Gateways to Appearance and Performance Enhancing Drug Use

Doping in Recreational Sports
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Introduction and Orientation

- Implications for prevention!
- ‘Gap Time’ as investigation tool
- How does it apply to APED use?
- What is a gateway substance?
What is a ‘Gateway Substance’
‘Gateway Hypothesis’

- Milder drugs cause initiation of more severe drug use
  
a). A fixed, temporal sequence whereby use of one drug precedes the use of another drug

b). A strong association between the two constructs, whereby people who use the initial drug are at an increased risk for using the subsequent drug

c). A causal link, which establishes that use of the initial drug brings about the use of the subsequent drug.

Sequential Progression

- Alcohol
- Nicotine
- Marijuana
- Cocaine
- Heroin
Strong Association

- Hypothesis: Smokers/Drinkers tend to also use marijuana
  - Smokers more likely to use marijuana and develop dependence

- Hypothesis: Marijuana users tend also be cocaine or heroin users
  - Adolescents using marijuana more likely to use prescription opioids

Causal Links?... Or Common Liability

Alcohol
Nicotine

Marijuana

Cocaine
Heroin

Common Liability

Genes
Environment
G X E
Antisocial
Young Age of Onset
Etc...
Criticisms of Gateway Hypothesis

- Unable to support connecting mechanisms
  - Doesn’t explain how one moves from one stage to another
- Unable to explain errors in sequencing
  - Many individuals move in reverse order of the sequence
- Unable to explain variability in the severity of the SUD at any stage of development
  - Age of onset (earlier = worse outcome) mediates severity of substance use

Vanyukov et al. (2012). *DAD*, 123S, 3S-17S
Does the ‘Gateway Hypothesis’ Apply to APEDs?

THEORY AND SUPPORT
## A Case of Mistaken Identity

<table>
<thead>
<tr>
<th>APEDs</th>
<th>Illicit Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Driven</td>
<td>Cue-driven</td>
</tr>
<tr>
<td>Detail Planning</td>
<td>Opportunistic</td>
</tr>
<tr>
<td>No Euphoria</td>
<td>Euphoria</td>
</tr>
<tr>
<td>Delayed Effect</td>
<td>Immediate Effects</td>
</tr>
<tr>
<td>Prolonged use</td>
<td>Acute use</td>
</tr>
<tr>
<td>Improves some functional markers</td>
<td>Impairs most functional markers</td>
</tr>
</tbody>
</table>
Rationale for Gateway Hypothesis?

- Wide range of substances that vary in:
  - Availability—Regulations
  - Severity of side effects
  - Abuse potential and potency

- Almost all APED users engage in polypharmacy
  - Near 100% of illicit APED users in our samples
  - Replicated in every modest sized sample where data are collected

- APED use is not an impulsive drug choice
  - No acute euphoria associated with most AASs or similar agents
  - Cultural context is stable despite heterogeneity in substances
Candidate Gateway Substances for APEDs

- Nutritional supplements are *legally* purchased
  - 12-15% of nutritional supplements contain illegal prohormones or AAS (Martello et al. 2007; *Food Addit Contam*, 24;258-65)

- Use of dubious claims, no safety information (Barret, 2003; *Int J Toxicol*, 22;392-2)
  - Failure to deliver on claims yields escalation of use

- Which supplements?
  - General Health
  - Muscle building/Mass building
  - Endurance/Fat burning
Use of fitness supplements ‘causes’ use of illegal and/or risky APED use

- A) Fitness supplement use precedes use of synthetic androgens (anabolic steroids).
- B) There is a strong association between Fitness supplement use and synthetic androgens.
- C) There is a causal link that establishes how Fitness supplements bring about use of synthetic androgens
  - This ‘causal’ relationship is hypothesized to be psychosocial, not biological per se.
Pilot Test of Gateway Hypothesis

BRIEF REPORT
Fitness Supplements as a Gateway Substance for Anabolic-Androgenic Steroid Use

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Rutgers, The State University of New Jersey

