

GAO

Report to the Committee on Oversight
and Government Reform, House of
Representatives

October 2007

ANABOLIC STEROID ABUSE

Federal Efforts to Prevent and Reduce Anabolic Steroid Abuse among Teenagers





Highlights of [GAO-08-15](#), a report to the Committee on Oversight and Government Reform, House of Representatives

Why GAO Did This Study

The abuse of anabolic steroids by teenagers—that is, their use without a prescription—is a health concern. Anabolic steroids are synthetic forms of the hormone testosterone that can be taken orally, injected, or rubbed on the skin. Although a 2006 survey funded by the National Institute on Drug Abuse (NIDA) found that less than 3 percent of 12th graders had abused anabolic steroids, it also found that about 40 percent of 12th graders described anabolic steroids as “fairly easy” or “very easy” to get. The abuse of anabolic steroids can cause serious health effects and behavioral changes in teenagers.

GAO was asked to examine federally funded efforts to address the abuse of anabolic steroids among teenagers and to review available research on this issue. This report describes (1) federally funded efforts that address teenage abuse of anabolic steroids, (2) available research on teenage abuse of anabolic steroids, and (3) gaps or areas in need of improvement that federal officials and other experts identify in research that addresses teenage anabolic steroid abuse. To do this work, GAO reviewed federal agency materials and published studies identified through a literature review and interviewed federal officials and other experts.

To view the full product, including the scope and methodology, click on [GAO-08-15](#). For more information, contact Laurie E. Ekstrand at (202) 512-7114 or ekstrand@gao.gov.

ANABOLIC STEROID ABUSE

Federal Efforts to Prevent and Reduce Anabolic Steroid Abuse among Teenagers

What GAO Found

There are two categories of federally funded efforts that address teenage abuse of anabolic steroids. Efforts are either designed to focus on preventing the abuse of anabolic steroids among teenagers or are broader and designed to prevent substance abuse in general—which can include abuse of anabolic steroids among teenagers. Two programs that received federal funding during their development and testing, Athletes Training and Learning to Avoid Steroids (ATLAS) and Athletes Targeting Healthy Exercise & Nutrition Alternatives (ATHENA), are designed to focus on preventing or reducing teen abuse of anabolic steroids through use of gender-specific student-led curricula. In addition, there are various research efforts and education and outreach activities that focus on this issue. Two federal grant programs—the Office of National Drug Control Policy’s Drug-Free Communities Support program and the Department of Education’s School-Based Student Drug Testing program—are designed to support state and local efforts to prevent substance abuse in general and may include anabolic steroid abuse among teenagers as part of the programs’ substance abuse prevention efforts. In 2007, about one-quarter of more than 700 Drug-Free Communities Support program grantees reported that they were addressing steroid abuse as one of their program’s objectives.

Almost half of the 16 studies GAO reviewed identified certain risk factors and behaviors linked to the abuse of anabolic steroids among teenagers. Several of these studies found connections between anabolic steroid abuse and risk factors such as use of other drugs, risky sexual behaviors, and aggressive behaviors. Most of the other studies were assessments of the ATLAS and ATHENA prevention programs and in general suggested that the programs may reduce abuse of anabolic steroids and other drugs among high school athletes immediately following participation in the programs.

Experts identified gaps in the research addressing teenage abuse of anabolic steroids. Experts identified a lack of conclusive evidence of the sustained effectiveness over time of available prevention programs, for example at 1 year following participants’ completion of the programs. Experts also identified gaps in the research on the long-term health effects of initiating anabolic steroid abuse as a teenager—including research on effects that may be particularly harmful in teens—and in research on psychological effects of anabolic steroid abuse.

Contents

Letter

Results in Brief	1
Background	3
Some Federally Funded Efforts Are Designed to Focus on Preventing Teenage Steroid Abuse, While Other Efforts Designed to Address Substance Abuse in General May Include Teenagers	4
Research Shows Teenage Anabolic Steroid Abuse Is Linked to Certain Risk Factors and That Prevention Programs May Have Some Short-term Effectiveness	9
Experts Find There Are Gaps in Research on the Sustained Effectiveness of Prevention Programs and on the Long-term Health Effects for Teenagers	14
Agency Comments	16

Appendix I

Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers	18
---	-----------

Appendix II

Articles Included in GAO's Review	21
--	-----------

Appendix III

GAO Contact and Staff Acknowledgments	23
--	-----------

Table

Table 1: Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers	18
---	----

Figures

Figure 1: Reported Lifetime Anabolic Steroid Abuse among 12 th Graders, 1991-2006	7
Figure 2: Reported Past Year Anabolic Steroid Abuse by Male and Female Adolescents, 2002-2006	8

Abbreviations

ATHENA	Athletes Targeting Healthy Exercise & Nutrition Alternatives
ATLAS	Athletes Training and Learning to Avoid Steroids
CDC	Centers for Disease Control and Prevention
HHS	Department of Health and Human Services
MTF	Monitoring the Future
NIDA	National Institute on Drug Abuse
NIH	National Institutes of Health
ONDCP	Office of National Drug Control Policy
SAMHSA	Substance Abuse and Mental Health Services Administration
USADA	United States Anti-Doping Agency
YRBS	Youth Risk Behavior Survey

This is a work of the U.S. government and is not subject to copyright protection in the United States. It may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



United States Government Accountability Office
Washington, DC 20548

October 31, 2007

The Honorable Henry A. Waxman
Chairman
The Honorable Tom Davis
Ranking Member
Committee on Oversight and Government Reform
House of Representatives

The abuse of anabolic steroids¹ by teenagers—that is, their use without a prescription—is a health concern. Anabolic steroids are synthetic forms of the hormone testosterone that can be taken orally, injected, or rubbed on the skin. Although a 2006 survey funded by the National Institute on Drug Abuse (NIDA) showed that less than 3 percent of 12th graders had abused anabolic steroids, the survey also showed that about 40 percent of 12th graders described anabolic steroids as “fairly easy” or “very easy” to get. The abuse of anabolic steroids can cause serious health effects and behavioral changes in teenagers. Under U.S. law, anabolic steroids are controlled substances whose manufacture, possession, and use are regulated by the federal government;² they also cannot be sold legally without a prescription.

