7.2</td>
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<tr>
<td>Hydrocodone (mg)</td>
<td>1</td>
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<tr>
<td>Hydromorphone (mg)</td>
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<table>
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<tr>
<th>Drug</th>
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<td>Meperidine hydrochloride (mg)</td>
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<td>Methadone (mg)</td>
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<td>&gt;40, &lt;=60</td>
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<td>&gt;60</td>
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<tr>
<td>Opium (mg)</td>
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<td>Oxycodone (mg)</td>
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<td>Pentazocine (mg)</td>
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<td>Tapentadol (mg)</td>
<td>0.4</td>
</tr>
<tr>
<td>Tramadol (mg)</td>
<td>0.1</td>
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</table>

[1] CMS
[2] CDC

---

Issues

• MME/day requires computation of the daily dose from
  – Quantity Dispensed
  – Days Supply
  – Strength (+ quantity factor in some cases)

• Some drugs are not covered (no longer on the market)
  – See earlier references for Nalbuphine and Propoxyphene

• Conversion is relatively straightforward in most cases, but
  – Transdermal systems
    • Conversion for strength in micrograms
      – But strength in mg in RxNorm
    • Conversion accounts for the duration of the patch
      – But only the concentration strength (+ duration) is provided in RxNorm
  – Injectables
    • Use presentation strength, not concentration strength as in RxNorm
Example #1

- **Drug**: NDC = 59011041010
  - 12 HR OxyCONTIN 10 MG Extended Release Oral Tablet [1049504]
  - Ingredient: Oxycodone
  - Strength: 10 MG

- **Dispensation information**
  - Quantity Dispensed: 20
  - Days Supply: 10

- **MME conversion factor**: 1.5

- **MME/day**: \[ MME(mg) = 10 \times \frac{20}{10} \times 1.5 = 30 \text{ mg} \]
Example #2

- **Drug:** NDC = 00781724055
  - 72 HR fentaNYL 0.012 MG/HR Transdermal System [577057]
  - Ingredient: Fentanyl
  - (Concentration) strength: 0.012 MG/HR
  - Quantity factor: 72 HR

- **Dispensation information**
  - Quantity Dispensed: 4
  - Days Supply: 12

- **MME conversion factor**: 100 (1 mg parenteral Fentanyl = 100 mg oral Morphine)

- **MME/day**: $MME (mg) = 72 \times 0.012 \times \frac{4}{12} \times 100 = 28.8 \text{ mg}$
Discussion of (preliminary) results from larger-scale analysis
Our MEDICARE dataset

• 20% random sample of Part D enrollees
  – 10.7 million beneficiaries (patients)
  – ~2.3 billion prescriptions

• Continuous enrollment (no gaps) between initial enrollment and end of study (death or 12/31/2015)
  – Required for outcomes research
  – 4.9 million beneficiaries (> 50% loss)
  – ~1 billion prescriptions
  • 41 million opioid prescriptions
Opioids in ATC

- NDC codes -> RxNorm -> ATC classes
- 3 ATC classes
  - N02A OPIOIDS
  - N07BC Drugs used in opioid dependence
  - N01AH Opioid anesthetics
  - R05DA Opium alkaloids and derivatives [Respiratory system*]
Opioid prescriptions

Proportion of patients with opioid prescription (by drug)

- BUPRENORPHINE
- BUTORPHANOL
- CODEINE
- DIHYDROCODEINE
- FENTANYL
- HYDROCODONE
- HYDROMORPHONE
- MEPERIDINE
- METHADONE
- MORPHINE
- NALBUPHINE
- OPIUM
- OXYCODONE
- PENTAZOCINE
- PROPOXYPHENE
- TAPENTADOL
- TRAMADOL

**NON-CANCER**

- BUPRENORPHINE: 28,871,494 claims
- BUTORPHANOL: 2,436,397 patients
- CODEINE: 11,504,312 claims
- DIHYDROCODEINE: 1,118,652 patients
- FENTANYL: 0.00%
- HYDROCODONE: 10.00%
- HYDROMORPHONE: 20.00%
- MEPERIDINE: 30.00%
- METHADONE: 40.00%
- MORPHINE: 50.00%
- NALBUPHINE: 60.00%
- OPIUM: 70.00%
- OXYCODONE: 0.00%
- PENTAZOCINE: 10.00%
- PROPOXYPHENE: 20.00%
- TAPENTADOL: 30.00%
- TRAMADOL: 40.00%

**CANCER**

- BUPRENORPHINE: 856,656 claims
- BUTORPHANOL: post-OUD excluded
- CODEINE: 11,504,312 claims
- DIHYDROCODEINE: 1,118,652 patients
- FENTANYL: 0.00%
- HYDROCODONE: 10.00%
- HYDROMORPHONE: 20.00%
- MEPERIDINE: 30.00%
- METHADONE: 40.00%
- MORPHINE: 50.00%
- NALBUPHINE: 60.00%
- OPIUM: 70.00%
- OXYCODONE: 0.00%
- PENTAZOCINE: 10.00%
- PROPOXYPHENE: 20.00%
- TAPENTADOL: 30.00%
- TRAMADOL: 40.00%
KEY TAKEAWAYS

1) DRUG ANALYTICS
   are a key element of current healthcare analytics efforts and are facilitated by the availability of datasets (e.g., Medicare Part D) and tooling (e.g., RxNav, RxClass).

2) PHARMACISTS
   can/should be involved in drug analytics, not only by providing domain expertise, but in doing some of the informatics work (“pharmacoinformatics”).
Self-Assessment Question 1

• Which type of information can be found in claims data, such as Medicare Part D dataset?
  – ✗ A. Patient name and address
  – ✗ B. ATC class (from the Anatomical Therapeutic Chemical drug classification)
  – ✓ C. “NDC codes” (from the National Drug Code directory)
  – ✓ D. Days supply
  – ✓ E. Quantity dispensed
Self-Assessment Question 2

• TRUE/FALSE: Medications can belong to only one ATC class?
  – ✗ A. True
  – ✓ B. False
Self-Assessment Question 3

• Conversion to oral morphine milligram equivalent
  – ✓ A. Enables comparison between daily doses of opioid drugs
  – ✗ B. Can be done by multiplying the unit strength by a factor, regardless of the dose form
  – ✓ C. Is required for characterizing the global evolution of opioid doses over time
  – ✓ D. Is required for characterizing differences in opioid doses dispensed across geographic areas