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

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.

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.
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

2012 130
2013 250
2014 1641
2015 2439

Not to scale.
Visitor Demographics

Based on 58% of known demographics from Google account users

- **43%** Male
  - 18-34 years-old

- **22%** Female
  - 18-34 years-old

- **20%** Male
  - 35+ 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

- 919 Canada
- 231 UK
- 50k United States
- 43 DE, ES, FR, IT
- 139 Australia
Who is Likely to Submit a Price?
Percent of visitors, 58% of known Google Account users, 1Q2015

- 18-24 years-old: 5.4%
- 25-34 years-old: 5.7%
- 35-44 years-old: 4.6%
- 45+ years-old: 4.0%
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

1,750
1,438
1,318
1,420
4,565
1,356
1,432
2,062
Cross-Validation of Black Market Prices

Dasgupta et al. *Journal of Medical Internet Research*. 2013
<table>
<thead>
<tr>
<th>Drug</th>
<th>n</th>
<th>Mean, US$ (95% CI)</th>
<th>Predicted Relative Potency (95% CI)</th>
<th>Clinical Equianalgesic Potencyb</th>
<th>Milligrams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydromorphone</td>
<td>75</td>
<td>3.29 (2.74-3.96)</td>
<td>6.3 (5.8-6.8)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Oxymorphone</td>
<td>38</td>
<td>1.57 (1.27-1.95)</td>
<td>3.0 (2.9-3.2)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td>21</td>
<td>0.96 (0.71-1.29)</td>
<td>1.8 (1.8-1.9)</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Oxycodone</td>
<td>454</td>
<td>0.97 (0.90-1.04)</td>
<td>1.9 (1.5-2.2)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Hydrocodone</td>
<td>228</td>
<td>0.81 (0.74-0.89)</td>
<td>1.5 (1.3-1.8)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Morphine</td>
<td>83</td>
<td>0.52 (0.40-0.68)</td>
<td>1.0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tramadol</td>
<td>21</td>
<td>0.05 (0.03-0.07)</td>
<td>0.1 (0.07-0.13)</td>
<td>0.3</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Drug</th>
<th>Abuse/tamper deterrent formulation</th>
<th>Original unprotected formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opana ER reformulated</td>
<td>N=194</td>
<td>N=170</td>
</tr>
<tr>
<td>Opana ER original</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OxyContin OP</td>
<td>N=2,230</td>
<td>N=843</td>
</tr>
<tr>
<td>OxyContin OC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xartemis XR</td>
<td>N=6</td>
<td>N=32</td>
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<tr>
<td>IR oxycodone</td>
<td>N=11,594</td>
<td>N=1,629</td>
</tr>
<tr>
<td>Exalgo</td>
<td>N=30</td>
<td>N=637</td>
</tr>
<tr>
<td>IR hydromorphone</td>
<td>N=3</td>
<td>N=1,309</td>
</tr>
<tr>
<td>codeine</td>
<td>N=30</td>
<td>N=637</td>
</tr>
<tr>
<td>morphine</td>
<td>N=3</td>
<td>N=1,309</td>
</tr>
<tr>
<td>Zohydro</td>
<td>N=30</td>
<td>N=637</td>
</tr>
<tr>
<td>Hysingla ER</td>
<td>N=10,135</td>
<td>N=637</td>
</tr>
<tr>
<td>IR hydrocodone</td>
<td>N=10,135</td>
<td>N=637</td>
</tr>
<tr>
<td>Nucynta ER</td>
<td>N=19</td>
<td>N=69</td>
</tr>
<tr>
<td>tapentadol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zubsov</td>
<td>N=18</td>
<td>N=251</td>
</tr>
<tr>
<td>Suboxone (film)</td>
<td>N=154</td>
<td>N=69</td>
</tr>
<tr>
<td>Suboxone (tablet)</td>
<td>N=154</td>
<td></td>
</tr>
<tr>
<td>Subutex</td>
<td>N=69</td>
<td></td>
</tr>
<tr>
<td>Vyvanse (amphetamine mixtures (Adderall))</td>
<td>N=2,030</td>
<td>N=13,705</td>
</tr>
<tr>
<td>Concerta</td>
<td>N=277</td>
<td></td>
</tr>
<tr>
<td>Ritalin LA</td>
<td>N=91</td>
<td></td>
</tr>
<tr>
<td>methylphenidate</td>
<td>N=1,237</td>
<td></td>
</tr>
</tbody>
</table>

**Price per Milligram (USD)**
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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