

Anabolic-androgenic steroid users in treatment

Örebro Studies in Medicine 28



KURT SKÅRBERG

Anabolic-androgenic steroid users in treatment
Social background, drug use patterns, and criminality

© Kurt Skårberg, 2009

Title: Anabolic-androgenic steroid users in treatment:
social background, drug use patterns, and criminality.

Publisher: Örebro University 2009
www.publications.oru.se

Editor: Maria Alsbjer
maria.alsbjer@oru.se

Printer: Intellecta Infolog, V Frölunda 04/2009

ISSN 1652-4063
ISBN 978-91-7668-662-1

ABSTRACT

Skårberg, Kurt (2009). Anabolic-androgenic steroid users in treatment: social background, drug use patterns, and criminality. *Örebro Studies in Medicine* 28. 98pp.

This dissertation is based on interviews with 36 users of anabolic androgenic steroids (AAS) seeking help at an addiction centre. A comparison group of 277 gym clients were asked to answer a questionnaire. The dissertation consists of four studies.

Histories of a troubled childhood as well as current social disadvantage were both more frequent among the AAS users. Users also reported poor relationships with their parents and almost half of them had experienced physical or mental abuse. The AAS user's experiences from school were mostly negative, and included concentration problems, boredom and learning difficulties. Their current circumstances included abuse of other drugs, battering of spouses and other crimes such as assault, illegal possession of weapons and theft.

There was significant variation in the development of drug use in relation to social background, onset of drug use, relationship to AAS use and experience of AAS effects. All patients had initially experienced positive effects from AAS but, over time, the negative experiences had outweighed the positive effects. All patients were dedicated to excess training and took AAS in combination with gym training, indicating that the use of these drugs is closely related to this form of training.

The results indicated that a history of polysubstance use among the patients was frequent. Over half were using drugs of abuse and also taking various other pharmaceuticals. Almost half of the patients also used human growth hormones. Moreover, almost half of the interviewed persons were drinking alcohol to a hazardous or harmful extent. The most common reason given for using AAS and other hormones was to increase muscle mass and strength, but some participants also used insulin as a mean of losing fat. Cannabis was used to improve sleep, heroin to decrease pain and amphetamine to increase endurance and burn fat. Our data suggest that most of the current AAS users who have been admitted to a treatment programme are multiple drug users with polysubstance dependence.

The criminal activity level increased significantly for the majority of the participants after they began using drugs. This was particularly obvious in the two subgroups who started their involvement with drugs by using AAS. Crimes of violence and weapon offences showed the greatest increases in incidence after drug use was initiated. The study also showed a significant decrease in criminality after treatment, particularly among participants who started their drug use with AAS. The results suggest that there is an association between the use of AAS and criminality, in particular with respect to crimes of violence and weapon offences, and that this criminality is enhanced when AAS are combined with other drugs of abuse.

This dissertation shows that AAS users often have a history of and a current problematic social situation, that AAS use is often combined with a polysubstance drug use, that AAS use is connected to criminal activities including crimes of violence and weapon crimes, and that AAS use can be a gateway to the use of other drugs of abuse.

Keywords: Anabolic androgenic steroids, narcotics, drugs of abuse, alcohol, pharmaceuticals, dietary supplements, social background, criminality

Kurt Skårberg, Örebro University, SE-70182 Örebro, Sweden.
E-mail: kurt.skarberg@orebroll.se

LIST OF PUBLICATIONS

This dissertation is based on the following original papers, which will be referred to in the text by their Roman numerals:

- I. Skarberg, K. & Engstrom, I. (2007) Troubled social background of male anabolic-androgenic steroid abusers in treatment. *Substance Abuse Treatment, Prevention, and Policy*, 2, 20.
- II. Skårberg, K., Nyberg, F. & Engström, I. (2008) The development of multiple drug use among anabolic-androgenic steroid users: six subjective case reports. *Substance Abuse Treatment, Prevention, and Policy*, 3, 24.
- III. Skarberg, K., Nyberg, F. & Engstrom, I. (2009) Multisubstance Use as a Feature of Addiction to Anabolic-Androgenic Steroids. *European Addiction Research*, 15: 99–106.
- IV. Skarberg, K., Nyberg, F. & Engstrom, I. Is there an association between use of anabolic-androgenic steroids and criminality? *Submitted*.

The studies presented in this dissertation have been reprinted with the kind permission of the publishers concerned (BioMed Central and S. Karger AG, Basel).

LIST OF ABBREVIATIONS

AAS	Anabolic androgenic steroids
AC	Addiction clinic
ANOVA	Analysis of variance
AUDIT	The alcohol use disorders identification test
BRÅ	The Swedish national council for crime prevention
CLA	Conjugated linoleic acid
DHT	5 α -dihydrotestosterone
DSM IV	Diagnostic and statistical manual of mental disorder, 4 th edition
FASS	The Swedish drug catalogue
FSH	Follicle stimulating hormone
GDR	German Democratic Republic
GHB	Gamma-hydroxybutyric acid
GRH	Gonadotropin-releasing hormone
HCG	Human chorionic gonadotropin
HDL	High-density lipoprotein
hGH	Human growth hormone
HMB	Beta-hydroxy-beta-methylbutyrate
HPG-axis	Hypothalamic-pituitary-gonadal axis
IGF-1	Insulin like growth factor-1
LDL	Low-density lipoprotein
LH	Luteinizing hormone
LSD	Lysergic acid diethylamide
SASB	Structural analysis of social behavior
SCL-90	Symptom checklist-90
SHBG	Sex hormone binding globulin
SPSS	Statistical package for the social sciences
TCI	Temperament and character inventory
THC	Tetrahydrocannabinol (cannabis)
THG	Tetrahydrogestrone

CONTENTS

PREFACE	13
1. INTRODUCTION.....	15
1.1 Definition and characterisation of AAS.....	15
1.1.1 Different classes of AAS.....	15
1.1.2 Veterinary AAS and other veterinarian drugs.....	16
1.2 The history of AAS.....	17
1.3 Prevalence of AAS.....	22
1.4 Three types of AAS users.....	22
1.5 Physical side effects of AAS use.....	23
1.5.1 Effects on the liver.....	23
1.5.2 Effects on the cardiovascular system.....	24
1.5.3 Effects on the reproductive and endocrine system.....	25
1.5.4 Effects on the skin.....	25
1.5.5 Effects on the musculoskeletal system.....	26
1.5.6 Special effects in males.....	26
1.5.7 Special effects in females.....	26
1.6 Psychic side effects of AAS use.....	27
1.7 Positive effects of AAS use.....	29
1.8 Other hormones in combination with AAS.....	29
1.9 Other drugs of abuse in combination with AAS.....	30
1.10 Alcohol in combination with AAS.....	30
1.11 Pharmaceuticals in combination with AAS.....	31
1.12 Dietary supplements in combination with AAS.....	31
1.13 Social background and current social situation of AAS users.....	32
1.14 AAS and crimes.....	33
1.15 Treatment of AAS users.....	34
2. AIMS.....	37
2.1 Overall.....	37
2.2 Study I.....	37
2.3 Study II.....	37
2.4 Study III.....	37
2.5 Study IV.....	37
3. METHODS AND SUBJECTS.....	39
3.1 Study design.....	39
3.2 Participants.....	40

3.2.1	Addiction Centre group (AC group).....	40
3.2.2	Comparison groups (gym groups)	40
3.3	Procedures and instruments	41
3.3.1	General.....	41
3.3.2	Social interview.....	42
3.3.3	Substance interview.....	43
3.3.4	Questionnaire	44
3.3.5	Register data.....	44
3.4	Methods.....	44
3.4.1	Study I.....	44
3.4.2	Study II.....	45
3.4.3	Study III.....	45
3.4.4	Study IV.....	46
3.5	Data analysis.....	47
3.6	Ethical approval	47
4.	RESULTS.....	49
4.1	Study I: Troubled social background of male anabolic-androgenic steroid abusers in treatment	49
4.2	Study II: The development of multiple drug use among anabolic-androgenic steroid users: six subjective case reports	51
4.3	Study III: Abuse of narcotics and other drugs in anabolic-androgenic steroid misusers.....	52
4.4	Study IV: Is there an association between use of anabolic-androgenic steroids and criminality?	54
5.	COMMENTS AND GENERAL DISCUSSION.....	57
5.1	Methodological discussion.....	57
5.2	Ethical discussion	61
5.3	Results discussion.....	62
5.4	Clinical implications.....	65
6.	SAMMANFATTNING PÅ SVENSKA (SUMMARY IN SWEDISH).....	67
7.	TACK TILL PERSONER SOM BIDRAGIT (ACKNOWLEDGEMENTS)	69
	EPILOGUE	71
	APPENDIX.....	73
	REFERENCES.....	89

PREFACE

Let me start off by giving a background to this dissertation. At the end of the 1980s, I damaged my back and after a number of medical examinations I was advised to undergo arthrodesis surgery, since the injury was regarded as incurable. I did not follow this advice, instead I went to a chiropractor and it was in conjunction with that and upon his advice that I started training at a gym.

For about a year, I trained at a gym although I still suffered from constant back pains and took high doses of the painkillers I had been prescribed. One morning during the Christmas break, after one year of intensive training, I woke up and felt that something strange had happened - the pain had disappeared. I continued training at a gym where a couple of competitive bodybuilders also trained. In the café they used to talk about something they called methandrostenolone but at the point in time I did not have a clue what type of substance they were talking about. Another person who trained at the same gym was a neighbour of mine and he physically abused his wife. It emerged that he was using something called anabolic steroids. At this time I was training to become a gym instructor with back problems as my particular area of interest. It was in this context that my interest in doping substances grew and I quite quickly learnt that they were called anabolic-androgenic steroids (AAS) and that there were many substances included under this term.

Later when I was studying to become a social worker I decided at an early stage that my Bachelor Dissertation would be about the treatment of AAS users. At the end of my course, we all did a six-month traineeship and I was given the opportunity to do mine at the Addiction Centre (AC) in Örebro. There I met AAS users who often suffered from severe mental problems. At the same time I tried to read any literature I could find on the subject, which was not very much. Towards the end, I told one of my patients that my traineeship would come to an end six weeks later. He said that this was all right but then failed to turn up to the sessions we had planned after that. However, it did not take long before his father called and told me that they had found him in a hotel room sleeping in a bath where he had tried to take his own life after having drunk alcohol mixed with different medicines. His suicide attempt failed because he was so big that he got stuck in the bath instead of sinking down under the water as he had planned. When I met him again he told me that when he had found out that I would not be working at the clinic for much longer, he had become very upset and felt that I, just like everybody else in his life, had let him down which is why he had given up on life. This taught me to never break off contact with an AAS user before the user has started talking about terminating the course of treatment him/herself.

I wrote my Bachelor Thesis on AAS and after I had completed my course I started studying psychiatry because I understood that this was something I had to do if I wanted to work with AAS users. During my course I got a temporary job at AC since they lacked knowledge on steroid users. My employment contract at the clinic was extended and I began to realise that there really was insufficient knowledge about AAS. This led me to start collecting information on the problem hoping that this would improve my and other's knowledge on the treatment of AAS users. Ingemar Engström at the Psychiatric Research Centre in Örebro became interested in our work and the thoughts we had regarding the collection of data on AAS users. He helped us to put our ambitions in some order so that they became scientifically useable. This work subsequently led me to this dissertation.

1. INTRODUCTION

1.1 Definition and characterisation of AAS

Anabolic-androgenic steroids (AAS) are synthetic derivatives of the male sex steroid testosterone (Brower 2002). Testosterone is synthesized in the body from cholesterol and the biosynthesis takes place in the Leydig cells of the testicles and in the adrenal glands in males (Mottram & George 2000) and in the adrenal glands and the ovaries in females (Talih, Fattal & Malone 2007). Production is governed by a negative feedback mechanism of the gonadotropins, luteinizing hormone (LH) och follicle-stimulating hormone (FSH), which are formed in the frontal lobe of the pituitary gland (Ganrot, Grubb & Stenflo 1997).

The term AAS includes both testosterone and other androgenic hormones whose structure is similar to that of testosterone (Marshall 1988). Testosterone has mainly two effects on the body. Firstly, the anabolic effect which mainly promotes protein synthesis, decreased nitrogen excretion, muscle growth (Pope & Katz 2003), erythropoiesis, the stimulation and inhibition of skeletal growth in the young. Secondly, the androgenic effect which is responsible for the development and maintaining of the secondary sex characteristics, for example changes in hair distribution, physical changes, genital size, and sperm production (Mottram & George 2000). No AAS are purely anabolic. Instead steroids of this type nearly always have a certain androgenic effect which leads to undesired side effects of different types (Kochakian 1993; Marshall 1988).

Hence, the correct term is anabolic-androgenic steroids (AAS), which is the term that will be used in this dissertation.

1.1.1 Different classes of AAS

A classic AAS substance is testosterone that has metabolised in the body into dihydrotestosterone, androstanolone, estradiol, androsterone or androstenedione (Lukas 1993). Testosterone has a short free-circulating half-life and in order to counteract the rapid rate of metabolism, a number of synthetic AAS have been designed to have a longer half-life. Over 1.000 testosterone derivatives have been produced (Hall 2005). Just like testosterone AAS have a four-ringed structure with 19 carbon atoms (Talih et al. 2007). AAS differ from testosterone through the addition of ethyl, methyl, hydroxyl, or benzyl groups at one or more sites along the synthetic steroid structure (Graham, Evans, Davies & Baker 2008).

AAS substances are sometimes divided into the following categories; C-17 β -ester derivatives, C-19-nortestosterone derivatives and C-17 α -alkyl derivatives (Clark & Henderson 2003).

1. C-17 β -ester derivatives, which usually include injectable variations, are AAS with a rapid effect that are hydrolysed in to free testosterone and which can subsequently be metabolised into 5 α -dihydrotestosterone (DHT) or aromatised into oestrogen. An esterification of the substance gives a thicker solution which postpones the breakdown and prolongs the effect of the testosterone when taken as an intramuscular injection. This group, which is easily aromatised in to 17 β -estradiol, includes substances like testosterone propionate, cypionate, enanthate and undecanoate. AAS from this group are less toxic for the liver and cholesterol levels than the third group.
2. 19-nortestosterone derivatives are AAS with a greater long-term effect. To this group belong for instance nandrolone decanoate, methenolone enanthate and nandrolone phenylpropionate. This mixture has less androgenous activity in relation to the androgenic receptor than 5 α -dihydrotestosterone. Nandrolone decanoate can be aromatised into estradiol to a lesser extent than the substances in the first group. AAS from this group are also relatively harmless for the liver and in relation to the cholesterol turnover.
3. 17 α -alkyl derivatives, which are taken orally since alkylation diminishes the first passage in the liver, are more toxic for the liver and cholesterol levels. Substances like methandrostenolone, stanozolol, oxymetholone, methyltestosterone, norethandrolone, flouxymesterone, danazol, oxandrolone and ethylestrenol belong to this group. It is not known whether substances in this group are converted into 5 α -dihydrotestosterone or oestradiol (Clark & Henderson 2003; Kuhn 2002).

1.1.2 Veterinary AAS and other veterinarian drugs

It is a well-known fact that AAS users also use substances meant for animals. Veterinarian drugs that are also used by humans are drugs like boldenone and trenbolone (Bahrke, Yesalis & Wright 1990b; Hall 2005; Parkinson & Evans

2006). Other AAS widely used in veterinary medicine are testosterone propionate, stanozolol, oxymetholone, testosterone enantate and mibolerone (Kochakian & Yesalis 2000b). Another veterinarian drug that is often used is clenbuterol (Eklof, Thurelius, Garle, Rane & Sjoqvist 2003). Little is known about what impact these substances have on the side effects of AAS.

1.2 The history of AAS

It has been known for centuries that the castration of men does not only lead to a decline in fertility but also to the loss of secondary male sex characteristics (Spencer 1946). The latter was later used as a reason to castrate young choirboys so that they would keep their light soprano voices as well as to produce eunuchs who guarded the harems where women lived (Kochakian 1988).

Numerous attempts were made in the 19th century to show that the testicles could produce substances that increased both physical and mental wellbeing. The first piece of the puzzle of how this is regulated was laid in 1849 when Arnold Adolf Berthold through a series of experiments with transplanted testicles from castrated roosters found that the testicles contained a substance that was transported via the bloodstream and had an impact on both behavioural and sexual characteristics. His findings were, however, questioned for over sixty years (Freeman, Bloom & McGuire 2001; Kochakian 1988). In 1889, a respected French physician, Charles Edouard Brown-Sequard announced that he had increased his physical strength, mental ability and appetite by injecting under his own skin a liquid containing some water mixed with blood from a testicle vein, sperm and juice pressed out of crushed testicles immediately after removing them from a dog or guinea pig (Brown-Sequard 1889). This substance became very popular and at the end of 1889 over 12,000 physicians had administered Brown Sequard's liquid, and chemists who manufactured and sold the substance became very wealthy from selling the new "Elixir of life" (Freeman et al. 2001).

The physiologist Oskar Zoth was the first to suggest injecting athletes with a hormonal substance since it had been proved that the substance increased muscle strength. He and his partner Fritz Pregl injected themselves with extract from bull testicles and then measured the increase in strength in a middle finger in 1896. They were later awarded the Nobel Prize in Chemistry in 1923 (Dotson & Brown 2007).

In the 1890's Lode succeeded in redoing and confirming Bertholdt's results but this was ignored at the time (Lode 1891, 1895). It was not until Pezard succeeded in redoing the experiment with castrated roosters and when he transplanted a

small piece of rooster testicle and put this piece in the abdomen of the same rooster that Bertholdt gained recognition (Pezard 1911, 1912). He concluded, just as Bertholdt had done, that the testicles contained a substance that was transported through the bloodstream (Kochakian 1988). These blood-borne factors were named hormones (which means to excite or arouse) (Starling 1905).

Based on the above conclusion, Casimir Funk and colleagues presumed in 1929 that the active substance (the hormone) must be cleared in the kidneys for it to be subsequently seen in the urine. The experiment that followed was carried out on roosters that had been castrated at two months of age. After a couple of days, the roosters showed clear signs of gender transition, their combs were lying to one side and the colour had changed from red to a pale pink. After injecting the roosters with urine extract, their combs grew and became red again already after a couple of days, and after a period of treatment the roosters behaved as if they had never been castrated (Funk, Harrow & Lejwa 1930).

The pharmaceutical industry was interested in developing this substance and a competition was started where three researchers tried to isolate the hormone from the testicles. In 1931, Adolf Butenandt became the first to isolate 15 mg of pure substance (Butenandt & Tscherning 1934b) which was called androsterone (andro="male", ster="sterol", one="ketone") (Freeman et al. 2001). He obtained its effects using 15.000–25.000 litres of urine that he took from a group of policemen (Butenandt 1931; Butenandt & Tscherning 1934a; Kochakian 1988).

Freeman, et al. 2001, describe in their article "A brief history of testosterone" how several researchers who were independent of each other determined that the testicles had a greater androgenous factor than urine and in 1935 Karoly Gyula David and colleagues published their classic article "On Crystalline Male Hormone from Testicles" where the term testosterone was coined for this new hormone (testo="testes", ster="sterol", one="ketone") (David, Dingermanse, Freud & Laqueur 1935). The synthesis of testosterone came later that year when Butenandt and Hanisch published their article "A Method for Preparing Testosterone from Cholesterol" (Butenandt & Hanisch 1935). A week later Ruzicka and Wettstein published their article "On the Artificial Preparation of the Testicular Hormone Testosterone" (Andro-sten-3-one-17-ol) (Ruzicka & Wettstein 1935). Ruzicka and Butenandt were awarded the Nobel Prize in Chemistry in 1939 for their work (Freeman et al. 2001).

It was through the intensive research that followed that it became increasingly clear that the male body produced more than one substance with male hormonal activity. The testosterone molecule can give rise to approximately 540 different

substances that together were given the name androgens (andro=“male”, gen=“to produce”) (Kochakian 1988).

Androsterone, androstendienone and testosterone became characterized and synthesized from cholesterol in 1935 (Kochakian & Yesalis 2000a), at the same time that Kochakian reported that androgens stimulated the protein anabolic process which could be used as an androgenous therapy to facilitate the building up of tissue and stimulate growth after illness (Kochakian 1988). This was then used in medical treatment both on people and animals (Bahrke et al. 1990b). Clinical trials were already underway in 1937 where people were injected with testosterone propionate, a slow release derivative of testosterone, and also given oral doses of methyltestosterone (Kochakian & Yesalis 2000a).

During the 1940s, there was a lot of discussion in clinical literature on the possible link between androgens and muscle growth and the possible use in sports. A well known book “The Male Hormone” was published in 1945 (De Kruif 1945), and also translated and published in Swedish called [“Hormonerna för mannen”] (De Kruif 1947). In this book, Paul de Kruif included information that made it easier for athletes to understand the latest findings on these substances (Hoberman & Yesalis 1995). During the Second World War, AAS were developed further by the German state to be used on soldiers in action. The idea was to build up an army of supermen (Marshall 1988).

At the end of the 1940s and at the beginning of the 1950s, bodybuilders started experimenting with testosterone substances and news about the effectiveness of these substances spread quickly among athletes (Hoberman & Yesalis 1995). Different testosterone substances were tried in medical treatment and used for the treatment of severe psychoses, melancholy and depression with varying results (Bahrke et al. 1990b). Athletes from the Soviet Union and East Germany started using AAS in the 1950s. This paved the way for the use of AAS in the Olympic Games. AAS were subsequently used a great deal by athletes and during the next decades the hormone was modified into derivatives that possessed more anabolic qualities (Dotson & Brown 2007).

It seems that during the 1950s and 1960s, the illegal use of AAS was primarily to be found among athletes, both men and women (Kashkin & Kleber 1989). During the 1960s, one of the biggest pharmaceutical experiments in history started in the German Democratic Republic (GDR), where the government promoted the use of drugs in sports, especially the use of different types of AAS substances. Previously confidential documents describe how physicians and scientists in the GDR administered different drugs to several thousand athletes, including teenagers of both sexes, for more than three decades. There were

especially many young girls and women who participated in this programme since they obtained the best athletic effect from AAS and similar substances (Franke & Berendonk 1997). The documents give an account of the various side effects of the AAS therapies, which have required surgical or medical treatment for virilisation and gynaecological damage. Stasi reports even describe the risk of pregnancy since the foetus might be damaged from such drug use and in such a situation an abortion would have been recommended (Franke & Berendonk 1997). In Sweden, Arne Ljungqvist carried out a study of the best Swedish athletes in different sports in 1973. Of 144 athletes he found that a third had used AAS (Ljungqvist 1975).

In the 1980s it became increasingly clear that the illegal use of AAS had also spread outside competitive sports to groups whose aim was to create a better body or to feel better mentally (Kashkin & Kleber 1989). At the beginning of the 1990s, several pharmaceutical companies stopped manufacturing AAS because of the abuse risk and the serious side effects. Instead black market sales of both genuine and fake AAS increased. This increase in sales can be explained by an increase in Internet trade and the fact that the substances became more readily available (Dotson & Brown 2007). An important black market developed which includes not only AAS for humans but also veterinarian versions (Marshall 1988). The growing black market sometimes provides bad quality AAS, which may not contain what has been promised or which have not been manufactured in a sterile environment (Parkinson & Evans 2006). Thus, in more recent years the use of AAS has spread among men and women who take AAS without the aim of performing better in a sport (Mottram & George 2000).

Today, the use of AAS is not only linked to the use of another illegal hormone substance but also to the use of other drugs of abuse, for example amphetamine (Brower 2002) as well as alcohol (Eklof et al. 2003) and other medicines (Brower 2002). In recent years researchers have also produced various “designer drugs”, for instance epitestosterone propionate in order to get round doping tests in sports (Franke & Berendonk 1997), a transdermal preparation (testosterone and epitestosterone) coded as “The Cream” (Kicman 2008) and a new AAS called tetrahydrogestrinone (THG) (Malvey & Armsey 2005). Users often take several AAS at the same time, known as “stacking”, or they gradually increase the dose until they reach a top level after which they reduce the dose, this is known as “pyramiding”. AAS are often taken in “drug cycles” often between six and twelve weeks, which are then followed by an equally long drug-free period when the users try to restore the body’s hormone levels (Dotson & Brown 2007). Some

users admit to using AAS continuously, which increases the risk of serious side effects (Parkinson & Evans 2006).

When AAS are taken for medical use, i.e. as part of the medical treatment of different diseases, the therapeutic doses normally lie between 25 and 50 mg every third to fourth week for osteoporosis and between 100 and 200 mg per week for different types of anaemia. An injection of 1.000 mg of testosterone undecanoate is given every 10th to 14th week for hypogonadism in men (FASS 2009). For non-medical use, supraphysiological doses of substances that exceed the therapeutic dose by 40 to 100 times are common (Hall 2005). Typical doses lie between 250 and 3.200 mg per week (Blue & Lombardo 1999), but doses of up to 6.000 mg per week have been reported (Parkinson & Evans 2006). Evans describes a saying which goes “the bigger the dose, the bigger the muscle” (Evans 2004). AAS are normally injected (oil or water-based), taken in tablet form, as a transdermal patch or as a skin cream (Kuhn 2002) and most users inject themselves (Korkia & Stimson 1997).

After long-term use, AAS affect the hypothalamus-pituitary-testicle (HPT) axis negatively meaning that the user becomes hypogonadal for a time (Kanayama, Hudson & Pope 2008). Furthermore, the long-term use of high doses of AAS may give rise to irreversible cardiovascular damage like for instance arteriosclerosis and cardiomyopathy (Kanayama et al. 2008) or concentric left ventricular hypertrophy (Urhausen, Albers & Kindermann 2004). AAS use may also give rise to other physical problems like acne, gynecomastia and psychic side effects, for example aggressiveness or depression with an increased suicide risk. In women there is also an increased risk of side effects like virilization and an enlarged clitoris (Dotson & Brown 2007). Despite the fact that knowledge of the side effects of AAS use has increased, it is sometimes difficult to assess which mental problems stem from the use of AAS (Kanayama et al. 2008). However, it is worth pointing out that due to the hidden use of the substance, there is a risk that side effects linked to AAS use are not reported sufficiently (Sjoqvist, Garle & Rane 2008).

In general, it can be said that the problem of AAS use has changed from having been a problem limited to competitive sports to being a growing public health issue today since people who train at a gym and who have body image as their prioritised goal are increasingly becoming AAS users.

1.3 Prevalence of AAS

Life-time prevalence of AAS in Western countries among males ranges from 1 to 5 % and among females (teenage girls) the prevalence is estimated to 0.1 % (Kanayama, Boynes, Hudson, Field & Pope 2007). An American study found that 3 million Americans may have used illegal AAS at some time in their lives and that the average age of an AAS user is 25 (range 14–68) (Cohen, Collins, Darkes & Gwartney 2007). Current figures indicate that between 2.7 and 2.9 % of adolescents in the USA have used AAS while studies of people training at a gym in the USA indicate figures between 15 and 39 % (Parkinson & Evans 2006). In the last fifteen years, different studies have indicated that between 0.4 and 6.7 % have used AAS in the USA. One reason for the huge spread in the figures may to a certain extent be due to major differences in the response rate, another reason may be the attitude to AAS of those replying to questions on AAS (Thiblin & Petersson 2005).

Estimates in Sweden indicate that between 50.000 and 100.000 people have used AAS, which corresponds to about 1 % of the Swedish population (Sjoqvist et al. 2008). Today, the use of AAS is still growing (Hall 2005; Thiblin, Mobini-Far & Frisk 2009).

1.4 Three types of AAS users

The interest of the media has previously focused on AAS use in competitive sports. However, in recent years this has changed to also include the general public's use of AAS (Cohen et al. 2007). Corcoran and Longo describe three different types of AAS users; athletes, aesthetes and a fighting elite (Corcoran & Longo 1992). The athletes' main reason for using AAS is to enhance their athletic performance by increasing their strength, speed, size, or aggressiveness. This applies to most athletes who compete in some form of sport at different levels. The aesthete, on the other hand, takes AAS to gain advantages through his or her looks. An aesthete might be an actor, model, bodybuilder, or anyone who is dissatisfied with his or her looks. The third group consists of criminals whose aim is to improve their chances in a fight, carry out a crime in a safer way, look "harder", or become more aggressive by using AAS. This group includes gangmembers, police officers, bouncers and service men (Corcoran & Longo 1992).

