Vietnam Era Study (VES)

- 1971 - Thousands of American soldiers returning from Vietnam were addicted to narcotics. The White House initiated a study conducted by Washington University in 1972 and 1974.
- 1993 - Washington University began a followup study.....

Acknowledgment

Funding support from the National Institute on Drug Abuse (R01DA07393, R01DA09281, K02AD00221)

Collaborators

WUSM
- Rumi Price, Lee Robins, Edward Spitznagel, George Murphy
- Seth Eisen, Katherine Virgo, Gary Collins, Robert Bellar, John Piepho
- Howard Chilcoat, Bruce Goldberger, Kurt Kroenke, Constantine Lyketsos, G. Lee Judy

St. Louis VA
- Research Triangle Institute, Psychemedics

Cycle of Epidemiologic Research

Linkage to other studies
- Epidemiologic data collection
- Intervention/prevention studies
- Followup on focused goals
- Development of new research
- Feasibility
- Instrumentation

Substance Abuse in Adulthood: Natural History Over a 25-Year Period

- Background
- Covariates of substance abuse
  - Year-to-year measures
  - General Estimation Equation (GEE) models
  - Social-environmental and psychiatric covariates
- Patterns and predictors of remission
  - Descriptive patterns
  - Predictors
  - “Spontaneous” remission
- Dynamics of substance abuse
  - Latent transition analysis (LTA)
  - Testing for different transition patterns
VES (1993--20??) - Phased Approach

I. Feasibility
- Locate the national sample not contacted since 1974
- Preliminary outcome assessment

II. Instrumentation
- Pretest
- Finalize interview data collection procedures

III. Epidemiologic study
- Adult course of substance abuse and psychiatric comorbidity
- Health care utilization
- Physical health
- Validity of self-report

IV. Suicide study
- Nested case-control design
- Episode-based interview
- Protective factors mitigating suicide risk
- Quantitative-qualitative integration

Interviewed Samples (Total N = 1,227)

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Interviewed</th>
<th>Final refusal</th>
<th>Other non-interviews</th>
<th>Non-veterans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>898</td>
<td>484</td>
<td>2</td>
<td>32</td>
<td>115</td>
</tr>
<tr>
<td>1974</td>
<td>855</td>
<td>308</td>
<td>19</td>
<td>323</td>
<td></td>
</tr>
<tr>
<td>1996-7</td>
<td>841</td>
<td>323</td>
<td>19</td>
<td>320</td>
<td></td>
</tr>
</tbody>
</table>

Validated Interviewed Samples (Total N = 1,227)

<table>
<thead>
<tr>
<th>Vet Status</th>
<th>D+</th>
<th>D-</th>
<th>Non-vet</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+ Vet</td>
<td>24</td>
<td>10</td>
<td>5</td>
<td>39</td>
</tr>
<tr>
<td>D- Vet</td>
<td>21</td>
<td>8</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>Non-vet</td>
<td>284</td>
<td>198</td>
<td>115</td>
<td>100</td>
</tr>
</tbody>
</table>

VES-III Field Status, 1997

<table>
<thead>
<tr>
<th>Field Status</th>
<th>D+ Veteran</th>
<th>D- Veteran</th>
<th>Non-veteran</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decayed during VES-III</td>
<td>24</td>
<td>10</td>
<td>5</td>
<td>39</td>
<td>3.6</td>
</tr>
<tr>
<td>Unlocated</td>
<td>21</td>
<td>8</td>
<td>3</td>
<td>32</td>
<td>2.9</td>
</tr>
<tr>
<td>Contacted</td>
<td>374</td>
<td>378</td>
<td>272</td>
<td>1024</td>
<td>93.5</td>
</tr>
<tr>
<td>Interviewed</td>
<td>323</td>
<td>320</td>
<td>198</td>
<td>841</td>
<td>82.1</td>
</tr>
<tr>
<td>Final refusal</td>
<td>19</td>
<td>38</td>
<td>45</td>
<td>102</td>
<td>10.0</td>
</tr>
<tr>
<td>Other non-interviews</td>
<td>32</td>
<td>20</td>
<td>29</td>
<td>81</td>
<td>7.9</td>
</tr>
<tr>
<td>Phase III Total Eligible</td>
<td>419</td>
<td>396</td>
<td>280</td>
<td>1095</td>
<td>100</td>
</tr>
</tbody>
</table>

