

# Opioid Crisis Analysis

Data Semantics Presentation

CSE6242 Course Project

# ARCOS Reference

- ARCOS Field Reference
  - <https://www.deaiversion.usdoj.gov/arcos/handbook/full.pdf>
- ARCOS Drug Data Dictionary Schema
  - <https://www.deaiversion.usdoj.gov/arcos/ndc/readme.txt>
- ARCOS Drug Data Dictionary
  - <https://www.deaiversion.usdoj.gov/arcos/ndc/ndcfile.txt>

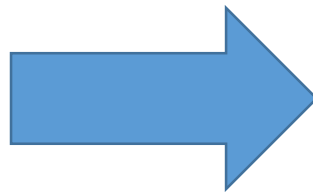
# Sample Opioid Data from DEA

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_gm	dos_str	measure
OXYCODONE HCL 30MG TABLETS, USP	OXYCODONE HYDROCHLORIDE	57664022488	1	null	null	100	2.6895	30	TAB
OXYCODONE HYDROCHLORIDE 15MG TABLETS	OXYCODONE HYDROCHLORIDE	00406851501	2	null	null	200	2.6895	15	TAB
OXYCONTIN - 10MG OXYCODONE.HCL CONTR	OXYCODONE HYDROCHLORIDE	59011010010	1	null	null	100	0.8965	10	TAB
OXYCODONE.HCL ER 10MG TABS	OXYCODONE HYDROCHLORIDE	68774016101	3	null	null	300	2.6895	10	TAB
OXYCODONE HYDROCHLORIDE TABLETS 5MG	OXYCODONE HYDROCHLORIDE	00406055201	5	null	null	500	2.24125	5	TAB
COMBUNOX - 5MG / 400MG OXYCODONE.HCL	OXYCODONE HYDROCHLORIDE	00456520001	1	null	null	100	0.44825	5	TAB
OXYCODONE HCL/ACETAMINOPHEN 10MG/325	OXYCODONE HYDROCHLORIDE	00406052301	4	null	null	400	3.586	10	TAB

# Consider 1 Row

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_gm	dos_str	measure
OXYCODONE HCL 30MG TABLETS, USP	OXYCODONE HYDROCHLORIDE	57664022488	1	null	null	100	2.6895	30	TAB

1. Quantity
2. Unit
3. Strength
4. Dosage Unit
5. Calc\_base\_wt\_in\_gm
6. Dos\_Str
7. Measure



What should we use?

Why are some NULL?

How to interpret?

# ARCOS Data – Major Fields

## Transaction Code

- ARCOS Transaction Code:
  - 4 Major Categories of Code
    - Inventory Transaction Code (Plain Report of Inventory) – **5 Codes**
    - Acquisition Transaction Code (Addition to Inventory) – **8 Codes**
    - Disposition Transaction Code (Reduction of Inventory) – **8 Codes**
    - Miscellaneous – **3 Codes**
- NOTE: NOT ALL ROWS ARE EQUAL
  - Need to interpret correctly
- **WASH POST:**
  - Has only Transaction code of 'S'
    - 'S' Stands for Selling – comes under 'Reduction of Inventory'
      - One of the 8 codes for Reduction of Inventory!

# ARCOS Data – Major Fields

## Action Indicator

- ARCOS Action Indicator:
  - **Related to Error Processing**
- Valid value can indicate (mostly this is null but still we may need to account)
  - D -> Deletion of a Record
  - A -> Revision (Adjustment) of a Record
  - I -> Insertion of a LATE Transaction Record
- **WASH POST:**
  - **Mostly Null**
  - **There are considerable records with non-null entries**
  - **We will need to account for this in our Analysis**

# ARCOS Data – Major Fields

## NDC Number

- **ARCOS NDC Number:**

- **11-Character Code**

- 5 + 4 + 2
    - **( 5 ) Labeller Code** -> Identifies Manufacturer or Distributor (*FDA Allots this number*)
    - **( 4 ) Product Code** -> Decided by the Labeler to indicate particular dosage/form/strength of a product
    - **( 2 ) Package Code** -> Developed by the Labeler. Can be different for different labellers
      - When \*\* -> Bulk product and this is where 'Strength', 'Unit' come into picture

- **WASH POST:**

- **NDC number is there for all rows just like the original full table**

- **National Drug Dictionary**

- For every NDC number, it captures full information about the product
  - Drug Dictionary
    - <https://www.deadiversion.usdoj.gov/arcos/ndc/ndcfile.txt>
  - Drug Dictionary Schema
    - <https://www.deadiversion.usdoj.gov/arcos/ndc/readme.txt>