You asked us to examine federally funded efforts to address the abuse of anabolic steroids among teenagers and to review available research on this issue. In this report, we

1. describe major, federally funded efforts that address teenage abuse of anabolic steroids,
2. describe the available research on teenage abuse of anabolic steroids, and

¹We use the term anabolic steroids to refer to anabolic steroids and their precursors, as defined in the Controlled Substances Act. See 21 U.S.C. § 802 (23), (41).

²The Crime Control Act of 1990 amended the Controlled Substances Act to include anabolic steroids. 21 U.S.C. § 812(c), Schedule III (e).

-
3. describe gaps or areas in need of improvement that federal officials and other experts identify in research that addresses anabolic steroid abuse among teenagers.

We focused our review on the abuse of anabolic steroids by teenagers in grades 8 through 12. To describe federally funded efforts to address anabolic steroid abuse among teenagers, we reviewed databases of federal grant programs.³ We also obtained and reviewed pertinent reports and information from the Web sites of agencies within the Department of Health and Human Services (HHS)—the Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), and the Substance Abuse and Mental Health Services Administration (SAMHSA)—as well as the Web sites of the Department of Education (Education) and the Office of National Drug Control Policy (ONDCP). We used these resources to identify federally funded programs,⁴ research, and education and outreach activities that address—through efforts to either prevent or reduce—anabolic steroid abuse among teenagers. After identifying these efforts, we interviewed and collected information from federal officials to confirm that these efforts are intended to prevent or reduce anabolic steroid abuse among teenagers. Where available, we requested funding information on the federal efforts that we identified.⁵

To describe the available research on teenage abuse of anabolic steroids, we conducted a systematic review of the published literature on this topic. We identified 16 articles that related to teenage abuse of anabolic steroids and were published from January 1995 through June 2007. To select the articles, we conducted a keyword search using the Dialog Database System,⁶ a system that searches numerous database files, and reviewed the

³We searched both the Catalog of Federal Domestic Assistance, a database of federal grant programs maintained by the General Services Administration, and the Computer Retrieval of Information on Scientific Projects, a database of research grants funded by the National Institutes of Health.

⁴We define federally funded programs as including programs that were developed, implemented, or tested using federal funding.

⁵The efforts that we discuss in this report may not represent all federally funded activities that address anabolic steroid abuse among teenagers but reflect those efforts mentioned by federal officials with whom we consulted. We were unable to determine the extent of total federal funding for programs that address teenage anabolic steroid abuse because, in some instances, funding information covers more than prevention of teenage anabolic steroid abuse.

⁶We searched using the keywords anabolic steroids, abuse, addiction, teen, youth, adolescent, prevent, and treat.

resulting article titles and abstracts to identify whether the articles focused on teenage abuse of anabolic steroids. We did not select articles that were international works, based on reviews of other articles or research, position papers, policy statements, or federal agency program documents. The references we make to articles refer strictly to those that we reviewed.

To describe the gaps or areas in need of improvement in research that addresses teenage abuse of anabolic steroids as identified by experts, we interviewed experts in anabolic steroid abuse and reviewed relevant literature. We interviewed federal officials from CDC, NIDA, SAMHSA, and Education, as well as other experts from universities and professional associations. We reviewed research articles identifying gaps or areas in need of improvement as part of our systematic review of the literature. We conducted the work for our review from January 2007 through September 2007 in accordance with generally accepted government auditing standards.

Results in Brief

There are two categories of federally funded efforts that address teenage abuse of anabolic steroids. Efforts are either designed to focus on preventing the abuse of anabolic steroids among teenagers or are broader and designed to prevent substance abuse in general—which can include abuse of anabolic steroids among teenagers. Two programs that received federal funding during their development and testing, Athletes Training and Learning to Avoid Steroids (ATLAS)⁷ and Athletes Targeting Healthy Exercise & Nutrition Alternatives (ATHENA), are designed to focus on preventing or reducing teen abuse of anabolic steroids. In addition, there are various research efforts and education and outreach activities that focus on this issue. For example, in addition to steroid-related research, since 2000 NIDA has provided nearly \$500,000 in funding for a variety of education and outreach activities including a multimedia educational initiative intended to prevent anabolic steroid abuse among teenagers. Two federal grant programs—ONDCP’s Drug-Free Communities Support program and Education’s School-Based Student Drug Testing program—

⁷ATLAS—the acronym for the prevention program named Athletes Training and Learning to Avoid Steroids—originally stood for *Adolescents* Training and Learning to Avoid Steroids, which was the title of the NIDA research grants that supported the program’s development. For this reason, some published research describing the program, as listed in appendix II, for example, refers to ATLAS as Adolescents Training and Learning to Avoid Steroids.

are designed to support state and local efforts to prevent substance abuse in general and may include anabolic steroid abuse among teenagers as part of the programs' substance abuse prevention efforts. In 2007, about one-quarter of more than 700 Drug-Free Communities Support program grantees reported that they were addressing steroid abuse as one of their program's objectives.

Almost half of the 16 studies we reviewed identified certain risk factors and behaviors linked to the abuse of anabolic steroids among teenagers. Several of these studies found connections between anabolic steroid abuse and risk factors such as use of other drugs, risky sexual behaviors, and aggressive behaviors. Most of the other studies we reviewed were assessments of the ATLAS and ATHENA prevention programs. In general, these studies suggested that the programs may reduce abuse of anabolic steroids and other drugs among high school athletes immediately following participation in the programs.

Experts identified gaps in the research that addresses anabolic steroid abuse among teenagers. Experts identified a lack of conclusive evidence of sustained effectiveness over time of available prevention programs, for example at 1 year following participants' completion of the programs. Experts also identified gaps in the research on the long-term health effects of initiating anabolic steroid abuse as a teenager—including research on effects that may be particularly harmful in teenagers—and in the research on psychological effects.

HHS and Education provided technical comments only, which we incorporated into the report as appropriate.

