

# Crowdsourcing as a way to evaluate drug abuse in the community

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*Advancements in  
the Assessment of  
Abuse Liability*

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This presentation will be  
available on Twitter  
@epidemico  
by the end of the animation



# Crowdsourcing

How is this different from routine biomedical research?

## **RADARS® SYSTEM**

The Researched Abuse, Diversion and Addiction-Related Surveillance collects timely product- and geographically-specific data on rates of abuse, misuse, and diversion, contributing to the understanding of trends and aiding the development of effective interventions.

The RADARS System is supported by surveillance subscriptions from pharmaceutical manufacturers. By contract, subscribers do not have access to raw data and are allowed no role in publication, scientific decisions, or site design.

## **Motivations**

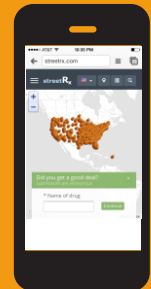
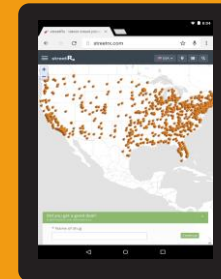
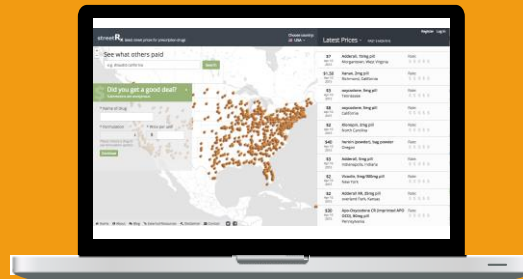
Street prices of diverted prescription pharmaceutical products can provide an indicator of drug availability, demand, and abuse potential. Crowdsourcing is a rapid and cost-effective way to gather information about transactions, and has been shown to provide a valid estimate of the street price of diverted prescription opioids.

## **CROWDSOURCING**

Systematic efforts to collect information from a wide audience, particularly through the use of online tools, that is mutually beneficial to the participants and activity sponsors



# StreetRx.com



StreetRx (streetrx.com) is a collection of databases, websites, and citizen reports enabling real-time collection, organization, and display of street price data on diverted pharmaceutical controlled substances. Based on principles of crowdsourcing for public health surveillance, the site allows users to anonymously submit prices they paid or heard were paid for diverted prescription drugs.

See what others paid

Search

\$

Did you get a good deal?

Submissions are anonymous

\* Name of drug

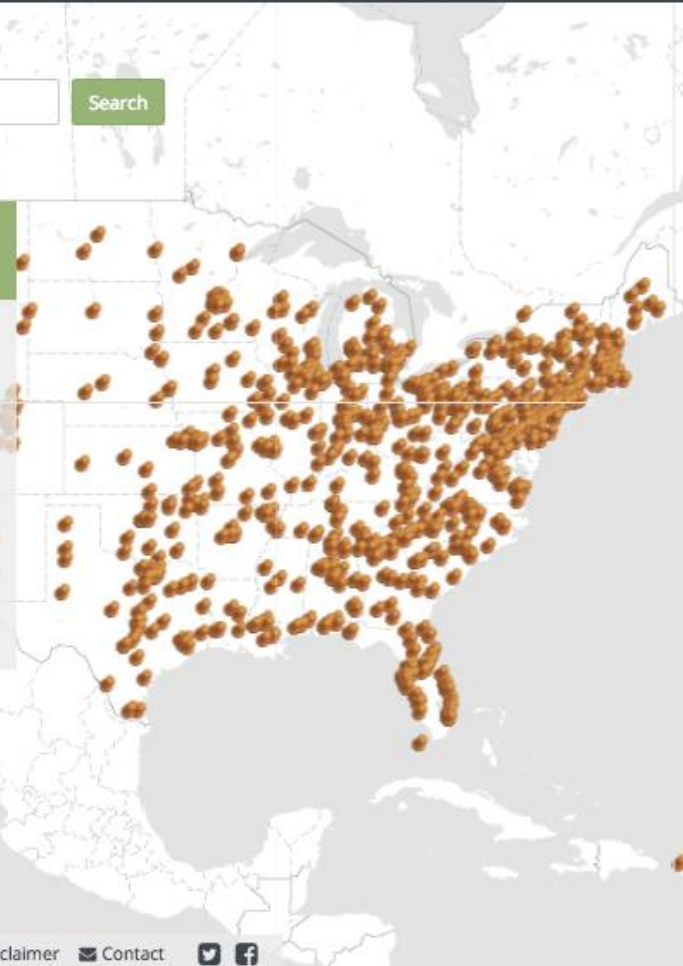
\* Formulation

\* Price per unit

\$

Please choose a drug to see formulation options

Continue



\$7 Apr 10 2015	Adderall, 15mg pill Morgantown, West Virginia	Rate: \$ \$ \$ \$ \$
\$1.50 Apr 10 2015	Xanax, 2mg pill Richmond, California	Rate: \$ \$ \$ \$ \$
\$3 Apr 10 2015	oxycodone, 5mg pill Tennessee	Rate: \$ \$ \$ \$ \$
\$8 Apr 10 2015	oxycodone, 5mg pill California	Rate: \$ \$ \$ \$ \$
\$2 Apr 10 2015	Klonopin, 2mg pill North Carolina	Rate: \$ \$ \$ \$ \$
\$40 Apr 10 2015	heroin (powder), bag powder Oregon	Rate: \$ \$ \$ \$ \$
\$3 Apr 10 2015	Adderall, 5mg pill Indianapolis, Indiana	Rate: \$ \$ \$ \$ \$
\$2 Apr 10 2015	Vicodin, 5mg/300mg pill New York	Rate: \$ \$ \$ \$ \$
\$2 Apr 10 2015	Adderall XR, 25mg pill overland Park, Kansas	Rate: \$ \$ \$ \$ \$
\$30 Apr 10 2015	Apo-Oxycodone CR (imprinted APO OCD), 80mg pill Pennsylvania	Rate: \$ \$ \$ \$ \$