1. New dead identified since December, 1993.
2. Percentage based on those contacted.

VES-III Demographic Characteristics (N = 839)

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Veterans</th>
<th>Non-veterans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug + (N = 323)</td>
<td>Drug + (N = 319)</td>
<td>Non-veterans (N = 197)</td>
</tr>
<tr>
<td>Age</td>
<td>Mean Age in 1996 (SD)</td>
<td>46.5</td>
</tr>
<tr>
<td>Race</td>
<td>Whites</td>
<td>62.2</td>
</tr>
<tr>
<td></td>
<td>Blacks</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td>Hispanics</td>
<td>5.3</td>
</tr>
<tr>
<td>Employment Status (%)</td>
<td>Active duty in 1972</td>
<td>16.1</td>
</tr>
<tr>
<td></td>
<td>Not employed in 1972/74</td>
<td>31.3</td>
</tr>
<tr>
<td></td>
<td>Not employed in 1996-97</td>
<td>26.8</td>
</tr>
</tbody>
</table>

1. Excludes missing cases.
2. Veteran status as of 1972; nonveteran employment status as of 1974, including laid-off.
3. Includes those who were “between jobs,” housekeeping, disabled, retired and other.

Covariates of Substance Abuse Over 25 Years

Purposes

- Are there stable factors “influencing” substance abuse over time?
- Are there environmental influences over and above psychiatric comorbidity?
- Can the over-time correlation structure be identified?
**Outcome Year-to-Year Measures**

- Alcohol: Heavy alcohol use\(^1\) Dependence\(^2\)
- Any illicit drug: Heavy use Dependence/abuse\(^3\)
- Marijuana: Heavy use Dependence/abuse\(^3\)
- Cocaine: Heavy use Dependence/abuse\(^3\)
- Opiates: Heavy use Dependence/abuse\(^3\)
- Illicit drugs other than marijuana: Heavy use Dependence/abuse\(^3\)

1. Constructed from onset-recency years.
2. DSM-IV.

---

**Prevalence Rates of Substance Abuse: 1972-1996**

- Heavy Alcohol Use
- Alcohol Dependence
- Any Illicit Drug Heavy Use
- Any Illicit Drug Dependence/abuse
- Marijuana Heavy Use
- Marijuana Dependence/abuse
- Cocaine Heavy Use
- Cocaine Dependence/abuse
- Illicit drugs other than marijuana Heavy Use
- Illicit drugs other than marijuana Dependence/abuse

---

**Measures**

- Socio-environmental covariates
  - Landmark events (negative or positive)
  - Employment
  - Married or cohabitating
  - Number of children\(^1\)
  - Number of important people (max = 4)\(^1\)
  - Number of important people who are regular alcohol/drug users (max = 4)\(^3\)

1. Constructed from onset/recency years.
Covariates of Substance Abuse

Measures

- Psychiatric covariates
  - Posttraumatic stress disorder (PTSD) (traumatic event before 1972 or after)\(^1,2\)
  - Major depression\(^1,2\)
  - Adult antisocial personality (ASP)\(^1,2\)

1. Constructed from onset/recency years.
2. DSM-IV.

- Time-invariant measures
  - Race (African-American)
  - High school education
  - Veteran
  - Drug-positive status
  - Age
  - Family psychopathology (depression, ASP symptoms, drinking problems, drug problems, hospitalization, life interference, suicide attempts)

Covariates of Substance Abuse

Prevalence Rates of Covariates: 1972-1996

- Any Event
- Positive Event
- Negative Event

- Any Event
- Positive Event
- Negative Event

Prevalence Rates of Covariates: 1972-1996

- % Married
- # of Children

Prevalence Rates of Covariates: 1972-1996

- # of important friends
- Important people w/ alcohol problems
- Important people w/ illicit drug use

Prevalence Rates of Covariates: 1972-1996

- Adult ASP
- PTSD
- Depression
### GEE First-Order Autoregressive Models

#### Alcohol Heavy Use

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>-.089*</td>
<td>-.089*</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.040*</td>
<td>.055</td>
</tr>
<tr>
<td>Employment</td>
<td>.017</td>
<td>.012</td>
</tr>
<tr>
<td>Married</td>
<td>-.054*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.007</td>
<td>.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.038</td>
<td>.076</td>
</tr>
<tr>
<td>Alc friend</td>
<td>.153*</td>
<td>.145</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.199</td>
<td>-.205</td>
</tr>
<tr>
<td>Depression</td>
<td>.318</td>
<td>.293</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.233</td>
<td>.226</td>
</tr>
</tbody>
</table>

