

# Anabolic steroids and other performance enhancing drugs in children & adolescents

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**Steroid  
Nation**

# Olympic-type Anti-doping

## Anti-doping tests

```
graph TD; A[Anti-doping tests] --- B[Screen by T:E (testosterone:epitestosterone) ratio]; A --- C[Detect synthetic carbons]; A --- D[HCG (blood: HGH)]; A --- E[EPO]; A --- F[Masking agents];
```

Screen by T:E  
(testosterone:epitestosterone) ratio

Detect synthetic  
carbons

HCG  
(blood:  
HGH)

EPO

Masking  
agents

# Adolescents and doping

## Case 1:

- Steve W
- In the 1970s, high school senior's M.D. neighbor withdrew blood, stored, and re-administered before the Illinois state wrestling tournament

## Case 2:

- 17 year at Univ Kansas Med Ctr increased weight from 130 to 220 admittedly using anabolic steroids
- Was to be admitted to inpatient unit, destroyed elevators in a rage; sent to state hospital

## Case 3:

- 21 year-old athlete admitted to Univ Iowa Hospitals with suicide attempt
- Known to our service, seen for depression and anxiety
- Admitted to ETOH, street drugs, and Equipoise (training for Indoor Football League)

Bonus case: 30ish male with Tourette Syndrome, and OCD, who stopped SSRI treatment. Bodybuilder who started using AAS. Now resides in Leavenworth for felony sexual offense

# Anabolic Steroid Withdrawal



The Taylor Hooton  
FOUNDATION  
FIGHTING STEROID ABUSE

Abolishing performance enhancing drug use by America's youth through evaluation, education, and elimination.



## Symptoms of anabolic steroid withdraw

- Mood lability, depression, anxiety
- Muscle joint pain
- Fatigue or restlessness
- Insomnia
- Decreased libido
- Anorexia, insomnia
- Headaches
- Craving for anabolic steroids
- SUICIDAL DEPRESSION



# Age of onset of PED (doping)

Anabolic  
Steroids

?HGH

?EPO

?Stimulants

?Viagra

?Clenbuterol

May see in pre-teen years

Buckley et al: 6.6% high school seniors juiced

- 2/3 began before 16 years of age

?HCG, ?Anti-estrogens

# Age of Onset (Dr. Hildebrandt)



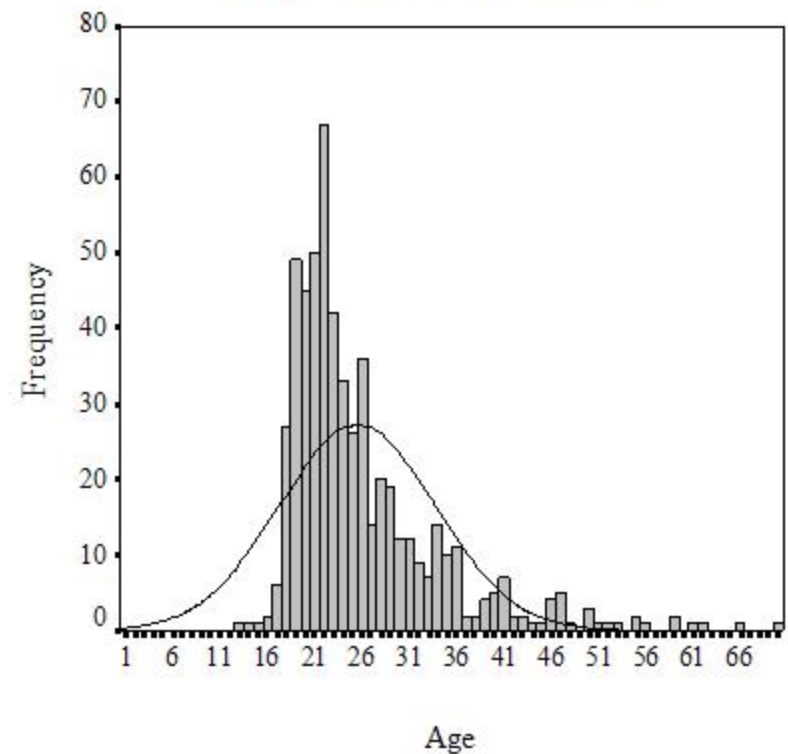
Begin use  
mainly in  
their early-  
mid 20s