# Unique Visitors per Day

Average daily visitors per year identified by Google Analytics



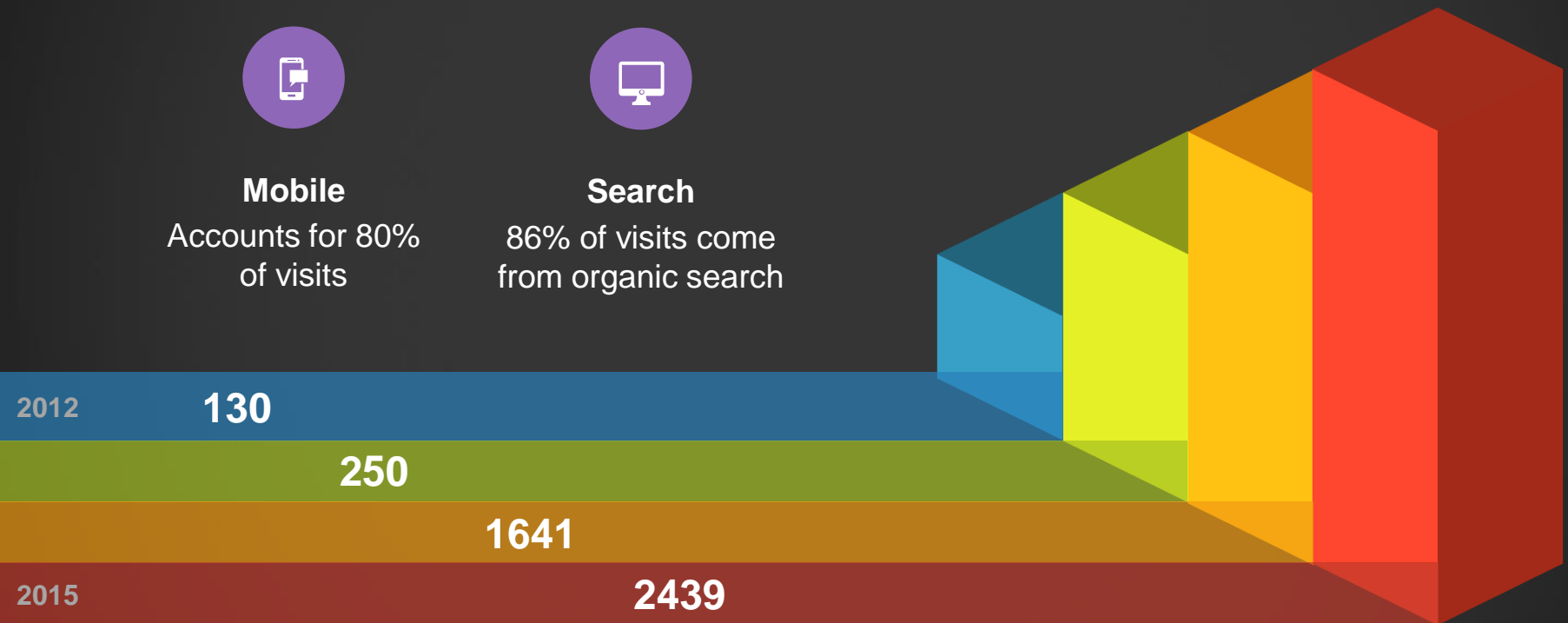
## Mobile

Accounts for 80%  
of visits



## Search

86% of visits come  
from organic search



Not to scale.