#### Alcohol Dependence

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>.004*</td>
<td>.005</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.002</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.049*</td>
<td>.055</td>
</tr>
<tr>
<td>Employment</td>
<td>.017</td>
<td>.012</td>
</tr>
<tr>
<td>Married</td>
<td>-.054*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.007</td>
<td>.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.038</td>
<td>.076</td>
</tr>
<tr>
<td>Alc friend</td>
<td>.153*</td>
<td>.145</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.199</td>
<td>-.205</td>
</tr>
<tr>
<td>Depression</td>
<td>.318</td>
<td>.293</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.233</td>
<td>.226</td>
</tr>
</tbody>
</table>

*p < 0.05, ** p < 0.0001. The odds ratio (OR) indicates "per-year" effect.

### GEE First-Order Autoregressive Models

#### Any Illicit Drug Heavy Use

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>-.073*</td>
<td>-.074**</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.041*</td>
<td>.049*</td>
</tr>
<tr>
<td>Employment</td>
<td>-.014</td>
<td>-.042</td>
</tr>
<tr>
<td>Married</td>
<td>-.055*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.063*</td>
<td>-.097*</td>
</tr>
<tr>
<td>Drug friend</td>
<td>.297*</td>
<td>.406*</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.298*</td>
<td>-.34*</td>
</tr>
<tr>
<td>Depression</td>
<td>.460</td>
<td>.58*</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.372*</td>
<td>.478**</td>
</tr>
<tr>
<td>Family depression</td>
<td>-.278</td>
<td>.361</td>
</tr>
<tr>
<td>Family drug</td>
<td>.178</td>
<td>.136</td>
</tr>
<tr>
<td>Year of birth</td>
<td>.125*</td>
<td>.133</td>
</tr>
</tbody>
</table>

#### Any Illicit Drug Dependence

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>-.064*</td>
<td>-.070*</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.002</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.041*</td>
<td>.049*</td>
</tr>
<tr>
<td>Employment</td>
<td>-.014</td>
<td>-.042</td>
</tr>
<tr>
<td>Married</td>
<td>-.055*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.063*</td>
<td>-.097*</td>
</tr>
<tr>
<td>Drug friend</td>
<td>.297*</td>
<td>.406*</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.298*</td>
<td>-.34*</td>
</tr>
<tr>
<td>Depression</td>
<td>.460</td>
<td>.58*</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.372*</td>
<td>.478**</td>
</tr>
<tr>
<td>Family depression</td>
<td>-.278</td>
<td>.361</td>
</tr>
<tr>
<td>Family drug</td>
<td>.178</td>
<td>.136</td>
</tr>
<tr>
<td>Year of birth</td>
<td>.125*</td>
<td>.133</td>
</tr>
</tbody>
</table>

*p < 0.05, ** p < 0.0001; only significant betas are shown. The odds ratio (OR) indicates "per-year" effect.

### GEE First-Order Autoregressive Models

#### Marijuana Heavy Use

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>-.089*</td>
<td>-.089*</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.040*</td>
<td>.055</td>
</tr>
<tr>
<td>Employment</td>
<td>.017</td>
<td>.012</td>
</tr>
<tr>
<td>Married</td>
<td>-.054*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.007</td>
<td>.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.038</td>
<td>.076</td>
</tr>
<tr>
<td>Drug friend</td>
<td>.153*</td>
<td>.145</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.199</td>
<td>-.205</td>
</tr>
<tr>
<td>Depression</td>
<td>.318</td>
<td>.293</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.233</td>
<td>.226</td>
</tr>
<tr>
<td>Family depression</td>
<td>-.176</td>
<td>.113</td>
</tr>
<tr>
<td>Family drug</td>
<td>.176*</td>
<td>.133</td>
</tr>
<tr>
<td>Year of birth</td>
<td>.125*</td>
<td>.133</td>
</tr>
</tbody>
</table>

