RAND DRUG POLICY RESEARCH CENTER

Integrating GPS data with other drug indicators to evaluate the effects of drug policy

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RAND

Outline

- Advantages and challenges of GPSs for drug policy analysis
- Case study: Using the U.S. National Survey of Drug Use and Health to estimate drug market size
- What can be done to make GPSs more useful?

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Data and methods must be appropriate to the question

- To evaluate the effect of a policy change, need a way to control for confounding factors
  - Find a counterfactual (difficult for national-level estimates)
  - Test sensitivity of findings to alternative assumptions
- The suitability of a data source depends on its specific design, reliability, immediacy, scope, and representativeness

General population survey estimates of users and consumption are a baseline

- Aims to capture the biggest segment of the population possible given financial, time, and other practical constraints

- Survey methods are developed pragmatically
  - Ideal collection is infeasible (i.e., huge representative sample, longitudinal, many questions on drug use, acquisition, treatment, incarceration)

The benefits of GPS

- Potential for uniformity across geographies
- Consistency for comparisons over time
- Scale is important for generalizability
  - Assumes heterogeneous drug use patterns within a sample frame
  - Understanding of the sample frame is essential

Specific challenges confronted by GPS

- Sample frames and administration methods
- Time periods and temporal proximity
- Norms about reporting drug use
- Endogenous effects of local policies, access to treatment, enforcement
- Response bias is likely
  - Phrasing and order of questions
  - Missing key populations (e.g., drug users missing from households)
  - Responses may not be accurate (recall error or knowingly misleading)

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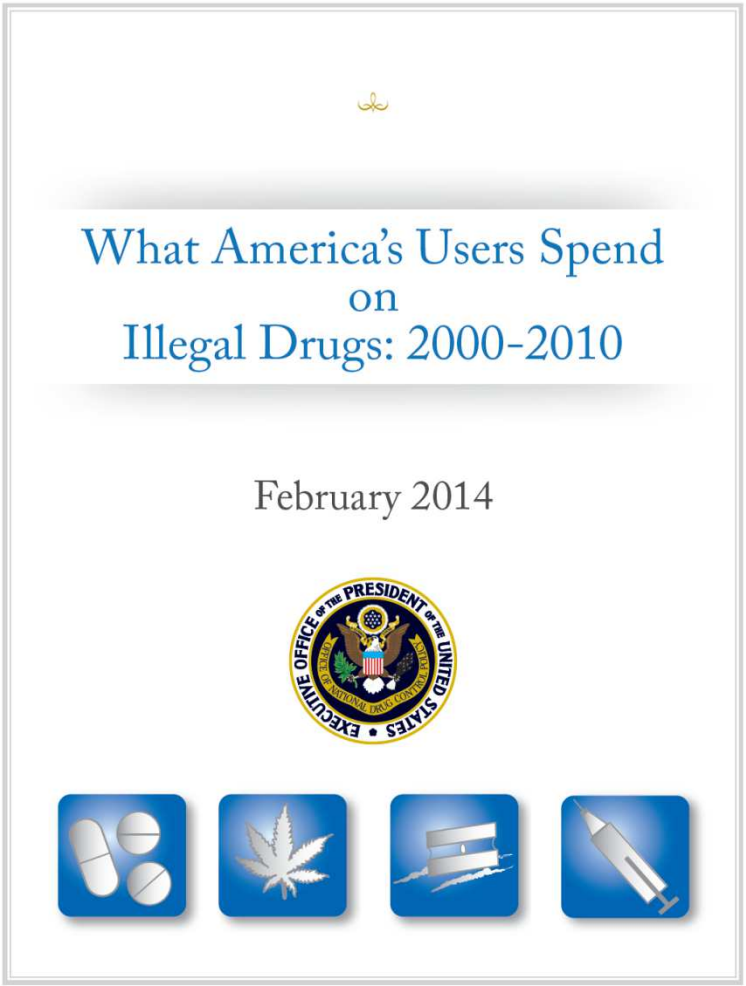
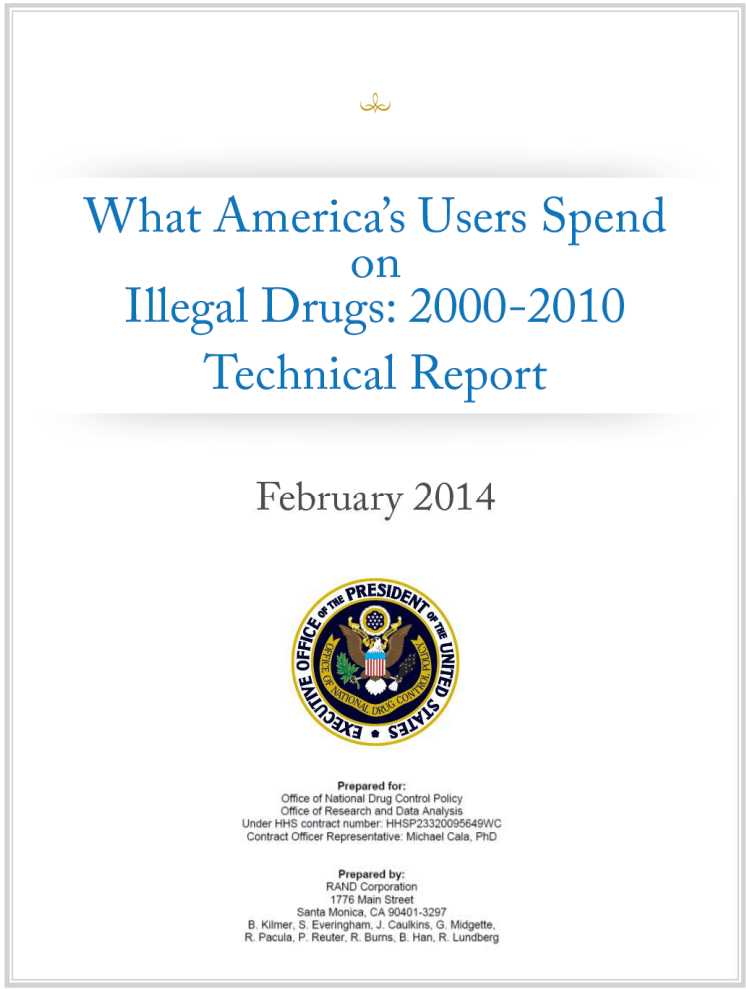
Building estimates of drug users and consumption