1.5 Physical side effects of AAS use

According to reviews, clinical studies and case reports, the use of AAS may give rise to numerous physical side effects, listed in sections 1.5.1 to 1.5.7 (Blue & Lombardo 1999; Bonetti, Tirelli, Catapano, Dazzi, Dei Cas, Solito, Ceda, Reverberi, Monica, Pipitone, Elia, Spattini & Magnati 2008; Boyadjiev, Georgieva, Massaldjieva & Gueorguiev 2000; Burnett & Kleiman 1994; Casavant, Blake, Griffith, Yates & Copley 2007; D'Andrea, Caso, Salerno, Scarafile, De Corato, Mita, Di Salvo, Severino, Cuomo, Liccardo, Esposito & Calabro 2007; Haupt & Rovere 1984; Hickson, Ball & Falduto 1989; Kicman & Gower 2003; Korkia, Lenehan & McVeigh 1996; Kutscher, Lund & Perry 2002; O'Sullivan, Kennedy, Casey, Day, Corrigan & Wodak 2000; Parkinson & Evans 2006; Parssinen & Seppala 2002; Sader, Griffiths, McCredie, Handelsman & Celermajer 2001; Sjoqvist et al. 2008; Talih et al. 2007; Thiblin et al. 2009; Urhausen et al. 2004).

The side effects can be short term and last only as long as AAS are used or for a short time thereafter, or permanently. They may develop rapidly within several weeks or less or up to several years of intake. For the most part, the side effects of AAS use are of short duration and regress upon cessation of use (Blue & Lombardo 1999). The risk for these side effects increases with dose and duration of use (Evans 2004) and they are more dramatic in women (Clark, Costine, Jones, Kelton-Rehkopf, Meerts, Nutbrown-Greene, Penatti, Porter, Yang & Henderson 2006) and may be irreversible (Kutscher et al. 2002). However, it is difficult to assess some of the side effects described since many users do not just stick to AAS. Normally they mix AAS with other accessory medicines (e.g. to enhance the anabolic effect, as a stimulant or to induce fat loss) and muscle-shaping drugs (e.g. insulin, ephedra and amphetamine) which may also have an impact on the side effects (Parkinson & Evans 2006).

It is possible to divide side effects into seven general categories; effects on the liver, effects on the cardiovascular system, effects on the reproductive and endocrine system, effects on the skin, effects on the musculoskeletal system, special effects in males and special effects in females.

1.5.1 Effects on the liver

Abnormal liver function

Hepatomegaly (a condition of an enlarged liver)

Jaundice, skin or eye (with liver disease)

Liver tumours, both malignant and benign

Hepatocellular carcinomas (primary malignancy (cancer) of the liver)

Hepacellar or hepatocellular adenoma (benign liver tumours)

Hepatic cholestasis (bile canal obstruction)

Peliosis hepatis (blood-filled sacs develop in the liver)

Effects on the liver are common side effects and in the literature there is a documented link between increasing liver values and AAS use (Haupt & Rovere 1984). Studies have shown that bodybuilders are usually aware of the liver problem risk, particularly with the use of oral C-17-alkylated AAS, e.g. methyltestosterone, metandienone, oxymetholone, oxandrolone and stanozolol (Kutscher et al. 2002).

1.5.2 Effects on the cardiovascular system

Abnormal cholesterol profiles with decreased levels of high-density lipoprotein (HDL) and increased low-density protein (LDL)

Cardiac arrhythmias

Cardiac hypertrophy (“athletes heart”), can lead to decreased maximal oxygen uptake, remodelling of the heart, myocardial ischaemia and cardiomyopathy

Decreased triglyceride level

Depressed amplitude of cardiac contraction or increased heart rate

Elevated blood pressure (can be a result from blood volume increases and fluid retention)

Fluid retention/Oedema (due to water retention)

Impaired diastolic function, could contribute to decreased maximum oxygen consumption ($VO_2\max$; an index of metabolic and cardiovascular endurance ability)

Increased risk of thrombosis (the formation or presence of a blood clot in a vein or artery)

Left ventricular hypertrophy (concentric increase in left ventricular wall thickness)

Myocardial hypertrophy

Myocardial infarction (heart attack)

Risk of sudden death

Stimulate platelet aggregation; increase coagulation enzyme activity and cause coronary artery vasospasm

If AAS are combined with hGH, the enlargement is greater and the link between AAS and myocardial hypertrophy has proved to be dose-related (Karila, Karjalainen, Mantysaari, Viitasalo & Seppala 2003). Studies have also shown that an enlarged left ventricular mass and even a reduced diastolic function may be established several years after a user has stopped using AAS (Urhausen et al.

2004) and case of myocardial injury and even sudden cardiac death have also been reported (Fineschi, Riezzo, Centini, Silingardi, Licata, Beduschi & Karch 2007).

AAS may also have an impact on cholesterol levels by reducing HDL (Sader et al. 2001) and enhancing LDL (Blue & Lombardo 1999) and since total cholesterol is generally unchanged, it is easy to miss the change in HDL and LDL if not all the cholesterol levels are tested (Glazer 1991). Triglyceride levels are also reduced through the exogenous administration of androgens and enhanced even when the user takes oral AAS (Blue & Lombardo 1999).

1.5.3 Effects on the reproductive and endocrine system

Disturbance of the hypothalamic-pituitary-gonadal axis (HPG-axis)

Decreased levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone and sex hormone binding globulin (SHBG) via the negative feedback loop of the HPG-axis

Deteriorated spermatogenesis (decreased sperm production)

Decreased thyroid function

Elevation of serum testosterone

Enlargement of the prostate volume

Hyperinsulinism and diabetes mellitus with type II symptoms due to decreased glucose tolerance and increased insulin resistance

Hypogonadotropic hypogonadism (a result from absent or decreased function of male testes or the female ovaries)

1.5.4 Effects on the skin

Alopecia (loss of hair from the head or body)

Higher levels of bloating (an abnormal general swelling)

Injection site pain

Hypertrophy of the sebaceous glands

Increase in the secretion of sebum

Sebaceous cysts (a common cyst of the skin; filled with fatty matter (sebum) that is secreted by a sebaceous gland that has been blocked)

Acne as a result of androgenic stimulation of sebaceous glands

Cystic acne (caused by an excess buildup of sebum in the pores)

Oily skin

Oily hair

Striae (stretch marks)

1.5.5 Effects on the musculoskeletal system

Muscle hypertrophy (especially neck, shoulders, arms and chest)

Tendon ruptures

It is also a well-known fact that AAS may also lead to muscle spasm during the administration of AAS (Haupt & Rovere 1984) and stunting of linear growth in adolescents (Kicman & Gower 2003).

1.5.6 Special effects in males

Acceleration of baldness (in men who are genetically predisposed)

Decreased endogenous testosterone production and hypogonadotropic hypogonadism associated with decreased size of testes (testicular atrophy)

Decreased spermatogenesis depending on decreased LH and FSH

Azoospermia (no measurable level of sperm in the semen)

Oligospermia (low semen volume, oligozoospermia, low count of sperm)

Erectile difficulties

Impotence, often after cessation of an AAS cycle

Infertility

Increased libido

Decreased libido

Priapism (a persistent, usually painful, erection that lasts for more than four hours and occurs without sexual stimulation)

Feminizing effects in males as gynecomastia, enlarged nipples and increase in voice pitch due to an alteration in the hormone balance between androgens and oestrogens from AAS that can undergo aromatization.

1.5.7 Special effects in females

Clitoral enlargement

Decreased body fat and breast mass

Elevation of serum testosterone

Hirsutism, excessive growth of hair in women in areas of the body where hair is normally absent or minimal

Alteration in pubic hair

Increased facial hair

Increased libido

Male pattern baldness

Menstrual irregularities as decreased menstruation or amenorrhea due to suppression of the hypothalamic-pituitary-gonadal axis

Voice deepening as a result of laryngeal hypertrophy

Problem with reproductive function and infertility.

1.6 Psychic side effects of AAS use

There are much fewer studies describing the psychic side effects of AAS use compared to the number describing the physical problems that may develop. This is perhaps because many studies are observational studies and therefore it is difficult to verify the exact substance abuse (Talih et al. 2007). Another difficulty that is often stressed is the question of whether the AAS user already suffered from mental problems before he or she started taking drugs, i.e. whether the user was predisposed to the development of mental disorders (Talih et al. 2007). The following examples are mentioned in the literature: antisocial personality disorder, low self-esteem and body dysmorphia (Kanayama, Pope, Cohane & Hudson 2003b).

Attempts have been made in animal studies, case reports and controlled clinical trials to link AAS with aggressive behaviour and mood swings (Pope & Katz 1988). In a review of animal studies, Clark and Henderson found that in several experiments aggression increased when rats were administered testosterone propionate (17 β -esters). There was no change in animals that were given nandrolone decanoate (19-nortestosterone derivatives) and the aggression in rats that were given stanozolol (17 α -alkylated) decreased. The study indicates that the effect of AAS on aggression is both dependent on gender and the type of substance used (Clark & Henderson 2003).

Even if animal experiments indicate a link between aggressiveness and AAS use, it is more difficult to obtain equally clear results from studies on humans (Bahrke, Wright, O'Connor, Strauss & Catlin 1990a). Although Kouri et al. found that aggression increased significantly after the administration of testosterone cypionate (17 β -ester) (Kouri, Lukas, Pope & Oliva 1995).

Other studies have reached more ambiguous results, for example Malone et al. who carried out psychological tests on 164 AAS users and non-users, and who did not find any significant differences when they measured hostility, and aggression (Malone, Dimeff, Lombardo & Sample 1995). In a further study, 240 mg of methyltestosterone (17 β -hydroxy) was administered to twenty volunteers for

fourteen days. The result of different psychiatric tests was a small but significant increase in negative moods like mood swings, irritability, violent feelings and hostility (Su, Pagliaro, Schmidt, Pickar, Wolkowitz & Rubinow 1993).

Depressive symptoms as a result of AAS use (Burnett & Kleiman 1994), particularly in the abstinence phase or after the end of a course of AAS, have been documented in many studies which can be linked to the down-regulation of the HPT axis (Brower 2002; Kashkin & Kleber 1989; Pope & Katz 1994). These studies have also observed several cases of suicide (Kanayama et al. 2008). In one Swedish study, the eight suicides of AAS users were investigated. Five had died of poisoning, one had hanged himself, one had shot himself and one had died through a violent act. Only one of these eight had talked about suicide prior to taking AAS (Thiblin, Runeson & Rajs 1999).

There are also reports claiming that supraphysiological doses of AAS are the direct cause of hypomanic or manic symptoms that may be linked to aggressiveness and violent behaviour (Pagonis, Angelopoulos, Koukoulis, Hadjichristodoulou & Toli 2006b; Wilson-Fearon & Parrott 1999). However, not all studies have indicated such a link (Bahrke, Wright, Strauss & Catlin 1992; Tricker, Casaburi, Storer, Clevenger, Berman, Shirazi & Bhasin 1996). Other psychic side effects that have been reported are; hypomania (Pope & Katz 1994), anxiety (Clark & Henderson 2003), paranoid delusions (Sjoqvist et al. 2008), anorexia (Medras & Tworowska 2001), anxiousness, sleeping problems, body obsession, self-fixation (Eklof et al. 2003), suspiciousness and negativism (Parrott, Choi & Davies 1994), mood alterations (Burnett & Kleiman 1994; Parkinson & Evans 2006) hostility (Perry, Yates & Andersen 1990) and aggression, aggression towards objects, verbal aggression, and aggression during training (Parrott et al. 1994). AAS use can also cause rage and lead to criminal behaviour including homicide and assault (Hall, Hall & Chapman 2005).

An AAS user can be characterised as someone with prominent body-image disorders such as muscle dysmorphia where the individual is entirely preoccupied with his/her conviction that he/she is not big and muscular enough despite a marked muscle mass from an objective point of view (Olivardia, Pope & Hudson 2000). Muscle growth becomes the most important factor for their self-confidence and if there is no growth this triggers an anxiety that can be said to stem from a dependence on AAS (Brower 2002).

Pagonis et al. studied a cohort of 320 amateur and recreational bodybuilding athletes, where 160 used AAS, 80 received a placebo and 80 were completely clean (Pagonis, Angelopoulos, Koukoulis & Hadjichristodoulou 2006a). The result shows that the mental problems that AAS users may suffer correlate with

increased use and that these problems increase when use continues. Some of the psychic side effects of AAS use may remain for a long time after a user has stopped taking AAS but they may not be discovered until the user tries to get psychiatric help many years later (Kanayama et al. 2008).

1.7 Positive effects of AAS use

There is no doubt that many AAS users experience a number of positive effects from the substances, particularly when they start using them. AAS are extremely anticatabolic and turn a negative nitrogen balance into a positive one by improving the uptake of dietary protein and by speeding up protein synthesis (Haupt & Rovere 1984). This is why AAS users grow more when they take protein supplements at the same time (Kutscher et al. 2002).

The anabolic effect of AAS is related to how high the dose is. A dose that exceeds 300 mg per week leads to a significant increase in muscular volume (Parkinson & Evans 2006). There are several reasons why testosterone affects the body; testosterone entails an increase in protein synthesis (Ferrando, Tipton, Doyle, Phillips, Cortiella & Wolfe 1998), enhances collagen synthesis (Parssinen, Karila, Kovanen & Seppala 2000), and creates an increased bone mineral density (Bagatell & Bremner 1996). Apart from the purely anabolic effects on the body, AAS also lead to feelings of euphoria, to increased energy and sexual arousal (Sjoqvist et al. 2008).

1.8 Other hormones in combination with AAS

Insulin growth factor-1 (IGF-1) is sometimes used as a complement to AAS but the prevalence is not well documented in previous research (Parkinson & Evans 2006). Human growth hormones (hGH) are also used combined with AAS. The anabolic effect of hGH is primarily indirect as a result of an increased production of IGF-1 in the liver and peripheral tissues (Rennie 2003). hGH and IGF-1 both increase the glucose uptake and stimulate protein synthesis, especially in the musculature (Tentori & Graziani 2007).

It is, however, a well-known fact that long-term use of hGH can lead to cardiac instability, hypertension, the development of insulin resistance and possibly also type 2 diabetes (Rennie 2003). AAS users take hGH and insulin with the aim of increasing their muscle mass and enhancing their performance (Jenkins 2001). Insulin is also used as a doping substance (Graham et al. 2008). Taking insulin in this way is clearly regarded as risky since it may induce severe hypoglycemia and

potentially even be fatal (Evans & Lynch 2003). Also the use of thyroid medications with the aim of inducing fat loss has increased in recent years among AAS users (Parkinson & Evans 2006).

1.9 Other drugs of abuse in combination with AAS

It was previously believed that AAS users were not prone to a mixed addiction (Malone et al. 1995) but in recent years a number of studies have indicated that users take both AAS and other drugs at the same time (Brower 2002; Parkinson & Evans 2006; Thiblin & Parklo 2002). Amphetamine can for instance be used as a stimulant (to enhance the ability to train and burn fat) (Brower 2002) or to reduce appetite (Parkinson & Evans 2006).

GHB is used to be able to sleep better and to enhance the release of growth hormones in order to increase muscle mass as well as strength (Brower 2002; Parkinson & Evans 2006). Other substances that have been noted in conjunction with AAS are ecstasy, marijuana, LSD (Nilsson, Baigi, Marklund & Fridlund 2001) and cocaine (Morrison 1996).

This is why it is important to ask a patient at the beginning of the treatment for AAS use whether he or she takes other drugs, for example other drugs of abuse which might on their own give rise to an increase in aggressiveness and violent behaviour (Sjoqvist et al. 2008). Unfortunately it seems to be unusual for therapists in their everyday clinical life to put questions regarding the concurrent use of other drugs (Celerier, Yazdi, Castane, Ghosland, Nyberg & Maldonado 2003; Hall 2005).

Several studies have discussed whether AAS might be a gateway to other drug use (Arvary & Pope 2000; Kanayama, Cohane, Weiss & Pope 2003a; Thiblin, Lindquist & Rajs 2000) without reaching any safe conclusions.

1.10 Alcohol in combination with AAS

Various studies have looked into the link between alcohol and AAS use (Ambrose 2004; Kindlundh, Isacson, Berglund & Nyberg 1999; Middleman, Faulkner, Woods, Emans & DuRant 1995; Sjoqvist et al. 2008). Bahrke et al. warned that it was very possible that AAS users also took other illegal substances as well as alcohol (Bahrke, Yesalis & Brower 1998). It is also a known fact that alcohol is used in sports as a sedative (Ambrose 2004).

According to one Swedish study, AAS users consumed a lot of alcohol at least once a week and this was interpreted as being a consequence of the AAS use

(Kindlundh et al. 1999). A study of criminals indicated that many AAS users also drink a lot of alcohol (Klotz, Petersson, Isacson & Thiblin 2007) and a recent Swedish study has confirmed the link between AAS and alcohol (Sjoqvist et al. 2008).

1.11 Pharmaceuticals in combination with AAS

Several different types of medicines are used as a complement together with AAS or to minimise the side effects from AAS use. One example is asthma medicine enabling an individual to train harder and longer thanks to the adrenergic effect (Ambrose 2004).

A Swedish study investigating the cause of death of 34 male AAS users noted that most of the men had taken different medicines, for instance benzodiazepines, antidepressive medicines, opioids, painkillers, and stimulants (Thiblin et al. 2000). Opioids are often used to relieve pain that comes from training (Brower, Blow, Beresford & Fuelling 1989). Different forms of diuretics (Parkinson & Evans 2006) which are used to reduce AAS-related water retention and to dilute the urine (Brower et al. 1989) are taken by AAS users, as is ephedrine. Ephedrine, which is a sympathomimetic drug, is structurally similar to amphetamine. This very common substance is used to enhance performance (Pipe & Ayotte 2002). Numerous problems have been linked to ephedrine, for example cardiovascular problems such as arrhythmias, myocardial infarction, sudden death, seizures, and stroke (Pipe & Ayotte 2002). Other pharmaceuticals that are combined with AAS are tranquillizers and sedatives (Kindlundh, Hagekull, Isacson & Nyberg 2001).

Oestrogen blockers such as tamoxifen are used in order to counteract the development of gynecomastia and human chorionic gonadotropin (HCG) and to restore the downward pressure on the HPT axis and counteract testicle reduction (Parkinson & Evans 2006).

1.12 Dietary supplements in combination with AAS

It is very common for people who train to take dietary supplements either as a supplement to or sometimes instead of other food. The reason is that it is believed that dietary supplements promote better training results, for example by facilitating recovery between training sessions or by reducing interruptions in training that are caused by illness or injury (Maughan, King & Lea 2004).

One of the most popular dietary supplements is creatine which is an amino acid mixture which can be found in fish and meat products (DesJardins 2002).

Creatine has been shown to enhance the users chance at increasing body mass, the fat-free index and maximal strength (Terjung, Clarkson, Eichner, Greenhaff, Hespel, Israel, Kraemer, Meyer, Spriet, Tarnopolsky, Wagenmakers & Williams 2000). Unless there is an overdose, it would seem that creatine is harmless for healthy users (Lattavo, Kopperud & Rogers 2007) but side effects that are mentioned are weight gain, muscle cramps, diarrhoea, abdominal pain, and nausea (Terjung et al. 2000).

Another common dietary supplement is protein that helps to increase body mass, strength, and recovery after training (Lattavo et al. 2007). According to Lattavo, people who train need more protein than they can get through their ordinary diet in order to obtain a positive nitrogen balance. Twice the recommended intake of 0.8 to 1.7 grams per kilo body weight and 24-hour period might be required (Ciocca 2005). Other supplements that are used are, for instance HMBs (Beta-hydroxy-beta-methylbutyrate) which are regarded as anticatabolic, caffeine and ephedra for their reviving effects as well as bicarbonate which reduces fatigue and makes it easier to burn fat during training (Lattavo et al. 2007; Maughan et al. 2004), moreover, ephedra has also been associated with acute myocardial infarction (Haller & Benowitz 2000; Lindsay 2002) and arrhythmia (Haller & Benowitz 2000).

Furthermore, some also use carnitine as a fuel for the working muscles as well as antioxidants and other vitamins (Maughan et al. 2004). One major problem with certain supplements that has emerged is that some may be mixed with AAS (such as testosterone, nandrolone and prohormones) or with ephedrine or caffeine (Maughan 2005). The following substances have been found to be mixed substances: protein powder, creatine, carnitine, ribose, guarana, zinc, pyruvate, HMB, tribulus terrestris, vitamins, minerals, and herbal extracts (Maughan 2005).

1.13 Social background and current social situation of AAS users

There is very little research on the current social situation of AAS users. However, there are studies that focus on the social risk factors of AAS use. It is much more common for men to use AAS compared to women and it is more common in major cities (Kindlundh et al. 1999; Nilsson 1995). AAS users often have a history of difficult relationships, for example a bad relationship with the father (Kanayama et al. 2003b) or difficult relationships with friends (Kindlundh et al. 1999).

Another risk factor for AAS users is that they played truant at school and suffered from school fatigue (Kindlundh et al. 1999). Brown summarises the most

common risk factors in the following way: the person is wealthy, white, grew up with one parent in a major town or city and did some form of sport, trained in a gym, for example (Brown 2005). It is clear that the risk factors are very general and it has proved difficult to observe more precise factors than that.

An AAS user can also be described in terms of risk behaviours which includes driving under the influence of alcohol, carrying a firearm and having several brief sexual relations (Middleman et al. 1995).

When the AAS user become older, people close to him/her can suffer which may lead to marriage problems (Parkinson & Evans 2006) or the AAS user abusing, verbally threatening or being violent in some other way against their partner (Choi & Pope 1994). It has also emerged in other studies that AAS may lead to violent behaviour (Thiblin, Kristiansson & Rajs 1997) which may turn into serious criminal behaviour and result in violent death including murder (Thiblin et al. 2000).

Today the use of AAS is more widespread among the general public (Sjoqvist et al. 2008) and this may lead to more social problems in the future. Studies on the long-term effects of AAS use are now emerging (Kanayama et al. 2008; Sjoqvist et al. 2008). Kanayama et al. warn that the problems we see today in long-term users may be small compared to what we will see in the future because the doses used today are much higher than they were in the 1960s and 1970s (Kanayama et al. 2008). If this will lead to increased social problems for AAS users in the future that will also have an impact on relatives, society and the healthcare sector, remains to be seen.

1.14 AAS and crimes

High levels of testosterone have long been understood to increase aggressive behaviour and violent crimes. Dabbs et al. described in a study the relationship between the testosterone levels of young interns and the type of crime they had been convicted for (Dabbs, Frady, Carr & Besch 1987). Interns with a high level of testosterone had for the most part committed violent crimes while those with lower levels of testosterone had been convicted for other types of crime. At the same time, the results showed that the higher the testosterone levels in the latter group, the longer the prison term and their prison term was also more likely to be extended due to bad conduct (Dabbs et al. 1987).

Another study carried out by Brooks and Reddon in 1996 reached a similar result. In this study they compared young violent male criminals with two groups, where one group had committed sexual offences and the other had committed

non-violent crimes. The result indicated that the group that had committed violent crimes had the significantly highest level of testosterone of all the groups (Brooks & Reddon 1996). Beaver et al. analysed data from the National Longitudinal Study of Adolescent Health (n=6.823) and found that there was a significant difference in the number involved in a violent act between those who had recently taken AAS and those who had never used AAS at all (Beaver, Vaughn, Delisi & Wright 2008).

The first case report of a violent crime linked to AAS use was published over twenty years ago by Baker, when he looked into the link between oxymetholone and aggression (Barker 1987). Another study found that male current users of AAS more often than non-users subjected their significant others to violence (Choi & Pope 1994).

Two epidemiological studies, have tried to prove that AAS use can unleash violence without quite succeeding (Isacsson, Garle, Ljung, Asgard & Bergman 1998; Pope, Kouri, Powell, Campbell & Katz 1996). Both studies encountered major methodological problems with the participants because many decided not to take part in the studies (Thiblin & Petersson 2005). In a study from 2007, Klötz et al. found that AAS use probably leads to an increase in violent crime, particularly if the AAS user also uses other illegal substances (Klotz et al. 2007). In a further study by Klötz et al., the authors found that there was a link between AAS use and being convicted of different crimes, e.g. a crime involving a firearm or fraud (Klotz, Garle, Granath & Thiblin 2006).

It has also been found that AAS users carry a firearm or end up in fights more often than non-users (Middleman & DuRant 1996) and several studies have also found a link between AAS use and an increased risk of premature death (Petersson, Garle, Granath & Thiblin 2006), of being a victim of violent death because of impulsive, aggressive behaviour or symptoms of depression (Thiblin et al. 2000), as well as of murder (Pope et al. 1996). Thiblin and colleagues described psychiatric symptoms, aggression and violent behaviour in AAS users and the result was that AAS is an indicator of violent behaviour (Thiblin et al. 1997). At the same time Pagonis and colleagues warned that there is a risk that the psychiatric problems that arise from AAS use will in all probability become worse as the use of AAS continues and increases (Pagonis et al. 2006a).

1.15 Treatment of AAS users

Relatively little research has been conducted on the issue of what a successful course of treatment is for a person using high doses of AAS (Brower 1997). One

of the first articles that presented a proposed course of treatment of AAS users was written by (Corcoran & Longo 1992). They based the programme on treatments for eating disorders, other drug abuse and narcissistic personality disorder. According to Brower, an AAS user who has different physical and psychic side effects may seek help without revealing that he or she uses AAS (Brower 2000).

AAS can act as a gateway to other substance abuse (Kanayama et al. 2003a) which entails further complications for the treatment of AAS. Therefore it is important to look into the use of other types of drugs before commencing treatment of an AAS user. After having established AAS use in a patient, it is vital to carry out a medical and psychiatric examination (Brower 2000) looking for specific physical and psychic side effects that occur in AAS users (Corcoran & Longo 1992). Furthermore, it is recommended to take urine and blood tests, for example liver tests, cholesterol tests, endocrine tests of LH, FSH and testosterone (Brower 2000).

The aim of the treatment should be (1) to relieve symptoms of abstinence and prevent complications, (2) to start and relieve abstinence from illegal AAS, (3) to reduce the risk of relapsing and continuing to take AAS and (4) to restore the function of the hypothalamic-pituitary-gonadal (HPG) axis (Brower 1997). Treating AAS use can primarily be regarded as detoxification which is why counselling is always needed with or without pharmacological treatment (Brower 1997). One study promotes the use of a testosterone substance that is then gradually phased out (Talih et al. 2007).

Symptoms of AAS abstinence include depression, fatigue, body aches, restlessness, eating disorders, sleeping problems, reduced sexual ability/desire, and a craving for drugs (Brower 2000). Further psychic problems include the risk of a psychotic break, of a suicide attempt, of extreme selfishness, and mood swings (Corcoran & Longo 1992). The therapist should initially not challenge or confront the patient's sensitive self-image because there is a risk that the patient will become more aggressive or depressed. Instead it is important to support the build up of the low level of self-esteem (Corcoran & Longo 1992) which requires a good therapeutic alliance (Brower 1997).

Advice as regards both diet and training given by a knowledgeable person might contribute to a positive treatment relationship (Brower 1997). There are also ideas about a revised twelve-step model where some steps could treat egocentrism, severed relationships, compromised values, and grandiosity (Corcoran & Longo 1992). A discussion on body image must be initiated at an early stage. Finally, they recommend group therapy after a certain period of individual

therapy. Group therapy can include sessions on cognitive thinking, lifestyle values, peer pressure, and discussions on motivation to stop using AAS.

Pharmacological treatment alternatives might include the use of HCG substances if LH and FSH have been down-regulated, as well as tamoxifen if high levels of oestrogen have been measured in a blood test. Also antidepressive, anti-inflammatory medicines and neuroleptics may come into question (Brower 2000). Finally, the therapist should keep a wary eye on the patient to see whether he/she is suicidal, whether he/she is aggressive towards others during the abstinence phase or whether he/she is unable to remain drug free. In such cases, it might be necessary to hospitalise the patient (Brower 2000). Several studies have shown that it is possible to cure AAS dependency both in men and women (Bahrke et al. 1990b; Brower 2002; Copeland, Peters & Dillon 1998; Kanayama et al. 2008).

2. AIMS

2.1 Overall

The aim of this dissertation was to gain knowledge about users of anabolic-androgenic steroids (AAS) who have sought treatment at an addiction clinic within the healthcare system. Particular interest has been paid to the following areas: social background, current social situation, the development of AAS abuse over time, connection to other drugs, connection to criminality as well as psychic and physical side effects.

2.2 Study I

The aim of this study was to describe the social background and current social situation of AAS abusers who were seeking treatment at an addiction clinic and to compare the findings with findings on gym clients with and without a history of AAS abuse.

2.3 Study II

The aim of this study was to let AAS users' own stories serve as a point of departure for examining the various consequences of the development of drug abuse among a group of people seeking help at an addiction clinic.

2.4 Study III

The aim of this study was to explore and describe the lifetime and current use of drugs by AAS users recruited from an addiction clinic in Sweden.

2.5 Study IV

The aim of this study was to enhance the understanding of the association between criminality and the use of AAS with or without the use of other drugs of abuse.

3. METHODS AND SUBJECTS

3.1 Study design

The aim of the dissertation was to gain knowledge about AAS users who have sought help at an addiction clinic. The main research group, the AC group from now on, consists of a consecutively included group of patients from the addiction care system that have been followed prospectively on repeated occasions. Every individual participating in the different studies of the dissertation is a gym client which makes for reasonable opportunities to compare AAS users with non-users (Tashakkori & Teddlie 2003).