Background

The abuse of anabolic steroids differs from the abuse of other illicit substances. When users initially begin to abuse anabolic steroids, they typically are not driven by a desire to achieve an immediate euphoria like that which accompanies most abused drugs such as cocaine, heroin, and marijuana. The abuse of anabolic steroids is typically driven by the desire of users to improve their athletic performance and appearance—characteristics that are important to many teenagers. Anabolic steroids can increase strength and boost confidence, leading users to overlook the potential serious and long-term damage to their health that these substances can cause. In addition, the methods and patterns of use for anabolic steroids differ from those of other drugs. Anabolic steroids are most often taken orally or injected, typically in cycles of weeks or months (referred to as “cycling”), rather than continuously. Cycling involves taking

multiple doses of anabolic steroids over a specific period of time, stopping for a period, and starting again. In addition, users often combine several different types of anabolic steroids to maximize their effectiveness (referred to as “stacking”).

While anabolic steroids can enhance certain types of performance or appearance, when used inappropriately they can cause a host of severe, long-term, and in some cases, irreversible health consequences. The abuse of anabolic steroids can lead to heart attacks, strokes, liver tumors, and kidney failure. In addition, because anabolic steroids are often injected, users who share needles or use nonsterile injection techniques are at risk for contracting dangerous infections, such as HIV/AIDS and hepatitis B and C. There are also numerous side effects that are gender-specific, including reduced sperm count, infertility, baldness, and development of breasts among men; and growth of facial hair, male-pattern baldness, changes in or cessation of the menstrual cycle, and deepened voice among women. There is also concern that teenagers who abuse anabolic steroids may face the additional risk of halted growth resulting from premature skeletal maturation and accelerated puberty changes.

The abuse of anabolic steroids may also lead to aggressive behavior and other psychological side effects. Many users report feeling good about themselves while on anabolic steroids, but for some users extreme mood swings also can occur, including manic-like symptoms leading to violence. Some users also may experience depression when the drugs are stopped, which may contribute to dependence on anabolic steroids. Users may also suffer from paranoia, jealousy, extreme irritability, delusions, and impaired judgment stemming from feelings of invincibility.

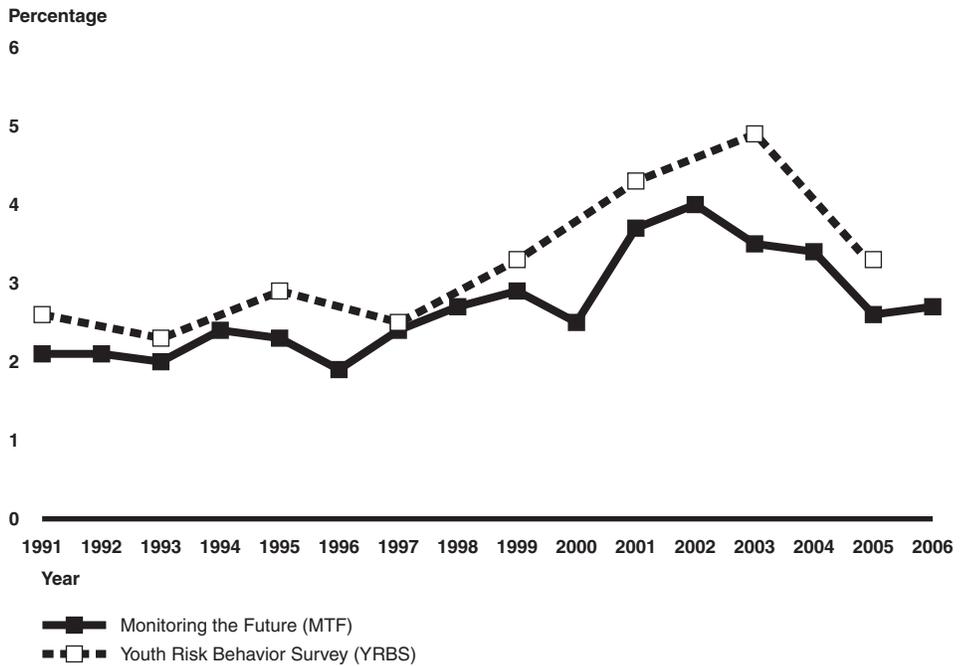
Two national surveys showed increasing prevalence in teenage abuse of steroids throughout the 1990s until about 2002 and a decline since then (see fig. 1). One of these two national surveys, the Monitoring the Future (MTF) survey, is an annual survey conducted by the University of Michigan and supported by NIDA funding.⁸ The MTF survey measures drug use and attitudes among students in grades 8, 10, and 12, and asks several questions about the use of and attitudes towards anabolic steroids, such as perceived risk, disapproval, and availability of anabolic steroids. The

⁸The MTF survey is administered to nationally representative samples of public and private secondary school students throughout the United States. In 2006, sample sizes were about 17,000, 16,600, and 14,800 in 8th, 10th, and 12th grades, respectively. In all, about 48,500 students in 410 secondary schools participated in the 2006 survey.

survey's questions are designed to assess respondents' use of steroids in the last 30 days, the past year, and over the course of the respondent's lifetime. Questions about steroid use were added to the study beginning in 1989. The most recent results from this survey showed that in 2006, 2.7 percent of 12th graders said they had used anabolic steroids without a prescription at least once. The second national survey, the Youth Risk Behavior Survey (YRBS), is a biennial survey conducted since 1991 by CDC.⁹ The YRBS is part of a surveillance system consisting of national, state, and local surveys of students in grades 9 through 12. These surveys collect information about a wide variety of risk behaviors, including sexual activity and alcohol and drug use. The most recent available national YRBS survey—conducted in 2005—asked one question related to lifetime steroid use without a prescription, which showed that 3.3 percent of 12th graders had used steroids at least once.

⁹The sampling frame for the 2005 national YRBS survey consisted of all public and private schools with students in at least one of grades 9 through 12 in the 50 states and the District of Columbia. For the 2005 national YRBS survey, 13,953 questionnaires were completed in 159 schools by a nationally representative sample of students in grades 9 through 12.

Figure 1: Reported Lifetime Anabolic Steroid Abuse among 12th Graders, 1991-2006



Source: GAO analysis of MTF and YRBS data.