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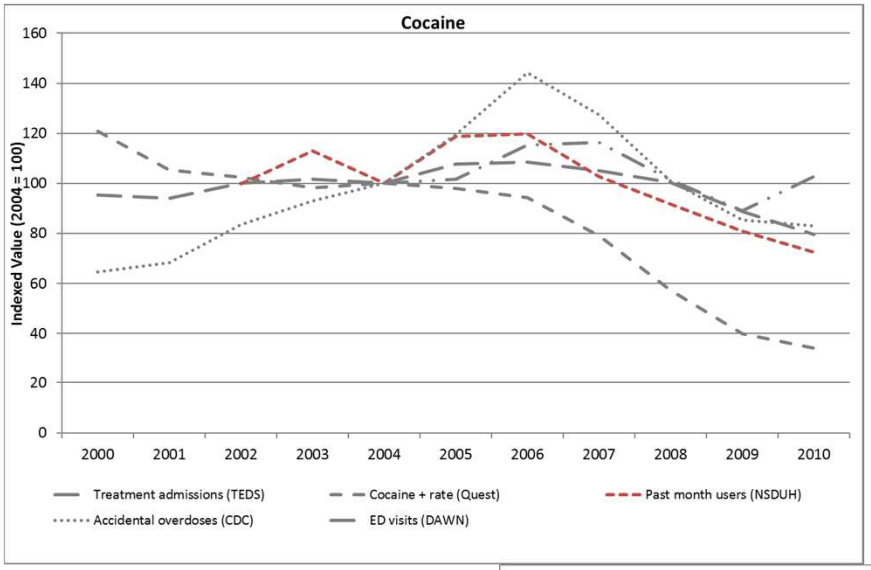
The U.S. National Survey of Drug Use and Health (NSDUH)

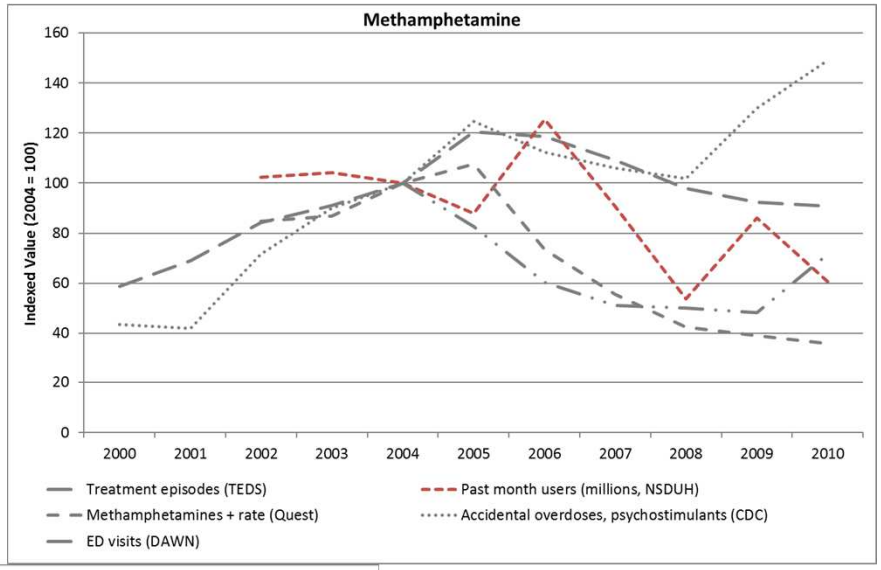
- Annual cross-sectional in-person household GPS
  - n ≈ 70,000 respondents per year
  - response rate ≈ 80%
- Nation representative GPS for the United States
  - Also state and substate-representative through year pooling
- Questions err toward basic
  - Not much detail on expenditures or intensity of use
  - No ongoing validation (e.g., urinalysis); previous reliability studies are limited