The dissertation is based on quantitative as well as qualitative methods. The purpose of this complex design was to combine more general knowledge (quantitative) with more detailed understanding (qualitative). Using more than one method was regarded as advantageous bearing the aim of the dissertation in mind (Schneider 2007).

Experience of previous research conducted on AAS users shows that it is extremely difficult to get hold of AAS users who are willing to participate because of the suspicion against professionals working in the field, making such research very difficult (Pope & Kanayama 2004). Furthermore, experience shows that it is equally difficult to get people to stay in such studies (Pope & Kanayama 2004). Hence, this dissertation was designed in such a way that the research was carried out in an environment which these people had chosen of their own accord, enhancing their motivation to participate in the project. It was also deemed vital that someone who was at home in an AAS user environment carried out the interviews. There were two reasons for this; firstly, to create a sense of legitimacy in the interview situation, and secondly, to be able to have a more initiated dialogue with the interviewees making it easier to gain access to the knowledge sought after.

This meant that the interviewer had an understanding of the problem area, which had to be taken into consideration, and which might have led both problems and possibilities in the scientific work. However, based on the experience of other researchers, an understanding of the area was regarded as a prerequisite in order to gain knowledge on the life situation of the interviewee, pattern of abuse, and any medical and social difficulties (Corcoran & Longo 1992). Any problems that might be caused by this prior knowledge will be brought up later in the discussion chapter.

3.2 Participants

3.2.1 Addiction Centre group (AC group)

All four studies were based on a group of 36 AAS users (34 male and 2 female), who were consecutively included from a psychiatric addiction clinic in Örebro County, central Sweden, a county of 275.000 inhabitants. The patients were attending the addiction clinic to get help for what they believed to be AAS-related side effects. The inclusion criteria for patients were that they must: a) be over 16 years of age, b) be fluent in Swedish, c) be misusing non-prescribed AAS, alone or in combination with other doping agents, d) have been using AAS for at least four months and e) be under the care of the addiction clinic where a decision to commence treatment for their AAS use had been agreed upon following an initial clinical assessment. The lower limit of four months was chosen to include more than one AAS cycle, thus indicating regular use.

The mean age for the AAS users was 27.6 years (range 19.0–42.0). The mean duration of AAS use was 4.7 years (range 0.5–16.0).

3.2.2 Comparison groups (gym groups)

The comparison groups consisted of clients recruited from a gym in Örebro County. These groups were chosen because all of the AAS users in the AC group were gym clients. Participants for the study were recruited by putting up posters at the gym. A total of 289 males responded anonymously to the questionnaire. Twelve participants, who did not answer the questions about hormones, were excluded from the study. The remaining 277 were divided into two comparison groups: 18 male gym clients who had used AAS at some time and 259 male gym clients who had not used AAS at any time. Both of these groups fell into the same age range as the AAS group (18–45 years).

The participants in the different studies and the data collection used are summarized in the following table:

Table 1. Summary of data collection among participants

Study	Participants	Data collection
I	n=34: AAS users from Addiction Clinic n=18: AAS users from gym n=259: Non users from gym	Social interview Questionnaire Questionnaire
II	n=6: AAS users from Addiction Clinic	Narratives generated from the social interview
III	n=32: AAS users from Addiction Clinic	Patients written report of drug use Substance interview
IV	n=32: AAS users from Addiction Clinic	Social interview Criminal records

The AC group included 36 people altogether. The four studies were based on the same group of people. The reasons for the different number of people in different studies will be presented below.

3.3 Procedures and instruments

3.3.1 General

The idea for the research project emerged within the framework of a clinic where patients using AAS started seeking help. To start with, AC had fairly limited possibilities to help these patients in a professional way. Nor was there much experience to be gained elsewhere, either nationally or internationally. Therefore there was an obvious need for more knowledge on the area.

The research project was designed after having met fifty-odd patients with AAS-related problems at the clinic. Patients were then asked to participate. A number of different stages were included in the project: a social interview, a substance interview, the questionnaires Temperament and Character Inventory (TCI), Symptom Checklist-90 (SCL-90) and Structural Analysis of Social Behavior (SASB). In addition, a whole series of laboratory tests were taken primarily geared towards detecting any side effects caused by AAS. Some of the patients were also offered a neuropsychological examination. The results from the social and substance interviews are presented in this dissertation.

3.3.2 Social interview

An interview model was produced specifically for this project since we were unable to find an established instrument for this area, which corresponded to a great enough extent to the scientific questions. This model was based on experiences of a clinical interview model that has been used at AC, for a long time as a basis for an individual care plan. Further questions on social background, current social situation and criminality were added to the clinical interview model in order to meet the aims of the research project. Further questions on drug use were added, e.g. hormone substances and other similar substances used for doping. Questions on substances were, however, of an introductory character since a more detailed interview on substances would follow.

When the patients had been informed about the research project and had agreed to participate, a social interview was booked for a couple of days later. The social interview was carried out at an early stage in the contact with a new patient, primarily because the aim was also to use the information in the planning of the clinical work. The patient was given a general idea about what the interview would be about.

The interview was carried out based on an interview model and the aim was to guarantee that all relevant areas were covered in the interview. The interview included questions on social background and the current social situation. The questions on social background covered the following areas: family history, contact with parents and other close relatives, experience of school, psychic and physical abuse, level of education, spare time activities including training, relationship with a partner, criminality and a description of drug habits. The questions on the current social situation covered the following areas: housing, employment, relationships, physical training and current use of alcohol and other substances/drugs.

The interviewer started by asking questions, however, the idea was for the patient to gradually be encouraged to talk freely about his/her life. The role of the interviewer was to show an interest in and encourage the patient to talk, to ask complementary questions and steer the interview to areas that did not come up spontaneously. The interviewer wrote down everything the patient said during the interview. The interviewer went through the notes and wrote them out immediately after the interview.

The social interview took in total between two and three hours per patient spread over two or three occasions. At the second and third meetings the interview started with a run through of the previous interview and the patient was given the opportunity to comment and if the need arose to correct any misunderstandings. All the patients read and approved the social interview.

3.3.3 Substance interview

An interview model for the substance interview based on previous studies (Evans 1997; Malone, et al. 1995) was produced specifically for the project since there was a lack of established instruments for this area. The aim of the interview was to cover the participants' collected experience of AAS, alcohol, pharmaceuticals and illegal drugs of all types.

The questions concerning alcohol consumption were taken from The Alcohol Use Disorders Identification Test (AUDIT) (Questions 35–38 in the appendix), which was developed by the World Health Organization (Saunders, Aasland, Babor, de la Fuente & Grant 1993) and which has been translated into Swedish (Bergman & Kallmen 2002). The internal consistency, test-retest reliability, and validity of the instrument has been found to be high (Bohn, Babor & Kranzler 1995; Conigrave, Saunders & Reznik 1995; O'Hare & Sherrer 1999; Selin 2003; Shevlin & Smith 2007).

In conjunction with an ordinary session, the patients were given the task of writing down information about the substances they had used, when and in what doses. The idea was to use this written account as a basis for the interview so that the interview would take a reasonable amount of time, and so that the patient at his or her own pace would try to remember all the substances he/she had used. Some patients were able to give a very detailed account of their experience of substances whilst others had a rougher idea of what had happened in that context. It was impossible to get some patients to give a written account at all.

The interview was based on an interview model but in practice it was more like a dialogue where the interviewer played the role of interested guide, encouraging the patient to freely describe his/her experience of drugs. The patient was also asked to describe the reason for his/her choice of different substances, as well as the effects, positive and negative, experienced with each respective substance. The interviewer wrote down all the information given by the patient and later put the information in chronological order.

The substance interview normally took two to three hours; usually spread over two to three meetings. At treatment session that followed, the patient was given the chance to read through the account of his/her experience of substances and the possibility to comment, and if he/she so wished correct the information.

An independent psychiatrist made the psychiatric diagnosis based on the information available.

3.3.4 Questionnaire

It was unreasonable for quantitative reasons to use the face-to-face interview method for the control group. Instead a questionnaire of fifty questions based on the interview with the AAS users was developed. The aim was that the questions should correspond as far as possible to the questions put in the interview in order to facilitate comparisons between the groups. Most questions were multiple-choice questions but for some of them it was possible to give an open answer. The questionnaire is described in the appendix. The questions in the questionnaire that were on alcohol use were taken from AUDIT (Questions 35–38 in the appendix), which has been translated into Swedish (Bergman & Kallmen 2002).

The questionnaires were distributed via the reception at a public gym in Örebro County. The staff were instructed to hand out the questionnaire to people training aged between 18 and 45 years of age, which corresponded to the age distribution in the AC group. The questionnaires were filled in anonymously and left in a closed box at the gym. Everyone who filled one in received four milk-based protein drinks (Gainomax) as a way of thanking them for their participation.

3.3.5 Register data

With special permission from The Regional Ethical Vetting Board, data was ordered from the Swedish National Council for Crime Prevention on crimes that the patients in the AC group had been convicted of. The data applied to all convictions during the person's lifetime up to a cut off date of 31st December 2007. The information included the type of crime committed and the penalty imposed.

3.4 Methods

3.4.1 Study I

The aim of Study I was to examine the social background and the current social situation of the AAS users in relation to a control group consisting of people with or without experience of AAS use who trained in a gym. All the 34 men in the AC group were included in the study. The two women in the AC group were excluded from the study since there were too few of them. The 34 men from the AC group were compared with 289 men who trained at the gym. Twelve people were excluded from the comparison group because they did not answer the question on experience of AAS use. The remaining people were subdivided into

two groups, the first a group of 259 people who had never used AAS and the second a group of 18 people who used or had used AAS.

The study was based on the results from the social interview (the AC group) and from the questionnaire (the gym groups). The social interview was based, as already described, on an interview model in order to ensure that all the relevant areas were taken into account during the interview. The answers from the patients were noted throughout the interview and coded into set answers for the scientific report. Where the answers were unclear the patient was asked which alternative answer was the most correct one in their opinion. The questionnaires were designed to generate set answers.

3.4.2 Study II

The aim of Study II was to based on the patients' own stories produce a fuller and more in-depth narrative on how their abuse developed over time and how different substances came into their lives. The study is based on the social and the substance interviews that were carried out with all the patients in the AC group. A strategic selection of six patients was made based on two aspects. First and foremost, it was important to have an as great a variation as possible as regards the patients' life stories in order to reflect differences in course of events and drug patterns. Secondly, it was important to include the life stories of both men and women.

The narratives were written down during the interviews (Snow, Lofland & Lofland 2005) and the material was then compiled into a personal, chronologically arranged narrative for each informant (Mishler 1995). The patients were given the opportunity to read and comment the entire narrative afterwards, or ask for something to be deleted from the text. All the interviews were made as neutral as possible in order to make it difficult to identify the informant.

3.4.3 Study III

32 patients (thirty men and two women) from the AC group participated in Study III. Four men from the AC group were excluded since their substance abuse had ended more than four years before, which might have made it difficult to remember substances and would mean that the validity of the information would be called into doubt. This study was also based on the patients' experience of substances that had been noted down by the interviewer.

An in-depth interview focused on drug patterns and use of substances was carried out at a later stage based on previous studies (Evans 1997; Malone et al. 1995). The purpose of the interview was to cover the entire spectrum of experience of AAS, alcohol and both legal and illegal drugs of all types. The questions concerning alcohol consumption were taken from AUDIT (Questions 35–38 in the appendix). All the interviews on drugs were carried out by the author and an independent psychiatrist made the psychiatric diagnoses based on the information available.

3.4.4 Study IV

Study IV included all the 36 patients of the AC group and was based on the part of the interview that concerned criminality in relation to the development of the drug use. Data from the Swedish National Council for Crime Prevention (Andersson 2005) was collected where 32 of the 36 participants were found registered as convicted of crimes subsequently described in the study. The continued account is based on these 32 patients, where we have had access to objective data with regard to the crimes they were convicted of.

The crimes that the patients had been convicted of were divided into the following crime groups: crimes of violence, weapon offences, fraud, crimes against property, drug-related crimes, traffic crimes and other crimes.

In order to compare the total criminality over time we developed a code system based on the maximum sentence for each crime according to Swedish law. Crimes that do not lead to the deprivation of liberty were given 1 point. Crimes with a maximum sentence of 0.5 years 2 points, maximum 1 year 3 points, maximum 2 years 4 points, maximum 3 years 5 points, maximum 4 years 6 points, maximum 6 years 7 points and maximum 10 years 8 points. The code system thus grouped the crimes into eight groups depending on the severity level according to the law.

The points for each individual were then divided by a time period in order to yield a weighted point which expressed a) the total number of crimes, b) the level of severity of the crimes, and c) the intensity of the criminal acts based on time. The computed crime quotients have been compared within four periods; period 1, from entry into criminality to drug start, period 2, from drug start to first treatment contact with AC, period 3, from the start of treatment at AC to the time when treatment at AC was terminated, and period 4, after the termination of treatment to the endpoint of the study on December 31, 2007.

The patients were also divided into four subgroups based on the type of drugs they had used and in which order: group 1 only AAS, group 2 first AAS then

other drugs of abuse, group 3 first other drugs of abuse then AAS and group 4 AAS and other drugs of abuse at the same time.

3.5 Data analysis

The statistical analysis of the numerical data in Study I was carried out using a one-way Analysis of Variance (ANOVA) for the equality of mean and a two-sided Fisher's exact test for the comparison of the three groups. The Statistical Package for the Social Sciences (SPSS) software package version 13.0 was used. A significance level of $p < 0.05$ was considered appropriate. No statistical analyses were made in Studies II, III and IV, but the SPSS software package version 16.0 was used to work with the data.

3.6 Ethical approval

The study protocol was approved by the Ethics Committee of Örebro County Council (No.: 538/99) and The Regional Ethical Vetting Board (No.: 2004: M-316) in accordance with Swedish legislation on the approval of medical research and the patients had all given their informed consent.

The six patients who were selected for Study II were given the opportunity to read the manuscript so that they could give comments and say whether they felt that the written narrative corresponded to their life stories, and also so that they could decide whether they felt it was all right for it to be published bearing in mind the possibility of identification. None of the patients wanted to change the written narratives.

4. RESULTS

4.1 Study I: Troubled social background of male anabolic-androgenic steroid abusers in treatment

This study examined the social background and the current social situation of the participants of three groups, all men. The first group consisted of 34 patients using AAS who had sought help at AC in Örebro. The second group consisted of 18 people who had been recruited via a gym and who had filled in the questionnaire and reported that they had used or were still using AAS. The third group consisted of 259 people from the same gym who had reported that they had never used AAS. The average age of the patient group (27.2 years of age) was similar to that of the control group with no experience of AAS (26.1 years of age), while the gym group with experience of AAS was significantly older (34.8 years of age). All the participants were, however, within the age interval 18 to 45 years of age.

Table 2. Comparison of social background between AAS users and non-users

		AC group, n = 34		Gym AAS users, n = 18		Gym, non-users, n = 259		p-value
		%	n	%	n	%	n	
Qualite of upbringing	Good	43.8	14	72.2	13	87.2	224	<0.001
	Indifferent	15.6	5	5.6	1	10.1	26	
	Bad	40.6	13	22.2	4	2.7	7	
Relation with mother	Good	68.7	22	88.9	16	93.7	239	<0.001
	Indifferent	21.9	7	5.6	1	5.5	14	
	Bad	9.4	3	5.6	1	0.8	2	
Relation with father	Good	46.9	15	61.1	11	76.1	194	0.001
	Indifferent	28.1	9	5.6	1	8.6	22	
	Bad	25.0	8	33.3	6	15.3	39	
Physically abused	Yes	30.3	10	22.2	4	5.8	15	0.001
	No	69.7	23	77.8	14	94.2	242	
Mentally abused	Yes	48.5	16	27.8	5	10.2	26	<0.001
	No	51.5	17	72.2	13	89.8	230	
Drug abuse in the family	Yes	43.7	14	35.3	6	19.9	51	<0.01
	No	56.3	18	64.7	11	80.1	205	

In a comparison of the groups there were statistically significant differences in most examined variables. There was a general pattern where both groups with AAS experience had a more difficult social background and were disadvantaged in their current social situation compared to the non-users. This applied above all to the AC group, while the AAS users in the gym group were similar to the AC group albeit to a lesser extent.

The social background was examined based on fifteen variables related to the original family and twelve variables related to experience of school. As regards the original family there were no differences between the groups as regards country of birth, nor were there any differences in the country of birth of the parents. It was significantly more common for the members of the AC group to have only lived with the mother. They were more often an only child in the family.

As regards the individuals' view of the quality of their upbringing, the patients in the AC group felt to a significantly greater extent that it was poor compared to the non-users. It is worth noting that a majority of the AC group saw their childhood as bad or indifferent. There were significant differences both as regards the relationship with the mother and the father, although the relationship with the father was described as being particularly bad. Both physical and mental abuse was more common in the AC group. Furthermore, both user groups reported a higher prevalence of drug and crime problems in the family compared to the non-users.

The patients' experiences of school were significantly more negative than the non-users. Only a few in the AC group saw their school years in a positive light. All the patients bar one reported academic difficulties compared to a fourth of the non-users. The patients in the AC group had extensive experience of concentration difficulties, reading and writing difficulties but also problems like truancy and boredom were more common. The patients also had a significantly lower level of education than the control group with non-users.

As regards the current social situation, the differences were obviously to the disadvantage of the AC group. It was more common for the patients in the AC group to live alone and they were less likely to have a partner. However, it was more common for them to have children compared to the non-users. The patients in the AC group were more likely to be living on social benefits or to be on sick leave compared to the non-user group. For those who had or had had a partner, threats and violence in the relationship were a more common occurrence. Nearly all the participants in the AC group also reported that they have been convicted of a crime where violence had played a major part.

In short, this study shows that patients who are AAS users have a obvious complicated social background compared to a control group of non-users. Their experiences of their family is often negative with bad relationships with both parents, experiences of physical and mental abuse and experience of drug abuse and crime within the family. Furthermore, as regards the current situation of the AAS users, this can be described as more difficult with problems with housing, trying to make a living and income. In addition, violence in close relationships

and crime are more common. In many respects, the group that was recruited from the gym who had had experience of AAS described a situation that lay somewhere between the AC group and the group of non-users. The reported differences between AAS users and non-users apply to the group level, which does not mean that the results automatically can be applied to each separate individual.

4.2 Study II: The development of multiple drug use among anabolic-androgenic steroid users: six subjective case reports

This study was based on the histories of four men and two women from the AC group focusing on upbringing, drug use, current social situation and the development of the use of drugs including different combinations of drugs, experiences of AAS effects and the reasons why they sought medical help. The selection of the patients was determined by a desire to reflect the variations in life stories, to ensure that the histories would be detailed and to include both men and women. The patients' experience of AAS varied between nine months and sixteen years. They were aged between 22 and 37 years of age.

One of the main outcomes of the study was that AAS use can develop under very different circumstances and that the results at the group level can therefore not be extrapolated to a separate individual. As an example, both women in this study describe their childhood as difficult while three of the men felt that they had had a good childhood, at least in their relationships with their parents. Two of the interviewees had a positive view of their schooling while the other four had different types of problems at school, for example with friends or in the shape of concentration difficulties or problems with reading and writing.

All the interviewees in this study started using AAS in conjunction with training. For four of them, AAS were the first drugs they tested. The men used several different types of AAS compared to the women and it was more common for the men to use different nandrolone and testosterone substances than the women, who instead most often used methandrostenolone and stanozolol. Two of the patients used AAS believing that this was necessary if they were going to compete in bodybuilding. These two were, however, more restrictive in their use of other drugs. These two also developed an obsession with their body appearance and this had an important impact on their lives.

The users described the first period of AAS use as very positive, even the best time of their life. The most common positive effects that were described were the increase in strength and body mass but also psychological effects like for example

an increase in self-confidence. However, gradually as they continued using AAS the side effects became more numerous and worsened so that they overshadowed the positive effects. All the interviewees described what they saw as side effects of their AAS use, both physical and psychic. Problems with potency in both directions were common among males. Several of the patients felt that they suffered from a serious form of jealousy, which created problems in their relationships of different kinds; this was further worsened by an increase in aggressiveness. Several of those interviewed went looking for trouble to vent their aggressions. One of the interviewees, who had already had problems with aggression prior to his AAS use, describes what is referred to as steroid rage. Several of those interviewed had also had suicidal tendencies.

In short, the outcome of this study shows that AAS use can develop in many different ways and that there is a risk that these people develop into multiple drug users including many different drugs and/or alcohol.

4.3 Study III: Abuse of narcotics and other drugs in anabolic-androgenic steroid misusers

The aim of this study was to examine the whole drug abuse picture of AAS users and the reason why different substances had been used. Thirty men and two women were included in the study who had on average used AAS for 5.1 years (range 1–16) The AAS debut occurred on average at the age of twenty (range 15–28). The reason for starting to use AAS was usually to get better results from the physical training and/or the desire to increase muscle strength and body mass but also to improve their chances in bodybuilding competitions.

The absolute majority of the patients came into contact with AAS at the gym and one or two bought it via the Internet. On average the patients had used six different AAS substances but in one case up to 28 different AAS substances had been used. The AAS substances that were used most often were for human use but almost half the patients had also used AAS for animals, e.g. boldenone, trenbolone and methandriol. The most common oral AAS substances were methandrostenolone and stanozolol, and the most commonly used injectable substances included nandrolone esters, different types of testosterone blends as well as the different testosterone substances like cypionate, enanthate, propionate and suspension.

Table 3. Reported lifetime and current use of drugs

Drugs/other preparations	Lifetime use		Current use	
	n	%	n	%
AAS	32	100	32	100
hGH	15	46.9	2	6.2
Insulin	9	28.1	3	9.4
Insulin-like growth factor 1	5	15.6	0	0.0
Thyroid hormone	4	12.5	1	3.1
Alcohol, hazardous or harmful use	15	46.9	13	40.6
Other drugs of abuse	29	90.6	18	56.2
Cannabis	26	81.2	4	12.5
Amphetamine	25	78.1	16	50.0
Ecstasy	18	56.2	4	12.5
GHB	15	46.9	5	15.6
Cocaine	13	40.6	2	6.2
LSD	9	28.1	0	0.0
Heroin	8	25.0	4	12.5
Pharmaceuticals	31	96.9	16	50.0
Other drugs	5	15.6	0	0.0
Dietary supplements	31	96.9	12	37.5

The AAS users also used other hormone substances to a large extent, e.g. hGH, IGF-1, insulin and thyroid hormone. Nearly all of them had also used an illegal drug of some kind. Cannabis seemed to be the most commonly reported other drug of abused in the life histories, closely followed by amphetamines. However, when it came to current use, amphetamines dominated totally. All the patients but one had apart from hormone substances and illicit drugs also used different types of medication as a doping substance and/or to counteract different types of side effects. More than half had used sympatomimetics like ephedrine, benzodiazepines (e.g. flunitrazepam [usually in the form of Rohypnol®] and diazepam), adrenergic drugs like clenbuterol and testosterone releasers like chorionic gonadotropin (HCG). Nearly half the patients also currently had an heavy alcohol consumption and two of the patients had even injected themselves with alcohol.

The substance abuse of all the patients was assessed by a psychiatrist who gave addiction diagnoses according to Diagnostic and Statistical Manual of Mental Disorder, 4th edition (DSM IV) (American Psychiatric Association 2000). Nine of the patients were judged as suffering from AAS abuse and eight fulfilled the criteria for AAS addiction. As regards the other drugs, nine patients were given an addiction diagnosis for amphetamine, seven suffered from amphetamine abuse and the four who took heroin fulfilled the criteria for an abuse diagnosis. In addition

seven patients were diagnosed as abusers of alcohol and five were diagnosed as addicted to alcohol.

Hormone substances were normally used in order to enhance muscle mass and strength. The thyroid hormone was used to reduce fat, but so was insulin. Stimulantia like amphetamines, cocaine, ephedrine and bronchodilators were used to have more strength in training and to increase the burning of fat. Opioids were used because they could act as painkillers during or after training. HCG substances (e.g. pregnyl) were used to combat AAS side effects, e.g. to reduce the risk of testicle reduction and to combat the oestrogen transformation effect that might lead to gynecomastia, anti-oestrogens like tamoxiphen was used. Practically all the patients used dietary supplements, like protein, creatine or vitamins.

In short, the results of this study show that patients who use AAS and who seek help at an addiction clinic rarely only use AAS. Instead they are often multiple drug users mixing different AAS substances with other hormone substances, other drugs of abuse, pharmaceuticals, alcohol and dietary supplements.

4.4 Study IV: Is there an association between use of anabolic-androgenic steroids and criminality?

In the social interview all the patients bar two said that they had committed crimes that they had been convicted for. The result was compared to data from the BRÅ, the Swedish National Council for Crime Prevention where it emerged that 32 of the patients (31 men and one woman) had been convicted for crimes they had committed. The continued analysis of the crime data was based on these patients where there is objective information regarding the crimes. The analysis was made in accordance with the code system described above where account was taken of both the severity of the crime as well as the time period the crimes had been committed in.

The results were compared between subgroups of patients with different patterns as regards the development of the abuse and with different debut drugs. The subgroups were called group 1 (only AAS), group 2 (AAS first, then also other drugs of abuse O), group 3 (O first, then also AAS) and group 4 (O and AAS at the same time). This subdivision was made in order to be able to examine the link between drug use and the development of criminality more closely.

5. COMMENTS AND GENERAL DISCUSSION

5.1 Methodological discussion

The aim of the dissertation was to gain knowledge about users of anabolic-androgenic steroids (AAS), with a particular focus on social background, current social situation, the development of AAS use over time, the link to other drugs and criminality, and psychic and physical side effects. The main focus of earlier research has been on users of AAS in competitive sports where the goal of the use has been to achieve a positive impact on performance. This was largely due to the fact that it was in the sports context that the use of AAS had originally started. In more recent years the use of AAS has, however, increased in groups of people who have no connection whatsoever with sports. AAS, which were originally a sports problem, have now become a social problem (Parkinson & Evans 2006). Research on groups outside competitive sports has, however, been fairly limited. Therefore, this study aims to address the problem of AAS use from a broader social perspective and not just limited to sport.

The first most important issue that had to be decided in the work on this dissertation was the matter of how to recruit AAS users to the project. The choice lay between trying to get hold of research informants via adverts in gyms or in newspapers, or to involve patients from the healthcare system. Since the project had its beginnings in the healthcare system based on the clinical question of how to best treat a new and previously unknown group of patients, it was natural to use this group. Hence, the title of this dissertation is AAS Users in Treatment. This decision meant that it was possible to gain broad knowledge about various aspects of AAS use from the group of people who seek help within the healthcare system, although the possibility of extrapolating this knowledge to apply to AAS users in general was fairly limited.

The study was conducted at the Addiction Centre in Örebro, which is an addiction clinic within the psychiatric care system. Young people (from the age of sixteen) and adults who have a drug addiction/dependency and a mental disorder, in other words a dual diagnosis, are offered diagnostic treatment and treatment sessions at the addiction clinic. Towards the end of the 1990s, it was apparent that more and more AAS users were coming to the clinic to seek help for various problems that they attributed to their AAS use. Not everyone came primarily to put a stop to their abuse; sometimes the reason was problems with side effects that they wanted help with. However, the ambition of the staff was also to encourage the patients to stop abusing AAS with support from the clinic.

It is a well-known fact that it is very difficult to get contact with AAS users (Pope & Kanayama 2005) and in addition very difficult to get patients to stay in treatment. In order to put together a reasonably sized research group, the original aim was to base our inclusion on several clinics. However, treatment specifically aimed at AAS users was only available at very few places around the country and nowhere near our region. Thus it was decided to recruit locally.

Notices were put up at the reception at the addiction clinic during the inclusion period in order to recruit patients to the study. Furthermore, all new patients who came to the clinic were asked whether they had used AAS and whether they were interested in participating in the research project. Those patients who showed an interest were given detailed information about the project, both orally and in writing. It was managed to include 36 patients over a period of 3.5 years with this approach. Despite the limited size of the group, it is still one of the world's biggest groups in this field of research. Most of the participants in the project were men although this was not really regarded as a disadvantage since in general it is more common for men than women to use AAS (Kindlundh, Isacson, Berglund & Nyberg 1998; Luicidi, Grano, Leone, Lombardo & Pesce 2004; Middleman et al. 1995; Nilsson 1995).

One important issue with regard to methodology at this stage was the question of who was going to meet the patients and carry out the interviews. The alternatives were to either use special interviewers who would only meet the patients as part of the research, or to integrate the research with the treatment. There were obvious advantages and disadvantages with both alternatives. The use of special interviewers would mean that an understanding of the patients and their problems that were the core of the project would probably be more limited. On the other hand, the interviews would probably be more structured and rational. The project was, however, planned after an clinical contact with fifty-odd AAS users. This experience combined with the experiences of other researchers made it plain that this patient group is extremely difficult to recruit and at least as difficult to keep in treatment and as a research informant. The explanation for this is may be AAS is a hidden abuse that the users to a large extent hide from the people around them. As has previously been mentioned, it is often the perceived side effects that make the user seek care. In a clinical experience, many AAS users are also wary of the care system and the authorities.