The MTF and YRBS surveys indicate a low abuse rate for anabolic steroids among teenagers¹⁰ when compared with the abuse rates for other drugs.¹¹ However, the reported easy availability of steroids¹² and the potential for serious health effects make anabolic steroid abuse a health concern for teenagers, particularly among males. In general, the reported rates of

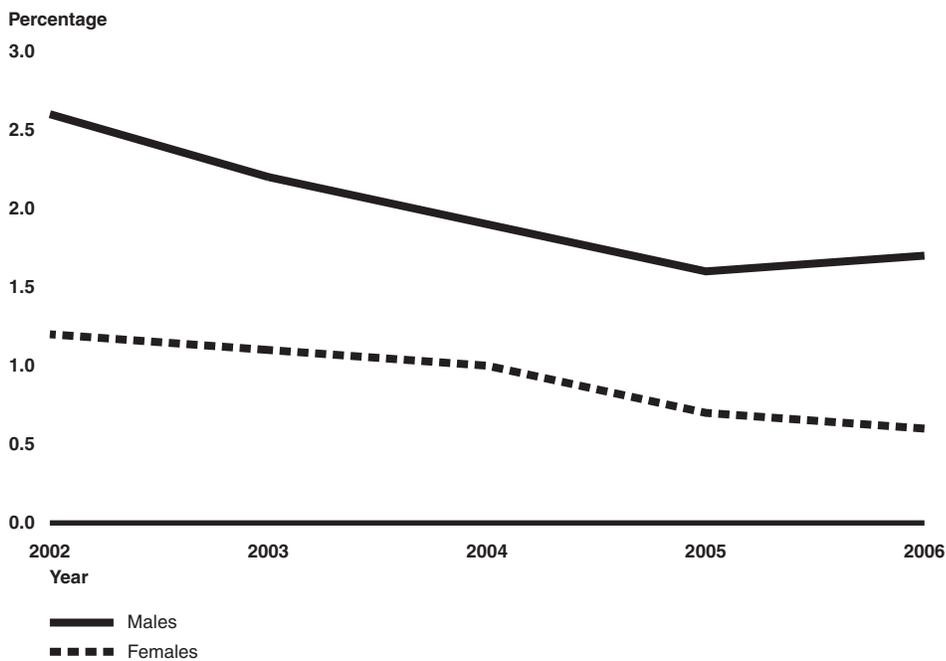
¹⁰Several researchers conducted an analysis indicating that the prevalence rates of teenage anabolic steroid abuse reported by MTF and YRBS are overestimated and that actual prevalence of teenage anabolic steroid abuse is even lower than these surveys report. See Gen Kanayama et al., “Anabolic Steroid Abuse Among Teenage Girls: An Illusory Problem?” *Drug and Alcohol Dependence*, 88 (2007): 156-162.

¹¹For example, according to the 2006 MTF survey, 42.3 percent of 12th graders reported abusing marijuana at least once, and 8.5 percent reported abusing cocaine at least once.

¹²In our previous work looking at the availability of anabolic steroids, we found that anabolic steroids were easily obtained without a prescription through the Internet. See GAO, *Anabolic Steroids Are Easily Purchased Without a Prescription and Present Significant Challenges to Law Enforcement Officials*, [GAO-06-243R](#) (Washington, D.C.: Nov. 3, 2005).

anabolic steroid abuse are higher for males than for females (see fig. 2). Data from the 2006 MTF survey showed that 1.7 percent of teenage males reported abusing anabolic steroids in the past year, as compared with 0.6 percent of females. Data from the 2005 YRBS survey showed that 4.8 percent of high school males reported abusing steroids in their lifetime, as compared with 3.2 percent of females.

Figure 2: Reported Past Year Anabolic Steroid Abuse by Male and Female Adolescents, 2002-2006



Source: GAO analysis of MTF data.

Note: These are combined data for 8th, 10th, and 12th grade students.

Some Federally Funded Efforts Are Designed to Focus on Preventing Teenage Steroid Abuse, While Other Efforts Designed to Address Substance Abuse in General May Include Teenagers

There are two categories of federally funded efforts that address teenage abuse of anabolic steroids. Efforts are either designed to focus on preventing the abuse of anabolic steroids among teenagers or are broader and designed to prevent substance abuse in general—which can include abuse of anabolic steroids among teenagers. Two programs that received federal research funding for their development and testing, ATLAS and ATHENA, are designed to focus on preventing or reducing teen abuse of anabolic steroids. In addition, there are various research efforts and education and outreach activities that focus on this issue. Two federal grant programs—ONDCP’s Drug-Free Communities Support program and Education’s School-Based Student Drug Testing program—are designed to support state and local efforts to prevent substance abuse in general and may include anabolic steroid abuse among teenagers as part of the programs’ substance abuse prevention efforts. See appendix I for a list of the federally funded efforts discussed below.

Some Federally Funded Programs, Research, and Activities Are Designed to Focus on Preventing Teenage Anabolic Steroid Abuse

There are various federally funded efforts—programs, research, and educational activities—that address teenage abuse of anabolic steroids. Some of these efforts are designed to focus on preventing or reducing anabolic steroid abuse among teenagers. As part of our review we identified two programs, the ATLAS and ATHENA programs, which received federal research funding during their development and testing and are designed to focus on preventing the abuse of anabolic steroids among male and female high school athletes, respectively.

ATLAS is a student-led curriculum designed to prevent male high school athletes from abusing anabolic steroids and other performance-enhancing substances. The program’s intervention strategy relies on peer pressure and providing information on healthy alternatives for increasing muscle strength and size. The ATLAS curriculum is typically delivered during a sport team’s season in a series of 45-minute sessions scheduled at the coaches’ discretion and integrated into the usual team practice activities. The athletes meet as a team in groups of six or eight students with one student functioning as the assigned group leader. Coaches, group leaders, and student athletes all work from manuals and workbooks, which provide brief, interactive activities that focus on drugs used in sports, sport supplements, strength training, sport nutrition, and decision making.

The ATHENA program is designed to prevent the abuse of body-shaping substances such as diet pills and anabolic steroids, although abuse of the latter is less common in females than in males. Like ATLAS, the ATHENA curriculum is integrated into a sport team’s usual practice activities and

uses workbooks and student group leaders. The ATHENA curriculum takes into account that female athletes are less likely than males to abuse anabolic steroids but are more likely to have problems with eating disorders and to use drugs such as diet pills and tobacco. As a result, ATHENA's curriculum gives more attention than ATLAS's to addressing these behaviors.