# Visitor Demographics

Based on 58% of known demographics from Google account users

43%  
Male  
18-34 years-old

20%  
Male  
35+ years-old



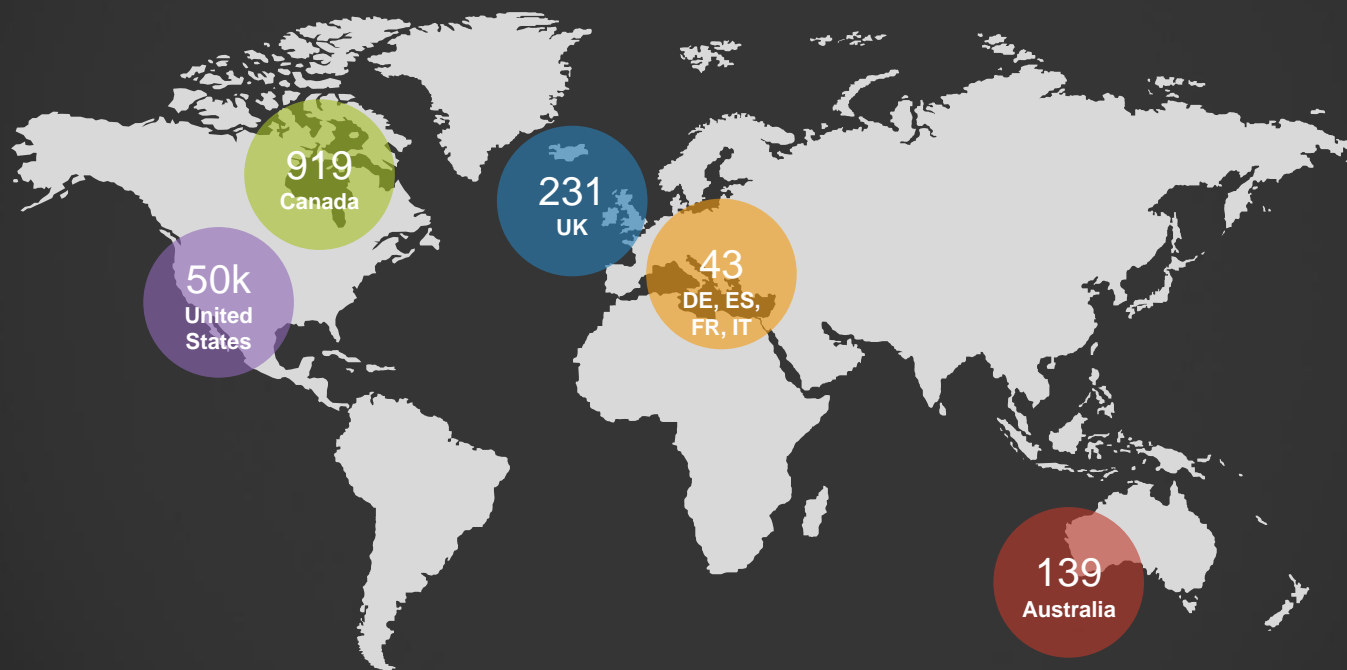
22%  
Female  
18-34 years-old

15%  
Female  
35+ years-old

*As captured by Google Analytics. January 1 through March 31, 2015*

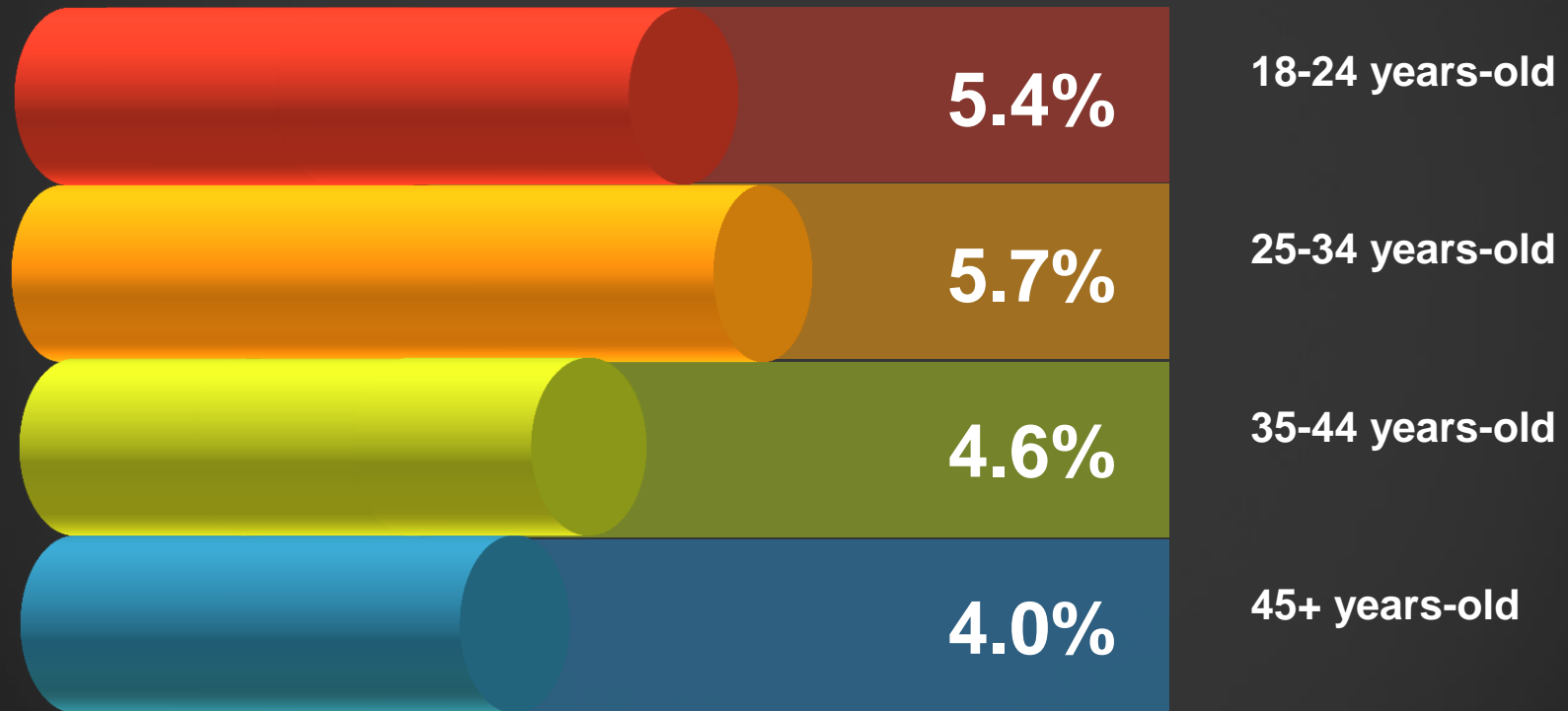
# Number of Price Reports

All RADARS System drugs, from November 1, 2010 through March 31, 2015



# Who is Likely to Submit a Price?

Percent of visitors, 58% of known Google Account users, 1Q2015





# External Referrals

Public health, pain patient advocacy, proper disposal