Thus all experience pointed at the fact that the research project would be difficult to carry out with regard to recruitment and the drop out risk. Furthermore, it was clear that the treatment relationship might be disturbed if the question of participation in the research project was put in an unsuitable way or

was badly timed. Therefore, it was decided that, based on long experience of both the gym environment and many patients who were AAS users, the author was most suited to be the one who conducted the research interviews. It was even felt that this was a prerequisite for the realisation of the project.

The disadvantage of this decision was that the researcher also was the therapist, which could be perceived as a dual role by the patients. Furthermore, good understanding of the area might influence the interpretation of the patients' responses. It was believed, however, that this prior knowledge was also a major advantage when it came to understanding these patients from this very special subgroup of people and it also meant that the patients could trust the interviewer as a person since due to his experience he understood what they were talking about (Kvale 2007). All in all, in the opinion his background as a therapist was an important prerequisite for the realisation of the project.

In the research context it is unusual to be able to follow such a large group of AAS patients over a longer period of time (Pope & Kanayama 2004). In order to make this possible, the author coordinated all activities regarding both research and treatment. A team, which also included a doctor, psychologist and a nurse was set up to make it possible to realise all the different parts of the project. Contact with the patients was relatively intensive during certain periods. The aim was to establish a relationship with the patients, which was based on mutual trust to encourage them to want to work on their AAS abuse, but also to contribute positively to the research project. This approach meant that the collection of data went beyond our expectations. Not one of the patients dropped out of the project, which must be regarded as fairly unique in this field of research.

As regards the choice of research methods that corresponded with the aims of the project, it became clear at an early stage that there were no established instruments that were available to us. This meant that instruments had to be produced that were adapted more exactly to both the questions raised in the study and the group of patients. Since the clinic had a great deal of experience of clinical interviews with AAS users, it became natural to base the research interviews on that experience. The structured interview model that has been used at the addiction clinic for many years included templates for anamnesis, substance anamnesis, somatic examinations, psychiatric evaluations, psychological evaluations, nurse examinations and urine and blood test templates. The examination of the patient was subsequently adapted to the AAS users based on scientific studies on the area (Bahrke et al. 1992; Bahrke et al. 1998; Blue & Lombardo 1999; Corcoran & Longo 1992; Haupt & Rovere 1984; Korkia et al. 1996; Malone et al. 1995; Middleman et al. 1995; Olrich & Ewing 1999; Pope et al. 1996).

Due to the nature of the research project, a combination of different scientific methods was regarded as most useful in order to achieve the aims of the study. This approach was judged to reinforce the outcome of the study. The interviews, which took the shape of an ongoing dialogue, required several meetings in order to obtain all the information that was needed. The information was subsequently extracted from these interviews in two different ways. Firstly, by translating the information into quantitative variables, and secondly, by transforming it into personal narratives in Study II.

Perhaps it would be a good idea to spend some time reflecting on this type of data analysis and give reasons for why it was carried out in this way in the dissertation. The aim of Study I was to describe the social background and the current social situation of a group of AAS users in treatment and compare the results with a group of people who trained at a gym. As regards the addiction clinic group (the AC group), there was not really a choice when it came to method. There were no established instruments that corresponded to the aims of the study. As mentioned above, the point of departure was well-tested clinical instruments that were transformed into research interviews. Information was extracted from these and translated into quantitative variables. In most cases, this did not present any methodological difficulties. However, in some cases, the responses given by a patient were difficult to interpret. In these cases, the interviewer continued asking questions until it was clear which alternative in the variables in question was most suitable. This approach was facilitated by the fact that the interviews were spread over several meetings which meant that the interviewer never had to guess which alternative was the most correct one, instead he was able to return to the question if there were any unclear points.

It would for several reasons have been a good idea to use the same method for the comparison groups as well. However, there were also good reasons to choose a different method. One important reason was that AAS users rarely admit their problem openly. It was very important to find out whether the people in the comparison group had any experience of AAS use. It was believed that it was more probable to obtain this information using an anonymous questionnaire instead of conducting personal interviews, and for this reason the questionnaire was the method to choose. Another reason was that it was desirable to use a fairly large comparison group, which meant that interviews were hardly a viable alternative.

The Fisher's exact test was used for the statistical analysis of three of the groups. This method was the choice on the fact that it was a wish to have a robust and conservative method that was suited to the type of data in the study.

A post-hoc test 2 x 2 would have been possible, but we refrained from using this for two reasons. The first reason was that when using Fisher's exact test, there is no correction for the effect of multiple comparisons. The second reason was that there were too few participants in each group (particularly in the gym AAS group) for them to be statistically sound.

The aim of Study IV was to examine the criminal activities of the patients in relation to the use of AAS and possibly also other drugs of abuse. The social interview included questions on criminal activity although at the design stage it was not self-evident that the information we obtained would be reliable. To our surprise, however, the patients were prepared to discuss these matters as well. In spite of this, it was felt that there was a risk that certain patients might exaggerate their criminal activities in order to seem more dangerous than they really were. Hence the risk for reporting too little vis-à-vis too much was carefully considered (Nilsson 2003). The consequence of this was a decision to validate the results with objective data. The method used was to collect data from the Swedish Council for Crime Prevention (BRÅ), which has a register of all crimes where a sentence has been passed. True, crimes committed that did not lead to a conviction were not included in the data, but this was still considered by far the best method with which to validate the interview data.

5.2 Ethical discussion

Attempts were made in the project to minimise any ethical problems with regard to the participants. The patients who participated in the interviews were told that they did not have to reply to questions of a sensitive nature. They could also drop out of the research whenever they wanted without this affecting their treatment.

It was not feasible, however, to rule out the possibility that the extensive and intrusive interviews might have a negative impact on the patients. Although since the research was integrated with the treatment, any negative reactions could be dealt with at the addiction clinic. As regards the gym group, the participants were guaranteed anonymity. While collecting the data for Study II, there was a risk that sensitive information would emerge. Thus the information anonymous, but for obvious reasons it was made somewhat not possible to do so entirely without eliminating important information. The ethical problem was minimised because the patients were given the opportunity to read through the accounts that were written and they were thus able to say whether they wanted something in the text to be deleted. In the end, this possibility was only used to a very limited extent.

5.3 Results discussion

Naturally it is important to relate the findings of the dissertation to previous research conducted in the field. This is, however, no easy task bearing in mind that there are only a few studies that the studies in this dissertation can be compared with. As regards the study on social background and current social situation, we only found a handful of studies; two from Sweden (Kindlundh et al. 2001; Kindlundh et al. 1999) and one from the USA (Kanayama et al. 2003b), which present slightly more detailed social data on AAS users.

The findings of Study I indicated that it was more common for AAS users compared to non-users to have had a difficult upbringing. This was particularly obvious in the AC group. Previous studies (Kanayama et al. 2003b) have pointed out that AAS users' contact with their fathers is often poorer and this is supported by the findings in this study where the users describe a bad relationship with their fathers and claim they were physically and mentally abused by their parents. It also emerged from Study I that alcohol or medicine abuse was more common among the patients' families, something not indicated in other studies.

When comparing the level of education and experience of different types of problems at school between users and non-users of AAS, it was found in general that the outcome of the AAS users was much lower in almost all the areas examined. The level of education of an AAS user was lower than that of a non-user, which corresponds to findings in previous studies (Kindlundh et al. 2001) where it emerged that AAS users obtained average or poor school results. These findings can be highlighted by these findings with regard to AAS users often having a history of concentration difficulties, reading and writing difficulties at school while they also reported that they suffered from school fatigue. In that light it might not be so odd that AAS users often played truant, which has been described earlier (Kindlundh et al. 1999).

It is naturally not possible to draw any causal conclusions when it comes to the relationship between social background and AAS use. We are happy to confine ourselves to saying that AAS use seems to be linked to experiences of a difficult childhood and adolescence, both as regards family and school. We interpret this as meaning that AAS use that leads to a desire to seek help within the healthcare system normally does not occur without a social background of the type described above. Moreover, we understand the findings to mean that AAS use also leads to a difficult current social situation. It is naturally impossible to say whether this situation would have existed without the use of AAS, but the impression from the interviews is still that AAS use often takes place in a sub-

culture that may be associated with social marginalisation, aggression in close relationships and criminal activity.

In Study II, six AAS users described how drugs (AAS and possibly other drugs of abuse) had affected their lives. The ambition was to as far as possible give a voice to their life histories even if it was expressed via my interpretation of the interviews with them. There are some previous studies that have included case studies (Allnutt & Chaimowitz 1994; Cowan 1994; Pagonis et al. 2006b; Pope & Kanayama 2004; Pope & Katz 1990; Thiblin & Parlklo 2002; Thiblin et al. 1999) but there are only a few where the users themselves have been given the opportunity to tell their story (Grogan, Shepherd, Evans, Wright & Hunter 2006; Monaghan 2002; Olrich & Ewing 1999; Todd 1987). In these latter studies it is, however, bodybuilders who have been given the opportunity to tell their stories and not people who have sought help within the healthcare system for problems linked to AAS use.

In this study, the patients described AAS use as being a very positive experience initially, for example due to an increase in strength and body mass, and enhanced self-esteem. One thing the patients had in common, however, was the fact that the negative effects gradually exceeded the positive ones. This corresponds with an earlier study (Olrich & Ewing 1999) where nine out of ten people described the effects of AAS as predominantly positive, for example as regards social status, impact on the body or sexuality.

The patients in Study II were selected in such a way to ensure as much variation as possible. The different variations were characterized in the following way: early combined drug use starting with AAS, late combined drug use starting with AAS, early development of a complex usage of hormone substances, body obsession and a complex usage of hormone substances, the use of enhancing drugs and an extreme body obsession, and oscillating drugs of abuse and AAS use. For four of the patients, AAS were the first drugs that they had used and this usually happened when they had reached a plateau in their training, i.e. when the training no longer gave any positive results. As far as I know there is no study that describes which drug comes first during the development of a poly-substance use of drugs.

Other drugs like other drug of abuse or medicines were often used to enhance the effect of AAS or to reduce different side effects of AAS use. Commonly reported side effects were either an increased or a decreased sexual ability or sexual desire, testicle reduction, acne, gynecomastia, mood swings, depression, increased aggressiveness and increased body obsession. These problems have been reported earlier (Brower 2002; Eklof et al. 2003; Parkinson & Evans 2006).

Moreover, pathological jealousy was a major problem for four of the patients, which is something previous studies have not reported. The drug use put major pressure on the relationships of the users, for example in the form of pathological jealousy. One of the patients suffered from an aggressive outburst known as roid rage on a couple of occasions, which is a very serious aggressive state. (Thiblin et al. 1997). In short, the study shows that the use of AAS may be a gateway to other drug use for both men and women and that it often leads to combined drug use.

Study III indicated that in most cases the AAS debut occurred because the person wanted to obtain better training results. For men the debut occurred on average at the age of 19.7 years of age and for women on average at the age of 20.5 years of age.

The patients often had extensive knowledge about AAS and what substances could be taken together with AAS. The patients obtained information about AAS use in different ways but most often from books that they regarded were an important source of information. Examples of such literature are a book written by a North American bodybuilder (Phillips 1996), a book on how drugs are discovered in amateur sports (Di Pasquale 1984), Steve Gallaway's "The Steroid Bible" (Gallaway 1997) and last, and perhaps most important of them all, William Llewellyn's Anabolics reference series (Llewellyn 2007). The latter is a very extensive reference book that includes detailed information on 200 active substances and almost 2.000 products on sale.

Study III reported how AAS are often combined with various narcotic substances, alcohol and medicines. Insulin is normally used to increase weight in conjunction with training but according to this study insulin can also be used to reduce fat, which is something that has not been reported before in the literature. Previous studies have warned that AAS may be a gateway to a damaging use of alcohol (Johansson, Lindqvist, Nyberg & Fahlke 2000). Our study confirms this risk. AAS have in several studies been identified as a gateway to other drug addiction (Arvary & Pope 2000; Celerier et al. 2003; Johansson et al. 2000; Kanayama et al. 2003a; Wines, Gruber, Pope & Lukas 1999) or multi-addiction (Gruber & Pope 2000), findings which are also supported by this study. Despite the patients' accounts of their polysubstance use, many see themselves as clean-living people and not as drug addicts since they take the substances in order to obtain a beautiful body.

There are only a few studies that touch upon the possible link between AAS and criminality. As far as we know, there is no study that has followed the criminal activities of AAS users over a period of several years and that compares

these activities with drug use of different kinds. Of the 32 patients that were followed in Study IV, the criminal activities, in terms of crimes leading to convictions, increased for most after they had started to use drugs. This link was most apparent in the subgroups that had started with AAS. The findings must be interpreted with great care since the material in the study is limited. However, we do believe that it is worth paying continued scientific attention to these findings.

There are a number of studies that have looked into the link between AAS and violent crime (Isacson et al. 1998; Klotz et al. 2006; Klotz et al. 2007; Pope & Kanayama 2004; Pope et al. 1996; Thiblin et al. 1997; Thiblin & Parklo 2002; Thiblin et al. 1999). Our study, unlike Klötz et al.' study from 2006, was able to report a link between AAS and the number of people with convictions in the crime groups drug-related crimes and violent crime. The reason for this discrepancy may possibly be due to differences in different types of populations.

In the study by Klötz et al. where both the AAS group and the non-user group were recruited from the test archives of a doping laboratory, the authors found that there was a higher risk of having been convicted of a crime involving a weapon or fraud if the individual had used AAS, but the study was, however, not able to establish a link between AAS use and violent crime or crime against property (Klotz et al. 2006). In our study, over 60 % had been convicted of a violent crime which supports The second study from Klötz et al. used material from the police register on people under the age of 40 dying of unnatural causes. The finding in this study was that AAS use could be linked to violent crime, particularly if AAS were combined with other drug of abuse drugs (Klotz et al. 2007). In our study, we also noted that violent crimes increased even more when AAS were used at the same time as other drug of abuse.

There was a clear decrease in the number of convictions upon completion of treatment. This was particularly evident in the group that had only used AAS, which makes one suspect that there is a very particular link between AAS and criminality, where treatment may have a positive impact. The study was not designed as a treatment study, and this means that the results cannot definitely be related to the treatment; and still less be extrapolated to apply to AAS users in general. However, in our opinion the findings, which are really secondary findings, deserve attention and should lead to continued scientific studies.

5.4 Clinical implications

Finally, I would like to discuss the clinical implications of the findings of the dissertation. The research project was conducted within the framework of a

clinical treatment situation. The research project was designed in such a way that the knowledge of each patient became very extensive, something that was useful in treatment. This knowledge could, however, with care be generalised to apply to AAS users in treatment at other addiction clinics.

The findings in Study I show how important it is in sessions with AAS users to allocate enough time to talk about their upbringing within the family, experiences of school and current social situation. It is true that not all the patients had experienced difficulties in these areas, but it did apply to most. This means that it is a good idea to give the patient the opportunity in therapeutic sessions to focus on different themes like relationships with parents and other people close to them, any experience of abuse and assault, experience of drug abuse and criminality within the family and relationships with partners. Other important areas to discuss in sessions are experiences of school both as regards schoolwork and schoolmates. It is also important to carefully map out the current social situation.

The findings in Study II show how important it is to listen to the life stories of the patients without having preconceived ideas since it is clear that there are enormous differences when it comes to how AAS use may develop and how it may, although not necessarily, be combined with the use of other drugs and/or pharmaceuticals. The patients' stories can provide valuable information about the life history of an individual and their substance use pattern to be used as a basis for an individualised treatment plan.

Knowledge from Study III may be useful in the training and skills enhancement professionals working with AAS users. The study provides in-depth information about the types of substances that are used and the reasons for the use. The study may also contribute to an awareness of the extent of polysubstance use in this patient group. Basic knowledge about this area is very important if the therapist is going to have a meaningful dialogue with the patient.

Study IV also provides a picture of an AAS user as being an aggressive and/or paranoid person with criminal tendencies, which therapists need to take into consideration during treatment. Criminality is common among AAS users and this may have an impact on the outcome of the treatment but it is also important to bear in mind that the study indicates that the treatment itself may have a positive impact on criminal activities.

In conclusion, the studies in the dissertation show how important it is that treatment is carried out by a therapist who has knowledge of the problems of AAS users in a broad sense and of the substances that AAS users may use in combination in their search for the perfect body.

6. SAMMANFATTNING PÅ SVENSKA (SUMMARY IN SWEDISH)

Denna avhandling grundar sig på intervjuer med 36 användare av anabola androgena steroider (AAS) som sökt hjälp vid en psykiatrisk beroendeklinik. En jämförelsegrupp bestående av 277 gymtränande personer ombads fylla i ett frågeformulär. Avhandlingen består av fyra delstudier.

I delstudie I påvisades att AAS-användarna ofta hade erfarenheter av svår uppväxt och svåra aktuella sociala problem var också mer vanliga bland dessa. Användarna rapporterade att de hade dåliga relationer med sina föräldrar och nästan hälften hade erfarenhet av fysisk eller psykisk misshandel. AAS-gruppens skolerfarenheter var mestadels negativa och innefattade koncentrationsproblem, skoltrötthet och inlärningssvårigheter. Deras aktuella situation innefattade ofta narkotikamissbruk, misshandel av partner och annan kriminalitet såsom misshandel, vapenbrott och stöld.

I delstudie II berättar AAS-användare om sina livshistorier. Utvecklingen av AAS-bruket visade på en betydande variation vad gäller social bakgrund, drogdebut, relation till AAS-bruk och erfarenhet av AAS-effekter. Alla patienterna hade till en början upplevt positiva effekter av AAS men allteftersom överskuggades de positiva effekterna av de negativa. Alla patienterna ägnade sig åt överdriven träning på gym och använde AAS i kombination med gymträning, vilket visar på att bruket av dessa preparat hör nära ihop med denna typ av fysisk träning.

Resultaten från delstudie III visar att blandmissbruk var mycket vanligt bland patienterna. Över hälften missbrukade både narkotika och olika mediciner. Nästan femtio procent av patienterna använde dessutom tillväxthormoner. Knappt hälften av de intervjuade personerna uppvisade ett riskbruk av alkohol. Den vanligaste orsaken man angav för AAS-bruk och användning av andra hormoner var att man ville öka muskelmassan och muskelstyrkan, men vissa personer tog också insulin för att bränna fett. Man använde cannabis för att sova bättre, heroin för att minska smärta och amfetamin för att öka uthålligheten och bränna fett. Dessa data tyder på att de flesta AAS-användarna inom missbrukspsykiatri är blandmissbrukare och flerdrogsberoende.

Delstudie IV belyser relationen mellan AAS-användning och kriminalitet. Kriminaliteten hos de flesta personerna i studien ökade markant efter det att de börjat använda droger. Detta var särskilt tydligt hos de två undergrupper som började sin missbrukskarriär genom att använda AAS. Ökningen var störst vad gäller våldsbrott och vapenbrott. Resultaten tyder på att det finns ett samband mellan AAS-bruk och kriminalitet, speciellt vad gäller våldsbrott och vapenbrott

samt att denna typ av kriminalitet ökar när AAS kombineras med annan narkotika.

Avhandlingen visar sammanfattningsvis att AAS-användare ofta har en bakgrund och en aktuell situation som präglas av sociala problem och att AAS-bruket ofta kombineras med andra droger och preparat, att AAS-bruket är kopplat till kriminalitet inklusive våldsbrott och vapenbrott och att AAS-bruk kan vara en inkörsport till missbruk av andra droger.

7. TACK TILL PERSONER SOM BIDRAGIT (ACKNOWLEDGEMENTS)

Ett stort tack till alla som under alla år stöttat mig vilket medverkat till att jag fått förmånen att genomföra detta avhandlingsarbete.

Ett speciellt tack till;

Mobilisering mot narkotika (Swedish National Drug Policy Coordinator) samt Örebro läns landsting som bidrog ekonomiskt till detta arbete.

Professor Ingemar Engström för hans ovärderliga hjälp. Han såg från första kontakten möjligheterna med det grundmaterial som fanns och har sedan dess stöttat mig i mitt arbete. Inte minst genom att bidra med positiva förändringsförslag i arbetet med avhandlingen. Han har även uppmuntrat och hjälpt mig att utveckla ett vetenskapligt tänkande vilket ibland inte varit så enkelt.

Professor Fred Nyberg för alla gånger han som bihandledare stöttat mig. Beroendecentrums chef Tommy Strandberg för att han ekonomiskt och med tid givit mig möjligheten att genomgå forskarutbildningen. Tillsammans med Ingemar, Fred och Tommy fick jag i slutet av 1990-talet också möjligheten att starta upp det nationella Nätverket mot narkotika, ett nätverk som idag växt till ett nordiskt nätverk mot narkotika.

Psykiater Björn Sundberg som diagnostiserade alla patienterna samt i övrigt bistod mig på ett positivt sätt.

Psykiater Sten Engdahl samt psykolog Jan Zeilke som var med och träffade patienter i början av forskningsprojektet.

Psykiater Björn Lindqvist som hela tiden stöttat mig inte bara med artikel- och litteraturtips utan även vid svåra patientärenden.

Alla kollegor och anställda på Psykiatriskt forskningscentrum som alltid haft tid med mina frågor och hjälpt mig med granskningar av mina arbeten samt vid korrekturarbetet med kappan.

Anna Wadejford för värdefull hjälp och support under doktorandtiden.

Mina arbetskamrater på Beroendecentrum som inte bara haft förståelse för mitt forskningsintresse utan även på ett positivt sätt uppmuntrat mig.

Alla patienter som genom att dela med sig av sin kunskap kring AAS genom många samtal, ifyllande av frågeformulär om sitt sociala liv, psykiska och fysiska mående bidragit på ett avgörande sätt till denna avhandling. Flera av er har även tipsat mig om litteratur jag borde läsa, om hemsidor jag borde besöka och andra viktiga saker. Utan er hade det inte blivit någonting!

Alla andra som på olika sätt hjälpt mig utveckla och förbättra min avhandling till vad den är idag.

Inte minst min familj:

Min fru Yvonne som troget stöttat mig genom hela avhandlingsarbetet och inte minst med livet vid sidan om studierna.

Mina barn Linda och Camilla som från att jag gick min socionomutbildning helhjärtat varit positiva till mina studier.

Min frus barn Åsa och Camilla och Tommy som på olika sätt varit intresserade av mitt arbete.

Mina och min frus barnbarn, Freja, Alva, Isak och Elis för att de är underbara och fulla av liv.

Mina och min frus svärsöner, Frans, Petter, Onni och Markus för att de finns.

Buster och Zorro som alltid haft tid att ta långa promenader och på annat sätt förgyllt mitt liv.

EPILOGUE

A well-known concept among people who train and particularly in the world of bodybuilding is: *No pain, no gain*. This means that if your muscles do not ache when you lift weights, the training will not lead to muscle growth. This concept can also be applied to a PhD education.

When I started working on this dissertation I had a very naïve understanding of research. I could not in my wildest imagination have understood the amount of (interesting) work that lay behind a dissertation. It started with reading all the literature available at the same time as I developed more and more contact with patients who were AAS users. After that I got in touch with people around Sweden who had experience of AAS use in many different ways, either clinically or scientifically. Eventually my plans became more structured when I was accepted as a doctoral student at the Psychiatric Research Centre. I started changing the way I thought about research and thus I became more organised in my work. I continued collecting data through the many sessions I had with patients, interviews, medical assessments, psychological examinations, urine and blood tests. All the data was entered into SPSS. A questionnaire was produced and used at a gym for interviews with gym clients. The collection of material went remarkably quickly and all the data was subsequently entered into the computer system. After some years it was possible to publish the data in the four studies that form the basis of this dissertation. I continued my sessions with patients, which had started a few years earlier, the telephone rang and I wrote. Finally, it was time to write the summarising chapter of my compilation dissertation. I would use four words to describe the journey to the completion of this dissertation: *No pain, no gain*. In this context the concept means that as a PhD student doing a doctoral dissertation if you do not work so hard that your body and head ache, there will be no dissertation growth.

APPENDIX

QUESTIONNAIRE ON TRAINING AT A GYM

The Psychiatric Research Centre, together with the Addiction Centre in Örebro, is carrying out a research project on the abuse of anabolic steroids and other doping substances. In the study, we are among other things studying the social background of the steroid users. Therefore we are now looking for a control group of people training at a gym to facilitate our work with evaluating the results.

If you answer the questions in this questionnaire, you will remain anonymous.

You answer the questions by ticking the right box or by writing in your response. When you are done, hand in your sealed filled in questionnaire to reception and no one will know who you are.

A couple of questions on who you are first

1. *Are you a man or a woman?*

Woman

Man

2. *How old are you (years)?*

3. *How tall are you (in cm, no decimals)?*

4. *How much do you weight (in kg, no decimals)?*

5. *Were you born in Sweden or abroad?*

- Sweden
- Abroad

6. *Were your parents born in Sweden?*

- Yes, both of them
- Yes, one of them
- No, neither of them

7. *How do you make a living?*

(Tick one or several)

- Income from work
- Income from sick leave benefit
- Income from study benefit
- Income from social benefit
- Income from unemployment benefit fund
- Other: _____

8. *Do you have a driver's licence?*

- Yes
- No

9. How would you describe your health?

- Very good
- Good
- Neither good nor bad
- Bad
- Very bad

10. Do you agree or disagree with the following statements?

(Tick one box in each line)

	Totally disagree					Agree				
a. <i>I have a positive image of myself.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. <i>I have a greater worth than most other people.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. <i>I am usually able to concentrate on what I am doing.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. <i>I am on the whole happy with my body.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. <i>I think a lot about what my diet consists of.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. <i>Sometimes I feel that I am worthless.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. <i>I often worry about different things in my life.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. <i>I often have trouble sleeping because of worry.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

i. *I always have someone to turn to when I need help.*

j. *I often have problems with my temper.*

Questions on your childhood and adolescence

11. *Who did you grow up with?*

(Tick one box)

- With both biological parents
- With my father
- With my mother
- Other: _____

12. *How were your childhood and adolescence years?*

(Tick one box)

- Very good
- Fairly good
- So so
- Fairly bad
- Very bad

13. *Are your biological parents divorced?*

- Yes
- No

13a. *If yes, how old were you when they got divorced?*

(Tick one box)

- 0–5
- 6–10

- 11–15
- 16–20
- Over 20

14. What was your relationship with your father like during your childhood and adolescence?

(Tick one box)

- Very good
- Fairly good
- So so
- Fairly bad
- Very bad

15. What was your relationship with your mother like during your childhood and adolescence?

(Tick one box)

- Very good
- Fairly good
- So so
- Fairly bad
- Very bad

16. How many full siblings have you got?

- None
- 1
- 2
- 3
- 4 or more

17. Have you got children of your own?

- Yes
- No

17a. If yes, how many?

- 1
- 2
- 3
- 4 or more

18. Was/Is there anybody else who was important to you during your childhood and adolescence?

- Yes
- No

18a. If yes, who?

(Tick one or several boxes)

- Maternal grandmother
- Maternal grandfather
- Paternal grandmother
- Paternal grandfather
- Maternal uncle
- Paternal uncle
- Maternal aunt
- Paternal aunt
- Other: _____

19. How old were you when you left home?

- 11–15
- 16–20
- 21–25
- Other: _____

20. *How do you live now?*

(Tick one box)

- Live alone
- Single parent
- With my father
- With my mother
- With a partner
- Other: _____

21. *How do you live now?*

(Tick one box)

- No permanent relationship
- Common law spouse
- Married
- Living apart
- Other: _____

22. *Have you ever hit someone you have lived with?*

- Yes
- No

23. *Have you ever threatened someone you have lived with?*

- Yes
- No

24. *Were you physically abused as a child/adolescent?*

- Yes
- No

24a. *If yes, by whom?*

(Tick one or several boxes)

- Father
- Mother
- Sibling
- Other

25. *Were you mentally abused as a child/adolescent?*

- Yes
- No

25a. *If yes, by whom?*

(Tick one or several boxes)

- Father
- Mother
- Sibling
- Other

School years

26. *What level of education have you got?*

(Tick one box)

- Dropped out of compulsory school
- Compulsory school
- Dropped out of upper secondary education
- Upper secondary education
- Dropped out of higher education
- Higher education

27. *How do you like/did you like school?*

(Tick one box)

- A lot
- Quite a lot
- It is/was ok
- Not much
- Not at all

28. *Do you/did you play truant?*

(Tick one box)

- No, never
- Once a semester or so
- Once a month
- 2–3 times a month
- Once a week
- Several times a week

29. *Have you ever experienced any other problems with your studies?*

- Yes
- No

29a. *If yes, which one(s)?*

(Here you can tick more than one box if you like)

- Concentration difficulties
- Writing difficulties
- Reading difficulties
- School fatigue
- Fights at school
- Sport was more important
- Drug abuse
- Other: _____

30. *Did you ever bully anyone at school?*

- Yes
- No

31. *Were you ever bullied at school?*

- Yes
- No

Some questions on training at a gym

32. *Why do you train at a gym?*

(Tick one or two alternatives)

- To perform better in a sport
- To become stronger
- To get a nicer body
- To meet friends
- To relax
- To feel good
- To have fun
- Other reason: _____

33. *How many times a week do you train?*

(Tick one box)

- More than 5 times a week
- At least 5 times a week
- 3–4 times a week
- 1–2 times a week
- Less often

34. *Have you ever taken/do you take dietary supplements?*

(By dietary supplements we mean e.g. protein, creatine, vitamins etc.)