Smaller  
group of  
adults begin  
use in middle  
age

Alarming  
number  
begin use as  
an adolescent  
(19.6%)

- Life extension medicine?

Age of First AAS Use



# Presentation of APED abuse

## Anabolic steroids

- Risk factors
  - Traditional
    - Weight lifters
    - Body builders
    - Strength athletes (football, track: field events)
    - Young aggressive males
  - Nontraditional
    - Sports: Cycling, swimming, baseball, skating
    - Females
    - Non-athletes
      - Adonis complex (Body Dysmorphia)

# Adolescents and doping

Pope et al.  
hypothesize  
a two stage  
model of  
anabolic  
steroid  
dependence

- Stage one (myoactive, psychological)
  - Develop muscle size and power
  - Enhance appearance or athletic performance
- Stage two (Psychoactive, myoactive, Neurological)
  - Genetic vulnerability
  - High dose exposure to AAS
    - Neuroadaptations: tolerance, withdrawal (DA, 5HT)
  - Stack (multiple use of PEDs)
    - Stacks
    - Pyramid
    - Cycles

## Spot the Role Model:



**Table 3.** U.S. National studies of lifetime anabolic steroid use by adolescents.

Reference	Year	Sample size	Grade level or age	Total use (%)	Male (%)	Female (%)
YRBBS	1991	12 267	9–12	2.7	4.1	1.2
	1993	16 267	9–12	2.2	3.1	1.2
	1995	10 904	9–12	3.7	4.9	2.4
	1997	16 262	9–12	3.1	4.1	2.0
MTF	1989	2283	12	3.0	4.7	1.3
	1990	2533	12	2.9	5.0	0.5
	1991	2500	12	2.1	3.6	0.4
	1992	2633	12	2.1	3.5	0.7
	1993	2716	12	2.0	3.5	0.6
	1994	2567	12	2.4	3.8	0.9
	1995	2567	12	2.3	3.8	0.8
	1996	2275	12	1.9	3.2	0.6
NHSDA	1991	8005	12–17 yrs	0.6	1.0	0.2
	1992	7254	12–17 yrs	0.3	0.4	0.1
	1994	4678	12–17 yrs	0.7	0.7	0.6