#### Cocaine Heavy Use

<table>
<thead>
<tr>
<th></th>
<th>BETA OR</th>
<th>BETA OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>-.089*</td>
<td>-.089*</td>
</tr>
<tr>
<td>(Year²)</td>
<td>-.001</td>
<td>-.002</td>
</tr>
<tr>
<td>Event</td>
<td>.040*</td>
<td>.055</td>
</tr>
<tr>
<td>Employment</td>
<td>.017</td>
<td>.012</td>
</tr>
<tr>
<td>Married</td>
<td>-.054*</td>
<td>-.084</td>
</tr>
<tr>
<td>Children</td>
<td>.007</td>
<td>.002</td>
</tr>
<tr>
<td>Important people</td>
<td>.038</td>
<td>.076</td>
</tr>
<tr>
<td>Drug friend</td>
<td>.153*</td>
<td>.145</td>
</tr>
<tr>
<td>PTSD</td>
<td>-.199</td>
<td>-.205</td>
</tr>
<tr>
<td>Depression</td>
<td>.318</td>
<td>.293</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.233</td>
<td>.226</td>
</tr>
<tr>
<td>Family depression</td>
<td>-.176</td>
<td>.113</td>
</tr>
<tr>
<td>Family drug</td>
<td>.176*</td>
<td>.133</td>
</tr>
<tr>
<td>Year of birth</td>
<td>.125*</td>
<td>.133</td>
</tr>
</tbody>
</table>

*p < 0.05, ** p < 0.0001; only significant betas are shown. The odds ratio (OR) indicates "per-year" effect.
GEE Analyses

Is the Assumption about the Correlational Structure Correct?
- Is the 1st-order autoregressive (AR1) better than the unconstrained?
- Are the beta estimates robust across different assumptions?
- Are the standard errors stable across different assumptions?

GEE Outcome Correlations

<table>
<thead>
<tr>
<th></th>
<th>Marijuana Heavy Use</th>
<th>Cocaine Heavy Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Year 1</td>
<td>Observed</td>
<td>AR1 1 Observed</td>
</tr>
<tr>
<td>Year 2</td>
<td>.866</td>
<td>.910</td>
</tr>
<tr>
<td>Year 6</td>
<td>.623</td>
<td>.624</td>
</tr>
<tr>
<td>Year 11</td>
<td>.526</td>
<td>.390</td>
</tr>
<tr>
<td>Year 25</td>
<td>.348</td>
<td>.104</td>
</tr>
</tbody>
</table>

1. The estimates did not converge due to iterations being caught in a loop.
2. 1st-order autoregressive.
### GEE Time-Lagged Models
#### Any Illicit Drug Heavy Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>No Lag Beta</th>
<th>P</th>
<th>1-Yr Lag Beta</th>
<th>P</th>
<th>5-Yr Lag Beta</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td>.034</td>
<td>.044</td>
<td>-.040</td>
<td>.032</td>
<td>-.014</td>
<td>.383</td>
</tr>
<tr>
<td>Job Status</td>
<td>-.061</td>
<td>.395</td>
<td>-.015</td>
<td>.841</td>
<td>-.028</td>
<td>.602</td>
</tr>
<tr>
<td>Marital Status</td>
<td>-.010</td>
<td>.814</td>
<td>-.068</td>
<td>.901</td>
<td>-.027</td>
<td>.423</td>
</tr>
<tr>
<td>Children</td>
<td>-.070</td>
<td>.040</td>
<td>-.018</td>
<td>.572</td>
<td>-.012</td>
<td>.696</td>
</tr>
<tr>
<td>Friends</td>
<td>-.071</td>
<td>.005</td>
<td>-.081</td>
<td>.002</td>
<td>-.082</td>
<td>.001</td>
</tr>
<tr>
<td>Drug Friend</td>
<td>.301</td>
<td>.001</td>
<td>.386</td>
<td>&lt;.001</td>
<td>.322</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>PTSD</td>
<td>.300</td>
<td>.005</td>
<td>.125</td>
<td>.425</td>
<td>.065</td>
<td>.638</td>
</tr>
<tr>
<td>Depression</td>
<td>.617</td>
<td>&lt;.001</td>
<td>.062</td>
<td>.826</td>
<td>.352</td>
<td>.004</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.339</td>
<td>.005</td>
<td>.260</td>
<td>.002</td>
<td>.267</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Fixed variables were not entered in the models. Year, (Year)^2 were estimated but not listed here. The measures for covariates covered 20 years (no lag: 77-96; 1-yr lag: 76-95; 5-yr lag: 72-91).