The ATLAS and ATHENA curricula were developed and tested with funding provided by NIDA.¹³ From fiscal years 1993 through 2001, NIDA provided more than \$3.4 million to fund the research that developed and tested the effectiveness of the ATLAS curriculum. Similarly, from fiscal years 1999 through 2003 NIDA provided \$4.7 million in research funding to develop and test the effectiveness of the ATHENA curriculum. While ATLAS and ATHENA were developed and tested with federal funding, the programs are implemented at the local level. Schools in at least 25 states have chosen to implement the programs with local and private funds, and the National Football League and *Sports Illustrated* magazine together have supported the programs in more than 70 schools nationwide.¹⁴

In addition to the ATLAS and ATHENA programs, there are various federally funded research efforts that focus on preventing or reducing anabolic steroid abuse among teenagers. NIDA has funded several research projects examining the factors that influence teenagers to abuse anabolic steroids and the effectiveness of interventions used to prevent teenage steroid abuse. From fiscal years 2000 through 2006, NIDA awarded nearly \$10.1 million in grants to support an average of four research projects each year related to anabolic steroid abuse with a specific focus on adolescents.¹⁵ In fiscal year 2006, for example, NIDA awarded a total of nearly \$638,000 to three research projects that examined risk factors for anabolic steroid abuse among teenagers or the effects of steroid abuse in

¹³The programs originated in investigator-initiated research into the risk factors associated with male and female high school athletes' abuse of anabolic steroids.

¹⁴According to NIDA officials, the principal investigators who developed the ATLAS and ATHENA programs signed a contract with the National Football League to place the programs in schools in the vicinity of eight National Football League teams in 2007. The contract was expected to support the training of about 800 coaches and 20,000 athletes.

¹⁵For fiscal years 2000 through 2006, NIDA officials reported that they awarded a total of 31 annual grants, many of which were continuation grants for previously-approved projects, for steroid-related research focused on the adolescent age group in humans or animals. Because of the continuity of the projects from year to year, we are reporting the average numbers of projects that were funded and active each year.

this population. Like NIDA, the United States Anti-Doping Agency (USADA)—an independent, nonprofit corporation funded primarily by ONDCP—supports research related to the abuse of anabolic steroids and other performance-enhancing drugs by athletes, including teenage athletes.¹⁶ In fiscal year 2006, USADA spent \$1.8 million for research, and an ONDCP official estimated that about one-third of that research funding was directed to anabolic steroids and another performance-enhancing drug, human growth hormone.

In addition to research, there are various education and outreach activities that focus on preventing anabolic steroid abuse among teenagers. Many of these efforts have been supported by NIDA. Since 2000, NIDA has provided nearly \$500,000 in funding for a variety of education and outreach efforts in support of this goal.¹⁷ For example, in April 2000, in response to an upward trend in steroid abuse among students, NIDA launched a multimedia educational initiative intended to prevent anabolic steroid abuse among teenagers. Along with several national partners, including the National Collegiate Athletic Association, the American College of Sports Medicine, and the American Academy of Pediatrics, the initiative produced a Web site, a research report on steroid abuse, and postcard-sized messages about steroids for placement in gyms, movie theaters, shopping malls, bookstores, and restaurants in selected areas. By 2007, NIDA funding for this particular initiative totaled about \$124,000.

In addition to NIDA, other federal agencies and organizations have supported educational and outreach activities that focus on preventing anabolic steroid abuse among teenagers, as the following examples illustrate.

- ONDCP has funded six informational briefings since 2001 to encourage journalists, entertainment writers, and producers to accurately cover

¹⁶ONDCP officials told us that from fiscal years 2001 through 2007, USADA funding from ONDCP totaled nearly \$46 million. In 2007, for example, ONDCP funding was \$8.4 million or about 70 percent of USADA's \$12 million budget, with the United States Olympic Committee providing the remaining 30 percent.

¹⁷In addition to this funding for education and outreach activities specifically focused on anabolic steroid abuse among teenagers, NIDA has contracted with Scholastic Magazines since 2002 to provide information about drug abuse and addiction to students and teachers during the school year. This program, under which Scholastic Magazines receives \$500,000 per year for fiscal years 2002 through 2009 for a total of \$4 million, supports broader substance abuse prevention activities that have at times included anabolic steroid prevention articles, posters, and other materials.

anabolic steroids and drug abuse among teenage athletes. ONDCP also has Web sites for teens and parents with information about anabolic steroids and links to NIDA resources.

- Since 2003, USADA has produced written publications and annual reports on anabolic steroid abuse and has distributed those publications through high schools and state high school associations. In addition, some USADA public service announcements to be aired during televised sports events and movie trailers have targeted anabolic steroid abuse.
- In fiscal years 2007 and 2008, SAMHSA expects to spend a total of \$99,000 under a contract to develop and disseminate educational materials addressing the abuse of anabolic steroids by adolescent athletes. These materials, which are intended for use by high school athletic and health science departments, include brochures, a video, and 10 high school outreach seminars.

Two Federal Grant Programs Designed to Address Substance Abuse May Address Teenage Anabolic Steroid Abuse

As part of our review, we identified two federal grant programs that are designed to support state and local efforts to prevent various forms of substance abuse and that may include teenagers. Grantees of these programs may address teenage anabolic steroid abuse as part of the programs' general substance abuse prevention efforts. The Drug-Free Communities Support program, funded by ONDCP and administered by SAMHSA under an interagency agreement, provides grants to community coalitions to address drug abuse problems identified in their communities.¹⁸ Many community coalitions choose to implement school-based drug prevention programs with their grant funding and are allowed to tailor these programs to address the drug prevention needs of their communities. In 2007, about one-quarter of more than 700 grantees reported that they were addressing steroid abuse as one of their program's objectives.¹⁹ Each community coalition is eligible for grants of up to \$125,000 per year, renewable for up to 4 more years, and requiring dollar-for-dollar community matching funds.²⁰ In 2007, the Drug-Free

¹⁸Project officers in SAMHSA's Center for Substance Abuse Prevention work with the Drug-Free Communities Support program grantees to provide technical assistance and help them comply with grant requirements.

¹⁹An ONDCP official told us that 189 of 702 communities (27 percent) provided information that they were addressing steroids in their grant activities along with other drugs.

²⁰Follow-on grants are also authorized. 21 U.S.C. § 1532(b)(3).