- Yes
- No

Some questions on drugs and other substances

Alcohol habits

By alcohol we mean “folköl”, beer purchased in a supermarket (approx. 3.5 % volume), “mellanöl/starköl”, medium or strong beer (+ 3.6 %) purchased at the alcohol retail monopoly, strong cider, wine, fortified wine and spirits.

(By 1 glass we mean 50cl “folköl” or 33cl “starköl” or 10 – 15cl white or red wine or 5 – 8cl fortified wine or 4cl spirits).

35. How often have you drunk alcohol during the last 12 months?

- 4 times a week or more
- 2–3 times a week
- 2–4 times a month
- Once a month or less often
- Never

36. How many glasses (see example above) of alcohol do you drink on an average drinking day?

- 1–2 glasses
- 3–4 glasses
- 5–6 glasses
- 7–9 glasses
- 10 or more glasses

37. How often do you drink six glasses or more on the same occasion?

- On a daily or almost a daily basis
- Every week
- Every month
- Less than once a month
- Never

38. How often have you drunk so much alcohol that you have been drunk in the last 12 months?

- Daily or almost daily
- A couple of times a week
- Once a week
- 2–3 times a month
- Once a month
- Once or a couple of times every six months
- Less often or never

Sniffing and illegal drugs

39. Have you ever sniffed?

- Yes, several times
- Yes, once
- No

40. Have you ever taken drugs?

(By drugs we mean e.g.: hash, marijuana, amphetamine, heroin, ecstasy, GHB, cocaine and crack)

- Yes, earlier on in my life
- Yes, in the last six months
- No

40a. If yes, which type(s) of drug(s) have you taken?

(Tick one or more boxes)

- Hash
- Marijuana
- Amphetamine
- Cocaine
- Heroin
- Crack
- LSD
- Kat
- GHB
- Another type of drug: _____
- Do not know

Use of anabolic-androgenic steroids and/or other doping substances

In all the questions on the use of anabolic-androgenic steroids including testosterone, growth hormones and other doping substances we do not mean drugs that have been prescribed by a doctor for medical use.

41. Have you ever taken any of the following doping substances?

(Tick one or more boxes)

- | | Earlier on in my life | In the last six months |
|---|--------------------------|--------------------------|
| <input type="checkbox"/> No, I have never taken any doping substances | | |
| <input type="checkbox"/> Yes, anabolic-androgenic steroids | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, testosterone | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, growth hormones | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, insulin | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, thyroid hormones | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, IGF 1 | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, Ephedrine | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, Clenbuterol | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Yes, other | <input type="checkbox"/> | <input type="checkbox"/> |

Use of prescribed medicines

42. Have you ever taken sedatives or sleeping pills prescribed by your doctor?

(Tick one or more boxes)

- No, I have never taken sedatives or sleeping pills
- Yes, sedatives (e.g. Valium, Sobril (Oxazepam), Librium, Apozepam (Diazepam), Stesolid (Diazepam), Xanor)
- Yes, sleeping pills (e.g. Mogadon, Nitrazepam, Sobril (Oxazepam), Stilnoct, Apodorm (Nitrazepam), Rohypnol, Flunitrazepam, Imovane)

43. Have you ever taken a sedative or a sleeping pill without a doctor's prescription?

(Tick one or more boxes)

- No
- Yes, a sedative
- Yes, a sleeping pill

Questions on the abuse of alcohol and other drugs in your family

44. Did anyone in your family ever abuse alcohol during your childhood and adolescence?

(Tick one or more boxes)

- No
- Yes, my father
- Yes, my mother
- Yes, a sibling(s)
- Yes, someone else

45. *Did anyone in your family ever abuse illegal drugs during your childhood and adolescence?*

(Tick one or more boxes)

- No
- Yes, my father
- Yes, my mother
- Yes, a sibling(s)
- Yes, someone else

46. *Did anyone in your family ever abuse medicines during your childhood and adolescence?*

(Tick one or more boxes)

- No
- Yes, my father
- Yes, my mother
- Yes, a sibling(s)
- Yes, someone else

Criminality

47. *Has anyone in your family ever been convicted of a crime?*

(Tick one or more boxes)

- No
- Yes, my father
- Yes, my mother
- Yes, a sibling(s)
- Yes, someone else

48. *Have you ever committed a crime?*

- Yes
- No

49. *Have you ever been convicted of a crime?*

- Yes
- No

49a. *If yes, what type of crime?*

(Tick one or more boxes)

- Crime involving a firearm
- Burglary
- Theft
- Assault
- Drug crime
- Sold drugs
- Sold doping substances
- Drink driving
- Some other crime: _____

50. *Have you ever been the victim of a crime?*

- Yes
- No

Thank you very much for your cooperation!

Put the questionnaire in the envelope and seal it. Hand it in to reception.

Kurt Skårberg
Psychiatric Research Centre
USÖ

REFERENCES

- Allnutt, S. & Chaimowitz, G. (1994) Anabolic steroid withdrawal depression: a case report. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie* **39**, 317-318.
- Ambrose, P. J. (2004) Drug use in sports: a veritable arena for pharmacists. *Journal of the American Pharmaceutical Association* **44**, 501-514.
- American Psychiatric Association. (2000) *Quick Reference to the Diagnostic Criteria From DSM-IV-TR*. American Psychiatric Association, Washington D.C.
- Andersson, J. (2005) The Swedish National Council for Crime Prevention: a Short Presentation. *Journal of Scandinavian Studies in Criminology and Crime Prevention* **6**, 74-88.
- Arvary, D. & Pope, H. G., Jr. (2000) Anabolic-androgenic steroids as a gateway to opioid dependence. *New England Journal of Medicine* **342**, 1532.
- Bagatell, C. J. & Bremner, W. J. (1996) Androgens in men - uses and abuses. *New England Journal of Medicine* **334**, 707-714.
- Bahrke, M. S., Wright, J. E., O'Connor, J. S., Strauss, R. H. & Catlin, D. H. (1990a) Selected psychological characteristics of anabolic-androgenic steroid users. *New England Journal of Medicine* **323**, 834-835.
- Bahrke, M. S., Wright, J. E., Strauss, R. H. & Catlin, D. H. (1992) Psychological moods and subjectively perceived behavioral and somatic changes accompanying anabolic-androgenic steroid use. *American Journal of Sports Medicine* **20**, 717-724.
- Bahrke, M. S., Yesalis, C. E., 3rd & Wright, J. E. (1990b) Psychological and behavioural effects of endogenous testosterone levels and anabolic-androgenic steroids among males. A review. *Sports Medicine* **10**, 303-337.
- Bahrke, M. S., Yesalis, C. E. & Brower, K. J. (1998) Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents. *Child and Adolescent Psychiatric Clinics of North America* **7**, 821-838.
- Barker, S. (1987) Oxymethalone and aggression. *British Journal of Psychiatry* **151**, 564.
- Beaver, K. M., Vaughn, M. G., Delisi, M. & Wright, J. P. (2008) Anabolic-androgenic steroid use and involvement in violent behavior in a nationally representative sample of young adult males in the United States. *American Journal of Public Health* **98**, 2185-2187.
- Bergman, H. & Kallmen, H. (2002) Alcohol use among Swedes and a psychometric evaluation of the alcohol use disorders identification test. *Alcohol and Alcoholism* **37**, 245-251.
- Blue, J. G. & Lombardo, J. A. (1999) Steroids and steroid-like compounds. *Clinics in Sports Medicine* **18**, 667-689.
- Bohn, M. J., Babor, T. F. & Kranzler, H. R. (1995) The Alcohol Use Disorders Identification Test (AUDIT): validation of a screening instrument for use in medical settings. *Journal of Studies on Alcohol* **56**, 423-432.
- Bonetti, A., Tirelli, F., Catapano, A., Dazzi, D., Dei Cas, A., Solito, F., Ceda, G., Reverberi, C., Monica, C., Pipitone, S., Elia, G., Spattini, M. & Magnati, G. (2008) Side effects of anabolic androgenic steroids abuse. *International Journal of Sports Medicine* **29**, 679-687.

- Boyadjiev, N. P., Georgieva, K. N., Massaldjieva, R. I. & Gueorguiev, S. I. (2000) Reversible hypogonadism and azoospermia as a result of anabolic-androgenic steroid use in a bodybuilder with personality disorder. A case report. *Journal of Sports Medicine and Physical Fitness* **40**, 271-274.
- Brooks, J. H. & Reddon, J. R. (1996) Serum testosterone in violent and nonviolent young offenders. *Journal of Clinical Psychology* **52**, 475-483.
- Brower, K. J. (1997) Withdrawal from anabolic steroids. *Current Therapy in Endocrinology and Metabolism* **6**, 338-343.
- Brower, K. J. (2000) Assessment and treatment of anabolic steroid abuse, dependence, and withdrawal. In: Yesalis, C. E. (ed) *Anabolic steroids in sport and exercise*. 2 ed, Human Kinetics, Champaign, pp. 305 - 332.
- Brower, K. J. (2002) Anabolic steroid abuse and dependence. *Current Psychiatry Reports* **4**, 377-387.
- Brower, K. J., Blow, F. C., Beresford, T. P. & Fuelling, C. (1989) Anabolic-androgenic steroid dependence. *Journal of Clinical Psychiatry* **50**, 31-33.
- Brown-Sequard, E. (1889) The effects produced on man by subcutaneous injections of a liquid obtained from the testicles of animals. *Lancet* **2**, 105-107.
- Brown, J. T. (2005) Anabolic steroids: what should the emergency physician know? *Emergency Medicine Clinics of North America* **23**, 815-826.
- Burnett, K. F. & Kleiman, M. E. (1994) Psychological characteristics of adolescent steroid users. *Adolescence* **29**, 81-89.
- Butenandt, A. (1931) Über die chemische Untersuchung der Sexualhormon (The chemical research of sex hormones). *Zeitschrift für Angewandte Chemie* **44**, 905-908.
- Butenandt, A. & Hanisch, G. (1935) Über die Umwandlung des Dehydroandrosterons in Androstenol-(17)-one-(3) (Testosterone); um Weg zur Darstellung des Testosterons auf Cholesterin (Vorlauf Mitteilung). (The conversion of dehydroandrosterone into androstenol-(17)-one-3 (testosterone); a method for the production of testosterone from cholesterol (preliminary communication)) *Berichte Deutsche Chemie Gesellschaft* **68**, 1859-1862.
- Butenandt, A. & Tscherning, K. (1934a) Über Androsteron ein Krystallisiertes Sexualhormon II. Seine Chemische Characterisierung (Androsterone, a crystalline sex hormone II. Its chemical characterization). *Zeitschrift Physiologische Chemie* **229**, 185-191.
- Butenandt, A. & Tscherning, K. (1934b) Über Androsteron, ein Krystallisiertes männliches Sexualhormon I. Isolierung und Reindarstellung aus Männerharn (Androsterone, a chrystalline male sex hormone I. Isolation and purification from urin). *Zeitschrift Physiologische Chemie* **229**, 167-184.
- Casavant, M. J., Blake, K., Griffith, J., Yates, A. & Copley, L. M. (2007) Consequences of use of anabolic androgenic steroids. *Pediatric Clinics of North America* **54**, 677-690.
- Celerier, E., Yazdi, M. T., Castane, A., Ghozland, S., Nyberg, F. & Maldonado, R. (2003) Effects of nandrolone on acute morphine responses, tolerance and dependence in mice. *European Journal of Pharmacology* **465**, 69-81.
- Choi, P. Y. & Pope, H. G., Jr. (1994) Violence toward women and illicit androgenic-anabolic steroid use. *Annals of Clinical Psychiatry* **6**, 21-25.
- Ciocca, M. (2005) Medication and supplement use by athletes. *Clinics in Sports Medicine* **24**, 719-738.

- Clark, A. S., Costine, B. A., Jones, B. L., Kelton-Rehkopf, M. C., Meerts, S. H., Nutbrown-Greene, L. L., Penatti, C. A., Porter, D. M., Yang, P. & Henderson, L. P. (2006) Sex- and age-specific effects of anabolic androgenic steroids on reproductive behaviors and on GABAergic transmission in neuroendocrine control regions. *Brain Research* **1126**, 122-138.
- Clark, A. S. & Henderson, L. P. (2003) Behavioral and physiological responses to anabolic-androgenic steroids. *Neuroscience and Biobehavioral Reviews* **27**, 413-436.
- Cohen, J., Collins, R., Darkes, J. & Gwartney, D. (2007) A league of their own: demographics, motivations and patterns of use of 1,955 male adult non-medical anabolic steroid users in the United States. *Journal of the International Society of Sports Nutrition* **4**, 12.
- Conigrave, K. M., Saunders, J. B. & Reznik, R. B. (1995) Predictive capacity of the AUDIT questionnaire for alcohol-related harm. *Addiction* **90**, 1479-1485.
- Copeland, J., Peters, R. & Dillon, P. (1998) A study of 100 anabolic-androgenic steroid users. *Medical Journal of Australia* **168**, 311-312.
- Corcoran, J. P. & Longo, E. D. (1992) Psychological treatment of anabolic-androgenic steroid-dependent individuals. *Journal of Substance Abuse Treatment* **9**, 229-235.
- Cowan, C. B. (1994) Depression in anabolic steroid withdrawal. *Irish Journal of Psychological Medicine* **11**, 27-28.
- D'Andrea, A., Caso, P., Salerno, G., Scarafile, R., De Corato, G., Mita, C., Di Salvo, G., Severino, S., Cuomo, S., Liccardo, B., Esposito, N. & Calabro, R. (2007) Left ventricular early myocardial dysfunction after chronic misuse of anabolic androgenic steroids: a Doppler myocardial and strain imaging analysis. *British Journal of Sports Medicine* **41**, 149-155.
- Dabbs, J. M., Jr., Frady, R. L., Carr, T. S. & Besch, N. F. (1987) Saliva testosterone and criminal violence in young adult prison inmates. *Psychosomatic Medicine* **49**, 174-182.
- David, K., Dingermanse, E., Freud, J. & Laqueur, E. (1935) Über Kristallinisches männliches Hormon aus Hoden (Testosteron) wirksamer als aus Harn oder Cholesterin Bereitetes, Androsteron (Crystalline male hormon from testes (testosterone) more active than androsterone preparations from urin or cholesterol). *Zeitschrift Physiologische Chemie* **233**, 281-293.
- De Kruif, P. (1945) *The male hormone*. Brace and Company, Harcourt.
- De Kruif, P. (1947) *Hormonerna gör mannen*. Bokförlaget Natur och Kultur, Stockholm.
- DesJardins, M. (2002) Supplement use in the adolescent athlete. *Current Sports Medicine Reports* **1**, 369-373.
- Di Pasquale, M. (1984) *Drug use and detection in amateur sports*. M.G.D. Press, Warkworth.
- Dotson, J. L. & Brown, R. T. (2007) The history of the development of anabolic-androgenic steroids. *Pediatric Clinics of North America* **54**, 761-769.
- Eklof, A. C., Thurelius, A. M., Garle, M., Rane, A. & Sjoqvist, F. (2003) The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology. *European Journal of Clinical Pharmacology* **59**, 571-577.

- Evans, N. A. (1997) Gym and tonic: a profile of 100 male steroid users. *British Journal of Sports Medicine* **31**, 54-58.
- Evans, N. A. (2004) Current concepts in anabolic-androgenic steroids. *American Journal of Sports Medicine* **32**, 534-542.
- Evans, P. J. & Lynch, R. M. (2003) Insulin as a drug of abuse in body building. *British Journal of Sports Medicine* **37**, 356-357.
- FASS. (2009) FASS Läkemedel i Sverige. LINFO Läkemedelsinformation AB, Stockholm.
- Ferrando, A. A., Tipton, K. D., Doyle, D., Phillips, S. M., Cortiella, J. & Wolfe, R. R. (1998) Testosterone injection stimulates net protein synthesis but not tissue amino acid transport. *American Journal of Physiology* **275**, 864-871.
- Fineschi, V., Riezzo, I., Centini, F., Silingardi, E., Licata, M., Beduschi, G. & Karch, S. B. (2007) Sudden cardiac death during anabolic steroid abuse: morphologic and toxicologic findings in two fatal cases of bodybuilders. *International Journal of Legal Medicine* **121**, 48-53.
- Franke, W. W. & Berendonk, B. (1997) Hormonal doping and androgenization of athletes: a secret program of the German Democratic Republic government. *Clinical Chemistry* **43**, 1262-1279.
- Freeman, E. R., Bloom, D. A. & McGuire, E. J. (2001) A brief history of testosterone. *Journal of Urology* **165**, 371-373.
- Funk, C., Harrow, B. & Lejwa, A. (1930) The male hormone. *American Journal of Physiology* **92**, 1680-1687.
- Gallaway, S. (1997) *The steroid bible*. Belle international, Sacramento.
- Ganrot, P. O., Grubb, A. & Stenflo, J. (1997) *Laurells Klinisk kemi i praktisk medicin*. 7 ed, Studentlitteratur, Lund.
- Glazer, G. (1991) Atherogenic effects of anabolic steroids on serum lipid levels. A literature review. *Archives of Internal Medicine* **151**, 1925-1933.
- Graham, M. R., Evans, P., Davies, B. & Baker, J. S. (2008) AAS, growth hormone, and insulin abuse: psychological and neuroendocrine effects. *Therapeutics and Clinical Risk Management* **4**, 587-597.
- Grogan, S., Shepherd, S., Evans, R., Wright, S. & Hunter, G. (2006) Experiences of anabolic steroid use: in-depth interviews with men and women body builders. *Journal of Health Psychology* **11**, 845-856.
- Gruber, A. J. & Pope, H. G., Jr. (2000) Psychiatric and medical effects of anabolic-androgenic steroid use in women. *Psychotherapy and Psychosomatics* **69**, 19-26.
- Hall, R. C. (2005) Abuse of supraphysiologic doses of anabolic steroids. *Southern Medical Journal* **98**, 550-555.
- Hall, R. C., Hall, R. C. & Chapman, M. J. (2005) Psychiatric complications of anabolic steroid abuse. *Psychosomatics* **46**, 285-290.
- Haller, C. A. & Benowitz, N. L. (2000) Adverse cardiovascular and central nervous system events associated with dietary supplements containing ephedra alkaloids. *New England Journal of Medicine* **343**, 1833-1838.
- Haupt, H. A. & Rovere, G. D. (1984) Anabolic steroids: a review of the literature. *American Journal of Sports Medicine* **12**, 469-484.
- Hickson, R. C., Ball, K. L. & Falduto, M. T. (1989) Adverse effects of anabolic steroids. *Medical Toxicology and Adverse Drug Experience* **4**, 254-271.
- Hoberman, J. M. & Yesalis, C. E. (1995) The history of synthetic testosterone. *Scientific American* **272**, 76-81.

- Isacson, G., Garle, M., Ljung, E. B., Asgard, U. & Bergman, U. (1998) Anabolic steroids and violent crime-an epidemiological study at a jail in Stockholm, Sweden. *Comprehensive Psychiatry* **39**, 203-205.
- Jenkins, P. J. (2001) Growth hormone and exercise: physiology, use and abuse. *Growth Hormone and IGF Research* **11**, 71-77.
- Johansson, P., Lindqvist, A., Nyberg, F. & Fahlke, C. (2000) Anabolic androgenic steroids affects alcohol intake, defensive behaviors and brain opioid peptides in the rat. *Pharmacology, Biochemistry and Behavior* **67**, 271-279.
- Kanayama, G., Boynes, M., Hudson, J. I., Field, A. E. & Pope, H. G., Jr. (2007) Anabolic steroid abuse among teenage girls: An illusory problem? *Drug and Alcohol Dependence* **88**, 156-162.
- Kanayama, G., Cohane, G. H., Weiss, R. D. & Pope, H. G. (2003a) Past anabolic-androgenic steroid use among men admitted for substance abuse treatment: an underrecognized problem? *Journal of Clinical Psychiatry* **64**, 156-160.
- Kanayama, G., Hudson, J. I. & Pope, H. G., Jr. (2008) Long-term psychiatric and medical consequences of anabolic-androgenic steroid abuse: a looming public health concern? *Drug and Alcohol Dependence* **98**, 1-12.
- Kanayama, G., Pope, H. G., Cohane, G. & Hudson, J. I. (2003b) Risk factors for anabolic-androgenic steroid use among weightlifters: a case-control study. *Drug and Alcohol Dependence* **71**, 77-86.
- Karila, T. A., Karjalainen, J. E., Mantysaari, M. J., Viitasalo, M. T. & Seppala, T. A. (2003) Anabolic androgenic steroids produce dose-dependant increase in left ventricular mass in power athletes, and this effect is potentiated by concomitant use of growth hormone. *International Journal of Sports Medicine* **24**, 337-343.
- Kashkin, K. B. & Kleber, H. D. (1989) Hooked on hormones? An anabolic steroid addiction hypothesis. *JAMA* **262**, 3166-3170.
- Kicman, A. T. (2008) Pharmacology of anabolic steroids. *British Journal of Pharmacology* **154**, 502-521.
- Kicman, A. T. & Gower, D. B. (2003) Anabolic steroids in sport: biochemical, clinical and analytical perspectives. *Annals of Clinical Biochemistry* **40**, 321-356.
- Kindlundh, A. M., Hagekull, B., Isacson, D. G. & Nyberg, F. (2001) Adolescent use of anabolic-androgenic steroids and relations to self-reports of social, personality and health aspects. *European Journal of Public Health* **11**, 322-328.
- Kindlundh, A. M., Isacson, D. G., Berglund, L. & Nyberg, F. (1998) Doping among high school students in Uppsala, Sweden: A presentation of the attitudes, distribution, side effects, and extent of use. *Scandinavian Journal of Social Medicine* **26**, 71-74.
- Kindlundh, A. M., Isacson, D. G., Berglund, L. & Nyberg, F. (1999) Factors associated with adolescent use of doping agents: anabolic-androgenic steroids. *Addiction* **94**, 543-553.
- Klotz, F., Garle, M., Granath, F. & Thiblin, I. (2006) Criminality among individuals testing positive for the presence of anabolic androgenic steroids. *Archives of General Psychiatry* **63**, 1274-1279.
- Klotz, F., Petersson, A., Isacson, D. & Thiblin, I. (2007) Violent crime and substance abuse: a medico-legal comparison between deceased users of anabolic androgenic steroids and abusers of illicit drugs. *Forensic Science International* **173**, 57-63.

- Kochakian, C. D. (1988) The evolution from "the male hormone" to anabolic-androgenic steroids. *Alabama Journal of Medical Sciences* 25, 96-102.
- Kochakian, C. D. (1993) History, chemistry and pharmacodynamics of anabolic androgenic steroid. *Weiner medizinische wochenschrift* 143, 359-363.
- Kochakian, C. D. & Yesalis, C. E. (2000a) Anabolic-androgenic steroids: a historical perspective and definition. In: Yesalis, C. E. (ed) *Anabolic steroids in sport and exercise*. 2 ed, Human Kinetics, Champaign, pp. 17-50.
- Kochakian, C. D. & Yesalis, C. E. (2000b) Veterinary applications. In: Yesalis, C. E. (ed) *Anabolic steroids in sport and exercise*. 2 ed, Human Kinetics, Champaign, pp. 40-41.
- Korkia, P., Lenehan, P. & McVeigh, J. (1996) Non-medical use of androgens among women. *Journal of Performance Enhancing Drugs* 1, 71-76.
- Korkia, P. & Stimson, G. V. (1997) Indications of prevalence, practice and effects of anabolic steroid use in Great Britain. *International Journal of Sports Medicine* 18, 557-562.
- Kouri, E. M., Lukas, S. E., Pope, H. G., Jr. & Oliva, P. S. (1995) Increased aggressive responding in male volunteers following the administration of gradually increasing doses of testosterone cypionate. *Drug and Alcohol Dependence* 40, 73-79.
- Kuhn, C. M. (2002) Anabolic steroids. *Recent Progress in Hormone Research* 57, 411-434.
- Kutscher, E. C., Lund, B. C. & Perry, P. J. (2002) Anabolic steroids: a review for the clinician. *Sports Medicine* 32, 285-296.
- Kvale, S. (2007) *Doing interviews*. SAGE Publications Ltd, Thousands Oak.
- Lattavo, A., Kopperud, A. & Rogers, P. D. (2007) Creatine and other supplements. *Pediatric Clinics of North America* 54, 735-760.
- Lindsay, B. D. (2002) Are serious adverse cardiovascular events an unintended consequence of the Dietary Supplement Health and Education Act of 1994? *Mayo Clinic Proceedings* 77, 7-9.
- Ljungqvist, A. (1975) The use of anabolic steroids in top Swedish athletes. *British Journal of Sports Medicine* 9, 82.
- Llewellyn, W. (2007) *Anabolics 2007*. 6 ed, Molecular Nutrition, Jupiter.
- Lode, A. (1891) Zur Transplantation der Hoden bei Hahnen: (The transplantation of the testis in roosters): Part I. *Wiener Klinische Wochenschrift* 4, 847.
- Lode, A. (1895) Zur Transplantation der Hoden bei Hahnen: (The transplantation of the testis in roosters): Part II. *Wiener Klinische Wochenschrift* 8, 341-346.
- Luicidi, F., Grano, C., Leone, L., Lombardo, C. & Pesce, C. (2004) Determinants of the intention to use doping substances: an empirical contribution in a sample of Italian adolescents. *International Journal of Sport Psychology* 35, 333-357.
- Lukas, S. E. (1993) Current perspectives on anabolic-androgenic steroid abuse. *Trends in Pharmacological Sciences* 14, 61-68.
- Malone, D. A., Jr., Dimeff, R. J., Lombardo, J. A. & Sample, R. H. (1995) Psychiatric effects and psychoactive substance use in anabolic-androgenic steroid users. *Clinical Journal of Sport Medicine* 5, 25-31.
- Malvey, T. C. & Armsey, T. D., 2nd (2005) Tetrahydrogestrinone: the discovery of a designer steroid. *Current Sports Medicine Reports* 4, 227-230.
- Marshall, E. (1988) The drug of champions. *Science* 242, 183-184.
- Maughan, R. J. (2005) Contamination of dietary supplements and positive drug tests in sport. *Journal of Sports Sciences* 23, 883-889.

- Maughan, R. J., King, D. S. & Lea, T. (2004) Dietary supplements. *Journal of Sports Sciences* **22**, 95-113.
- Medras, M. & Tworowska, U. (2001) [Treatment strategies of withdrawal from long-term use of anabolic-androgenic steroids]. *Polski Merkuriusz Lekarski* **11**, 535-538.
- Middleman, A. B. & DuRant, R. H. (1996) Anabolic steroid use and associated health risk behaviours. *Sports Medicine* **21**, 251-255.
- Middleman, A. B., Faulkner, A. H., Woods, E. R., Emans, S. J. & DuRant, R. H. (1995) High-risk behaviors among high school students in Massachusetts who use anabolic steroids. *Pediatrics* **96**, 268-272.
- Mishler, E. G. (1995) Models of Narrative Analysis: A Typology. *Journal of Narrative and Life History* **5**, 87-123.
- Monaghan, L. (2002) Vocabularies of motive for illicit steroid use among bodybuilders. *Social Science and Medicine* **55**, 695-708.
- Morrison, C. L. (1996) Cocaine misuse in anabolic steroid users. *Journal of Performance Enhancing Drugs* **1**, 10-15.
- Mottram, D. R. & George, A. J. (2000) Anabolic steroids. *Baillieres Best Practice and Research. Clinical Endocrinology & Metabolism* **14**, 55-69.
- Nilsson, S. (1995) Androgenic anabolic steroid use among male adolescents in Falkenberg. *European Journal of Clinical Pharmacology* **48**, 9-11.
- Nilsson, S. (2003). *Misuse of anabolic steroids in youth: trends, attitudes and evaluation of an intervention programme*. [Doctoral Dissertation]. Göteborg University, Göteborg.
- Nilsson, S., Baigi, A., Marklund, B. & Fridlund, B. (2001) Trends in the misuse of androgenic anabolic steroids among boys 16-17 years old in a primary health care area in Sweden. *Scandinavian Journal of Primary Health Care* **19**, 181-182.
- O'Hare, T. & Sherrer, M. V. (1999) Validating the Alcohol Use Disorder Identification Test with college first-offenders. *Journal of Substance Abuse Treatment* **17**, 113-119.
- O'Sullivan, A. J., Kennedy, M. C., Casey, J. H., Day, R. O., Corrigan, B. & Wodak, A. D. (2000) Anabolic-androgenic steroids: medical assessment of present, past and potential users. *Medical Journal of Australia* **173**, 323-327.
- Olivardia, R., Pope, H. G., Jr. & Hudson, J. I. (2000) Muscle dysmorphia in male weightlifters: a case-control study. *American Journal of Psychiatry* **157**, 1291-1296.
- Olrich, T. W. & Ewing, M. E. (1999) Life on steroids: Bodybuilders describe their perceptions of the anabolic-androgenic steroid use period. *Sport Psychologist* **13**, 299-312.
- Pagonis, T. A., Angelopoulos, N. V., Koukoulis, G. N. & Hadjichristodoulou, C. S. (2006a) Psychiatric side effects induced by supraphysiological doses of combinations of anabolic steroids correlate to the severity of abuse. *European Psychiatry* **21**, 551-562.
- Pagonis, T. A., Angelopoulos, N. V., Koukoulis, G. N., Hadjichristodoulou, C. S. & Toli, P. N. (2006b) Psychiatric and hostility factors related to use of anabolic steroids in monozygotic twins. *European Psychiatry* **21**, 563-569.
- Parkinson, A. B. & Evans, N. A. (2006) Anabolic androgenic steroids: a survey of 500 users. *Medicine and Science in Sports and Exercise* **38**, 644-651.