## Find Addiction Treatment

SAMSA, ADIN, DroguesInfoService.fr, L'ANAPAA, DBDD



## Overdose Prevention

Medication safety sites, HRC, naloxone



## Safe Storage, Disposal & Takeback

FDA, Health Products Stewardship Association



## Safe Pain Management & Advocacy

Canadian Pain Coalition, PainAustralia.org, RBK Stuttgart



## Harm Reduction

HRC, EuroHRN

# 42,058 Referrals to Health Organizations

From November 1, 2010 through March 31, 2015

## Drug Treatment & Harm Reduction

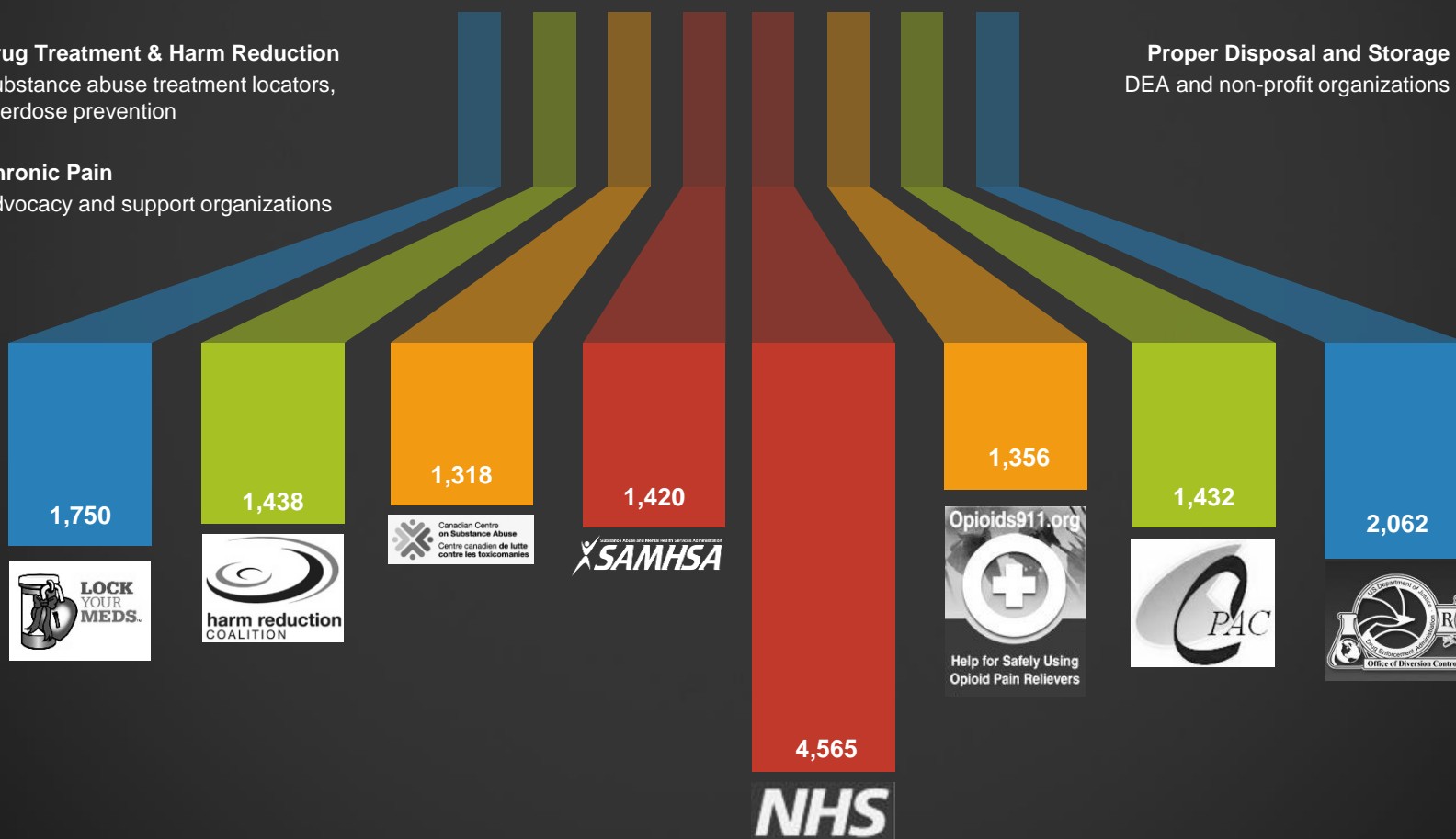
Substance abuse treatment locators,  
overdose prevention