Communities Support program is providing about \$80 million in grants to 709 community coalitions for drug prevention activities based on the needs of the communities.

Another federal grant program that supports substance abuse prevention efforts for teenagers and that may also include efforts to address anabolic steroid abuse in this population is the School-Based Student Drug Testing program in Education's Office of Safe and Drug-Free Schools.²¹ Since 2003, this program has provided grants to school districts and public and private entities to establish school-based drug-testing efforts. For fiscal years 2003 through 2007, the Office of Safe and Drug-Free Schools awarded \$32.2 million in grants to 87 individual School-Based Student Drug Testing grantees.²² According to information provided in the grantees' grant applications, 34 of the grantees (representing 180 middle, junior, and high schools and at least 70,000 students) proposed using their grant-supported drug testing to test for anabolic steroids in addition to other substances such as amphetamines, marijuana, and cocaine.²³ Education officials told us that although grantees generally identify the drugs for which they are testing in their annual performance reports, there has been no independent verification by Education staff that confirms that the 34 grantees actually have implemented anabolic steroid testing or whether additional grantees have included steroid testing in their efforts.

²¹Education funds no programs specifically targeting steroid prevention for teens. Except for alcohol prevention efforts, the department addresses illegal drug abuse in schools with a comprehensive strategy, not drug by drug.

²²Total funding for the School-Based Student Drug Testing program for fiscal years 2003 through 2007 was about \$36 million, of which \$32.2 million (89 percent) was awarded to grantees. The remainder of the funding supported evaluation and peer review activities.

²³During a discussion of Education's program, an ONDCP official said that because testing for anabolic steroids is more expensive than for other drugs—adding \$50 to \$100 to the cost of a common panel of five drug tests—some schools add steroids to the tests for only a few of the students, as a deterrent. The official said that in some cases, federal funding helps schools afford to add steroids to their usual test panel. The official estimated that about 1,000 schools and school districts across the country were doing some sort of student drug testing and sometimes were including steroids. According to the official, New Jersey requires steroid testing for some athletic teams and Florida and Texas were considering similar legislation.

Research Shows Teenage Anabolic Steroid Abuse Is Linked to Certain Risk Factors and That Prevention Programs May Have Some Short-term Effectiveness

Of the 16 studies we reviewed, nearly half focused on linking certain risk factors and behaviors to teenagers' abuse of anabolic steroids, including the use of other drugs, risky sexual behaviors, and aggressive behaviors.²⁴ Most of the other studies we reviewed were assessments of the ATLAS and ATHENA prevention programs and in general suggested that the programs may reduce abuse of anabolic steroids and other drugs among high school athletes immediately following participation in the programs. Appendix II is a list of the articles we reviewed.

Almost half of the studies we reviewed identified certain risk factors and behaviors linked to the abuse of anabolic steroids among teenagers.²⁵ Risk factors, such as antisocial behavior, family violence, and low academic achievement, are linked to youths' likelihood of engaging in risky behaviors, including drug abuse. Several studies found that the use of alcohol and other drugs—such as tobacco, marijuana, and cocaine—is associated with the abuse of anabolic steroids among teenagers, including teenage athletes and non-athletes. One 2005 study found that the use of other drugs was more likely to predict anabolic steroid abuse than participation in athletic activities. Several studies we reviewed found no difference between athletes and non-athletes in their abuse of anabolic steroids, and one 2007 study of teenage girls found that female athletes were less likely than female non-athletes to abuse anabolic steroids. A few studies we reviewed found a positive correlation between anabolic steroid abuse and risky sexual behaviors such as early initiation of sexual activity and an increased number of sexual partners. Some studies found that aggressive behaviors such as fighting were related to anabolic steroid abuse by both males and females. Moreover, one 1997 study found that adolescents (both male and female) who reported abusing anabolic steroids in the past year were more likely to be perpetrators of sexual violence. However, the cause-and-effect relationships between anabolic steroid abuse and other risky behaviors, such as violence, have not been determined.²⁶

²⁴We reviewed 16 studies published from January 1995 through June 2007.

²⁵These studies sought to identify a correlation between risk factors and behaviors and anabolic steroid abuse by teenagers. The studies did not identify causation.

²⁶Because aggressive behavior is one of the potential psychological effects of anabolic steroid abuse, anabolic steroids could predispose an individual to aggressive acts, including sexual violence.

About half of the studies we reviewed were assessments of the ATLAS and ATHENA prevention programs, and in general these studies suggested that these programs may reduce abuse of anabolic steroids and other drugs among high school athletes immediately following participation in the programs. Researchers assessing the ATLAS program reported that both the intention to abuse anabolic steroids and the reported abuse of steroids were lower among athletes who participated in the ATLAS program than among athletes who did not participate in the program. The most recent study found that although the intention to abuse anabolic steroids remained lower at follow-up 1 year later for athletes who participated in the ATLAS program, the effectiveness of the program in reducing reported use diminished with time. Similarly, researchers assessing the ATHENA program found that girls who participated in the program reported less ongoing and new abuse of anabolic steroids as well as a reduction in the abuse of other performance-enhancing and body-shaping substances. The authors note that these results are short term, and the long-term effectiveness of the ATHENA program is not known.

The authors of the one study in our review that looked at student drug-testing programs found that the abuse of anabolic steroids and other illicit drugs and performance-enhancing substances was decreased among athletes at schools that implemented mandatory, random drug-testing programs. However, this group of athletes also showed an increase in risk factors that are generally associated with greater abuse of illicit drugs, including anabolic steroids. For example, athletes at schools with drug-testing programs were more likely to believe that peers and authority figures were more tolerant of drug abuse, had less belief in the negative consequences of drug abuse, and had less belief in the efficacy of drug testing. Based on these seemingly inconsistent findings, the study's authors called for caution in interpreting the findings.

Experts Find There Are Gaps in Research on the Sustained Effectiveness of Prevention Programs and on the Long-term Health Effects for Teenagers

Experts identified gaps in the research that addresses anabolic steroid abuse among teenagers. Experts identified gaps in the current research on the outcomes of prevention programs that focus on anabolic steroids. Experts also identified gaps in the research on the long-term health effects of initiating the abuse of anabolic steroids as teenagers.