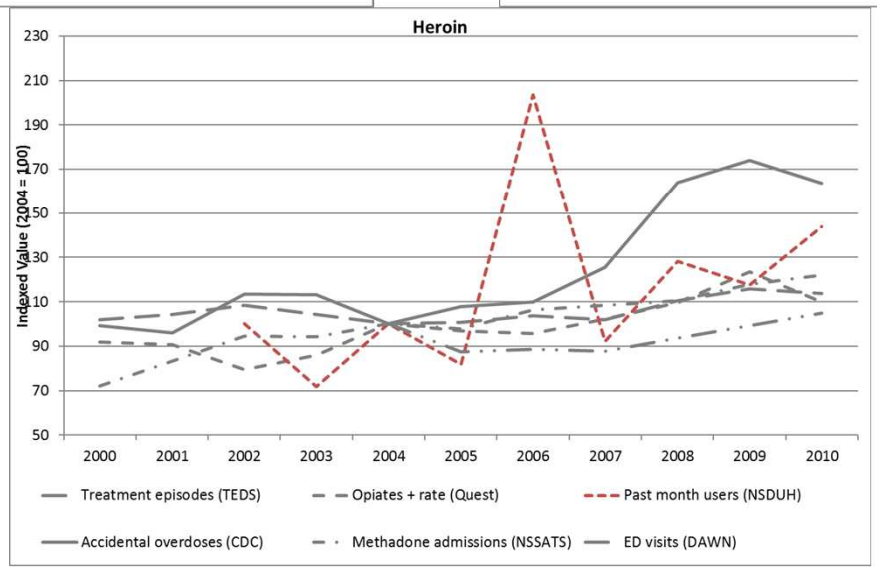
The U.S. National Survey of Drug Use and Health (NSDUH)

- Very good source of data for marijuana use
  - Also tobacco, alcohol
- Not good for other drugs
- Should never be the sole source of information on consumption and resultant public health and safety effects
  - Missing key groups and key questions, no validation

GPS-based hard drug user estimates are volatile







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Using GPS to estimate drug consumption, users, and expenditures

- Consider five user types:
  - Daily/near-daily: ≥21 use days in past month
  - More than weekly: 11 to 20
  - Weekly: 4 to 10
  - Light: 1 to 3
  - Infrequent: Past year but not past month

Chronic

Occasional

Cannabis users

Users and use days

1. Start with NSDUH estimates for each user category
2. Adjust youth population based on the observed difference between NSDUH & Monitoring the Future
3. Adjust adult population to account for underreporting and those outside of households