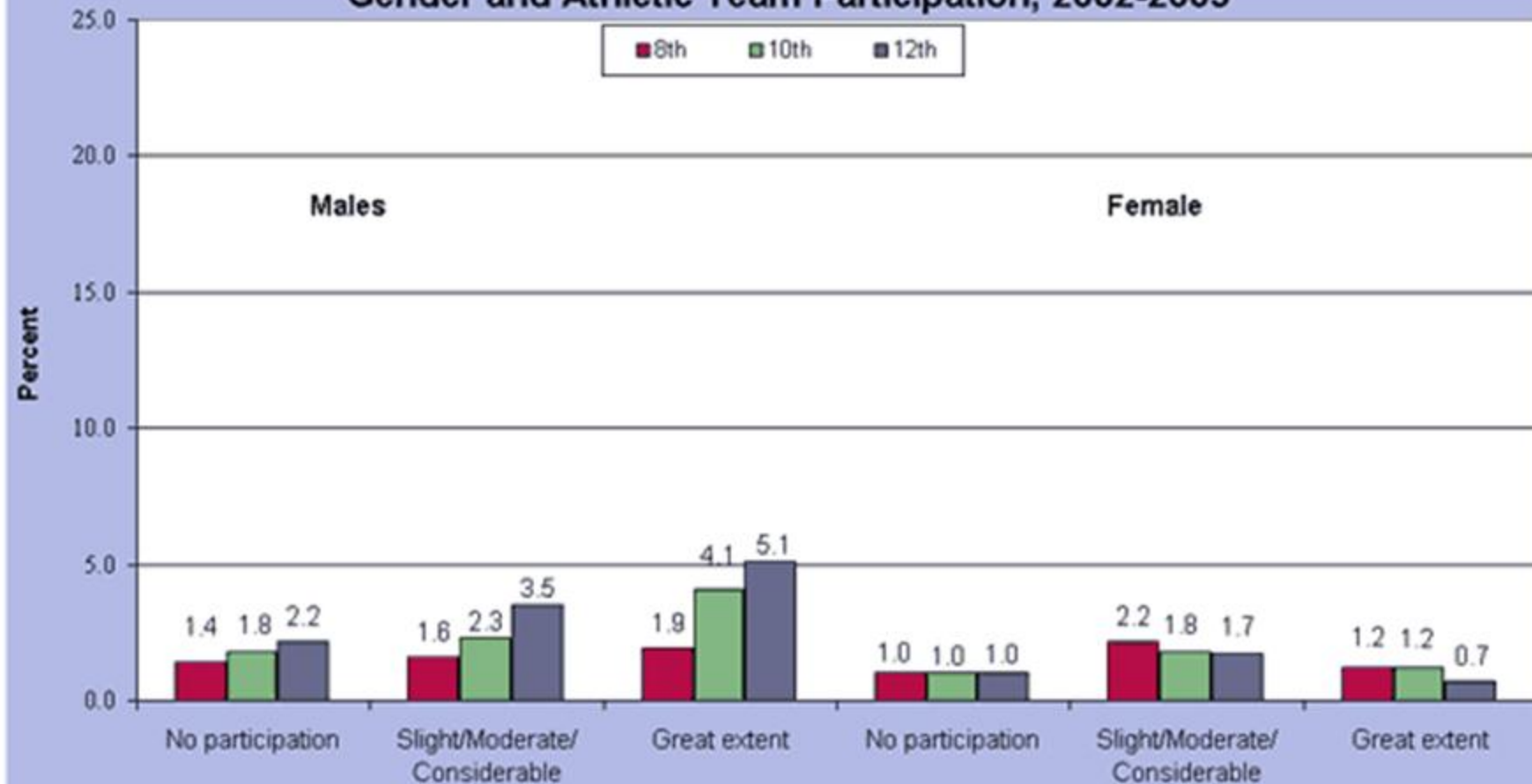
Youth Risk and Behavior Surveillance System (YRBBS).<sup>11</sup>

Monitoring the Future Study (MTF).<sup>70</sup>

National Household Survey on Drug Abuse (NHSDA).<sup>71</sup>

Figure 1

### Percentage of Students Who Have Used Steroids in the Last Year, by Gender and Athletic Team Participation, 2002-2003



Note: Participation on athletic team was measured on a 5-point scale with the following categories: (1) Not at all, (2) Slight, (3) Moderate, (4) Considerable, or (5) Great Extent. In 2003, 37 percent of eighth graders, 34 percent of tenth graders, and 16 percent of twelfth graders reported participating on an athletic team to a "great" extent.

Source: Child Trends analyses of *Monitoring the Future National Survey Results on Drug Use, 1975-2003, Volume 1: Secondary school students*: (NIH Publication No. 04-5507). Bethesda, MD: National Institute on Drug Abuse. Tables D-73 and D-74. Online.