## Chronic Pain

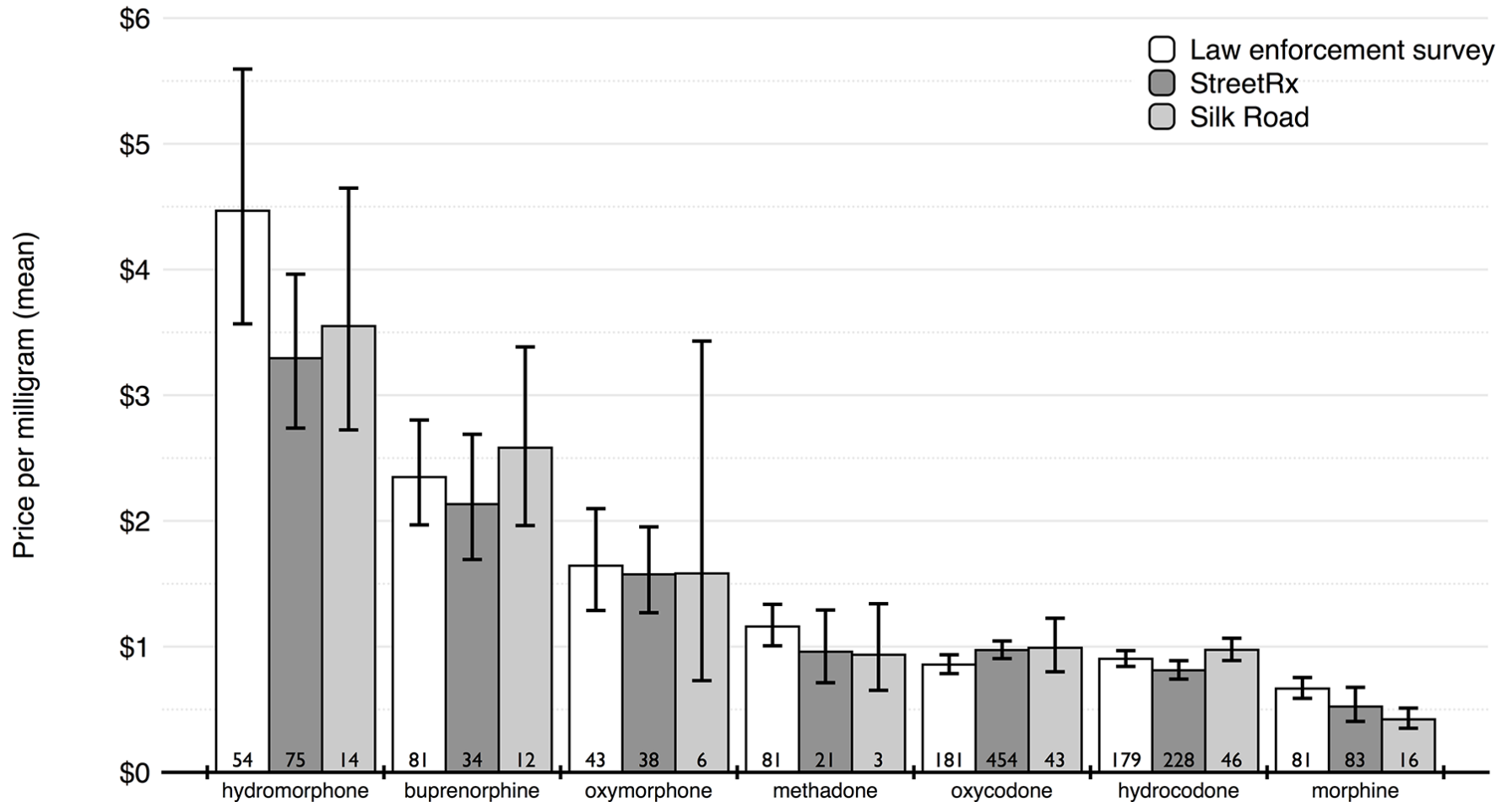
Advocacy and support organizations

## Proper Disposal and Storage

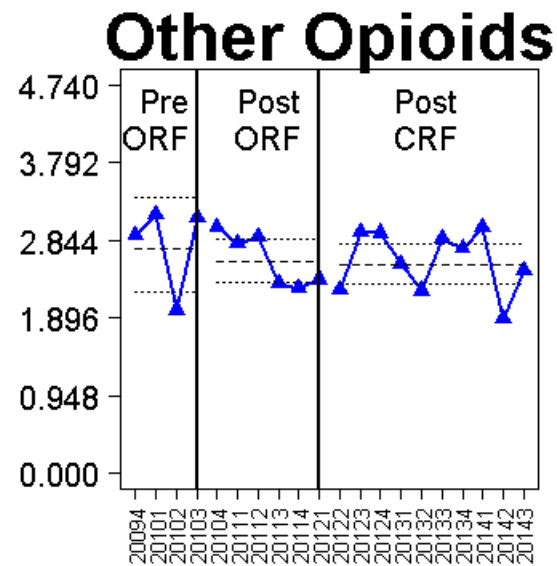
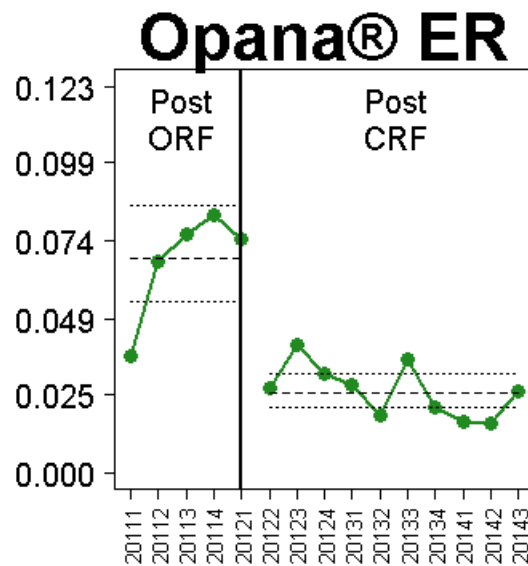