Approximately 3.0% of young Americans have used anabolic-androgenic steroids (AAS). A traditional model of adolescent substance use, the gateway hypothesis, suggests that drug use follows a chronological, causal sequence, whereby initial use of a specific drug leads to an increased likelihood of future drug use. Therefore, the use of illicit appearance and performance enhancing drugs (APED), such as AASs, also follows an analogous progression, whereby legal APEDs, (e.g., nutritional supplements) precedes illicit APED use. We examined the relationship between nutritional supplement use, beliefs about APEDs, and APED use in 201 male (n = 100) and female (n = 101) undergraduates. Participants completed measures of muscle dysmorphia (MDDI), body checking (BCQ, MBCQ), eating disorder symptoms (EDE–Q), perfectionism (FMPS), positive beliefs about the efficacy-safety of AAS use and APED use patterns. A series of covariance structure models (CSM) showed body image disturbance, compulsive exercise, illicit drug use, and perfectionism, independent of gender, were significant predictors of positive beliefs about AAS. Those who used both fat burning and muscle building supplements reported the strongest beliefs in AAS efficacy-safety, which was associated with higher likelihood of current illicit APED use. There was evidence of significant indirect relationships between supplement use and illicit APED use through contact with other AAS users and beliefs about AAS. The potential role for nutritional supplement use in the initiation of illegal APED use is discussed. Future prevention efforts may benefit from targeting legal APED users in youth.

Keywords: anabolic-androgenic steroids, gateway hypothesis, nutritional supplements, body image disturbance, risk factor
Hypothesized Relationships

- Strong relationship between supplement use and self reported illicit APED use (i.e., AASs).
- Supplement use statistical mediator of relationship between psychosocial risk factors and illicit APED use.
  - Sports Participation
  - Perfectionism
  - Eating disorder symptoms
  - Body image disturbance
  - Illicit drug use (i.e., cocaine, marijuana, opiates)
- This ‘causal’ relationship occurs through the role supplements play in...
  - Changing beliefs about efficacy and danger of AASs
  - Providing access and information exchange with ‘sources’ who can teach about AASs
Compulsive Exercise
Sport Participation
Concern over Mistakes
Personal Standards
MDDI Total
EDE-Q Global
Illicit Drug or Alcohol

Number of Supplements
Illicit APED Use

$\beta = .01 (.06)$
$\beta = .10 (.05)$
$\beta = .36 (.05)$
$\beta = .23 (.06)$
$\beta = -.44 (.05)$
$\beta = .30 (.05)$
$\beta = .40 (.06)$
$\beta = .29 (.05)$
$\beta = .16 (.04)$
$\beta = .17 (.05)$
$\beta = .39 (.06)$
$\beta = .20 (.06)$
$\beta = .18 (.05)$
$\beta = .39 (.06)$

$X^2(2) = 3.36, p = .19, \text{RMSEA} = .01, \text{CFI} = .98$
Male Specific Model (n = 100)

\[ \beta = .43 (.06) \]

\[ \beta = .23 (.03) \]

Fat/Weight Loss APEDs

\[ \beta = .22 (.04) \]

\[ \beta = .40 (.05) \]

\[ \beta = .40 (.05) \]

Muscle Building APEDs

\[ \beta = .36 (.06) \]

\[ \beta = .60 (.03) \]

Safety of Illicit APEDs

\[ \beta = .15 (.04) \]

\[ \beta = .22 (.08) \]

\[ \beta = .48 (.04) \]

Efficacy of illicit APEDs

\[ \beta = .48 (.04) \]

APED Social Network

\[ \beta = .66 (.03) \]

Illicit APEDs

\[ X^2(2) = 59.99 \quad p < .001, \quad \text{RMSEA} = .04, \quad \text{CFI} = .98 \]
**Female Specific Model (n = 101)**

\[ X^2(7) = 122.31 \ p < .001, \ RMSEA = .03, \ CFI = .98 \]
Indirect Effects

Table 2
Summary of Indirect Effects With Bootstrap Bias Corrected Standard Errors for Supplements on Illicit APED Use

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Via</th>
<th>Partial indirect effect</th>
<th>Total indirect effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle building supplements</td>
<td>APED efficacy</td>
<td>.129 (.114–.133)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APED network</td>
<td>.042 (.038–.048)</td>
<td>.170 (.161–.177)</td>
</tr>
<tr>
<td>Muscle building supplements</td>
<td>APED safety</td>
<td>.061 (.049–.075)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APED network</td>
<td>.029 (.018–.034)</td>
<td>.090 (.083–.091)</td>
</tr>
<tr>
<td>Muscle building supplements</td>
<td>APED network</td>
<td>.267 (.263–.275)</td>
<td></td>
</tr>
<tr>
<td>Fat–Weight Loss supplements</td>
<td>APED safety</td>
<td>.034 (.019–.045)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APED network</td>
<td>.004 (−.001–.012)</td>
<td>.038 (.018–.050)</td>
</tr>
</tbody>
</table>