---

### GEE Time-Lagged Models
#### Any Illicit Drug Heavy Use

<table>
<thead>
<tr>
<th>No Lag Beta</th>
<th>P</th>
<th>1-Yr Lag Beta</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td>.034</td>
<td>.044</td>
<td>.032</td>
</tr>
<tr>
<td>Job Status</td>
<td>-.061</td>
<td>.395</td>
<td>.841</td>
</tr>
<tr>
<td>Marital Status</td>
<td>-.010</td>
<td>.814</td>
<td>.901</td>
</tr>
<tr>
<td>Children</td>
<td>-.070</td>
<td>.040</td>
<td>.572</td>
</tr>
<tr>
<td>Friends</td>
<td>-.071</td>
<td>.005</td>
<td>.002</td>
</tr>
<tr>
<td>Drug Friend</td>
<td>.301</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>PTSD</td>
<td>.300</td>
<td>.005</td>
<td>.425</td>
</tr>
<tr>
<td>Depression</td>
<td>.617</td>
<td>&lt;.001</td>
<td>.826</td>
</tr>
<tr>
<td>Adult ASP</td>
<td>.339</td>
<td>.005</td>
<td>.002</td>
</tr>
</tbody>
</table>

Fixed variables were not entered in the models. Year, (Year)^2 were estimated but not listed here. The measures for covariates covered 20 years (no lag: 77-96; 1-yr lag: 76-95; 5-yr lag: 72-91).

---

### Use and Remission Patterns
#### Class of Drugs

<table>
<thead>
<tr>
<th>Class of Drugs</th>
<th>ALC</th>
<th>SED</th>
<th>STIM</th>
<th>MJ</th>
<th>COC</th>
<th>OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>634</td>
<td>189</td>
<td>226</td>
<td>404</td>
<td>215</td>
<td>139</td>
</tr>
</tbody>
</table>

| % Frequent use starting in 1972 or later | 30.6 |
| Mean duration (yrs.) of initiation to last remission (S.D.) | 17.7 (6.9) |
| Mean number of remissions (S.D.) | 1.4 (9) |
| Mean duration of remitted years (S.D.) | 10.7 (8.9) |

1. ALC = alcohol, SED = sedatives, STIM = stimulants, MJ = marijuana, COC = cocaine, OP = opiates.
2. 7+ drinks/day, daily drinking 2+ weeks, or 6+ drinks/one day/week for several weeks since 1972.
3. 5+ times use since 1972.
4. Based on questions about most frequently used years. Comparable measures were used to eliminate cases starting frequent use prior to 1972.
5. Remission is defined as negative of years using most frequently.

---

### Patterns and Predictors of Remission
#### Purposes

- Are the remission patterns stable over time?
- Are the remission patterns different across classes of substances?
- Are the predictors of remission the same as covariates of long-term abuse?
- How common is spontaneous remission?
- Why spontaneous remission?

---

### Use and Remission Patterns
#### Class of Drugs

<table>
<thead>
<tr>
<th>Class of Drugs</th>
<th>ALC</th>
<th>SED</th>
<th>STIM</th>
<th>MJ</th>
<th>COC</th>
<th>OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>634</td>
<td>189</td>
<td>226</td>
<td>404</td>
<td>215</td>
<td>139</td>
</tr>
</tbody>
</table>

| % Frequent use starting in 1972 or later | 30.6 |
| Mean duration (yrs.) of initiation to last remission | 17.7 |
| Mean number of remissions | 1.4 |
| Mean duration of remitted years | 10.7 |

1. ALC = alcohol, SED = sedatives, STIM = stimulants, MJ = marijuana, COC = cocaine, OP = opiates.
2. 7+ drinks/day, daily drinking 2+ weeks, or 6+ drinks/one day/week for several weeks since 1972.
3. 5+ times use since 1972.
4. Based on questions about most frequently used years. Comparable measures were used to eliminate cases starting frequent use prior to 1972.
5. Remission is defined as negative of years using most frequently.