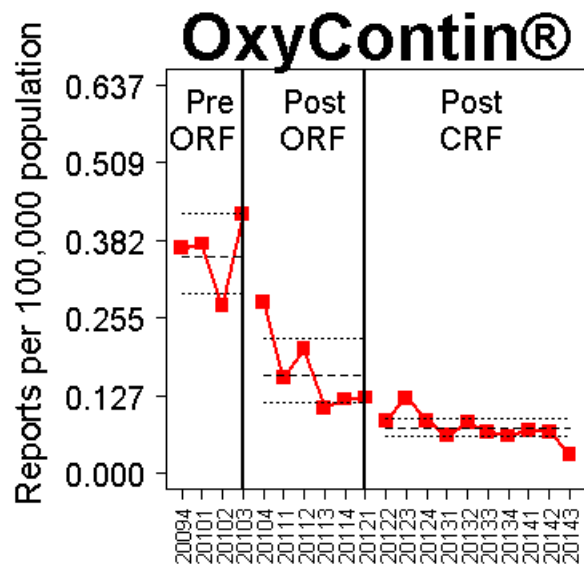
DEA and non-profit organizations



# Cross-Validation of Black Market Prices

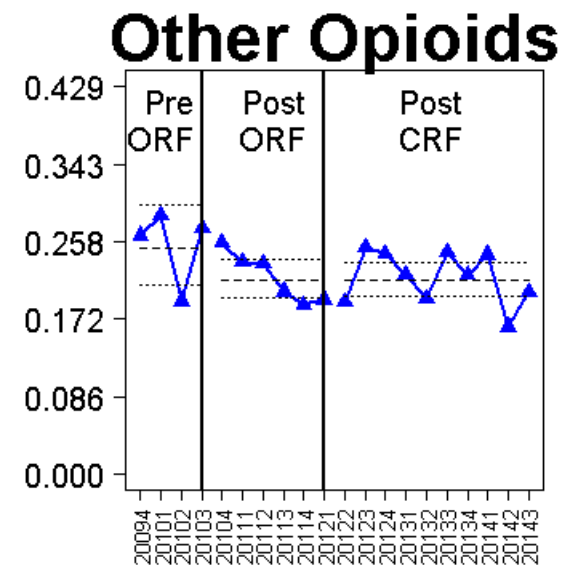
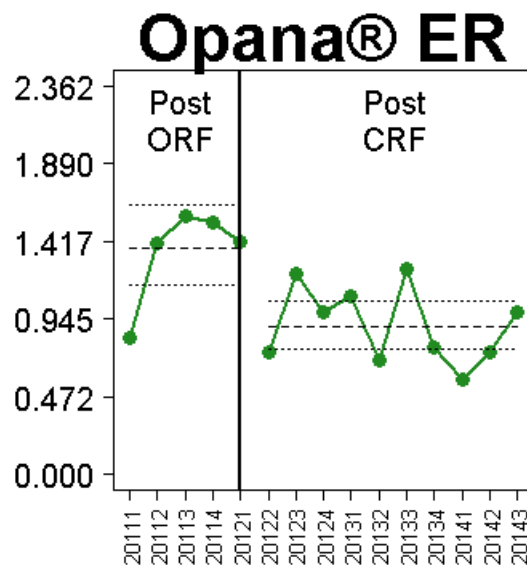
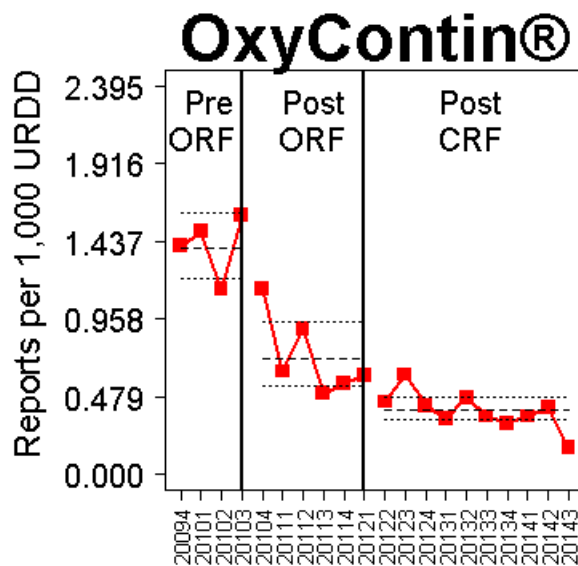