Cannabis users

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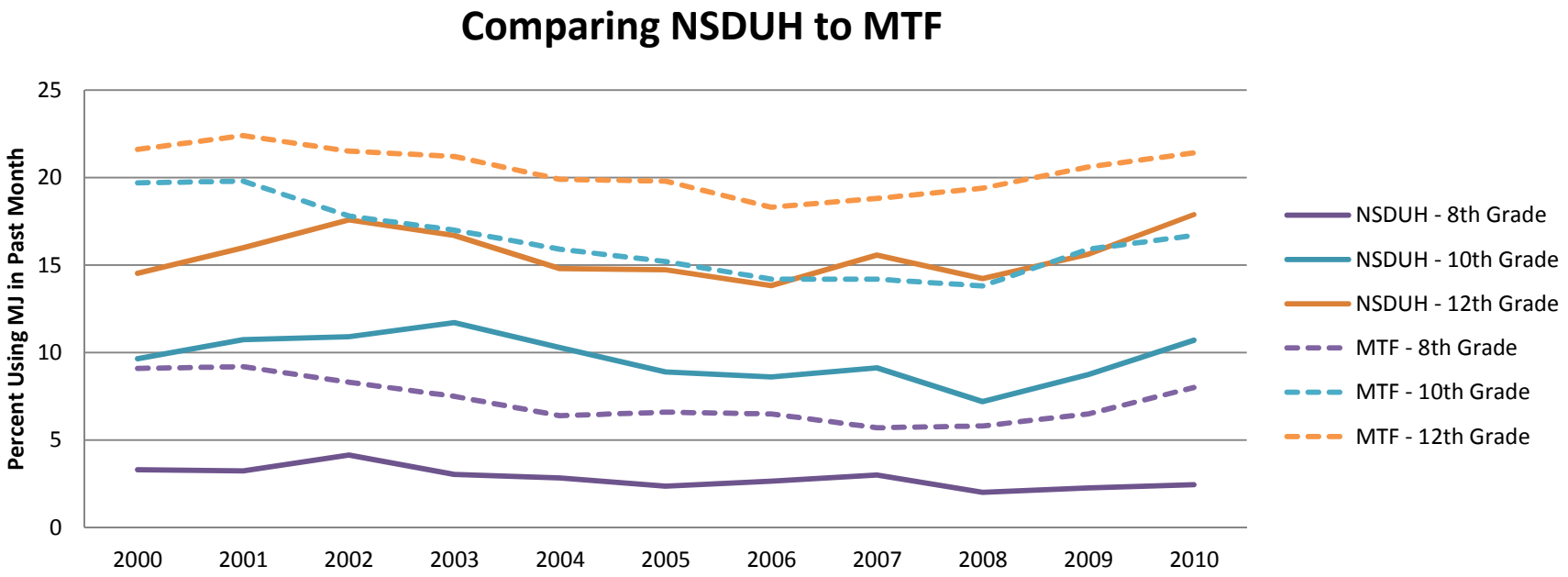