- Parrott, A. C., Choi, P. Y. & Davies, M. (1994) Anabolic steroid use by amateur athletes: effects upon psychological mood states. *Journal of Sports Medicine and Physical Fitness* **34**, 292-298.
- Parssinen, M., Karila, T., Kovanen, V. & Seppala, T. (2000) The effect of supraphysiological doses of anabolic androgenic steroids on collagen metabolism. *International Journal of Sports Medicine* **21**, 406-411.
- Parssinen, M. & Seppala, T. (2002) Steroid use and long-term health risks in former athletes. *Sports Medicine* **32**, 83-94.
- Perry, P. J., Yates, W. R. & Andersen, K. H. (1990) Psychiatric symptoms associated with anabolic steroids: a controlled retrospective study. *Annals of Clinical Psychiatry* **2**, 11-17.
- Petersson, A., Garle, M., Granath, F. & Thiblin, I. (2006) Morbidity and mortality in patients testing positively for the presence of anabolic androgenic steroids in connection with receiving medical care A controlled retrospective cohort study. *Drug and Alcohol Dependence* **81**, 215-220.
- Pezard, A. (1911) Sur la determination des caracteres sexuels secondaire chez les gallinaces (The determination of the secondary sexual characteristics of fowl). *Compte Rendu Academie des Sciences* **153**, 1027-1032.
- Pezard, A. (1912) Sur la determination des caracteres sexuels secondaire chez les gallinaces (The determination of the secondary sexual characteristics of fowl). *Compte Rendu Academie des Sciences* **154**, 1183-1186.
- Phillips, B. (1996) *Doping. Medicinbruk inom idrotten*. Hilon förlag, Oppsal.
- Pipe, A. & Ayotte, C. (2002) Nutritional supplements and doping. *Clinical Journal of Sport Medicine* **12**, 245-249.
- Pope, H. G., Jr. & Kanayama, G. (2004) Bodybuilding's dark side: Clues to anabolic steroid use. *Current Psychiatry* **3**.
- Pope, H. G., Jr. & Kanayama, G. (2005) Can you tell if your patient is using anabolic steroids? *Current Psychiatry in Primary care* **1**.
- Pope, H. G., Jr. & Katz, D. L. (1988) Affective and psychotic symptoms associated with anabolic steroid use. *American Journal of Psychiatry* **145**, 487-490.
- Pope, H. G., Jr. & Katz, D. L. (1990) Homicide and near-homicide by anabolic steroid users. *Journal of Clinical Psychiatry* **51**, 28-31.
- Pope, H. G., Jr. & Katz, D. L. (1994) Psychiatric and medical effects of anabolic-androgenic steroid use. A controlled study of 160 athletes. *Archives of General Psychiatry* **51**, 375-382.
- Pope, H. G., Jr. & Katz, D. L. (2003) Psychiatric effects of exogenous anabolic-androgenic steroids. In: Wolkowitz, O. M. & Rothschild, A. J. (eds) *Psychoneuro-endocrinology, the scientific basis of clinical practice*. American Psychiatric Publishing, Inc, London, pp. 331-358.
- Pope, H. G., Jr., Kouri, E. M., Powell, K. F., Campbell, C. & Katz, D. L. (1996) Anabolic-androgenic steroid use among 133 prisoners. *Comprehensive Psychiatry* **37**, 322-327.
- Rennie, M. J. (2003) Claims for the anabolic effects of growth hormone: a case of the emperor's new clothes? *British Journal of Sports Medicine* **37**, 100-105.
- Ruzicka, L. & Wettstein, A. (1935) Über die kristallinische Herstellung des Testikelhormons, Testosteron (Androsten-3-ol-17-ol) (The crystalline production of the testicle hormone, testosterone (Androsten-3-ol-17-ol)). *Helvetica Chimica Acta* **18**, 1264-1275.

- Sader, M. A., Griffiths, K. A., McCredie, R. J., Handelsman, D. J. & Celmajer, D. S. (2001) Androgenic anabolic steroids and arterial structure and function in male bodybuilders. *Journal of the American College of Cardiology* 37, 224-230.
- Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R. & Grant, M. (1993) Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-II. *Addiction* 88, 791-804.
- Schneider, S. L. (2007) Experimental and quasi-experimental designs in behavioral research: on context, crud, and convergence. In: Outhwaite, W. & Turner, S. P. (eds) *The SAGE handbook of Social Science Methodology*. SAGE, Thousand Oaks, pp. 172-189.
- Selin, K. H. (2003) Test-retest reliability of the alcohol use disorder identification test in a general population sample. *Alcoholism, Clinical and Experimental Research* 27, 1428-1435.
- Shevlin, M. & Smith, G. W. (2007) The factor structure and concurrent validity of the alcohol use disorder identification test based on a nationally representative UK sample. *Alcohol and Alcoholism* 42, 582-587.
- Sjoqvist, F., Garle, M. & Rane, A. (2008) Use of doping agents, particularly anabolic steroids, in sports and society. *Lancet* 371, 1872-1882.
- Snow, D., Lofland, J. & Lofland, L. (2005) *Analyzing social settings: a guide to qualitative observations and analysis*. Wadsworth Publishing Company, Belmont.
- Spencer, R. F. (1946) The cultural aspects of eunuchism. *CIBA Symposia* 8, 406-420.
- Starling, E. H. (1905) The chemical correlation of the functions of the body. *Lancet* 1, 339-341.
- Su, T. P., Pagliaro, M., Schmidt, P. J., Pickar, D., Wolkowitz, O. & Rubinow, D. R. (1993) Neuropsychiatric effects of anabolic steroids in male normal volunteers. *JAMA* 269, 2760-2764.
- Talih, F., Fattal, O. & Malone, D., Jr. (2007) Anabolic steroid abuse: psychiatric and physical costs. *Cleveland Clinic Journal of Medicine* 74, 341-352.
- Tashakkori, A. & Teddlie, C. (2003) *Mixed methodology -combining qualitative and quantitative approaches*. SAGE, Thousand Oaks.
- Tentori, L. & Graziani, G. (2007) Doping with growth hormone/IGF-1, anabolic steroids or erythropoietin: is there a cancer risk? *Pharmacological Research* 55, 359-369.
- Terjung, R. L., Clarkson, P., Eichner, E. R., Greenhaff, P. L., Hespel, P. J., Israel, R. G., Kraemer, W. J., Meyer, R. A., Spriet, L. L., Tarnopolsky, M. A., Wagenmakers, A. J. & Williams, M. H. (2000) American College of Sports Medicine roundtable. The physiological and health effects of oral creatine supplementation. *Medicine and Science in Sports and Exercise* 32, 706-717.
- Thiblin, I., Kristiansson, M. & Rajs, J. (1997) Anabolic androgenic steroids and behavioural patterns among violent offenders. *Journal of Forensic Psychiatry* 8, 299-310.
- Thiblin, I., Lindquist, O. & Rajs, J. (2000) Cause and manner of death among users of anabolic androgenic steroids. *Journal of Forensic Sciences* 45, 16-23.
- Thiblin, I., Mobini-Far, H. & Frisk, M. (2009) Sudden unexpected death in a female fitness athlete, with a possible connection to the use of anabolic androgenic steroids (AAS) and ephedrine. *Forensic Science International* 184, 7-11.

- Thiblin, I. & Parlklo, T. (2002) Anabolic androgenic steroids and violence. *Acta Psychiatrica Scandinavica. Supplementum* **412**, 125-128.
- Thiblin, I. & Petersson, A. (2005) Pharmacoevidence of anabolic androgenic steroids: a review. *Fundamental and Clinical Pharmacology* **19**, 27-44.
- Thiblin, I., Runeson, B. & Rajs, J. (1999) Anabolic androgenic steroids and suicide. *Annals of Clinical Psychiatry* **11**, 223-231.
- Todd, T. (1987) Anabolic steroids: the gremlins of sport. *Journal of Sport History* **14**, 87-107.
- Tricker, R., Casaburi, R., Storer, T. W., Clevenger, B., Berman, N., Shirazi, A. & Bhasin, S. (1996) The effects of supraphysiological doses of testosterone on angry behavior in healthy eugonadal men-a clinical research center study. *Journal of Clinical Endocrinology and Metabolism* **81**, 3754-3758.
- Urhausen, A., Albers, T. & Kindermann, W. (2004) Are the cardiac effects of anabolic steroid abuse in strength athletes reversible? *Heart* **90**, 496-501.
- Wilson-Fearon, C. & Parrott, A. C. (1999) Multiple drug use and dietary restraint in a Mr. Universe competitor: psychobiological effects. *Perceptual and Motor Skills* **88**, 579-580.
- Wines, J. D., Jr., Gruber, A. J., Pope, H. G., Jr. & Lukas, S. E. (1999) Nalbuphine hydrochloride dependence in anabolic steroid users. *American Journal on Addictions* **8**, 161-164.

STUDY I

Research

Open Access

Troubled social background of male anabolic-androgenic steroid abusers in treatment

Kurt Skarberg^{1,2} and Ingemar Engstrom*¹

Address: ¹Department of Clinical Medicine, Psychiatric Research Centre, Orebro University, Sweden and ²Addiction Centre, Orebro County Council, Orebro, Sweden

Email: Kurt Skarberg - kurt.skarberg@orebroll.se; Ingemar Engstrom* - ingemar.engstrom@orebroll.se

* Corresponding author

Published: 5 July 2007

Received: 24 May 2007

Substance Abuse Treatment, Prevention, and Policy 2007, 2:20 doi:10.1186/1747-597X-2-20

Accepted: 5 July 2007

This article is available from: <http://www.substanceabusepolicy.com/content/2/1/20>

© 2007 Skarberg and Engstrom; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: The aim of this study was to investigate the social background and current social situation of male abusers of anabolic-androgenic steroids (AAS).

Methods: We compared thirty-four AAS-abusing patients from an Addiction Centre (AC) with two groups, 18 users and 259 non-users of AAS from a public gym in Orebro, Sweden. The study is based on semi-structured interviews and questionnaires.

Results: Histories of a troubled childhood as well as current social disadvantage were both more frequent among the AAS users. Users also reported poor relationships with their parents and almost half of them had experienced physical or mental abuse. The AC group's experiences from school were mostly negative, and included concentration problems, boredom and learning difficulties. Their current circumstance included abuse of other drugs, battering of spouses and other criminality such as assault, illegal possession of weapons and theft.

Conclusion: In conclusion, this study shows that abusers of AAS often have a troubled social background. This underlines the importance of making a thorough social assessment as a part of the treatment programme. The results of the study may help in directing appropriate questions relevant to the abuse of AAS.

Background

Experimenting with anabolic-androgenic steroids (AAS) has been common among athletes for several decades [1]. In the 1950s and 1960s, usage was almost entirely restricted to highly trained athletes [2]. Later, AAS abuse spread from professional to high school sports performers [3] and these substances are now also being abused by those whose training is purely recreational and/or cosmetic [4].

Today, the abuse of AAS is thus no longer confined to elite athletes but can be found among various groups of people. Until recently, AAS abusers were rarely seen at addiction clinics in Sweden, but today they have begun seeking help there. Unfortunately, even clinicians working at addiction clinics frequently neglect to ask about AAS in their history taking [5]. It has therefore become important to encourage the systematic gathering of information about the lives and backgrounds of these patients, so that effective treatment programmes may be designed.

The abuse of AAS is often combined with use of other hormones such as growth hormone (GH), insulin, thyroid hormone, insulin-like growth factor 1 (IGF 1) [6], other doping agents such as Clenbuterol, Ephedrine, Tamoxifen, Gammahydroxybutyrate (GHB) [7] and other drugs [8,9]. These doping agents are also known as "body image" drugs [10].

AAS may cause medical and psychiatric illness [11-13], including dependence syndromes [7], psychological dependence [14] or withdrawal symptoms, such as AAS craving [7]. AAS may also stimulate aggressive behaviour, criminal activity, violence [15,16], and suicide and homicide [17]. These side-effects may also put those who come into contact with abusers at risk [18]. It is therefore imperative that we enhance current knowledge about AAS abusers.

To our knowledge, no specific studies of the social backgrounds of AAS abusers have previously been carried out. Some studies, however, provide information about risk factors for AAS abuse, which may be of a social nature.

There is consensus that AAS use is more common among males than females [9,19-21]. It has been noted that AAS abusers often have poor relationships with their fathers [22]. Other risk factors that have been reported are unsupervised recreation, poor social support [4] and a clear avoidance of social contacts [23].

The significance of peer pressure as a trigger for AAS abuse has been emphasized by many researchers [14,24-26]. Seeing friends suddenly grow and gain bulk may encourage others in a group to try AAS [25]. A Swedish study [27] found that AAS abusers reported poorer relationships with their peers and lower levels of academic achievement than non-users. Other risk factors may be dissatisfaction with school, living alone at an early age, repeated truancy from school and frequent strength training [9].

A history of behavioural disorders in childhood is often reported by AAS abusers [22] as is hyperactivity [18]. Abusers have also been shown to have low self-esteem [16,27] and/or self-confidence [22].

Our survey of the literature found no specific studies of the social backgrounds of AAS abusers. The available information is mostly derived from questionnaires used in high schools, while we have found none that examines the social circumstances of those who attend addiction clinics. We therefore consider it highly relevant to explore this question from a clinical perspective.

The aim of this study was to describe the social background and current social situation of AAS abusers who

were seeking treatment at an addiction centre and to compare the findings with findings from gym clients with and without a history of AAS abuse. We propose that knowledge in this area is of importance for the appropriate design of treatment programmes for AAS abusers.

Methods

Selection of subjects

The male AAS-abusers were consecutively included under three years from a psychiatric addiction clinic (AC) (Beroendecentrum) in Orebro county, central Sweden, a county of 275 000 inhabitants. The inclusion criteria for patients were that they must: a) be over 16 years of age, b) be fluent in Swedish, c) be using non-prescribed AAS, alone or in combination with other doping agents, d) have been using AAS for at least four consecutive months and e) be under care in the addiction clinic where a decision to commence treatment had been agreed upon following with an intention to treat, based on the initial clinical assessment. The AC AAS abusing group, from now on called AC group, consisted of 34 male patients.

The comparison groups were recruited from gym clients in Orebro. These groups were chosen because all individuals in the AC group were gym clients, a finding that has been noted in earlier studies [22]. Participants for the study were sought by putting up posters at the gym. Two hundred eighty nine males responded to the questionnaire. 12 people, who did not answer the questions about hormones, were excluded from the study. Those who then remained, 277 people, were divided into two comparison groups: 18 male gym clients who had used AAS at some time and 259 male gym clients who had not used AAS at any time, according to their self-report. Both of these groups fell into the same age range as the AAS group (18-45 years).

Questionnaire

The AC group were interviewed using a semi-structured format that was based on a clinical interview structure that had been used at the clinic for several years for investigating social factors. The interview consisted of questions concerning the person's social background and current social situation. The questions about social background covered family history, contact with parents and other relatives, physical or mental abuse, school experiences, education, vocational training, criminality, drug use history and relations with partners. Questions about the person's current social situation concerned their housing, occupation, ongoing physical training and current use of alcohol and drugs.

For our comparison groups we designed a 50-item questionnaire, based wholly on the interview format described above. The questions were kept as close as possible to the

Table 1: Comparison of basic biological data between AAS users in two groups and non-users.

	AC group, n = 34		Gym, AAS-users, n = 18		Gym, non-users, n = 259		p-value ¹
	Mean	SD	Mean	SD	Mean	SD	
Age (years)	27.2	5.7	34.8	8.4	26.1	7.0	<0.001
Height (cm)	179.0	6.2	177.8	5.4	181.1	6.6	<0.05
Weight (kg)	100.4	18.4	94.3	13.5	83.2	12.4	<0.001
BMI ²	31.12	5.04	29.73	3.42	25.32	3.31	<0.001
First used AAS (years)	20.69	4.03	-	-	-	-	

¹ Oneway ANOVA for equality of means (df 2, 308).

² Body Mass Index (kg/m²)

interview schema. The answer options were derived from the answers we received in the interviews with the addition of a few extra, open alternatives. The questions concerning alcohol consumption were taken from AUDIT (The Alcohol Use Disorders Identification Test), which was developed by the World Health Organization [28] and which has been translated into Swedish [29]. The questionnaire was distributed through the reception at the gym. Respondents left their questionnaires anonymously in sealed envelopes dropped into a box.

Dropout analysis

No one in the AC group declined to participate in the study. The results from the 12 potential participants in the gym who were excluded due to a history of AAS abuse will, however, be analysed separately.

Ethical approval

The study protocol was approved by the Research Ethics committee of Orebro County Council, # 538/99.

Statistics

Statistical analysis of numerical data was carried out using a one-way ANOVA for equality of means and two-sided Fisher's exact test for comparison of three groups. The SPSS software package version 14.0 was used. A significance level of $p < 0,05$ was considered appropriate.

Results

Age and biological data

The mean age of the AC group was 27.2 years, for the non-users 26.1 years and for the gym AAS-abusers 34.8 years (all in the range 18–45). The mean age of initial use of AAS in the AC-group was 20.7 years (range 15–30) (not known in the gym AAS-abuser group).

Table 1 shows that the groups differed significantly, with respect to weight and BMI. The AAS-abusers from the gym were on average older and shorter than the other groups. The AC group tended to be heavier than the other groups.

Social background

The social background variables are presented in table 2. Almost all of the participants were born in Sweden (in total 93 %) and 79 % came from families in which both parents had been born in Sweden. There were no significant differences between the groups in this respect. Sixty-two percent of the AC group grew up with both parents, while 67 % of the gym AAS-abusers and 79 % of the non-using group did so. Growing up with only their mother or with someone other than one's own parents (usually grandparents) was thus more common among members of the AAS groups compared to the non-user group.

The majority of the members of the AC group had divorced parents. The divorce had generally taken place later in the AC group than in the comparison groups; only six percent had divorced before the child had started school while the corresponding figure for the gym group was 50 % and for the non-using group, 37 %.

The groups differed significantly in how they evaluated their relationships with their parents. When they were asked to qualify their contact with their mother and father respectively as either "good", "bad" or "indifferent" the vast majority of the members of the non-using group described their relationship with their mother as good. Least good relationship with their mother reported the AC group. The same result were found with regard to the relation with their father. Best relations were found among the members of the non-using group and least good in the AC group.

We asked the participants if there had been any significant other person available to them when they were children. The responses we received from members of the three groups showed no significant differences. However, all three groups noted grandfathers as the most significant other persons in their lives: sixty-eight percent of the non-using group, 50 % of gym AAS-abusers and 23 % of the AC group.

Table 2: Comparison of social background between AAS users in two groups and non-users.

		AC group, n = 34		Gym, AAS- users, n = 18		Gym, non-users, n = 259		p-value ¹
		%	n	%	n	%	n	
Born in Sweden	Yes	97.1	33	88.9	16	92.7	240	0.475
	No	2.9	1	11.1	2	7.3	19	
Parents born in Sweden	Both	88.3	30	61.1	11	79.5	206	0.187
	One	8.8	3	22.2	4	11.2	29	
	None	2.9	1	16.7	3	9.3	24	
Brought up with....	Both biological parents	62.5	20	66.7	12	78.9	203	<0.05
	Mother only	28.1	9	27.8	5	18.7	48	
	Father only	0.0	0	0.0	0	1.2	3	
	Other	9.4	3	5.6	1	1.2	3	
Quality of upbringing	Good	43.8	14	72.2	13	87.2	224	<0.001
	Indifferent	15.6	5	5.6	1	10.1	26	
	Bad	40.6	13	22.2	4	2.7	7	
Single child	Yes	27.3	9	35.3	6	13.9	36	<0.05
	No	72.7	24	64.7	11	86.1	223	
Divorced parents	Yes	59.4	19	44.4	8	38.3	98	0.071
	No	40.6	13	55.6	10	61.7	158	
Age at the time of divorce (years)	0-6	5.9	1	50.0	4	37.0	34	<0.05
	7-12	41.2	7	12.5	1	20.6	19	
	>12	52.9	9	37.5	3	42.4	39	
Relation with mother	Good	68.7	22	88.9	16	93.7	239	<0.001
	Indifferent	21.9	7	5.6	1	5.5	14	
	Bad	9.4	3	5.6	1	0.8	2	
Relation with father	Good	46.9	15	61.1	11	76.1	194	0.001
	Indifferent	28.1	9	5.6	1	8.6	22	
	Bad	25.0	8	33.3	6	15.3	39	
Other significant person	Yes	54.5	18	58.8	10	65.4	168	0.401
	No	45.5	15	41.2	7	34.6	89	
Physically abused	Yes	30.3	10	22.2	4	5.8	15	0.001
	No	69.7	23	77.8	14	94.2	242	
Mentally abused	Yes	48.5	16	27.8	5	10.2	26	<0.001
	No	51.5	17	72.2	13	89.8	230	
Age at the time of moving away from home (years)	Not yet moved	7.1	2	0.0	0	14.4	36	0.090
	11-15	10.7	3	0.0	0	2.4	6	
	16-20	60.7	17	82.4	14	52.0	130	
	21-25	21.5	6	17.6	3	30.8	77	
	>25	0.0	0	0.0	0	0.4	1	
Drug abuse in the family	Yes	43.7	14	35.3	6	19.9	51	<0.01
	No	56.3	18	64.7	11	80.1	205	
Criminality in the family	Yes	18.8	6	27.8	5	12.1	31	0.097
	No	81.2	26	72.2	13	87.9	225	

¹ Fisher's exact test, 2-sided for three groups

The AAS-abusers had experienced significantly more physical and mental abuse than the non-using group. The perpetrator of the physical abuse of the AC group was usually the father (60 %), and/or another relative (40 %), the mother (20 %) or siblings (20 %). In the gym AAS-abuser group the perpetrator was often the mother (75 %) and/or the father (50 %). It was more common to find a history of mental abuse among the AAS abusers groups compared to the non-using group. As with physical abuse, the perpetrator for the AC group was most commonly the

father (87 %), and/or the mother (69 %), another relative (31 %) or siblings (12 %). In the gym AAS-abuser group the perpetrator was often the father (60 %), and/or another relative (40 %) and/or the mother (20 %).

Drug abuse in the family was significantly more common in the AC group compared to the non-user group. This was true both for alcohol (Fisher's exact $p < 0.01$) and for pharmaceuticals (Fisher's exact $p < 0.01$) but not for illegal drugs (Fisher's exact $p = 0.265$). The incidence of crim-

inality in the families of the three groups did not differ significantly.

Education and school problems

The educational backgrounds of the three groups are reported in table 3. In general, the members of the non-using group had a higher educational level than those of the AAS groups. Over 33 % of the gym AAS-abusers and almost a quarter of the AC group had only completed primary schooling.

It is clear that the vast majority of the AC group did not have a positive experience of their school years and over 62 % of them reported frequent school truancy. However, we found no significant differences concerning experiences of having been bullied in school but the gym AAS-abuser group reported a significantly higher rate of having bullied others in school.

Thirty of the thirty-four members of the AC group reported having had academic problems in school. This represents a highly significant difference from the comparison groups. The reasons for the reported 'problems at school' were several e.g. concentration problems, boredom, drug abuse and mental problems. All of these were significantly more common in the AC group, particularly concentration problems, boredom and drug abuse, compared to the gym groups. The AAS-abusers had more specific writing problems and the gym-abusing group had significantly more reading problems.

Current social situation

The current social situation of the groups is tabulated in table 4. Housing conditions differed significantly between the groups. Almost nine percent in the AC group had no housing and the majority lived alone. Some of the men who were living alone had their rent paid by their mothers and many would either eat and/or sleep at their mother's house. Stable relationships with partners were significantly more common in the gym AAS-abuser group than the other groups. It was more common among both AAS abuser groups to have children compared to the non-user group.

It was more common that members of the AC group at some time assaulted and/or threatened their female partners compared to those in the non-using group.

Approximately half of the AC group held steady employment and which was less than in the gym AAS-abusers and the non-using group. Thirty-eight percent of the AC group was living off social security or sickness benefits.

The AAS-abusers used alcohol, drugs and non-prescribed pharmaceuticals to a greater extent than members of the non-using group. In the AAS abuser groups it was more

common that members of the AC group abused alcohol, narcotics and unprescribed pharmaceuticals compared to the gym AAS abusers group. Twenty-two percent of the gym AAS-abusers had sniffed solvents compared to 12 % of the AC group and almost nine percent of non-users (ns). Moreover, more than half of the AC group (53 %) consumed alcohol in quantities that would qualify as abuse according to AUDIT [28], while this was true of only 18 % of the non-using group and 11% of the gym-abusing group.

All individuals in the AC group except for one admitted having been found guilty of some kind of crime, while 39 % of gym AAS-abusers and only 16 % of the non-using group reported this. The most common kinds of crime in the AC group were assault (61 %), illegal drug use (54 %), illegal possession of weapons (42 %), burglary (39 %), theft (39 %) and selling doping agents, (39 %). According to gym AAS-abusers the most common crime among them was illegal drug use, for which 22 % had been found guilty.

All members of these three groups were training at gyms, though the members of the AC group did so slightly more frequently. The most common motivation for training at gym given by AC group was to improve physique (76 %), while 57 % of non-users and 59 % of gym AAS-abusers reported this. The desire to enhance achievement in sport was reported by 65 % of the AC group, compared to 22 % of the non-using group and none of the gym AAS-abusers. Only three percent of the AC group mentioned enhanced well being as a reason for training, while 83 % of the gym AAS-abuser group and 65 % of the non-users reported this as a motivation. Also of interest is the fact that only 22% of gym AAS-abusers and 17 % of non-users claimed they trained for fun, while no one from the AC group did so.

Discussion

The aim of this study was to examine the social background and current social situation of a group of AAS abusers who were patients at an addiction clinic in central Sweden. Two groups of people who also trained frequently at a gym, one group of AAS-abusers and one group that had no experience of AAS, were recruited for comparison. The gym AAS-abusers were generally older than the members of the other two groups but were still in the same age range, 18–45 years. We consider these three groups to be comparable since the members were of the same sex and had similar training habits.

The social backgrounds in the AC group were found to be relatively disadvantaged in comparison to the non-using group. The gym AAS-abusers fell between the other two groups in this regard, but they were often nearly as disadvantaged as the AC group members. The family backgrounds of the AAS-abusers were often problematic in a

Table 3: Comparison of education and school problems between AAS users in two groups and non-users.