Drug	Crowdsourced Data from StreetRx		Predicted Relative Potency	Clinical Equianalgesic Potency <sup>b</sup>
	n	Mean, US\$ (95% CI)	(95% CI) <sup>a</sup>	Milligrams
Hydromorphone	75	3.29 (2.74-3.96)	6.3 (5.8-6.8)	4
Oxymorphone	38	1.57 (1.27-1.95)	3.0 (2.9-3.2)	3
Methadone	21	0.96 (0.71-1.29)	1.8 (1.8-1.9)	1.5
Oxycodone	454	0.97 (0.90-1.04)	1.9 (1.5-2.2)	2
Hydrocodone	228	0.81 (0.74-0.89)	1.5 (1.3-1.8)	1
Morphine	83	0.52 (0.40-0.68)	1.0	1
Tramadol	21	0.05 (0.03-0.07)	0.1 (0.07-0.13)	0.3



Year/Quarter

RADARS® System Drug Diversion (law enforcement)



Year/Quarter

# Can the Black Market Discriminate between ADFs?

Do different deterrence strategies and platforms result in discernible street price differences?



STEP 1

USA Data in USD  
Nov 1, 2010 through Mar 31, 2015  
Solid oral formulations



STEP 2

Compare 14 ADF to  
unprotected street price per  
milligram, within active  
ingredient



STEP 3

Geometric means and 95% CI  
N = 49,995



STEP 4

Non-parametric Wilcoxon  
rank-sum (Mann-Whitney)  
tests

(Partial-) Antagonists: *Subutex* vs. *Suboxone*

Prodrugs: *morphine* vs. *codeine*; *Vyvanse* vs. *amphetamines*

Physical barriers: *Zohydro* vs. *Hysingla ER* vs. *IR hydrocodone*; *OxyContin OP* vs. *OC*;

*Opana ER reformulation* vs *original*; *Xartemis XR* vs. *IR oxycodone*;

*Exalgo* vs. *IR hydromorphone*; *Concerta* vs. *Ritalin LA* vs. *methylphenidate*, *Nucynta ER* vs. *IR tapentadol*

Not enough data to evaluate yet:

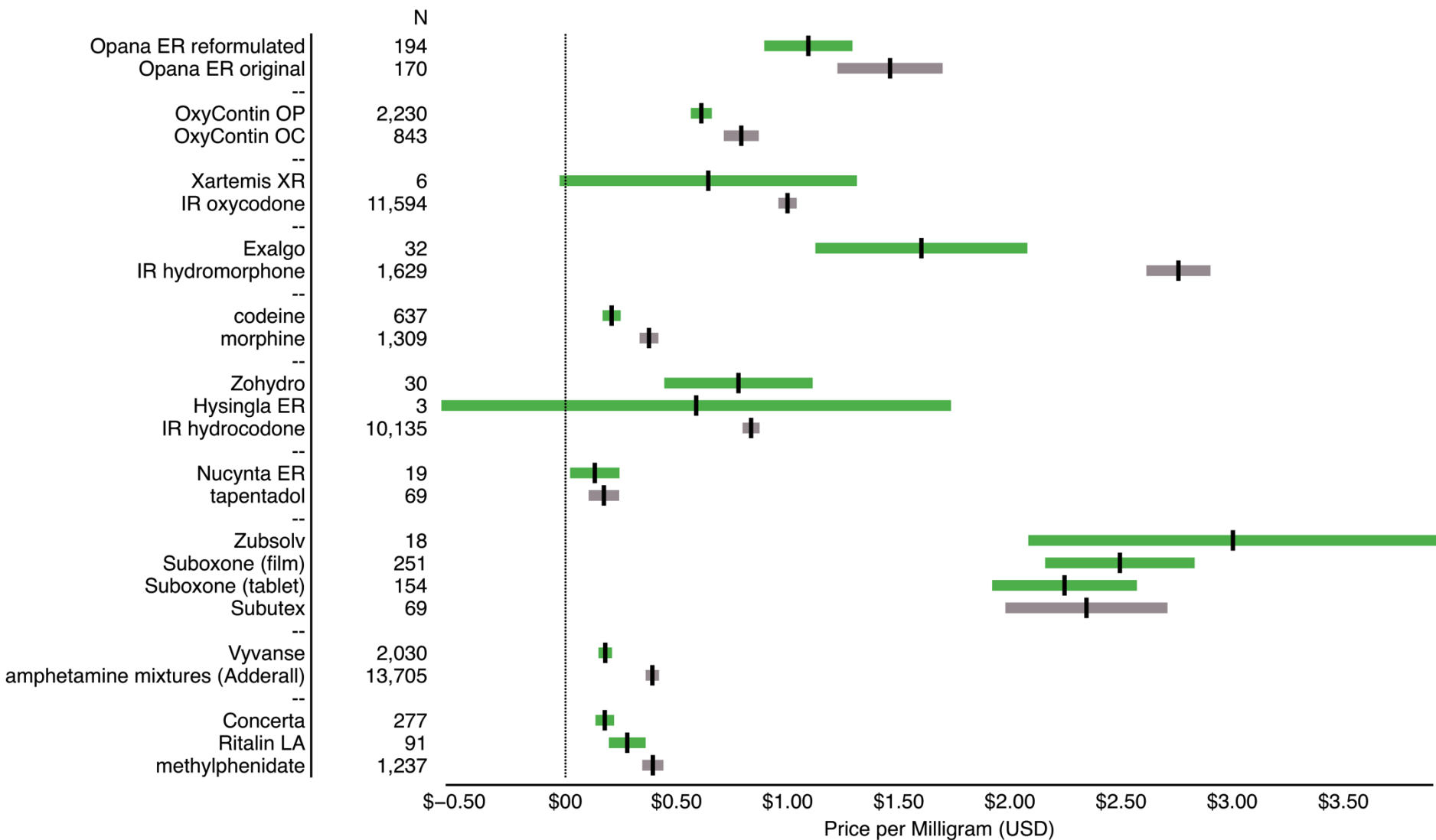
*Embeda*, *Targin(iq)*, *Oxytrex*, *Oxecta*, *Quillivant XR*, *Talwin NX*, *Amrix*