According to experts, available research does not establish the extent to which the ATLAS and ATHENA programs are effective over time in preventing anabolic steroid abuse among teenage athletes. Experts acknowledge that both programs appear promising in their ability to prevent the abuse of anabolic steroids among teenage athletes immediately following participants' completion of the programs. Assessment of the effectiveness of the ATLAS program 1 year later, however, found that the lower incidence of anabolic steroid use was not sustained, although participants continued to report reduced intentions to use anabolic steroids. The long-term effectiveness of the ATHENA program has not been reported. The effectiveness of these programs has been assessed only in some schools in Oregon, and therefore experts report that the effectiveness of the programs may not be generalizable. In another example, experts identified the need for additional research to assess the effectiveness of drug-testing programs, such as those funded under Education's School-Based Student Drug Testing program, in reducing anabolic steroid abuse among teenagers.²⁷

According to experts, there are several gaps in research on the health effects of teenage abuse of anabolic steroids. Experts report that while there is some research that has examined the health effects of anabolic steroid abuse among adults—for example, the harmful effects on the cardiovascular, hormonal, and immune systems—there is a lack of research on these effects among teenagers. There is also a lack of research on the long-term health effects of initiating anabolic steroid abuse during the teenage years. Some health effects of steroid abuse among adults, such as adverse effects on the hormonal system, have been shown to be reversible when the adults have stopped abusing anabolic steroids. Experts point out, however, that it is not known whether this reversibility holds true for teenagers as well. While some experts suggest that anabolic steroid abuse may do more lasting harm to teenagers, due to the complex physical changes unique to adolescence, according to other experts there

²⁷Education officials told us that the agency is currently conducting an evaluation of the effectiveness of the student drug-testing programs implemented by its grantees.

is no conclusive evidence of potentially permanent health effects. Experts also report that the extent of the psychological effects of anabolic steroid abuse and, in particular, of withdrawal from steroid abuse, is unclear due to limited research. Some experts we consulted noted a need to better inform primary care physicians and pediatricians about anabolic steroid abuse among teenagers, so these providers would be better able to recognize steroid abuse in their patients and initiate early intervention and treatment.

Agency Comments

We provided a draft of this report to HHS and Education for comment and received technical comments only, which we incorporated into the report as appropriate.

As arranged with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution of it until 30 days after its issue date. At that time, we will send copies of this report to the Secretary of Health and Human Services and to the Secretary of Education. We will also provide copies to others upon request. In addition, the report is available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff members have any questions regarding this report, please contact me at (202) 512-7114 or ekstrandl@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff members who made major contributions to this report are listed in appendix III.



Laurie Ekstrand
Director, Health Care

Appendix I: Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers

Table 1 lists selected federally funded efforts—including programs, research, and educational and outreach activities—that are designed to focus on preventing or reducing the abuse of anabolic steroids by teenagers (focused efforts), as well as other broader efforts that may address teenage abuse of anabolic steroids as part of the programs’ general substance abuse prevention efforts. The list includes programs funded by two departments and the Office of National Drug Control Policy (ONDCP), in the Executive Office of the President.

Table 1: Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers

Program	Funding for fiscal year 2006	Program implementers or eligible applicants	Targeted beneficiaries	Program description
Department of Health and Human Services				
National Institute on Drug Abuse (NIDA)				
Athletes Training and Learning to Avoid Steroids (ATLAS)	---a	School districts, schools, behavioral health agencies, others	Male high school athletes	Focused effort: program to prevent male high school athletes from abusing anabolic steroids and other performance-enhancing drugs, and to promote healthy strength training and nutrition
Athletes Targeting Healthy Exercise & Nutrition Alternatives (ATHENA)	---b	School districts, schools, behavioral health agencies, others	Female high school athletes	Focused effort: program to prevent female high school athletes from abusing body-shaping substances such as diet pills, tobacco, and anabolic steroids, and to promote healthy training and nutrition
Research projects	\$638,000	Researchers	Adolescent age group	Focused effort: funding for three steroid-related research projects focused on the adolescent age group in humans and animals
Educational and outreach activities	\$521,000	NIDA and its partners, including National Collegiate Athletic Association, American Academy of Pediatrics, American College of Sports Medicine, others	Teenage students, teachers, general public	Focused and broad efforts: to distribute a research report on anabolic steroid abuse to schools; develop steroid abuse posters for schools; and support Scholastic Magazines substance abuse information to schools including anabolic steroids

Appendix I: Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers

Program	Funding for fiscal year 2006	Program implementers or eligible applicants	Targeted beneficiaries	Program description
Substance Abuse and Mental Health Services Administration (SAMHSA)				
Center for Substance Abuse Treatment: What Steroids Can Do to You – The Drug-The Danger-The Deception	---	SAMHSA contractor	High school teachers, coaches, students	Focused effort: program of print materials, video, and high school assemblies to disseminate accurate information describing the health effects of anabolic steroids
Department of Education				
School-Based Student Drug Testing grants program	\$8.6 million	School districts, public and private entities	Students primarily in grades 6 through 12	Broad effort: as of 2006, 72 grants to support programs that address drug prevention in schools, including anabolic steroid prevention efforts
Executive Office of the President				
Office of National Drug Control Policy (ONDCP)				
Drug-Free Communities Support program	about \$80 million	Community coalitions	Various beneficiaries, including school-age youth, depending on community needs assessments	Broad effort: as of 2006, more than 700 grants to communities to support coalitions and grassroots organizations engaged in efforts to prevent use of alcohol, tobacco, and illicit drugs including anabolic steroids
ONDCP public information and entertainment industry outreach	\$5,000 for 1 event in January 2006	Medical experts, coaches, teen athletes	Journalists, entertainment writers, producers	Focused and broad efforts: 6 briefings from 2001-2007, including roundtable for a journalists' conference on teen athletes, briefings for magazine staffs, and media roundtables on teen athletes and performance-enhancing drugs
United States Anti-Doping Agency (USADA) research projects ^d	\$1.8 million	Researchers	Young athletes including teenagers	Focused and broad efforts: grants for research on current and emerging drug issues; estimated one-third of research funding addresses anabolic steroids and human growth hormone

Appendix I: Selected Federally Funded Efforts That Address or Can Address Anabolic Steroid Abuse among Teenagers

Program	Funding for fiscal year 2006	Program implementers or eligible applicants	Targeted beneficiaries	Program description
USADA education and outreach activities ^d	\$1.5 million	Public and private organizations	Teenagers, young adult athletes, parents, coaches	Focused and broad efforts: publications about anabolic steroid issues for high schools, public service announcements, and Web sites

Sources: Agency documents and program officials.