Available at [http://www.monitoringthefuture.org/pubs/monographs/vol1\\_2003.pdf](http://www.monitoringthefuture.org/pubs/monographs/vol1_2003.pdf)

# Anabolic steroid use in Iowa youth

	Steroid Use	%	Male	Female
All grades	Never		97.5	98.8
	Over 30		1.2	0.8
	Within 30d		1.3	0.4
	Ever		2.5	1.2

1999 Survey data from the Iowa Youth Survey

Entire Sample (N=~86,000)

## Anabolic Steroid Use by Grade and Gender

		Females	Males	All
6th	Never	99.3	99.2	99.5
	Over 30	0.4	0.5	0.4
	Within 30d	0.3	0.3	0.1
	Ever	0.7	0.8	0.5
8th	Never	98.2	98	98.4
	Over 30	1	1	1
	Within 30d	0.8	0.9	0.6
	Ever	1.8	2	1.6
11th	Never	97.1	95.5	98.7
	Over 30	1.5	2	0.9
	Within 30d	1.4	2.5	0.4
	Ever	2.9	4.5	1.3

## Relationship between Steroid Use and Aggressiveness

Grade	Assault	Male		Female	
		Yes	No	Yes	No
6	No Steroids	26	74	12.3	87.7
	Steroid, Not last 30d	75.9	24.1	51	49
	Steroid within 30d	71.4	28.6	43.8	56.3
	Total Steroid	68.8	31.2	49.3	50.7
8	No Steroids	30.9	69.1	14.7	85.3
	Steroid, Not last 30d	81.2	18.8	53.5	46.5
	Steroid within 30d	81.8	18.2	70.1	29.9
	Total Steroid	81.5	18.5	59.8	40.2
11	No Steroids	22.6	77.4	9.9	90.1
	Steroid, Not last 30d	55.3	44.7	43.1	56.9
	Steroid within 30d	71.4	28.6	59.3	40.7
	Total Steroid	64.1	35.9	48.2	51.8

**Relationship between Steroid Use and Suicidal Ideation**

Grade	Thoughts Suicide	Male		Female	
		Yes	No	Yes	No
6	No Steroids	4.6	95.4	3.6	96.4
	Steroid, Not last 30d	32.8	67.2	30	70
	Steroid within 30d	46.3	53.7	43.8	56.3
	Total Steroid	38.4	61.6	33.3	66.7
8	No Steroids	7	93	13.1	86.2
	Steroid, Not last 30d	35.1	64.9	57.6	42.4
	Steroid within 30d	48.9	51.1	60	40
	Total Steroid	41.5	58.5	58.5	41.5
11	No Steroids	10.6	89.4	16.8	83.2
	Steroid, Not last 30d	27.2	72.8	52.6	47.4
	Steroid within 30d	44.9	55.1	55.6	44.4
	Total Steroid	36.9	63.1	53.5	46.5

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# Summary

Society that struggles with cheating; behind every 'elite' drug-cheat is a doctor, trainer, or coach

Artificially enhances sports, model/actors, International politics, academics, etc.

Make excuses, ignore laws

Unscrupulous athletes moving to manipulating the genes themselves

Leadership to stop cheating, to set straight the ethical standards

First step, draft sports fraud laws, then bring back ethics is all areas of society

# Time course of AAS withdrawal

Possible  
biphasic

- Hyperadrenergic state (resembles opioid withdrawal)
  - 1-2 days from cessation
  - Duration = 1 week
- Later phase
  - Craving
  - Depression
  - Begins first week
  - Duration may be months

# Goals of treatment in AAS withdrawal

Support:  
motivation, 'new  
philosophy'

- Patient will feel smaller, weaker, more vulnerable

Pharmacotherapy

- HPA Dysfunction
- Replacement testosterone
- HCG (stimulate testosterone)
- Anti-estrogens (Clomid)
- LHRH agonists

Symptom  
treatments

- Psychosis: Neuroleptics
- Depression/mood lability: Neuroleptics, Antidepressant, Mood stabilizers
- Anxiety: SSRIs (benzodiazepines= ?dysinhibition)