		AC group, n = 34		Gym, AAS-users, n = 18		Gym, non-users, n = 259		p-value ¹
		%	n	%	n	%	n	
Educational level	Interrupted primary school	0.0	0	0.0	0	3.9	10	<0.01
	Primary school	24.2	8	33.3	6	8.9	23	
	High school	69.7	23	55.6	10	63.2	163	
	Higher education	6.1	2	11.1	2	24.0	62	
Well-being in school	Yes	18.7	6	50.0	9	74.7	192	<0.001
	Indifferent	21.9	7	33.3	6	15.6	40	
School truancy at least once a week	No	59.4	19	16.7	3	9.7	25	<0.001
	Yes	62.5	20	11.1	2	17.5	45	
Bullied others in school	No	37.5	12	88.9	16	82.5	212	<0.05
	Yes	25.0	8	61.1	11	31.0	80	
Been bullied in school	No	75.0	24	38.9	7	69.0	178	0.069
	Yes	43.8	14	44.4	8	27.4	71	
Academic difficulties	No	56.2	18	55.6	10	72.6	188	<0.001
	Yes	93.7	30	38.9	7	25.6	66	
...as concentration problems	No	6.3	2	61.1	11	74.4	192	<0.001
	Yes	78.1	25	27.8	5	12.5	32	
...as writing problems	No	21.9	7	72.2	13	87.5	223	<0.01
	Yes	21.9	7	27.8	5	7.1	18	
...as reading problems	No	78.1	25	72.2	13	92.9	236	0.010
	Yes	9.4	3	27.8	5	6.7	17	
...as boredom	No	90.6	29	72.2	13	93.3	238	<0.001
	Yes	50.0	16	22.2	4	13.7	35	
...as drug abuse	No	50.0	16	77.8	14	86.3	220	<0.001
	Yes	37.5	12	22.2	4	5.9	15	
...as mental problems	No	62.5	20	77.8	14	94.1	240	0.010
	Yes	12.5	4	0.0	0	1.6	4	
	No	87.5	28	100.0	18	98.4	251	

¹ Fisher's exact test, 2-sided for three groups

variety of ways. They had generally poor social support, their parents were often divorced, and in the AC group the divorce had usually taken place at a fairly late stage in the child's development. Together with other information about the use of drugs and history of physical and/or mental abuse in the family, these factors suggest that AAS-

abusers had been brought up in families with a high degree of intra-familial conflict.

The AAS-abusers often described poor or indifferent relations with their parents. Less than half of the member of the AC group described their relationships with their fathers as positive. Like an earlier study [22], ours showed

Table 4: Comparison of current social situation between AAS users in two groups and non-users.

		AC group, n = 34		Gym, AAS-users, n = 18		Gym, non-users, n = 259		p-value [†]
		%	n	%	n	%	n	
Housing	Homeless	8.8	3	0.0	0	0.0	0	<0.001
	Living alone	52.9	18	18.8	3	40.2	102	
	Living with partner	5.9	2	0.0	0	16.5	42	
	Living with partner	26.5	9	75.0	12	37.8	96	
	Other	5.9	2	6.3	1	5.5	14	
Established partner	Yes	44.1	15	88.9	16	53.8	136	<0.01
	No	55.9	19	11.1	2	46.2	117	
Children	Yes	36.4	12	41.2	7	14.7	38	0.001
	No	63.6	21	58.8	10	85.3	221	
Threatened partner	Yes	39.4	13	22.2	4	8.6	22	<0.001
	No	60.6	20	77.8	14	91.4	235	
Battered partner	Yes	30.3	10	11.1	2	6.6	17	<0.001
	No	69.7	23	88.9	16	93.4	240	
Income from	Work	55.9	19	77.8	14	86.1	223	<0.001
	Subsidiary	38.2	13	16.7	3	7.3	19	
	Other	5.9	2	5.6	1	6.6	17	
Alcohol	Risk consumption or abuse	52.9	18	11.1	2	17.9	46	<0.001
	Regular or no	47.1	16	88.9	16	82.1	211	
Narcotics	Yes	91.2	31	61.1	11	26.6	69	<0.001
	No	8.8	3	38.9	7	73.4	190	
Unprescribed pharmaceuticals	Yes	57.6	19	41.2	7	11.8	30	<0.001
	No	42.4	14	58.8	10	88.2	225	
Driving license	Yes	47.1	18	72.2	13	77.0	194	<0.05
	No	52.9	16	27.8	5	23.0	58	
Sentenced for crime	Yes	97.1	33	38.9	7	16.5	42	<0.001
	No	2.9	1	61.1	11	83.5	213	
Food additives	Yes	90.6	29	88.9	16	75.2	194	0.075
	No	9.4	3	11.1	2	24.8	64	
Training frequency per week	>4 times	35.3	12	16.7	3	16.2	42	0.096
	3-4 times	47.1	16	72.2	13	67.2	174	
	<3 times	17.6	6	11.1	2	16.6	43	

[†] Fisher's exact test, 2-sided for three groups

that AAS-abusers had poorer relationships with their fathers than non-users. The importance of fathers is well recognized so it was no surprise to find that these conflict-ridden families involved worse relationships between fathers and sons than between mothers and sons.

In both AAS-abuser groups, we found a common pattern of frequent physical and/or mental abuse, which reinforces the image of conflict-filled milieus. The father was the most common perpetrator, but in quite a few cases mothers were also responsible, particularly when it came to physical abuse in the gym AAS-abuser group.

Almost half of the AC group and one third of gym AAS-abusers came from families in which one or both of the parents were alcoholics or drug addicts, and this was often associated with various forms of criminality.

Just over half of the AAS-abusers could name a particular person who had played an important role as 'significant other' during their childhood. The most common "significant other" was a grandfather. The presence of a significant other is generally considered to provide a buffer for children in adversity [30]. It is especially notable that the AAS-abusers did not identify any friends whom they felt had been of great importance when they were children.

The general picture of the family backgrounds of both AAS-abusers groups is therefore somewhat bleak. The typical scenario consists of a conflict-ridden family in which the son feels alone, with no significant other to turn to, even among his friends.

Like Kindlundh et al[9], we found that AAS-abusers also encountered far greater difficulties at school than did their counterparts from the non-using group. Almost all in the AC group described their school experience as very negative in one or more respects. The AAS-abusers educational level was also generally lower than that of members of the non-using group. This is probably a result of the combination of adverse family conditions and negative experiences of school. The AAS-abusers described a variety of problems from their time at school. The most frequently reported problems in the AC group were lack of concentration and specific reading/writing difficulties, but also well-being in school, truancy and boredom. Both AAS-abusing groups reported having been bullied, experienced writing/reading problems and problems with drug abuse and/or mental problems of various kinds. The gym AAS-abusers, however, more frequently reported having bullied others in school than did the AC group and non-users.

The AC group in our study was often living alone or had no housing of their own. It is known from earlier studies that children who grow up with "risk" elements in the environment may get difficulties with intimate relations [30]. It is also known that AAS abuse often co-exists with abuse of other drugs [6]. Most of the AC group and many of the gym AAS-abusers were mixed drug abusers, and this may have had a negative impact on their social situation since mixed drug abusers often buy their drugs before paying their rent.

The AC group were less likely to be living with a stable partner than non-users, but both AAS-abuser groups had more children than non-users. AAS often enhances sex drive initially [31] and this may lead to abusers engaging

in serial, short-lived sexual relationships. The frequency of physical and mental abuse of female partners is extremely high among AAS-abusers and this may be caused by the irritability that AAS induces.

The non-users in this study were more likely to have salaried employment than AC group, most of whom were dependent on social security and/or sickness benefits. The AC group were seldom able to hold a job for long and, if they were working at all, it was often in temporary employment. The difference found regarding possession of driving licenses might be due to the loss of driving privileges in patients who had higher rates of alcohol abuse and associated drunk-driving episodes.

It has been noted that AAS may provoke criminal activity and violence [16]. The AC group in our study reported an extremely high rate of criminality, which usually involved various kinds of violence. The design of this study did not enable us to examine the temporal relationship between AAS use, other drug use and criminality, but we are currently planning further investigations to explore these sequences of events in more detail.

A small group of 12 persons (with a mean age of 24.2 years) did not respond to the question regarding history of AAS abuse. When we analysed their answers they proved to fall somewhere between the two AAS-abuser groups. We suspect, however, that they should be considered AAS-abusers but since they did not complete the questionnaire we had to exclude them.

To our knowledge, this study is the first to systematically examine the social backgrounds of AAS-abusers. The size of the AAS groups was not large. It is not easy to recruit subjects to this kind of study since they are usually hesitant to admit their AAS use, to seek help or to remain under medical care when they begin to feel better. The findings from this study cannot therefore be generalized to all forms of AAS use since these particular groups were also involved with abuse of other drugs. However, in our experience, exclusive use of AAS is quite uncommon. Sooner or later, AAS-abusers tend to start using other drugs as well, primarily central stimulants. We are, however, aware of the fact that the study group in this case was involved in relatively serious drug abuse and this should be borne in mind when drawing conclusions.

We found a high frequency of reported use of narcotics in both AAS groups, which was surprising since patients seeking help may be expected to be more honest than non-patients about their use of other drugs. It is also of significance that the AC group, who want help with their drug problem, are subject to drug testing. However, the unexpectedly high rate of reporting of the use of narcotics

in the gym AAS-abuser group and among non-users suggests that the methods used may be fairly reliable.

The statistical comparisons were predominantly done using Fisher's exact test for three groups, which show whether there was an overall statistically significant difference between the three groups. We have refrained from doing post-hoc tests between paired groups in order to keep the statistical methods conservative, not to draw too far-going conclusions. There would otherwise have been a risk for a statistical effect of multiple comparisons as well as statistical power problems due to small numbers in some of the group comparisons.

Another methodological issue that warrants comment is the fact that the AC-group was interviewed while the comparison groups simply answered a questionnaire. Our original intention was to recruit a clinical comparison group whose members were performing physical training and using drugs, but not AAS. However, this proved impossible since we were simply unable to find people that met these criteria, which leads us to conclude such people are rare. Our second option was therefore to recruit a large group of people who were training but who were not taking AAS. We found, though, that this group inevitably ended up containing both AAS-users and non-users.

The study was carried out using a mixture of methods; interviews in the index group and questionnaires in the comparison groups. This combination of methods must be taken into consideration when comparing the results. All of the interviews were carried out at the clinic by one experienced clinician in order to minimize the possibility of misunderstandings and varying interpretations of questions and answers. Anonymity was guaranteed for participants from all groups. The use of a questionnaire was decided upon for the larger comparison group for practical reasons. It meant we were able to obtain a much larger sample than would have been possible using interviews. In order to reach optimal comparability, the questions used in the questionnaire were derived from the responses received in the interviews [32]. Although questionnaires are known to make it easier for respondents to answer sensitive questions [33] the question concerning the use of doping agents was the one most frequently left unanswered. This means that the difference between the non-using and abusing-groups might be even greater than it would seem according to the responses, and this would support our contention that the reported differences are not overestimations.

Conclusion

This study has shown that abusers of AAS often come from severely disadvantaged family backgrounds and that they also live their adult lives in difficult social situations.

This study is based on a fairly small and selected sample and it is therefore not possible to extrapolate the results to AAS-abusers generally, but since there are very few studies of AAS-abusers in substance abuse treatment, we believe that the results are nevertheless of significant value. It is clearly of great clinical value to track the social backgrounds of AAS-abusers and to pay close attention to the conditions under which they are currently living. We propose that an interview that explores specific social issues should form an integral part of the treatment programme. The results of this study may help in directing appropriate questions relevant for AAS abuse, which we do not believe are being put forward in general clinical practice.

We intend to continue studying this group, particularly with regard to the relationship over time between factors such as alcohol abuse, AAS abuse, drug abuse and criminality. In this way we hope to enrich our understanding of the risks associated with AAS use, both from a social and from a medical perspective.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

KS conceived of the study, participated in its design, carried out all interviews and gathered the questionnaire data, performed the statistical analysis and drafted the manuscript. IE was responsible for the design and helped to draft the manuscript. Both authors read and approved the final manuscript.

Acknowledgements

This study was supported by grants from the Swedish National Drug Policy Coordinator (Mobilisering mot Narkotika) and from Orebro County Council. We would like to thank Professor Lennart Bodin for his advice regarding statistical analysis and Dr Sten Engdahl for his contributions from the psychiatric perspective.

References

1. Hoberman JM, Yesalis CE: **The history of synthetic testosterone.** *Sci Am* 1995, **272**(2):76-81.
2. Kashkin KB, Kleber HD: **Hooked on hormones? An anabolic steroid addiction hypothesis.** *JAMA* 1989, **262**(22):3166-3170.
3. Mottram DR, George AJ: **Anabolic steroids.** *Baillieres Best Pract Res Clin Endocrinol Metab* 2000, **14**(1):55-69.
4. Handelsman DJ, Gupta L: **Prevalence and risk factors for anabolic-androgenic steroid abuse in Australian high school students.** *Int J Androl* 1997, **20**(3):159-164.
5. Hall RC: **Abuse of supraphysiologic doses of anabolic steroids.** *South Med J* 2005, **98**(5):550-555.
6. Evans NA: **Current concepts in anabolic-androgenic steroids.** *Am J Sports Med* 2004, **32**(2):534-542.
7. Brower KJ: **Anabolic steroid abuse and dependence.** *Curr Psychiatry Rep* 2002, **4**(5):377-387.
8. Eklof AC, Thurelius AM, Garle M, Rane A, Sjoqvist F: **The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology.** *Eur J Clin Pharmacol* 2003, **59**(8-9):571-577.

9. Kindlundh AM, Isacson DG, Berglund L, Nyberg F: **Factors associated with adolescent use of doping agents: anabolic-androgenic steroids.** *Addiction* 1999, **94(4)**:543-553.
10. Kanayama G, Pope HG Jr., Hudson JI: **"Body image" drugs: a growing psychosomatic problem.** *Psychother Psychosom* 2001, **70(2)**:61-65.
11. Franke WW, Berendonk B: **Hormonal doping and androgenization of athletes: a secret program of the German Democratic Republic government.** *Clin Chem* 1997, **43(7)**:1262-1279.
12. Parssinen M, Seppala T: **Steroid use and long-term health risks in former athletes.** *Sports Med* 2002, **32(2)**:83-94.
13. Thiblin IB, Fugelstad AB, Leifman AG, Romelsjo AP, Agren GS, Sorimachi Y: **Relationships between the deinstitutionalization of healthcare for patients with mental disorder, substance abuse, and isolated death.** *J Forensic Sci* 2004, **49(2)**:354-360.
14. Olrich TW, Ewing ME: **Life on steroids: Bodybuilders describe their perceptions of the anabolic-androgenic steroid use period.** *Sport Psychol* 1999, **13**:299-312.
15. Kanayama G, Cohane GH, Weiss RD, Pope HG: **Past anabolic-androgenic steroid use among men admitted for substance abuse treatment: an underrecognized problem?** *J Clin Psychiatry* 2003, **64(2)**:156-160.
16. Thiblin I, Pariklo T: **Anabolic androgenic steroids and violence.** *Acta Psychiatr Scand Suppl* 2002, **412**:125-128.
17. Thiblin I, Lindquist O, Rajs J: **Cause and manner of death among users of anabolic androgenic steroids.** *J Forensic Sci* 2000, **45(1)**:16-23.
18. Thiblin I, Kristiansson M, Rajs J: **Anabolic androgenic steroids and behavioural patterns among violent offenders.** *J Forensic Psychiatry* 1997, **8(2)**:299-310.
19. Bahrke MS, Yesalis CE, Brower KJ: **Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents.** *Child Adolesc Psychiatr Clin N Am* 1998, **7(4)**:821-838.
20. Luicidi F, Grano C, Leone L, Lombardo C, Pesce C: **Determinants of the intention to use doping substances: an empirical contribution in a sample of Italian adolescents.** *Int J Sport Psychol* 2004, **35**:333-357.
21. Nilsson S: **Androgenic anabolic steroid use among male adolescents in Falkenberg.** *Eur J Clin Pharmacol* 1995, **48(1)**:9-11.
22. Kanayama G, Pope HG, Cohane G, Hudson JI: **Risk factors for anabolic-androgenic steroid use among weightlifters: a case-control study.** *Drug Alcohol Depend* 2003, **71(1)**:77-86.
23. Thiblin I, Runeson B, Rajs J: **Anabolic androgenic steroids and suicide.** *Ann Clin Psychiatry* 1999, **11(4)**:223-231.
24. Lovstakken K, Peterson L, Homer AL: **Risk factors for anabolic steroid use in college students and the role of expectancy.** *Addict Behav* 1999, **24(3)**:425-430.
25. Midgley SJ, Heather N, Davies JB: **Dependence-producing potential of anabolic-androgenic steroids.** *Addict Res* 1999, **7**:539-550.
26. Tanner SM, Miller DW, Alongi C: **Anabolic steroid use by adolescents: prevalence, motives, and knowledge of risks.** *Clin J Sport Med* 1995, **5(2)**:108-115.
27. Kindlundh AM, Hagekull B, Isacson DG, Nyberg F: **Adolescent use of anabolic-androgenic steroids and relations to self-reports of social, personality and health aspects.** *Eur J Public Health* 2001, **11(3)**:322-328.
28. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M: **Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption—II.** *Addiction* 1993, **88(6)**:791-804.
29. Bergman H, Kallmen H: **Alcohol use among Swedes and a psychometric evaluation of the alcohol use disorders identification test.** *Alcohol Alcohol* 2002, **37(3)**:245-251.
30. Garmezny N: **Children in poverty: resilience despite risk.** *Psychiatry* 1993, **56(1)**:127-136.
31. Moss HB, Panzak GL, Tarter RE: **Sexual functioning of male anabolic steroid abusers.** *Arch Sex Behav* 1993, **22(1)**:1-12.
32. Hebert R, Bravo G, Kerner-Bitensky N, Voyer L: **Refusal and information bias associated with postal questionnaires and face-to-face interviews in very elderly subjects.** *J Clin Epidemiol* 1996, **49(3)**:373-381.
33. Siemiatycki J: **A comparison of mail, telephone, and home interview strategies for household health surveys.** *Am J Public Health* 1979, **69(3)**:238-245.

Publish with **Bio Med Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp



STUDY II

Research

Open Access

The development of multiple drug use among anabolic-androgenic steroid users: six subjective case reports

Kurt Skårberg^{1,2}, Fred Nyberg³ and Ingemar Engström*¹

Address: ¹School of Health and Medical Sciences, Psychiatric Research Centre, Örebro University, Örebro, Sweden, ²Addiction Centre, Örebro County Council, Örebro, Sweden and ³Department of Pharmaceutical Biosciences, Uppsala University, Uppsala, Sweden

Email: Kurt Skårberg - kurt.skarberg@orebroll.se; Fred Nyberg - fred.nyberg@farmbio.uu.se;

Ingemar Engström* - ingemar.engstrom@orebroll.se

* Corresponding author

Published: 28 November 2008

Received: 10 July 2008

Substance Abuse Treatment, Prevention, and Policy 2008, **3**:24 doi:10.1186/1747-597X-3-24

Accepted: 28 November 2008

This article is available from: <http://www.substanceabusepolicy.com/content/3/1/24>

© 2008 Skårberg et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: The inappropriate use of anabolic androgenic steroids (AAS) was originally a problem among athletes but AAS are now often used in nonsport situations and by patients attending regular addiction clinics. The aim of this study was to improve understanding of the development of multiple drug use in patients seeking treatment at an addiction clinic for AAS-related problems.

Methods: We interviewed six patients (four men and two women) with experience of AAS use who were attending an addiction clinic for what they believed were AAS-related problems. The patients were interviewed in-depth about their life stories, with special emphasis on social background, substance use, the development of total drug use and subjective experienced psychological and physical side effects.

Results: There was significant variation in the development of drug use in relation to social background, onset of drug use, relationship to AAS use and experience of AAS effects. All patients had initially experienced positive effects from AAS but, over time, the negative experiences had outweighed the positive effects. All patients were dedicated to excess training and took AAS in combination with gym training, indicating that the use of these drugs is closely related to this form of training. Use of multiple drugs was common either in parallel with AAS use or serially.

Conclusion: The study shows the importance of understanding how AAS use can develop either with or without the concomitant use of other drugs of abuse. The use of AAS can, however, progress to the use of other drugs. The study also indicates the importance of obtaining accurate, comprehensive information about the development of AAS use in designing treatment programmes and prevention strategies in this area.

Background

Anabolic androgenic steroids (AAS) are synthetic derivatives of the male endogenous sex hormone testosterone, which exhibits both anabolic (protein-synthesizing) and androgenic (masculinizing) effects. These drugs were orig-

inally used only in the context of elite sports [1]. Today, however, AAS are used by a far wider range of groups outside of sports and athletics [2,3]. The use of AAS has therefore become a subject of considerable scientific interest in addiction and psychiatric research.

Epidemiological studies on this topic are notoriously difficult to conduct in a reliable manner since AAS usage is largely clandestine, partly because the drugs are illegal and partly because usage tends to take place in closed sub-cultural settings. Despite these problems, we know that the current use of AAS is relatively widespread in many countries, including Sweden, which is the site of the current study. AAS are found in both cities and smaller communities [3]. The majority of users are male [4,5] and most of the users begin using the drugs in their teens or early twenties [6].

It has been noted that AAS are often combined with alcohol [7] and other drugs of abuse [8] as well as with testosterone releasers, anti-estrogens [2,9] and other medications [10,11]. The reasons usually given for this are that the combination both increases the effects of AAS and decreases various physical and psychological side effects. Side effects from AAS use reported in men include impotence and infertility due to inhibited endogenous testosterone production. In women, increased virility, including deepening of the voice, changes in libido and clitoral enlargement, occurs as a consequence of AAS use [12]. Other known side effects include atherosclerosis, hypertension, dilated cardiomyopathy and sudden death. Psychiatric side effects include irritability, aggressiveness, mood swings, decreased impulse control and suicidal or homicidal behaviour [12].

AAS continue to be used, despite knowledge of these potentially serious side effects. The most commonly reported motives for using AAS are enhanced performance in sports, improved physical appearance, increased body size and aggressiveness, strengthened libido and an enhanced sense of well-being [3,13-15]. Other justifications for continuing with AAS include self-fulfilment accounts, condemnation of condemners (a way of shifting focus from the user's own deviant acts) and denial of injury [16].

Most studies regarding motives for using AAS and combinations of drugs are based on athletes. To the best of our knowledge, there are no studies exploring why and how non-athletic users have started to use a combination of drugs. It can therefore be said that the pathways for the development of mixed abuse are inadequately described. It has been proposed that AAS abuse can be a gateway to the use of other drugs of abuse [17-19] and alcohol abuse [20] but the empirical grounds for these conclusions are fairly weak.

Although AAS have been studied extensively in recent years, the perspectives of the users themselves are only sparsely described, despite in-depth knowledge among users about the drugs, their effects, their possible side

effects and how they can be combined [6,8,21]. It has also been reported that AAS users find it problematic that doctors and other healthcare staff have a limited understanding of the issue [15,22-24]. There are thus many reasons to pay greater attention to the users' own stories about the development of their abuse patterns and how their use of different combinations of drugs has developed.

There are a few articles in the scientific literature based on case reports [16,25-27] describing the development of AAS use from the user's perspective. Todd [25] performed in-depth interviews with American weight-lifters concerning AAS use from the athletes' perspective. His conclusion was that the largest group of AAS users seems to be "average guys who just want to get bigger and stronger as fast as they can". Monaghan [16] interviewed 67 bodybuilders and weight-lifters concerning their motivation for use of AAS. One important finding was that most AAS users generally expressed a positive view about the effects of AAS. Olrich & Ewing [27] interviewed ten men about their experiences with these drugs. Nearly all of them described predominantly positive experiences. Their feelings of affirmation extended well beyond the walls of the gym and their narratives suggested feelings of elevated status in most social environments. The authors suggest that the users enjoyed benefits linked with the "embodiment of masculinity" in our culture. The authors therefore stress that all measures to address AAS abuse, both prevention and treatment, must be designed on the basis of these results, since the decision to stop using AAS means foregoing experiences of powerfully enhanced masculinity.

Grogan et al. [26] interviewed five women and six men using snowball sampling. Again, a major finding was that most of the users in this study reported largely positive experiences of AAS. The majority felt that moderate use of AAS was nonproblematic and that the risk of serious side effects was not a sufficient deterrent to put them off using the drugs. Information from the healthcare sector regarding AAS was generally disbelieved, particularly since it differed from their personal experience. The importance of noting users' largely positive experiences is stressed, and cooperation with the body building community was reported as being decisive for the outcome of any programme.

In earlier studies, we have described a group of AAS users from an addiction clinic in terms of their social backgrounds, current social situation [28] and total drug use pattern [29]. These studies revealed that AAS abusers often come from problematic family backgrounds, have a history of major problems in school, have considerable social problems in daily life and have common histories of polysubstance drug use. In the present study, we aim to complement these data by using in-depth interviews to

focus on the users' own perspectives of their experiences with AAS.

The aim of the study was thus to let AAS users' own stories serve as a point of departure for examining the various consequences of development of drug usage among a group of people seeking help at an addiction clinic. The participants were selected to capture as wide a variation as possible in experiences.

Methods

Sample

This study is based on a total of 36 AAS-users, 34 men and 2 women, who were consecutively included from a psychiatric addiction clinic in Orebro county, central Sweden, a county of 275,000 inhabitants. All patients were attending the addiction clinic to seek help for what they believed to be AAS-related side effects. The inclusion criteria for participants were that they must: a) be over 16 years of age, b) be fluent in Swedish, c) have been using non-prescribed AAS within the last four months, alone or in combination with other doping agents, d) have been using AAS for at least four months and e) be under the care of the addiction clinic where a decision to commence treatment for their AAS use had been agreed upon following an initial clinical assessment. With these criteria for inclusion, the study included only current users. The lower limit of four months was chosen to include more than one AAS cycle, thus indicating regular use.

Selection of subjects

The patients were primarily selected in order to exemplify variation in the possible combinations of drug use. We also wanted to include both men and women in order to illustrate gender-related differences. Another important criterion for selection was that the narratives should be detailed and the content richly described. Although the cutoff point for AAS use was four months, the selected subjects had a regular use of AAS from nine months to six years.

Interviews

Prior to the interview, each patient was asked to write down a description of how their drug use had developed over the years, including the names of the drugs they used and when they began using them. The semi-open face-to-face interviews [30] were conducted by one of the authors (KS), who has many years of experience in training and instructing at gyms and who consequently has a good understanding of the environment with which AAS are usually associated.

The interview was carried out as a conversation in which the patient was given considerable freedom on how to tell their life story [31]. Open-ended questions were used in

the interviews and they were posed in such a way that the patient was encouraged to relate their experiences as fully and freely as possible. The order in which the questions were posed varied and the interviewer tried to adhere as much as possible to the patient's chosen method of narration. However, at the end of the interview, the inclusion of all the areas of interest was checked. The following areas were covered in the interview:

- childhood, family situation, school experiences
- reason for and situation in which AAS usage was begun
- progress of drug usage
- abuse of other substances
- times at which various substances were first used
- experience of side-effects
- reason for seeking care

The interviews took between one and three hours per patient. The narratives were written down during the interview [32] and the material was then compiled into a personal, chronologically arranged narrative for each informant [33]. The patients were then given the opportunity to read and comment on these texts and to assess whether they seemed reasonable and whether they wished to remove any part. All information that might enable identification of the person was removed in order to guarantee anonymity, and all names used in this article are therefore fictional. The life stories were formulated as closely to the language in which the story was told as possible and in such a way that the informants recognized them as being accurate and in accordance with their experience.

Ethical approval

The procedures used in this study have been approved by the regional ethical vetting board (No.: 538/99) in accordance with the Swedish law concerning approval of medical research and the patients have given their informed consent.

Results

Case 1 – John, 25

The development of early combined drug use starting with AAS

John had a difficult childhood. He felt that he did not receive any love from his mother since she did not bother much about him. He was also subjected to sexual abuse by a relative. He was slender during his teens and bullied by his classmates. For this reason he began training at a gym at the age of 16. His goal was to increase both his strength

and his body mass. After four years of training, at the age of 20, one of his gym mates advised him to start taking AAS to enhance the effects of the training, which he did. He soon noticed considerable effects on his training and also enhanced emotional well-being.

After using AAS for some time, he took the advice of some more experienced gym mates and began taking anti-estrogens in order to prevent gynecomastia. He also started using ephedrine, other bronchodilators and dietary supplements that contained ephedrine in order to make him more energetic and to enable him to train harder. He felt both psychologically and physically well when taking ephedrine and started using this even when not using AAS. He also began taking testosterone releasers to speed up his own hormone production. The tough training regimen he now followed led to pain in his muscle insertions and ligaments, which prompted him to begin also taking analgesics. John trained regularly and heavily, sometimes several times a day.

His social interactions became increasingly limited to other AAS users and his knowledge about the drugs and their effects grew rapidly. As a child he was very shy, particularly in relation to girls. He had no contact with girls but instead developed sexual fantasies that occupied a great deal of his time and that has continued into adulthood. When he was twenty-four years of age, he met a woman at the gym and they embarked on a relationship, which was a new experience for him.

In this period of life, the most important thing for him was training at the gym and his life became increasingly focused upon medication, diet and training. In order to train even more, he began using amphetamines; he felt that this helped him to keep alert during training. His experience was that amphetamines allowed him to train even harder. Amphetamines made him feel good mentally but also led to difficulties in relaxing after training. He therefore began taking hashish and benzodiazepines to help him wind down and sleep better. He was now using amphetamines more frequently because he found them to be wonderful for recreational use. John had previously drunk alcohol sparsely but now began using alcohol more frequently to help him sleep and as recreation at the weekends.

Altogether, John was taking fourteen human and veterinary AAS products during a period of five years (oral: oxymetholone, stanozolol, methandrostenolone and methenolone acetate; injected: trenbolone acetate, testosterone blends, boldenone, nandrolone esters, methenolone and stanozolol). Throughout the training period he ate or drank dietary supplements (e.g. protein and var-

ious products containing protein, creatine and ephedra) with the purpose of enhancing the effects of training.