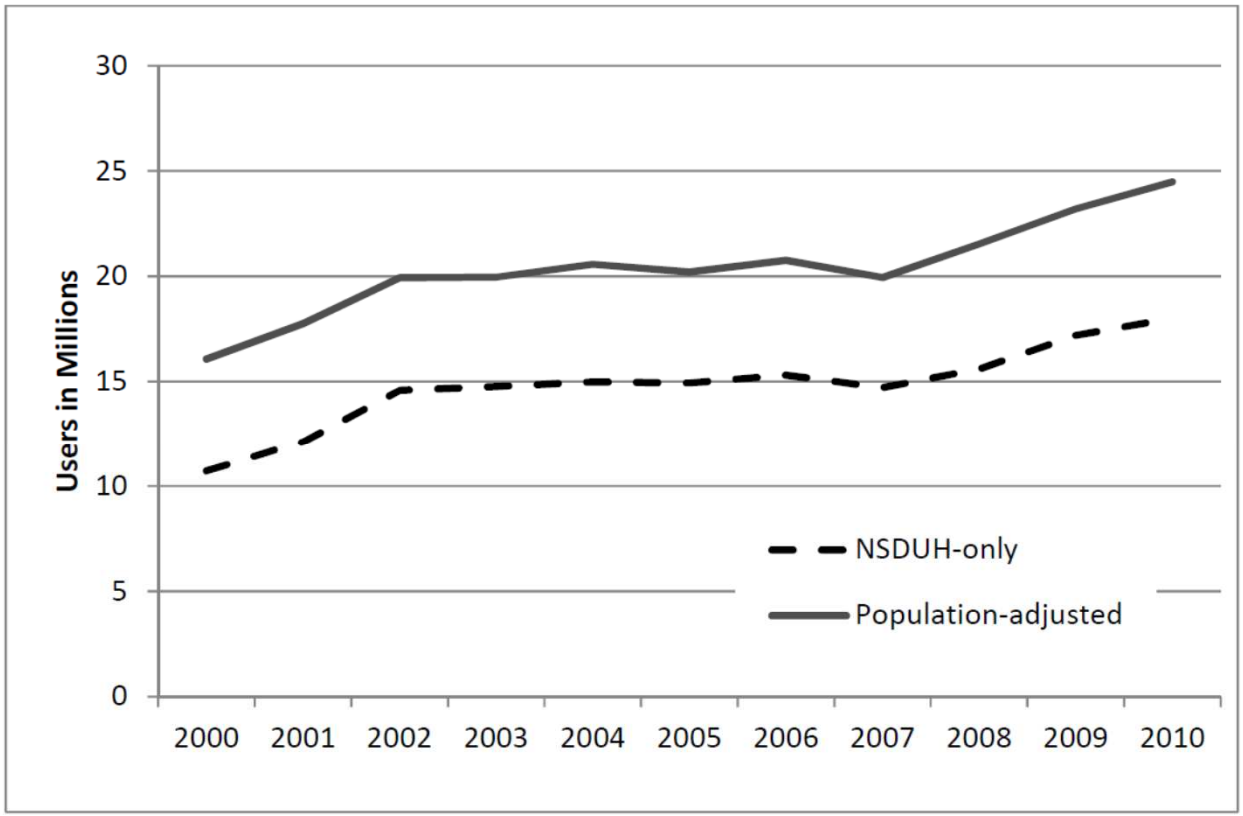
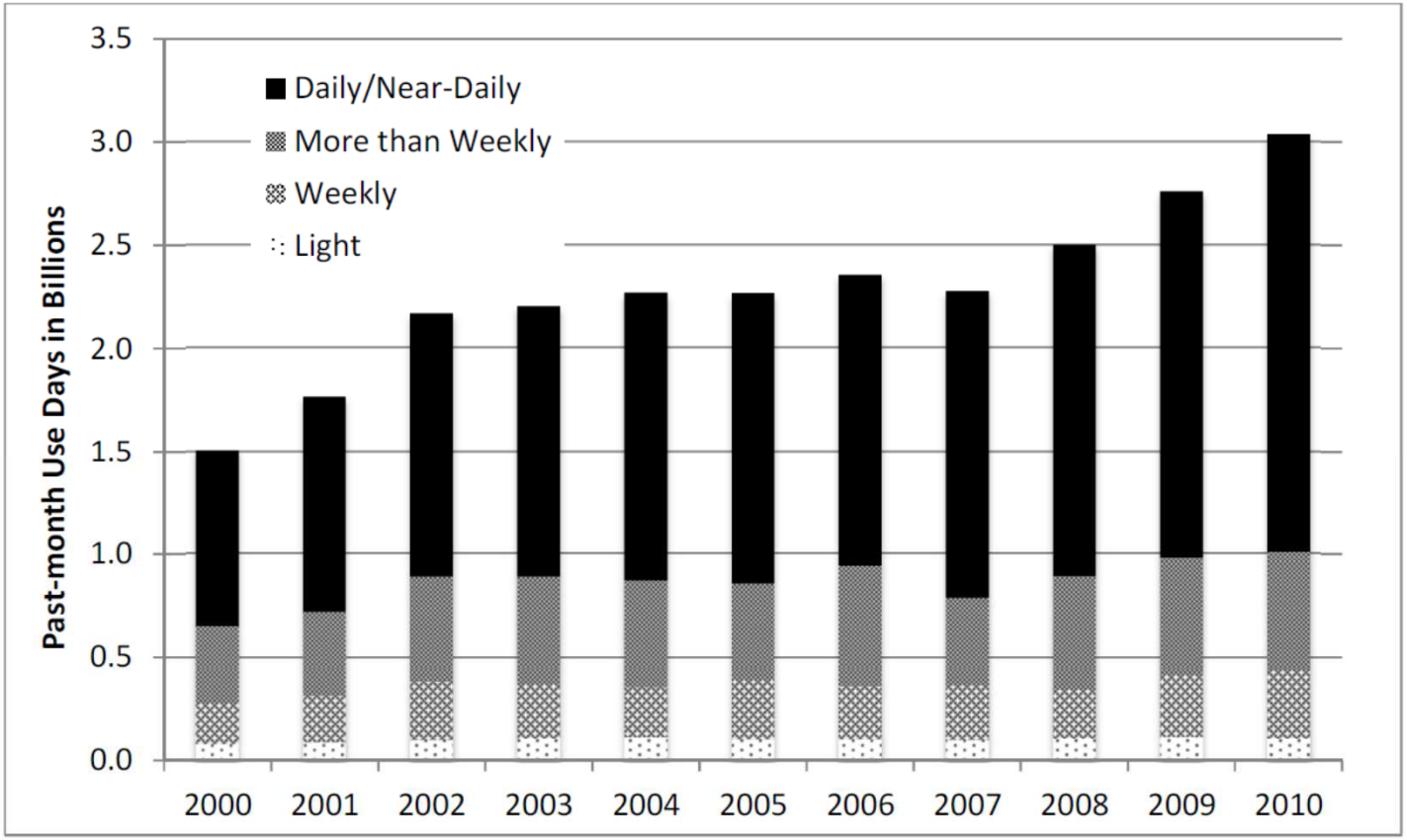