# ARCOS Data – Major Fields

## NDC Number

- NDC Code : 00406851501
  - Labeller Code: 00406 (FDA Assigned)
  - Product Code: 8515 (Labeller Assigned)
  - Package Code: 01 (Labeller Assigned but documented in Drug Dictionary)
- Look up the [Drug Dictionary](#) for this NDC Code
  - Know more about this NDC!
- NOTE: This dictionary is NOT field separated.
  - It is CHARACTER INDEX based.
  - Go by the [SCHEMA](#)



# ARCOS Data – calc\_base\_wt\_in\_gm

## APPENDIX 5

### ARCOS RECORD: DATA FIELDS AND CALCULATIONS

NDC Pkg. Code (1)	Trans. Record Quantity Field (2)	Unit Field (3)	Strength Field (4)	Inventory Quantity (5)	Inventory Quantity X Ingredient weight (6)
Numeric or Alpha	Numeric	Blank	Numeric (Partial Pkg.)	Quantity X Pkg.% if applicable	Qty of DU's to Grams
	Numeric	Blank	Blank	Quantity	Qty of DU's to Grams
		D	Blank	Quantity x 12	Qty of DU's to Grams
		K	Blank	Quantity x 1000	Qty of DU's to Grams
**(RAW) Bulk Powder	Numeric	1	Numeric	Quantity X .000001 x Strength	Micrograms to Grams
		2	"	Quantity X .001 x Strength	Milligrams to Grams
		3	"	Quantity X Strength	Grams to Grams
		4	"	Quantity X 1000 X Strength	Kilograms to Grams
		5	"	Quantity X 1 X Strength	Milliliters to Grams
		6	"	Quantity X 1000 X Strength	Liters to Grams
** (Unpackaged, Bulk Dosage Units)	Numeric	Blank	Blank	Quantity	Qty of DU's to Grams
		D	"	Quantity X 12	Qty of DU's to Grams
		K	"	Quantity X 1000	Qty of DU's to Grams
		1	"	Quantity X .000001	Micrograms to Grams
		2	"	Quantity X .001	Milligrams to Grams
		3	"	Quantity X 1	Grams to Grams
		4	"	Quantity X 1000	Kilograms to Grams
		5	"	Quantity X 1	Milliliters to Grams
		6	"	Quantity X 1000	Liters to Grams

All these Calculations are ALREADY DONE and reported in “**calc\_base\_wt\_in\_gm**” field!

This Table is ONLY FOR OUR CLARITY!

We don't need to use QTY, UNIT, STRENGTH and DOSAGE fields at all.

Just use “**calc\_base\_wt\_in\_gm**” – This tells how much opioid substance was transferred by that Transaction!

This chart demonstrates the procedure employed by the ARCOS system in calculating the quantity of controlled substance in a reported ARCOS transaction.

# DEA Calculations Explained

- Report (A Row) can be in terms of PACKAGES
  - Quantity of Package
  - UNIT Modifier D or K (Dozen or Thousand Multiplier) (or) STRENGTH Modifier acting as Package %
  - Weight in Grams of sensitive substance from [Drug Dictionary](#) per Package
- Report can be for Bulk
  - No Pre-Defined Dictionary Information (last 2 chars in NDC is \*\*)
  - Information needs to be inferred from Quantity, Unit and Strength

# DEA Calculation Illustrated

For Non-Bulk QTY Based Reporting

## ARCOS Entry (A Row)

NDC\_NO last 2 digits  
is 88 and hence QTY  
based Reporting

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_gm	dos_str	measure
OXYCODONE HCL 30MG TABLETS, USP	OXYCODONE HYDROCHLORIDE	57664022488	1	null	null	100	2.6895	30	TAB

## Drug Dictionary Entry for NDC

576640224881 12 1 OXYCODONE HCL 30MG TABLETS; 100 TABL000100000TAB 9143.005 OXYCODONE HYDROCHLORIDE 0000026895000

### From Dictionary Schema:

Package Quantity Code = 000100000

Package Quantity = Qty Code with a decimal before the last 3 digits = 000100.000 = 100

Total Package Quantity = 100 \* 1 = 100

Ingredient Base Weight Code = 0000026895000

Ingredient Base Weight = Decimal before the last 7 digits = 000002.6895000 = 2.6895 Grams

Total Ingredient Base Weight = 2.6895 \* 1 = 2.6895

**CONCLUSION: 1 PACKAGE QUANTITY CONSISTS OF 100 UNITS (tablets) and the amount of sensitive substance is 2.6895 GRAMS**

# DEA Calculation Illustrated

For Non-Bulk QTY Based Reporting

## ARCOS Entry (A Row)

NDC\_NO last 2 digits  
is 01 and hence QTY  
based Reporting

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_gm	dos_str	measure
OXYCODONE HYDROCHLORIDE TABLETS 5MG	OXYCODONE HYDROCHLORIDE	00406055201	5	null	null	500	2.24125	5	TAB