Note. APED = appearance and performance enhancing drug use. 95% confidence intervals in parentheses.
Summary

- Gateway Hypothesis is a plausible for APEDs
  - Does not rule out effects of common liability but...
    - APED use is quite distinct from other substances of abuse
- Gateway Hypothesis for APEDs suggests
  - Fitness supplements are potential gateway substances
  - Causal mechanisms are complex and related to psychosocial environment
- Social context matters...
  - Access offered from fitness supplement use may affect internal beliefs about safety and efficacy of AASs.
How to use ‘Gap Time’ to investigate Gateway Hypotheses
Sequencing and Gap Time?

Time between first use of distinct substances

Fitness Supplements → AASs
When do users initiate AASs?

- ~3% young adult males (majority in USA)
- Median age of onset = 25

N = 1000 Male AAS users

Hildebrandt et al. unpublished data
Is There Evidence Sequencing?

<table>
<thead>
<tr>
<th>Temporal Sequence</th>
<th>Nutritional Supplement</th>
<th>Prohormone</th>
<th>OTC Fat Burner</th>
<th>Illicit APED</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Gateway</td>
<td>1</td>
<td>2/3</td>
<td>2/3</td>
<td>4</td>
<td>29.69%</td>
</tr>
<tr>
<td>Intermediate Gateway</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>42.19%</td>
</tr>
<tr>
<td>Supplement Gateway</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>15.63%</td>
</tr>
<tr>
<td>Bodybuilding Gateway</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

| Age                     | 19.79 (6.92)           | 22.14 (7.48) | 21.52 (6.52) | 26.8 (9.6)   |

N = 84 APED users
Sequence is Associated with Age of Onset

Survival Function for APED Sequences

- Complete Gateway
- Intermediate Gateway
- Supplement Gateway
- Bodybuilding Gateway

Cum Survival vs Age of Illicit APED Use Onset
Modeling Gap Time

- 143 adult AAS users + 29 heavy exercising controls (N = 172)
  - Age 18 to 60 ($M = 34.16$, $SD = 10.43$)
  - 73.3% primarily heterosexual ($n = 126$),
- Age of onset take from Structured Interview (APEDUS)
  - MDDI
  - EDE-Q
  - Barratt Impulsivity Scale (BIS-11)
  - Influences (Self-directed vs. Other-directed)
Table of Gap Time Correlations
Social Influence X Eating Disorder Symptoms

Source of social influence matters *Less* among those with *Greatest* eating concerns
Source of social influence matters \textbf{Less} among those with \textbf{Greatest} impulsivity
Impulsivity matters *More* for those using supplements at a *Older* age.
Implications for Prevention

IDENTIFYING WHO TRANSITIONS QUICKLY
Who Do We Target?

- **Quick Transitions**
  - Middle aged men with high degree of impulsivity
  - Eating Concerns and Impulsivity for those self-motivated

- **Eating Concerns**
  - Focused concerns about the effects of eating and implications for deviating from rule bound eating

- **Impulsivity**
  - Disposition to act without planning, seek reward, and difficulty inhibiting an unwanted action.
Self-Motivated Individuals

- **Target interpersonal domains**
  - Reduce concerns about eating and its effects
    - Psychoeducation
    - Behavioral interventions to normalize habits
    - Cognitive interventions reducing value of eating rules
  - Reduce impact of impulsive action
    - Mindfulness-based interventions
    - Stimulus-control (limit access to triggers)
  - Age adjusted targets
    - Middle age med have rapid transitions and are most vulnerable
Other-Influenced Individuals

• **Target social environment**
  - Social skills training
    - Assertiveness
  - Improve self-esteem
    - Rely on others less for guidance

• **Target natural environment**
  - Limiting access or discussion in gym settings to supplements
  - Regulating information on safety and efficacy of substances
Closing Thoughts

- Developmental sequence of APEDs remains poorly understood.

- Need more longitudinal data!

- Scaling APED use severity remains a hurdle limiting theory about gateways
  - Use may be less meaningful than what type of use for most APEDs