# Descriptive Results

95% Confidence interval of the geometric mean

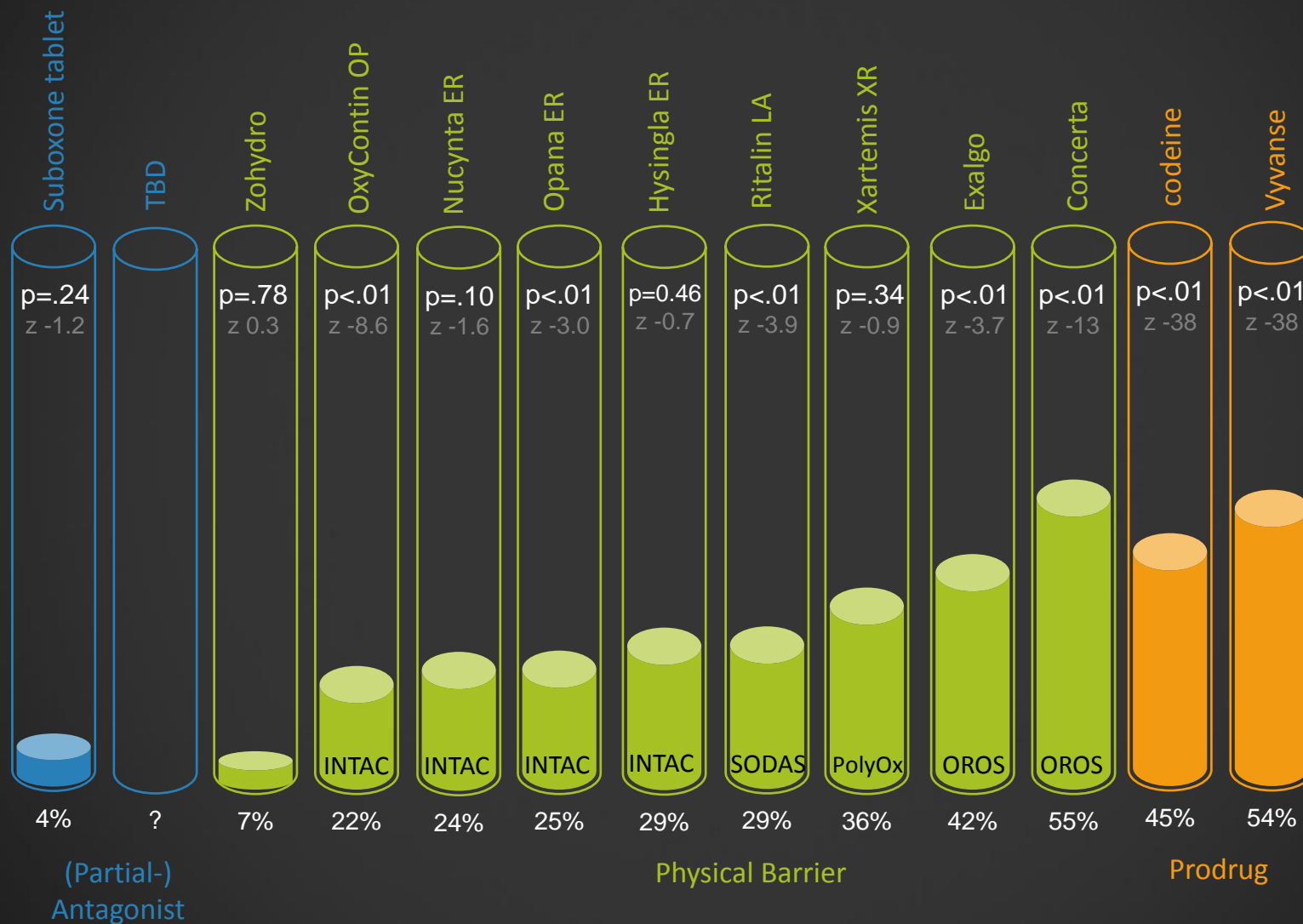
Abuse/tamper deterrent formulation

Original unprotected formulation



# Percent Reduction in Street Price

Putative abuse-deterrent formulation versus unprotected formulations with same active ingredient, using statistical comparison that is less influenced by outliers.





# Thanks you & Contact Info



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