---
Continuous Remission from Substance Abuse

Cox Regression

Outcome Measures
- Marginal success (hazard) rate of the last year of frequent use
- Classes of substances
  - Alcohol
  - Sedatives
  - Stimulants
  - Marijuana
  - Cocaine
  - Opiates

Cox Regression Predictor Measures

Substance use behavior predictors
- Age of onset - age started using heavily
- Frequency of use when using most frequently
  - Alcohol - number of drinks quintile
  - Drugs - 5-point scale
- Smoking
- IV use
- Substance abuse comorbidity
  - Alcohol - any illicit drug dependence/abuse
  - Drugs - alcohol dependence

Socio-environmental predictors
- PTSD (traumatic event before 1972 or after)
- Major depression
- Adult ASP
- Childhood ASP before 1972 (10-point scale)

Time-invariant measures
- Race (African-American)
- High school education
- Veteran
- Drug-positive status
- Age
- Parental drinking/drug problems

Predictors of Continuous Remission

Class of Substances Alcohol Sedatives Stimulants Marijuana Cocaine Opiates
Effective N 620 183 219 383 209 136
Age of onset .98** .94** .95** NS .97** NS
Frequency of use NS NS NS .86** NS NS
Smoking HE HE NS NS .86** NS
IV use NE NE .85* NE NS NS
Alcohol dependence NE .40* .52* .77* .71* .42*
Drug dep/abuse ....... .70* ....... NE NE ...... NS

Dropped from models: insignificant demographics (veteran, drug-positive status, age); multilinear childhood ASP; variables with unstable estimates (parental substance use problems). Insignificant predictors across 6 classes of substances are not shown here: (alc friends, depression, adult ASP). Odds ratios are shown: NS, not entered; NE = not entered; **, p < .01; *, p < .05.
### Predictors of Continuous Remission

<table>
<thead>
<tr>
<th>Class of Substances</th>
<th>Alcohol</th>
<th>Sedatives</th>
<th>Stimulants</th>
<th>Marijuana</th>
<th>Cocaine</th>
<th>Opiates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective N</td>
<td>620</td>
<td>183</td>
<td>219</td>
<td>383</td>
<td>209</td>
<td>136</td>
</tr>
</tbody>
</table>

#### Age of onset
- Alcohol: 56**
- Sedatives: 94**
- Stimulants: 55**
- Marijuana: NS
- Cocaine: 97**
- Opiates: NS

#### Frequency of use
- Alcohol: NS
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Smoking
- Alcohol: NS
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Alcohol dependence
- Alcohol: NE
- Sedatives: NE
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Drug dependence
- Alcohol: .76**
- Sedatives: .82**
- Stimulants: .77*
- Marijuana: .71*
- Cocaine: .42*

#### Negative events
- Alcohol: .70**
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: .59**

#### Employment
- Alcohol: 1.45*
- Sedatives: NS
- Stimulants: 1.50
- Marijuana: 2.13**
- Cocaine: 2.04**
- Opiates: 2.25**

#### Marital status
- Alcohol: 1.18
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Children
- Alcohol: NS
- Sedatives: 1.17*
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Important people
- Alcohol: NS
- Sedatives: 1.15*
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Drug friend
- Alcohol: NS
- Sedatives: .86
- Stimulants: .82*
- Marijuana: NS
- Cocaine: .75*

### Unmet Needs: Inpatient Utilization

#### Problem identified for last 5 yrs
- Alcohol: 41.1%
- Sedatives: 51.0%
- Stimulants: 36.9%
- Marijuana: 61.8%
- Cocaine: 42.6%

#### Drug Use
- W Drug: 20.8%
- WO Drug: 38.3%
- W Drug: 41.7%
- WO Drug: 55.3%

#### ALC or Dep/Abuse
- W Drug: 20.8%
- WO Drug: 38.3%
- W Drug: 41.7%
- WO Drug: 55.3%

#### PTSD
- W Drug: 8.5%
- WO Drug: 19.8%
- W Drug: 15.4%
- WO Drug: 34.2%

### Patterns and Predictors of Remission

#### “Spontaneous” Remission

<table>
<thead>
<tr>
<th>Class of Substances</th>
<th>Alcohol</th>
<th>Sedatives</th>
<th>Stimulants</th>
<th>Marijuana</th>
<th>Cocaine</th>
<th>Opiates</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>620</td>
<td>183</td>
<td>219</td>
<td>383</td>
<td>209</td>
<td>136</td>
</tr>
</tbody>
</table>

#### % Attempted to quit (N=)
- Alcohol: 65.3
- Sedatives: 77.8
- Stimulants: 76.1
- Marijuana: 71.8
- Cocaine: 72.6
- Opiates: 77.0

#### % Quit attempts that were cold turkey
- Alcohol: 66.4
- Sedatives: 87.6
- Stimulants: 97.6
- Marijuana: 76.3
- Cocaine: 64.5
- Opiates: 28.6