Adjusted cannabis user estimate



Note: The 2000-2003 marijuana estimates are not perfectly comparable to the later years because of changes in survey questions and methods.

Use days by user type



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Cannabis

Consumption

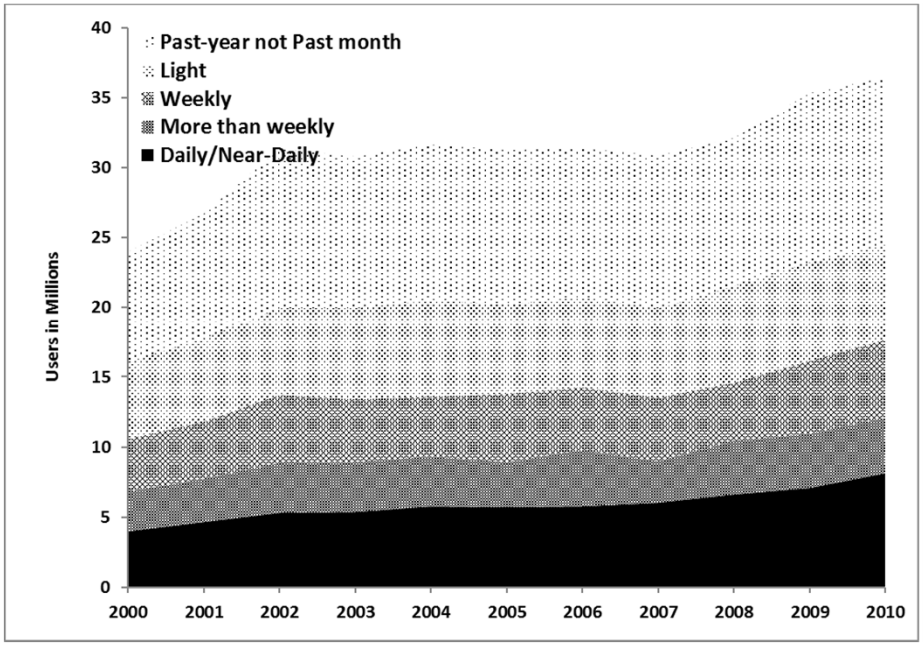
1. Estimate amount used per day from external source (NESARC)
2. Use days × Amount used per use day
   - Used ADAM to estimate joint size (new use modes will require adjustments)
   - Daily users use more per use day than other frequent users
   - If interested in THC consumed, need potency estimate

Expenditures

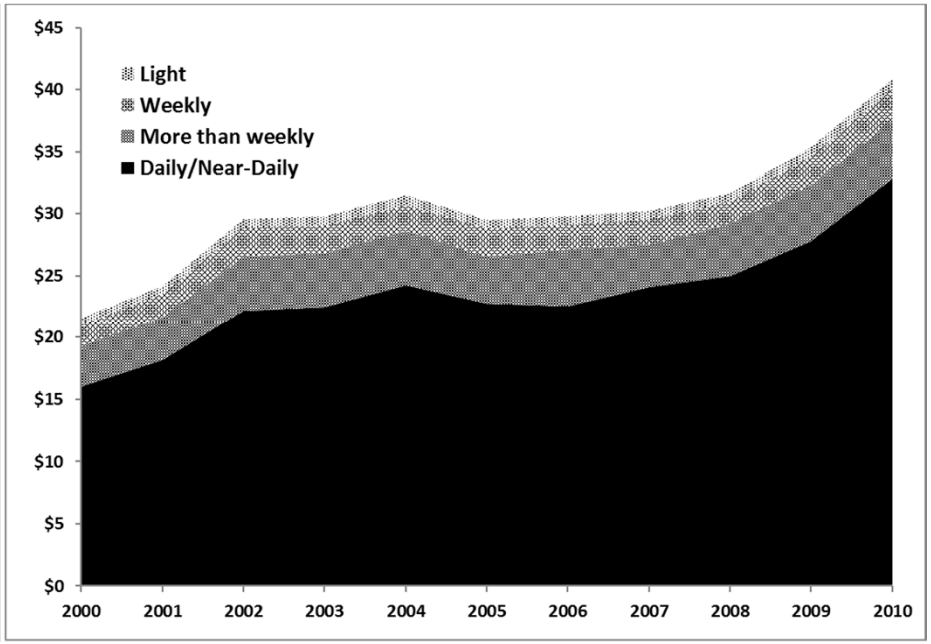
1. Estimate price per gram (or pure gram)
2. Adjust NSDUH reported purchase value for random incidence
3. Consumption × price at referent purchase quantity

Cannabis Users and Expenditures

Users



Expenditures ($ billions)