Referral to endocrinologist

- Accurate determination of hormonal status
- HPA axis assessment

# Worst outcome likely multifactor causes



Bad outcomes = assault,  
suicide, homicide



## Multifactorial etiology

- Chris Benoit, WWE wrestler with homi-suicide
- Use of massive doses of anabolic steroids
- HGH, IGF-1
- SSRIs, Benzodiazepines
- Narcotics
- Multiple head injuries, and concussions
- High stress, demanding profession
- Marital strife



# Abuse of HGH (Growth Hormone, rHGH)

# HGH

- Leaner, more muscular
- Glucose intolerance
- Lower jaw growth
  - Braces (note world class sprinters)
- Cardiac complications (hypertrophy)
- Edema, joint pain,
- Evidence of increased aggressiveness with HGH treatment (patients with HGH prescriptions)



# Abuse of EPO, CERA-EPO

## EPO side effects

- Medical effects
  - Increased HB and HCT
  - Increase cardiac load
    - MI, and CHF
    - PE
    - Hypertension
    - Seizures
    - Death
  - More vulnerable to fluid loss (sweating, vomiting)

# Stimulant abuse: Physical effects

## Physical side effects

- Tachycardia
- Hypertension
- Anorexia
- Insomnia
- Pupillary dilation

# Stimulant abuse: Psychological effects

## Psychological side effects

- Overdose
  - Irritability, aggressiveness, ?depression
  - Psychosis
- Chronic
  - Mood lability, irritability
  - Aggressiveness
  - Insomnia and anorexia
  - 'Paranoid' ideation
  - Psychosis
    - Hallucinations, delusions, formication

# PEDs in Psychiatry

PED use clearly occurs in adolescents and young adults

Certain populations may be at high risk

- Bodybuilders
- Strength, power and explosive sports
- Aggressive males
- Don't overlook females

Look for behavioral and physical changes in relation to the risk level for PED abuse

PED and anabolic steroid use now present a major public health threat

Office, hospital, and drug treatment programs should be aware of the problem, the symptoms, and the treatments

Advocate to clean up sports, to change the role models for the adolescent

# Steroids: Medical side effects

## General medical symptoms

- Males
  - Vitals: increased BP, rapid weight gain
  - Dermatological: Acne, needle marks, male pattern baldness
  - HEENT: Jaundiced eyes
  - Chest: Gynecomastia
  - Abdominal: Organomegaly
  - GU: Testicular atrophy, ?enlarged prostate
  - Muscular skeletal: Hypertrophy, disproportionate development of upper body
  - Extremities: Edema

# Anabolic steroid use in females

## General medical symptoms

- Females
  - Vitals: increased BP, rapid weight gain
  - Dermatological: Acne, needle marks, male pattern baldness
  - HEENT: Jaundiced eyes; deepened voice, hirsutism
  - Chest: Decrease in breast tissue
  - Abdominal: Organomegaly
  - GU: Clitoral hypertrophy
  - Muscular skeletal: Hypertrophy, disproportionate development of upper body
  - Extremities: Edema



# Psychiatric symptoms of steroid abuse

## Psychiatric symptoms

- Rage attacks
- Mood lability, depression
- Psychosis
- Manic symptoms
  - rare less than 200mg test/week
  - More common 1000mg test/week
- ADHD symptoms (or anxiety)
- Insomnia

# investigations

## Liver function tests

- Elevated Bilirubin, AST (SGOT), ALT (SGPT), LDH
- Reportedly GGT not affected

## Muscle enzymes

- Elevated CPK

Serum creatinine may increase from training

## Cholesterol

Increased LDL; Decreased HDL

## Blood indices

- Increase EPO = HCT and HB increase

# Medical laboratory investigations 2

## Endocrine measures

- Reduced testosterone (oral agents), LH FSH
- Or increased testosterone with esters
- Serum estrogen may be increased or reduced
- GGT abnormal, but fasting glucose is WNL
- Sperm count decreased

## Other parameters

- EKG may reveal LVH (athletes)

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