^aIn 2006, NIDA did not provide any funding for the ATLAS program. From 1993 through 2001, however, NIDA funded \$3.4 million in research related to developing and testing the ATLAS curriculum.

^bSimilarly, NIDA did not fund research related to the ATHENA program in 2006, but from 1999 through 2003 the agency provided \$4.7 million to develop and test the program.

^cSAMHSA officials reported that the agency expects to spend up to \$99,000 on this project. A contract for that amount was awarded on July 6, 2006. As of August 2007, SAMHSA reported that it had made \$40,000 in payments under the contract and expects to pay the remaining \$59,000 in fiscal year 2008.

^dUSADA is not organizationally part of the Executive Office of the President. However, because it is an independent, nonprofit corporation funded primarily by ONDCP, for purposes of this report we have grouped USADA's activities with ONDCP's.

Appendix II: Articles Included in GAO's Review

- Borowsky, I.W., M. Hogan, and M. Ireland. "Adolescent sexual aggression: risk and protective factors." *Pediatrics*, vol. 100, no. 6 (1997): e71-e78.
- Dukarm, C.P., R.S. Byrd, P. Auinger, and M. Weitzman. "Illicit substance use, gender, and the risk of violent behavior among adolescents." *Archives of Pediatric & Adolescent Medicine*, vol. 150, no. 8 (1996): 797-801.
- DuRant, R.H., L.G. Escobedo, and G.W. Heath, "Anabolic-steroid use, strength training, and multiple drug use among adolescents in the United States." *Pediatrics*, vol. 96, no. 1 (1995): 23-28.
- Elliot, D., J. Cheong, E.L. Moe, and L. Goldberg. "Cross-sectional study of female students reporting anabolic steroid use." *Archives of Pediatric & Adolescent Medicine*, vol. 161, no. 6 (2007): 572-577.
- Elliot, D., and L. Goldberg. "Intervention and prevention of steroid use in adolescents." *American Journal of Sports Medicine*, vol. 24, no. 6 (1996): S46-S47.
- Elliot, D.L., L. Goldberg, E.L. Moe, C.A. DeFrancesco, M.B. Durham, and H. Hix-Small. "Preventing substance use and disordered eating: Initial outcomes of the ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives) program." *Archives of Pediatric & Adolescent Medicine*, vol. 158, no. 11 (2004): 1043-1049.
- Elliot, D.L., E.L. Moe, L. Goldberg, C.A. DeFrancesco, M.B. Durham, and H. Hix-Small. "Definition and outcome of a curriculum to prevent disordered eating and body-shaping drug use." *The Journal of School Health*, vol. 76, no. 2 (2006): 67-73.
- Fritz, M.S., D.P. MacKinnon, J. Williams, L. Goldberg, E.L. Moe, and D.L. Elliot. "Analysis of baseline by treatment interactions in a drug prevention and health promotion program for high school male athletes." *Addictive Behaviors*, vol. 30, no. 5 (2005): 1001-1005.
- Goldberg, L., D. Elliot, G.N. Clarke, D.P. MacKinnon, E. Moe, L. Zoref, E. Greffrath, D.J. Miller, and A. Lapin. "Effects of a multidimensional anabolic steroid prevention intervention: the Adolescents Training and Learning to Avoid Steroids (ATLAS) program." *JAMA*, vol. 276, no. 19 (1996): 1555-1562.

Goldberg, L., D. Elliot, G.N. Clarke, D.P. MacKinnon, L. Zoref, E. Moe, C. Green, and S.L. Wolf. "The Adolescent Training and Learning to Avoid Steroids (ATLAS) prevention program: background and results of a model intervention." *Archives of Pediatric & Adolescent Medicine*, vol. 150 (1996): 713-721.

Goldberg, L., D.L. Elliot, D.P. MacKinnon, E. Moe, K.S. Kuehl, L. Nohre, and C.M. Lockwood. "Drug testing athletes to prevent substance abuse: Background and pilot study results of the SATURN (Student Athlete Testing Using Random Notification) study." *Journal of Adolescent Health*, vol. 32, no. 1 (2003): 16-25.

Goldberg, L., D.P. MacKinnon, D.L. Elliot, E.L. Moe, G. Clarke, and J. Cheong. "The Adolescents Training and Learning to Avoid Steroids Program: Preventing drug use and promoting health behaviors." *Archives of Pediatric & Adolescent Medicine*, vol. 154, no. 4 (2000): 332-338.

MacKinnon, D.P., L. Goldberg, G. Clarke, D.L. Elliot, J. Cheong, A. Lapin, E.L. Moe, and J.L. Krull. "Mediating mechanisms in a program to reduce intentions to use anabolic steroids and improve exercise self-efficacy and dietary behavior." *Prevention Science*, vol. 2, no. 1 (2001): 15-28.

Miller, K.E., J.H. Hoffman, G.M. Barnes, D. Sabo, M.J. Melnick, and M.P. Farrell. "Adolescent anabolic steroid use, gender, physical activity, and other problem behaviors." *Substance Use & Misuse*, vol. 40, no. 11 (2005): 1637-1657.

Naylor, A.H., D. Gardner, and L. Zaichkowsky. "Drug use patterns among high school athletes and nonathletes." *Adolescence*, vol. 36, no. 144 (2001): 627-639.

Rich, J.D., C.K. Foisie, C.W. Towe, B.P. Dickinson, M. McKenzie, and C.M. Salas. "Needle exchange program participation by anabolic steroid injectors." *Drug and Alcohol Dependence*, vol. 56, no. 2 (1999): 157-160.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Laurie Ekstrand, at (202) 512-7114 or ekstrandl@gao.gov.

Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Christine Brudevold, Assistant Director; Ellen M. Smith; Julie Thomas; Rasanjali Wickrema; and Krister Friday.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "E-mail Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are \$2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, DC 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Gloria Jarmon, Managing Director, jarmong@gao.gov, (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548