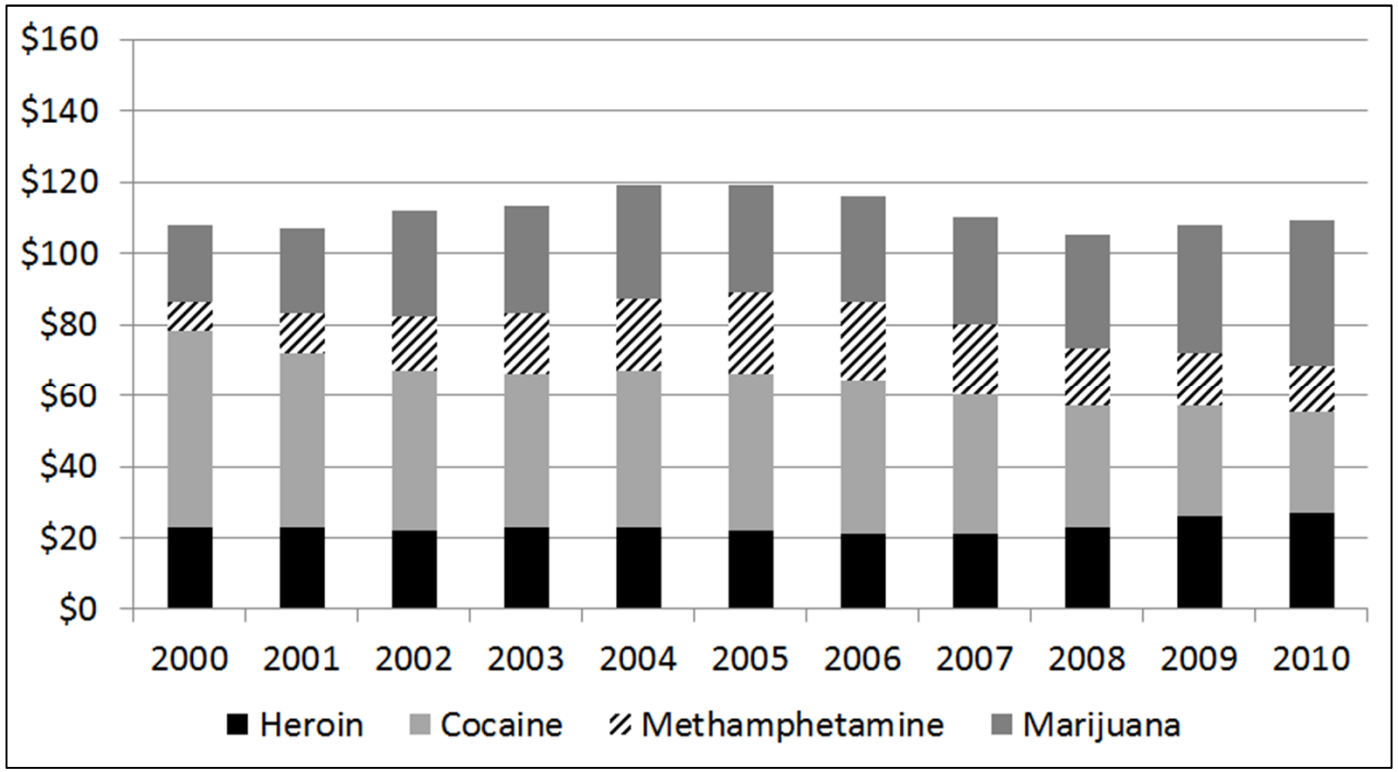


ONCDP, 2014

Cocaine, heroin, and methamphetamine

1. Quantify the relationship between
   a) the proportion of positive drug tests among adult male arrest events recorded in ADAM counties
   b) county-level covariates that are available for all counties in U.S.
2. Project proportion for other counties
3. Estimate number of arrestees who are heavy users
4. Make adjustments for non-arrestees, females & juveniles
   - 4 × (NSDUH estimate) provides estimates light/occasional users
5. Expenditures: multiply by spending estimates to get
   - Consider three different types of frequent drug users
   - Spending for hard drugs based on ADAM
6. Consumption: divide by purity adjusted prices
   - Expected Purity Hypothesis-based price estimates based on STRIDE and ADAM

U.S. expenditures by drug, 2000-2010 ($ in billions)



Kilmer, Caulkins, Reuter and Midgette, 2014

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What can be done to make GPSs more useful?

- Be up front about survey mode effects
- Add more questions about quantity consumed and expenditures (e.g., Before the Grand Opening [Kilmer et al, 2015], EMCDDA European Web Survey on Drugs, 2016)
- Validation studies using alternative sources and methods
- Compare GPS-informed estimates of consumption with wastewater testing (see, e.g., EMCDDA, 2016)

Backup slides

Sources of data for national and supranational drug policy analysis

Concept	EU/EMCDDA	U.S. Analog
General Population Survey	GPS (Nat'l surveys)	NSDUH
	HRDU/PDU	
Mortality	DRD	CDC WONDER MCD
Drug-related infectious disease	DRID	
Chemical Dependence Treatment	TDI	TEDS
Wastewater testing	SCORE	
Workplace Drug Testing	Sporadic coverage	Quest Diagnostics
Arrestee Drug Use		ADAM (discontinued)
Illicit drug prices	???	DEA STRIDE/Star LIMS
Socioeconomic and demographic data	Various sources	Census, BLS

What are the main drivers of uncertainty?