## Drug Dictionary Entry for NDC

004060552011 12 1 OXYCODONE HYDROCHLORIDE TABLETS 5MG 000100000TAB 9143.005 OXYCODONE HYDROCHLORIDE 0000004482500

### From Dictionary Schema:

Package Quantity Code = 000100000

Package Quantity = Qty Code with a decimal before the last 3 digits = 000100.000 = 100

Total Packages = 5

Total Package Quantity = 100 \* 5 = 500

Ingredient Base Weight Code = 0000004482500

Ingredient Base Weight = Decimal before the last 7 digits = 000000.4482500 = 0.44825 Grams

Total Ingredient Base Weight = 0.44825 \* 5 = 2.24125 Grams

CONCLUSION: 5 PACKAGE QUANTITY CONSISTS OF 500 UNITS (tab) and the amount of sensitive substance is 2.24125 GRAMS

# DEA Calculation Illustrated

## Bulk Reporting

NDC Number ends with \*\*

ARCOS Entry

Bulk Entry

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_gm	dos_str	measure
HYDROCODONE BIT/ACETA 5MG/325MG USP	HYDROCODONE BITARTRATE HEMIPENTAHYDRATE	004060365**	5820	null	null	5820	17.61714	5	TAB

### Drug Dictionary Entry for NDC

004060365\*\*1N12 1 HYDROCODONE BIT/ACETA 5MG/325MG USP 000001000TAB 9193.068 HYDROCODONE BITARTRATE HEMIPENTAHYDRATE 0000000030270

Since this is BULK and no UNIT and STRENGTH are given, we can simply multiply the Quantity with Ingredient weight

Ingredient weight = 000000.0030270 \* 5820  
= 0.003027 \* 5820  
= 17.61714

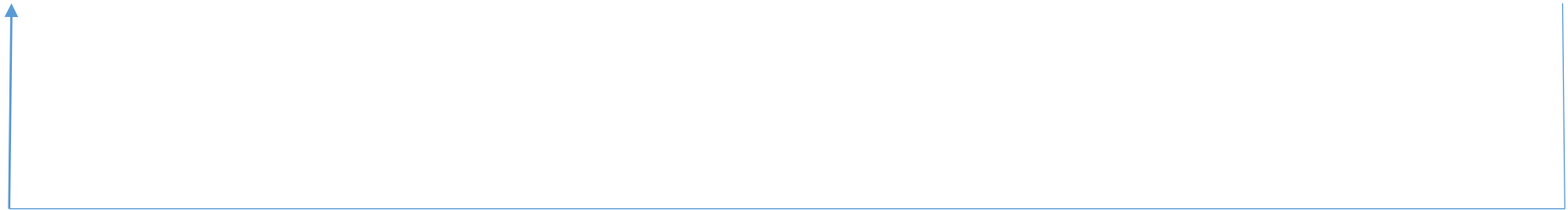
Explains the DEA calculation for 'calc\_base\_wt\_in\_gm'

# calc\_base\_wt\_in\_gm

- We can use this field to know the “Sensitive Substance” amount in each and every DEA ARCOS entry
- For all Summations and Metrics to know how much Opioid reached a county, we can SUM this field

# dos\_str Field – Where does this come from?

product_name	ingredient_name	ndc_no	quantity	unit	strength	dosage_unit	calc_base_wt_in_g	dos_str	measure
OXYCODONE HCL 30MG TABLETS, USP	OXYCODONE HYDROCHLORIDE	57664022488	1	null	null	100	2.6895	30	TAB



This is REALLY of no consequence in the Calculations....

Just Recording the Observation!

# Washington Post Data

- How is it different from Full Data?
- It turns out that the following SQL on Full Data matches the Number of Rows in Washington Post Data
  - ```
select count(*) from dea_arcos_full_string
where transaction_code = 'S' and ((drug_code = '9193') or (drug_code = '9143')) and measure = 'TAB' and buyer_bus_act in
('PRACTITIONER-DW/30',
'CHAIN PHARMACY',
'PRACTITIONER',
'RETAIL PHARMACY',
'PRACTITIONER-DW/275',
'PRACTITIONER-DW/100'
)
```
- It eliminates DISTRIBUTOR <-> DISTRIBUTOR chain sales
- It only looks for “Sale” based disposition of Sensitive Substances
  - Filters out Additions to Inventory, Inventory Reports, Miscellaneous Reports and Reduction Entries apart from Sales
- Only 2 Drugs of Interest and TABLET prescriptions
- RECEIVER is one of the Types listed in SQL. There are several other types which are not considered.
  - Not clear what is the specialty of this group. We may have to find this out.