#### % Cold turkey quit attempts associated with continuous remission
- Alcohol: 89.0
- Sedatives: 89.8
- Stimulants: 94.5
- Marijuana: 87.4
- Cocaine: 95.4
- Opiates: 95.3

### Unmet Needs: Outpatient Utilization

#### Problem identified for last 5 yrs
- Alcohol: 50.0
- Sedatives: 46.5
- Stimulants: 63.2
- Marijuana: 56.6
- Cocaine: 64.5
- Opiates: 64.5

#### Drug Use
- W Drug: 4.8
- WO Drug: 10.0
- W Drug: 8.3
- WO Drug: 46.7
- W Drug: 28.2
- WO Drug: 28.2

#### ALC or Dep/Abuse
- W Drug: 2.4
- WO Drug: 4.7
- W Drug: 5.3
- WO Drug: 26.4
- W Drug: 10.2
- WO Drug: 10.2

### Predictors of Continuous Remission

<table>
<thead>
<tr>
<th>Class of Substances</th>
<th>Alcohol</th>
<th>Sedatives</th>
<th>Stimulants</th>
<th>Marijuana</th>
<th>Cocaine</th>
<th>Opiates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective N</td>
<td>620</td>
<td>183</td>
<td>219</td>
<td>383</td>
<td>209</td>
<td>136</td>
</tr>
</tbody>
</table>

#### Age of onset
- Alcohol: .98**
- Sedatives: 94**
- Stimulants: 55**
- Marijuana: NS
- Cocaine: 97**
- Opiates: NS

#### Smoking
- Alcohol: NS
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Alcohol dependence
- Alcohol: NE
- Sedatives: NE
- Stimulants: NS
- Marijuana: NS
- Cocaine: NE
- Opiates: NS

#### Drug dependence
- Alcohol: .76**
- Sedatives: .62**
- Stimulants: .77*
- Marijuana: .71*
- Cocaine: .42*

#### Negative events
- Alcohol: .70**
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: .59**

#### Employment
- Alcohol: 1.45*
- Sedatives: NS
- Stimulants: 1.50
- Marijuana: 2.13**
- Cocaine: 2.04**
- Opiates: 2.25**

#### Marital status
- Alcohol: 1.18
- Sedatives: NS
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Children
- Alcohol: NS
- Sedatives: 1.17*
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Important people
- Alcohol: NS
- Sedatives: 1.15*
- Stimulants: NS
- Marijuana: NS
- Cocaine: NS
- Opiates: NS

#### Drug friend
- Alcohol: NS
- Sedatives: .86
- Stimulants: .82*
- Marijuana: NS
- Cocaine: .75*

#### Education
- Alcohol: NE
- Sedatives: NS
- Stimulants: NS
- Marijuana: 1.29*
- Cocaine: 1.45*
- Opiates: 1.41

### Dynamics of Substance Abuse Over Time

- **What's the relationship between use of one drug and use of another drug over time?**
- **Is there evidence for the "substitution" hypothesis?**
- **Is there evidence for the "unpiling" hypothesis?**
- **Is there evidence for the "rock-bottom" hypothesis?**

### VES-III: Substance Abuse in Adulthood

- [Add details about VES-III and its relevance to the text here]
**Dynamics of Substance Abuse Over Time**

**Latent Transition Analysis (LTA)**
- Reasonably aggregated time periods.
- Endorsement items consist of repeated measures of multiple drugs within a time period.
- Class structure and endorsement patterns assess polydrug use within a time period.
- Transition rates across time periods assess different hypotheses about dynamics of substance abuse.

**Basics of Latent Transition Analysis**

**Constructs and Measures**
- Constructs (Statuses)
  - Alcohol + marijuana
  - Opiates + cocaine
  - Alcohol + any illicit drugs
  - Alcohol + marijuana + other illicit drugs
- Same samples used in GEE (N = 839)
- 8-Year Time Interval
- Measures (Endorsement Items)
  - Heavy use or dependence/abuse at t
  - Dichotomous, max of 2 adjacent years

**Latent Transition Model of Polydrug Use**

**LTA Hypothesis Testing for Transitions Rates (τ)**

<table>
<thead>
<tr>
<th>τ1</th>
<th>τ2</th>
<th>None</th>
<th>ALC only</th>
<th>MJ only</th>
<th>ALC + MJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALC</td>
<td>U</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ</td>
<td>U</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALC</td>
<td>R</td>
<td>U</td>
<td>U</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S: Substitution hypothesis - switch from one substance to another.
U: Unpiling hypothesis - quit one substance at a time.
R: Rock-bottom hypothesis - quit substances altogether.