- Probability (Arrest | CDU)
- Extrapolating from 10 ADAM II sites in the later years
- Spending per user per month
  - That said, spending for daily/near daily users was fairly stable
  - Improving the “technology” of how to assess past month spending would be a good place to invest

Table 2.1. Covariates Used to Predict Drug Prevalence Rates

		Cocaine	Opiates	Meth
Socioeconomic	Population	X	X	X
	Poverty rate	X	X	X
	High school graduation rate	X	X	X
	Percent of population ages 18–24	X	X	X
NSDUH	State			X
	Substate	X		
Treatment	Treatment Episode Daily System (TEDS)—Cocaine	X	X	X
	TEDS—Heroin	X	X	X
	TEDS—Meth	X	X	X
	N-SSATS-Methadone		X	
QUEST	Positive test rate for cocaine	X	X	X
CDC	Cocaine mortality	X	X	X
	Heroin mortality		X	
	Psychostimulants mortality	X	X	
	Model-fit statistics for preferred specification			
	Observations	183	183	183
	R^2	0.899	0.733	0.822
	Akaike information criterion	45.08	219.1	315.2
	Bayesian information criterion	199.1	299.2	379.4
	Number of covariates	47	24	19

Notes: Region-fixed effects were included in all models. Time and interaction effects were handled differently for each drug, which explains the different number of covariates for each model. See Technical Report for more information.

Table 2.2. Estimating the Number of Chronic Hard-Drug Users (four or more days in the past month)

Factor	Adjustments	Data	Years covered	For which user categories?
	Start: Number of adult male arrest events with a positive urinalysis test			
F1	1. For adult male arrest events with a positive test, percent using four or more days in past month[a]	ADAM-II (based on urinalysis and self-report information)	Average across annual estimates, 2000–03, 2007–10	Calculate for three groups: four to ten use days in past month, 11–20 days, 21 or more days
	Multiplying by F1 yields the number of adult male CDU arrest events with a positive urinalysis test			
F2	2. Number of arrests with positive test per person arrested and testing positive[a]	ADAM-I-II (based on self-report information about arrests in the past year, excluding warrants)	Estimate from pooled ADAM-I-II (2000–03, 2007–10)	Calculate for two groups: four to ten use days in past month, 11 or more days[b]
	Dividing by F2 yields the number of adult male CDUs who are arrested and have a positive urinalysis test			
F3	3. Proportion of adult male criminally active CDUs who get arrested each year[a]	Take arrests per arrestee from #2, assumes criminally active CDUs get arrested according to a Poisson distribution[c]	Estimate from pooled ADAM-I-II (2000–03, 2007–10)	Calculate for two groups four to ten use days in past month, 11 or more days[b]
	Dividing by F3 yields the number of criminally active adult male CDUs			
F4	4. Adult male CDUs who are not criminally active	Number of adult male CDUs who report never having been arrested in NSDUH, multiplied by 4[d]	Estimate from pooled NSDUH (2000–10)	Calculate for three groups: four to ten use days in past month, 11–20 days, 21 or more days
	Adding F4 gives the number of adult male CDUs			
F5	5. Ratio of adult CDUs (male + female) to just adult male CDUs	Drug-specific ratios from (1) NSDUH Days of Use, (2) NSDUH CDUs Days of Use, (3) NSDUH number of CDUs, (4) TEDS Users in Treatment, (5) TEDS CDUs in Treatment, (6) Drug Abuse Warning Network (DAWN), (7) Vital Stats overdoses	Generate 2000–2010 average for each of these seven factors, take simple average of these seven values	Calculated for one group: four or more days in past month
	Multiplying by F5 gives the number of adult CDUs			
F6	6. Ratio of all CDUs (adult + juvenile) to just adult CDUs	Drug-specific ratios from 1) NSDUH Days of Use, 2) NSDUH CDUs Days of Use, 3) NSDUH number of CDUs, 4) TEDS Users in Treatment, 5) TEDS CDUs in Treatment	Generate annual average across these five factors, impose linear trend for cocaine and meth (heroin constant 0.03)	Calculated for one group: four or more days in past month
	Multiplying by F6 gives the number of CDUs			

[a] ADAM-I-II: No weights, do not account for those who refuse urinalysis test, no data for 2004–2006.
[b] To boost sample, combine those who used on 11–20 days with those who used 21 or more days. Dropping those brought in on warrants has relatively little effect.
[c] Different from ONDCP (2012c) because we use Poisson assumption only to extrapolate to criminally active CDUs who did not get arrested, not to all CDU who do not get arrested.
[d] Based on ONDCP (2012c) assumption that occasional users of cocaine, heroin, and meth in NSDUH should be multiplied by four because of underreporting.