LTA Endorsement Patterns:
Alcohol + Marijuana - 4 classes, Unconstrained

<table>
<thead>
<tr>
<th>Class</th>
<th>ALC</th>
<th>MJ</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>ALC only</td>
<td>COC only</td>
<td>ALC only</td>
</tr>
<tr>
<td>3</td>
<td>MJ + mild</td>
<td>OP + mild</td>
<td>COC + OP</td>
</tr>
<tr>
<td>4</td>
<td>Both high</td>
<td>MJ-quitting</td>
<td>Both high</td>
</tr>
</tbody>
</table>

χ² (diff) = 484, d.f. = 37

LTA Optimal Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>ALC + MJ Dep/Abuse</th>
<th>ALC + MJ Dep/Abuse</th>
<th>COC + OP Heavy Use</th>
<th>ALC + Drugs Dep/Abuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>ALC only</td>
<td>ALC only</td>
<td>COC only</td>
<td>ALC only</td>
</tr>
<tr>
<td>3</td>
<td>MJ + mild</td>
<td>MJ only</td>
<td>OP + mild</td>
<td>Drug + mild</td>
</tr>
<tr>
<td>4</td>
<td>Both high</td>
<td>MJ-quitting</td>
<td>Both high</td>
<td>Both high</td>
</tr>
</tbody>
</table>

χ² (diff) = 484, d.f. = 37
### LTA Transitions Rates (τ)
#### Alcohol + Marijuana - Dependence/Abuse

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Unpiling</th>
<th>Both MJ</th>
<th>Both ALC</th>
<th>Both MJ</th>
<th>Both ALC</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1→T2</td>
<td>.91</td>
<td>.09</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>T2→T3</td>
<td>.94</td>
<td>.06</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
</tr>
</tbody>
</table>

#### Means Constraining τ = 0 Yielded a χ^2 (Diff) Above the Cutoff at p = .05.
#### Means Estimated τ = 0 Without a Constraint.

### LTA Transitions Rates (τ)
#### Cocaine + Opiates - Heavy Use

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Unpiling</th>
<th>Both COC</th>
<th>Both OP</th>
<th>Both COC</th>
<th>Both OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1→T2</td>
<td>.94</td>
<td>.05</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>T2→T3</td>
<td>.58</td>
<td>.42</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
</tbody>
</table>

#### Means Constraining τ = 0 Yielded a χ^2 (Diff) Above the Cutoff at p = .05.
#### Means Estimated τ = 0 Without a Constraint.

#### Means Constraining τ = 0 Yielded an Insignificant χ^2 (Diff).

### Limitations
- Generalizability somewhat limited.
- Impact of censoring by death unknown.
- Year-to-year symptom measures not available for some behaviors.
- Nicotine not examined.

### Patterns and Predictors of Remission
- Relatively few remissions.
- Marijuana most stable pattern of use.
- Substance use comorbidity detrimental to continuous remission.
- Psychiatric factors not good predictors.
- Spontaneous remission is a rule, not an exception.
- Considerable unmet needs for chronic drug users.

### Covariates of Substance Abuse over 25 years
- Strong psychiatric comorbidity.
- Socio-environmental factors equally important.
- Covariates are similar across classes of psychoactive substances; alcohol and marijuana are somewhat different.
- Inference to causal relationship warrants future analyses.
- Over-time correlational structure stable, perhaps except for cocaine.
Implications

- Cessation from substance abuse is a long, complicated process
  - Do not expect an overnight improvement.
  - Do not expect improvement from a single treatment.
  - Psychiatric comorbidity exacerbates substance abuse, but remission is more likely to be successful with changes in everyday milieu.

Implications (cont.)

- Uni-substance policies do not make sense.
- Substance use comorbidity is an obstruction to continuous remission.
- Cessation takes place mostly in the context of “narrowing of repertoire” over time.
- Substance abusers do recover over the long haul, but costs may be high.
  - Considerable levels of barriers to care.
  - Underutilization of services and underdetection of problems both contribute to drug abuse in middle age.

This presentation is brought to you by:

Nathan Risk
Dustin Stwalley
Jacki Mallmann
Keith Murray
Rumi Price

“If you are far enough behind the times, you become an institution” — T. Drewes.