Initially, John felt the positive effects from his AAS use far outweighed the negative. He describes increased self-confidence, improved libido and affirmation from both men and women in his surroundings. However, despite using various medications to counteract psychological and physical problems, he experienced more and more negative effects. He experienced testicle shrinkage, skin lesions and potency problems. He also began to experience hallucinations, depression, mood swings, aggressiveness and feelings of persecution. His sexual fantasies also became more marked.

By the age of 25, after five years of AAS abuse, he was tested for AAS use at the gym at which he trained. His regimen at this time included nandrolone decanoate and amphetamine. When the tests proved positive, he was barred from the gym. John cites this as the stimulus for his increasing use of amphetamine and alcohol, although he discontinued both training and AAS. His use of other drugs of abuse and alcohol worsened, with associated severe social problems. His company ran out of business, his girlfriend left him, he failed to pay his rent and he became destitute. It was in this situation that he sought help from the addiction clinic, mainly because of his psychological problems.

Case 2 – Joe, 37

The development of late combined drug use starting with AAS

Joe grew up with his biological parents. He was and remains very close to his mother but was often beaten by his father, with whom he had a very remote relationship. Joe describes his upbringing as very strict because of his father's principles. At school he was often afraid and teased for being small. However, he completed his schooling with top grades. In his early teens, he was prescribed analgesics for frequent headaches and he has continued to take them ever since.

At 16 years of age, he started training at the bench press at a gym and, at the same age, he began drinking alcohol. He drank a fair amount of alcohol in his late teens but, because he felt it impaired his training, he decided to completely quit alcohol in his early twenties. When he was 21 years of age, he felt he had reached a plateau in his training. A friend told him to try AAS to enhance his training. His first course consisted of oral AAS (stanozolol, oxymetholone and testosterone undecanoate) and the associated rapid improvement in strength he experienced prompted him to continue using AAS.

Joe combined AAS with ephedrine and other ephedra preparations to perk himself up. He also took dietary sup-

plements such as protein powder and other protein supplements, creatine, nutritional replacements and multivitamins. He learned from other AAS users at the gym that he could also add anti-estrogens and testosterone releasers in order to counteract the unwanted effects of AAS. He has had to use a number of medications to counteract what he believed to be side effects from his AAS use and hard gym training, including analgesics for pain from over-training, benzodiazepines for insomnia, and analgesics for headaches and pain in muscles and joints.

He combined a painkiller containing codeine with water in a plastic bottle from which he drank continually while at the gym so that he could train harder and longer.

He also took muscle relaxants immediately after a training session. Altogether, he used thirteen different AAS medications during 16 years of AAS abuse (oral: fluoxymesterone, methandrostenolone, methenolone acetate, oxymetolone, stanozolol and testosterone undecanoate; injected: nandrolone esters, stanozolol, several testosterone injections, testosterone blends and trenbolone acetate).

He felt that his self-confidence was much improved when using AAS and he described experiencing better control of his feelings so that he never felt afraid when he was in a confrontational situation. He became stronger and gained weight and felt that his healing capacity was improved. With time, however, the negative effects increased in number and severity. He had previously found it easy to mix with girls. Now he became markedly jealous, had violent mood swings, outbreaks of aggression and frequent depression. He also describes an emotional numbness in relation to others. The physical problems included wear and tear of his joints, testicular atrophy, gynecomastia, acne, blood in his urine, kidney pain and infected skin lesions. The cost of supporting his drug use also continued to rise, leading to criminal behaviour.

At the age of 30, he began using other drugs of abuse, including amphetamines and cocaine. Initially, he took these drugs to increase his ability to train but later he also started taking them at parties for recreational purposes. His other drugs of abuse increased rapidly in number and he began using hashish as well. He sought treatment because of his narcotics use and for the troubling physical and psychological problems he believed were derived from AAS.

Case 3 – Sune, 24

The early development of a complex usage of hormone preparations
Sune had good contact with his father and siblings during his childhood, but contact with his mother was not as

good and he describes her as having alcohol and psychological problems. Sune had many friends at school and has maintained contact with several of them later in life. He was never bullied or the victim of any kind of violence. The only problem he recalls from childhood was that he became aggressive rather easily.

He began training at a gym with some friends at about 15 years of age and, when he was 16, he and some friends became curious about whether AAS would give supplementary effects. Even before he began trying AAS, Joe had started using various dietary supplements such as protein and creatine. The first AAS he bought was a testosterone product that was to be injected into the buttock. He experienced clear positive results from this, predominantly as an increase in weight and strength. He noted, however, that he became more irritable. He soon began using AAS more steadily. He used oral AAS (methandrostenolone, stanozolol), injectable varieties (nandrolone esters, different testosterone blends and trenbolone cyclohexylmethylcarbonate) and a fluid form of AAS (unknown name) that could be administered as drops under the tongue.

He later combined AAS with growth hormone and insulin. He took these hormones hoping that this combination would produce even quicker muscle growth. He also started using an anti-estrogen so as to reduce the risk of gynecomastia and testosterone releasers to enhance his own hormone production. Other substances that were added later were ephedrine, prohormones, anticatabolics and testosterone boosters. He was able to train harder and more frequently while using AAS; however, pain in his muscle insertions and joints soon developed. He therefore started taking analgesics in order to be able to train despite the pain.

When he started using hormones, he also started taking protein and creatine supplements and various plant steroid compounds. After four years of abuse and 10 different human steroid products, when he was about 20 years old, his regimen consisted of AAS drugs (nandrolone ester, methandrostenolone) in combination with insulin, testosterone releasers and ephedrine.

Sune experienced mainly positive effects from AAS, particularly in the beginning. He mentioned increased strength and weight gain above all but also a feeling of attractiveness to girls. His sexual drive was considerably increased after the debut of AAS. Sune was, however, at that time also troubled by hair growth on his back, skin lesions between his shoulder and chest musculature, acne, potency problems, testicular atrophy and a cough that bothered him particularly after taking testosterone preparations. He had also suffered serious psychological problems such as pathological jealousy, mood swings,

depression and aggressiveness. Several times he had become so angry that he smashed up the furniture at his parents' house. He also attempted to commit suicide. Sune also sometimes had memory problems and his fixation with his body was greatly increased. His parents contacted the addiction clinic because they felt their son's personality had undergone such a radical change.

Case 4 – Bill, 25

The development of body fixation and a complex usage of hormone preparations

Bill describes his childhood in glowing terms. He had good contact with his parents and a younger sister. He was very active in sports such as football, ice hockey, boxing and taekwondo while he was growing up. After leaving home at the age of 15, he stopped these sports and took up training at a gym instead. His training became so intense and time-consuming that his schoolwork began to suffer. He completed his schooling with poor grades.

After a few years of training, he became increasingly focused on competing in the field of bodybuilding. Bill had read about AAS and, while he was thinking about starting to compete, he felt he needed to begin taking AAS so as to increase his body size, since he believed everyone in elite level bodybuilding was using AAS. He was 20 years old when he began taking AAS. The first course consisted of oral methandrosterone and injections of testosterone blends. He described the positive effects as including increased body bulk and strength as well as a powerful "pump" feeling, particularly in his biceps, when he was training. He described the feeling when the blood pumped into a specific muscle as almost orgasmic. He also described increased libido and significantly enhanced self-confidence that meant he "felt like a king in the town". He sought out fights because it gave him a "good feeling" when others were afraid of him. Bill soon became preoccupied with his AAS use and began reading more about preparations, training and AAS. He found advice that prompted him to start using testosterone releasers for speeding up his own hormone production.

He had previously begun using dietary supplements such as protein and creatine and now he added other compounds. His strength and body bulk increased but he wanted to become even bigger. He now began using a combination of AAS and other hormone preparations such as growth hormone, insulin and IGF-1 (Insulin growth factor 1).

During the four years of AAS use, he used a total of nine different human and veterinary AAS preparations: oral AAS consisting of methandrosterone, stanozolol and testosterone undecanoate and injectible AAS in the form of boldenone, nandrolone ester, various testosterone

blends and trenbolone acetate. The whole time that Bill was training, he used stimulants such as ephedrine and sometimes bronchodilators to reduce fat and fluid in the muscle tissues. He has also tested other drugs of abuse such as amphetamines and hashish at parties and has used alcohol occasionally.

The second to last course he took, which included nandrolone esters, testosterone blends, growth hormone, insulin, and testosterone releasers, resulted in such a drastic drop in blood sugar level that he was hospitalized. The first time he sought help at the addiction clinic he described himself as severely depressed. The reason he gave was that he had gone from weighing 128 kg to, as he said, "only 124 kg". He said he could not imagine going back to his old gym where everyone would see how "small he had become". In order to gain weight quickly he therefore began his last course of AAS. During this course, he had such drastic physical and psychological problems that he decided to completely stop using AAS.

Altogether, he suffered a range of physical problems such as breast development, acne, skin lesions, testicular atrophy, reduced libido and fatigue. Psychologically, he felt depressed, with mood swings, increased aggressiveness, panic attacks and pronounced body fixation. Sometimes, under the influence of AAS, he would wander around the streets of his hometown looking for fights because he felt himself to be invincible. While using AAS, he developed a criminal career and was sentenced several times for various acts of violent crime.

Case 5 – Irene, 26

The development of the use of enhancing drugs and an extreme body fixation

Irene describes her childhood as very problematic. She felt she was pushed aside as a child because her brothers always came first. She also experienced sexual harassment by a close relative and was bullied in school. In her early teens, she became increasingly fixated with her body, constantly asking others what they thought of it. Irene completed her schooling with poor grades.

As a teenager she was very active in several sports and at the age of 17 she began training at a gym as a complement to her handball training. She felt good and she believed that her body became more beautiful thanks to the tough gym training. She soon quit her other sports and decided to begin gym training to compete in bodybuilding. She was then convinced that a prerequisite for success in this sport was the use of AAS, and this led to her AAS debut at the age of 20. The first course, which lasted three months, consisted of stanozolol injections. She felt that, once she had begun using AAS, her body fixation intensified. During the second course, she took not only AAS injections

but also growth hormone (hGH). Her psychological problems, with mood swings, anxiety and irritation, worsened.

She soon began experiencing more physical problems, such as clitoris enlargement, hair loss and yellowing of her skin. In the six years during which she used hormones, she used four different types of AAS (oral: methandrostenolone and stanozolol; injected: methenolone enanthate and stanozolol). She also took several courses that included hGH. Early on in her AAS use, she also used ephedrine and other preparations to reduce subcutaneous fat and fluid in the muscles (e.g. bronchodilators and a drug which contained a combination of ephedrine, caffeine and aspirin).

Irene trained far harder after starting to take hormones. Sometimes she would train several times a day, which led to pains in her muscle insertions. She began taking analgesics in order to continue training despite the pain. She became much stronger after starting to use AAS, and she then preferred to train with men. Because she was afraid of building up fat or retaining fluid, she has only occasionally used dietary supplements over the years and, when she has done so, has primarily taken protein supplements. She tested creatine but stopped because of weight gain. Irene was just over 26 when she stopped using AAS after a final course consisting of oral methenolone acetate, an ephedra preparation, ephedrine tablets and bronchodilators.

Irene describes the positive effects she experienced with AAS as increased muscle bulk, a harder body and a psychological boost including improved self-confidence. However, she also notes psychological problems that at times were considerable, such as jealousy, extreme body fixation, powerful mood swings, aggressiveness and recurrent depression including suicidal fantasies.

She has tried various anti-depressant medications, all of which she discontinued because she felt they made her retain fluid. She has also undergone breast enhancement surgery and her voice became deep. Irene describes how she became very popular among men and she had an increased sex drive leading to unfaithfulness. She has lived in several partnerships but all of them broke up because of her body fixation and her extreme jealousy, which often led to maltreatment of partners. Irene sought treatment at the addiction clinic for her psychological problems, particularly for her fixation with her body. Before she came to the clinic she had met several doctors but had not found them helpful since they knew so little about AAS.

Case 6 – Sonja, 22

The development of oscillating drugs of abuse and AAS use

Sonja grew up with her biological mother and an older sister. Their parents divorced when the girls were very

young and their mother refused to allow them to meet their father. Sonja describes her upbringing as slack. Their mother was described by Sonja as selfish and the girls were allowed to do as they pleased. Her schooling was rife with problems and she quit school at the age of fourteen. She found it difficult to concentrate in class and often fought with her teachers and with other students. Sonja became more interested in sports after leaving school and involved herself in several, including running and swimming.

She travelled overseas to work at the age of 17 and remained there for one and a half years. After this, she returned home and met a man who was using other drugs of abuse. Her contact with him was her gateway into drug use, and he introduced her to amphetamine. Sonja then stopped all her sports and instead developed quite a severe problem with drug use, including heroin and other opiates, amphetamines and analgesics. Later, she also included hashish and cocaine.

At the age of 21, she met a man who was using AAS. Under his influence, she also started to train at the gym. Since she wanted to have a larger and stronger body, she began using AAS (oral methandrostenolone), and she discontinued her use of drugs of abuse. Sonja's self-confidence improved and she felt generally good taking AAS, which led her to continue with testosterone undecanoate and stanozolol. While taking this course, she noticed that her skin became greasier, her hair looked unwashed, and she had more acne, mood swings and outbreaks of aggression. She was now training seven days a week at the gym, sometimes twice a day. She began to take dietary supplements such as protein, creatine, vitamins and sometimes CLA (Conjugated Linoleic Acid) to keep her weight under control.

Her aggressiveness worsened after starting AAS use and she increasingly frequently got into fights in order to find release for these feelings. She began walking around town looking for someone to fight with because fighting gave her a sense of satisfaction. She felt she was truly alive on these occasions. She bought herself a dog, which she also beat when it did not behave. During her nine months of AAS use, she used oral methandienone, testosterone undecanoate and stanozolol. She also took ephedrine and clenbuterol before training. After a drug-free period she once again began taking other drugs of abuse, although in smaller quantities than before.

She finally stopped taking AAS after encountering problems such as pain and acne but above all because of her aggression and suicide attempts. She was also arrested several times for her involvement in fights. She had previously been sentenced for theft but her criminality increased markedly after she began using AAS. She was

then sentenced for drugs of abuse and doping offences. She sought treatment for her drug problem, which had increased to include ecstasy, amphetamines, buprenorphin and benzodiazepines.

Discussion

As far as we are aware, this study is the first in which patients from an addiction clinic describe the development of their multiple drug use including doping agents (hormone preparations sometimes in combination with other drugs) from a subjective perspective. A primary finding from the patients' narratives is that the use of AAS can develop under widely varying conditions in terms of social background, timing of initiation, development of multiple drug use, and the associated physical and psychological problems. Despite these significant variations, certain common features in the patients' stories are discernible.

Most of the patients in this study describe childhoods with many problems, including physical or psychological abuse. Their problems extended into their time at school and affected both their social and academic achievements. In an earlier study [28], we found social problems to be highly overrepresented among AAS users compared with gym users who were not taking drugs. Negative experiences of school-mates have also been revealed in other studies [34]. It is important to remember, however, that some AAS users describe positive childhoods, which means that there is no straightforward relationship between upbringing and abuse of AAS [28].

All of the patients in this study began using AAS in association with gym training. Most of them were in their late teens, which tallies with earlier reports [6]. The use of AAS continued for between nine months and 16 years. This variation in the duration of AAS use reflects the variations found in clinical addiction treatment practice. For four of these patients, AAS was the first drug they had ever used, while one of them had used alcohol as a first drug and another had used other drugs of abuse (predominantly amphetamines). The only gender-related differences we noticed were that the women used fewer AAS drugs than the men.

In this study, we found that the participants started gym training with the addition of dietary supplements and were later advised to add AAS and other hormones to enhance the effects of training. To prevent AAS-related problems and to enhance the AAS effects, they added various pharmaceuticals, such as ephedrine, testosterone releasers and anti-estrogens, and also alcohol. Some of them also later added other drugs of abuse, such as amphetamine, to further enhance the effects on their training.

A common reason for taking AAS seems to be the experience of reaching a plateau in training effects, leading them to seek possibilities for enhancement. As noted in an earlier study [35], others started AAS to increase body size and muscle strength. Two patients in our study who began using AAS because they wished to compete in bodybuilding believed that AAS use was essential for success in this field. It is of interest that neither of these two patients mixed the hormones with other drugs of abuse.

For two other informants, use of AAS was soon associated with use of other hormone preparations, different drugs of abuse, medications, alcohol, and dietary supplements. This was, however, not the case for the two who wished to compete. The reasons given for the increasing numbers of preparations were to increase the effects of training and the effects of the AAS or to reduce what were believed to be side effects of AAS. In a case description by Wilson-Fearon and Parrot, a male bodybuilder described how he used a cocktail of drugs before competing [36] and Pope and Kanayama [24] describe a case of an AAS user starting to use opioids after getting "pain in his 'deltis' from military presses".

Several of the patients spoke of a great interest in learning more about AAS and other hormone preparations. They readily talked about the underground literature (books, magazines) and web sites where detailed descriptions could be found of which preparations and drugs can and, according to some authors, should be taken with AAS. The fact that information is sought through these media has also been noted in a previous study [37].

The knowledge held by many patients about combining various preparations has clearly become extensive after taking the drugs for some time. This indicates that they felt that their careers were dependent on their considerable knowledge about which drugs can be taken in combination with AAS. In a study by Grogan et al., this was reflected in the comment "I know more than my doctor", particularly when it came to knowledge of the positive and negative effects of AAS [26].

The subjective experience of AAS varied in type and severity but was pronounced and associated with considerable medical and/or psychological problems in all patients. The most commonly reported physical problems were changes in sexual potency (increased and/or decreased libido), skin lesions, testicular atrophy, acne and gynaecomastia. Among the commonly reported psychological side effects were mood swings, aggressiveness, depression, jealousy and increased fixation with body image. These problems are commonly reported by AAS users, for example on the Swedish anti-doping hot-line [7].

Aggressiveness affected four of the patients (two men and two women) and prompted three of them to actively seek out fights. The fourth patient, who already had problems with aggressiveness before using AAS, was the only one who reported aggressive breakthroughs as "roid rage". In a study by Wilson-Fearon, a competitive body builder described how he had to quit work as a security guard several weeks before competing because of problems in controlling his aggressiveness [36].

Pathologically extreme jealousy was a major problem for four of the patients, causing severe disruptions in their relationships. Some of the other problems the patients reported included pain, hair loss or hair growth, clitoris enlargement, unfaithfulness, suicide attempts or suicidal thoughts, and emotional numbness. This emotional numbness was, however, seen as desirable by some informants since it facilitated fighting.

An important finding in this study is that most of the patients describe their early experiences of AAS as definitely positive, perhaps even as the best time of their lives. Olrich and Ewing showed that three common positive effects from AAS use were improvement of one's social status, positive peer recognition and improved vocational performance (increases in work effectiveness, alertness at work and confidence at work) [27]. The most common positive effects described by the patients in this study were increases in strength, body bulk and self-confidence. However, the patients also said that, as their AAS use continued, the negative experiences began to outweigh the positive experiences and that this development was a necessary prerequisite for seeking treatment.

The results of this study should be viewed in light of the fact that the sample is small and specifically selected to represent the wide variations in the development of AAS abuse that we have noted in our clinical work. It should be noted that, consequently, quantitative conclusions couldn't be drawn from this study. In an earlier study [28] we noted, however, that most AAS users at an addiction clinic had social problems from their childhoods with respect to both family and schooling. In another study [29], we also showed that AAS use is often associated with use of other drugs of abuse, pharmaceuticals and alcohol.

Conclusion

This study shows the wide variation in patterns of development of multiple drug abuse in users of AAS. Earlier studies have demonstrated that multiple drug use is common. This study adds information on how this development can occur along different paths and for different reasons, and indicates that AAS can be a gateway to the use of other drugs of abuse. The stories told by the users provide information about AAS use from a subjective per-

spective, which can be important when designing treatment programmes that are adapted to this special group of patients. By listening to the patients, we can learn about what can trigger an interest in AAS, how multiple drugs can be added and what positive and negative effects can be experienced. This knowledge could help counteract the low levels of trust that AAS users often show towards health care providers.

Our objective was not to make broad generalizations but rather to show the wide variation in the patterns of development of preparation use and effects on users of AAS. We contend that care providers should see their task as two-fold. Firstly, it is important as a care provider to possess a high level of general knowledge about AAS use and the possibility of concomitant drug use in order to instill confidence in the patient at the outset of treatment. Secondly, it is important that the care provider avoids stereotypical notions of how abuse usually develops since it can take a variety of forms and have a variety of outcomes. Good general knowledge and an interest in the individual patient's particular life experience are two equally important factors in working with AAS users.

The information from this study may also be useful for policy planning. It is important that the designers of abuse prevention programmes understand the reasons for starting using AAS in order to develop a fact-based message for target groups. This information may also be important in the development of policies concerning detection of abuse and the development of assistance programmes, since AAS users often experience a range of highly desirable effects from the drugs and only seek treatment as an alternative when the negative effects outweigh the positive effects.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

KS conceived the idea for the study, participated in its design, carried out all interviews, took part in the analysis of results and drafted the manuscript. FN was active in the analysis of results and helped to draft the manuscript. IE was responsible for the design of the study and helped to draft the manuscript. All three authors have read and approved the final manuscript.

Acknowledgements

This study was supported by grants from the Swedish National Drug Policy Coordinator (Mobilisering mot Narkotika) and from Orebro County Council.

References

1. Mottram DR, George AJ: **Anabolic steroids**. *Baillieres Best Pract Res Clin Endocrinol Metab* 2000, **14**:55-69.

2. Evans NA: **Gym and tonic: a profile of 100 male steroid users.** *Br J Sports Med* 1997, **31**:54-58.
3. Nilsson S, Baigi A, Marklund B, Fridlund B: **The prevalence of the use of anabolic androgenic steroids by adolescents in a county of Sweden.** *Eur J Public Health* 2001, **11**:195-197.
4. Miller KE, Hoffman JH, Barnes GH, Sabo D, Melnick MJ, Farell MP: **Adolescent anabolic steroid use, gender, physical activity, and other problem behaviors.** *Subst Use Misuse* 2005, **40**:1637.
5. Gruber AJ, Pope HG Jr: **Psychiatric and medical effects of anabolic-androgenic steroid use in women.** *Psychother Psychosom* 2000, **69**:19-26.
6. Parkinson AB, Evans NA: **Anabolic androgenic steroids: a survey of 500 users.** *Med Sci Sports Exerc* 2006, **38**:644-651.
7. Eklof AC, Thurelius AM, Garle M, Rane A, Sjoqvist F: **The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology.** *Eur J Clin Pharmacol* 2003, **59**:571-577.
8. Brower KJ, Blow FC, Beresford TP, Fuelling C: **Anabolic-androgenic steroid dependence.** *J Clin Psychiatry* 1989, **50**:31-33.
9. Bahrke MS, Yesalis CE, Brower KJ: **Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents.** *Child Adolesc Psychiatr Clin N Am* 1998, **7**:821-838.
10. Ropero-Miller JD, Goldberger BA: **Recreational drugs. Current trends in the 90s.** *Clin Lab Med* 1998, **18**:727-746.
11. Graham MR, Davies B, Grace FM, Kicman A, Baker JS: **Anabolic steroid use: patterns of use and detection of doping.** *Sports Med* 2008, **38**:505-525.
12. Casavant MJ, Blake K, Griffith J, Yates A, Copley LM: **Consequences of use of anabolic androgenic steroids.** *Pediatr Clin North Am* 2007, **54**:677-690.
13. Cohen J, Collins R, Darkes J, Gwartzney D: **A league of their own: demographics, motivations and patterns of use of 1,955 male adult non-medical anabolic steroid users in the United States.** *J Int Soc Sports Nutr* 2007, **4**:12.
14. Bahrke MS, Yesalis CE: **Abuse of anabolic androgenic steroids and related substances in sport and exercise.** *Curr Opin Pharmacol* 2004, **4**:614-620.
15. Dawson RT: **Drugs in sport – the role of the physician.** *J Endocrinol* 2001, **170**:55-61.
16. Monaghan L: **Vocabularies of motive for illicit steroid use among bodybuilders.** *Soc Sci Med* 2002, **55**:695-708.
17. Thiblin I, Lindquist O, Rajs J: **Cause and manner of death among users of anabolic androgenic steroids.** *J Forensic Sci* 2000, **45**:16-23.
18. Arvary D, Pope HG Jr: **Anabolic-androgenic steroids as a gateway to opioid dependence.** *N Engl J Med* 2000, **342**:1532.
19. Kanayama G, Cohane GH, Weiss RD, Pope HG: **Past anabolic-androgenic steroid use among men admitted for substance abuse treatment: an underrecognized problem?** *J Clin Psychiatry* 2003, **64**:156-160.
20. Johansson P, Lindqvist A, Nyberg F, Fahlke C: **Anabolic androgenic steroids affects alcohol intake, defensive behaviors and brain opioid peptides in the rat.** *Pharmacol Biochem Behav* 2000, **67**:271-279.
21. Brown JT: **Anabolic steroids: what should the emergency physician know?** *Emerg Med Clin North Am* 2005, **23**:815-826.
22. Pope HG Jr, Kanayama G, Ionescu-Pioaggia M, Hudson JI: **Anabolic steroid users' attitudes towards physicians.** *Addiction* 2004, **99**:1189-1194.
23. Pope HG Jr, Kanayama G: **Can you tell if your patient is using anabolic steroids?** *Current Psychiatry in Primary care* 2005, **1**.
24. Pope HG Jr, Kanayama G: **Bodybuilding's dark side: Clues to anabolic steroid use.** *Current Psychiatry* 2004, **3**.
25. Todd T: **Anabolic steroids: the gremlins of sport.** *J Sport Hist* 1987, **14**:87-107.
26. Grogan S, Shepherd S, Evans R, Wright S, Hunter G: **Experiences of anabolic steroid use: in-depth interviews with men and women body builders.** *J Health Psychol* 2006, **11**:845-856.
27. Olrich TW, Ewing ME: **Life on steroids: Bodybuilders describe their perceptions of the anabolic-androgenic steroid use period.** *Sport Psychol* 1999, **13**:299-312.
28. Skarberg K, Engstrom I: **Troubled social background of male anabolic-androgenic steroid abusers in treatment.** *Subst Abuse Treat Prev Policy* 2007, **2**:20.
29. Skarberg K, Nyberg F, Engström I: **Abuse of narcotics and other drugs in anabolic-androgenic steroid misusers.** *Eur Addict Res* 2008 in press.
30. Rubin H, Rubin I: *Qualitative Interviewing: The Art of Hearing Data* Thousand Oaks: Sage Publications; 2004.
31. Atkinson R: **The life story interview.** In *Handbook of interview Research: Context & Method* Edited by: Gubrium J, Holstein J. Thousand Oaks: Sage Publications; 2002.
32. Snow D, Lofland J, Lofland L: *Analyzing Social Settings: A Guide to Qualitative Observations and Analysis* Belmont: Wadsworth Publishing Company; 2005.
33. Michler E: **Models of Narrative Analysis: A Typology.** *Journals of Narrative and Life History* 1995, **5**:87-123.
34. Kindlundh AM, Hagekull B, Isacson DG, Nyberg F: **Adolescent use of anabolic-androgenic steroids and relations to self-reports of social, personality and health aspects.** *Eur J Public Health* 2001, **11**:322-328.
35. Kindlundh AM, Isacson DG, Berglund L, Nyberg F: **Factors associated with adolescent use of doping agents: anabolic-androgenic steroids.** *Addiction* 1999, **94**:543-553.
36. Wilson-Fearon C, Parrott AC: **Multiple drug use and dietary restraint in a Mr. Universe competitor: psychobiological effects.** *Pecept Mot Skills* 1999, **88**:579-580.
37. Perry PJ, Lund BC, Deninger MJ, Kutscher EC, Schneider J: **Anabolic steroid use in weightlifters and bodybuilders: an internet survey of drug utilization.** *Clin J Sport Med* 2005, **15**:326-330.

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp



STUDY III

Multisubstance Use as a Feature of Addiction to Anabolic-Androgenic Steroids

Kurt Skarberg^{a,b} Fred Nyberg^c Ingemar Engstrom^a

^aSchool of Health and Medical Sciences, Psychiatric Research Centre, Orebro University, ^bAddiction Centre, Orebro County Council, Orebro, and ^cDepartment of Pharmaceutical Bioscience, Uppsala University, Uppsala, Sweden

Key Words

Anabolic-androgenic steroids · Drugs of abuse · Alcohol · Pharmaceuticals · Dietary supplements

Abstract

The aim of this study was to explore and describe total drug use among anabolic-androgenic steroid (AAS) users and the reasons given for the use of these drugs. The study was based on semi-structured interviews and questionnaires involving 32 patients who were attending an addiction centre in Orebro, Sweden, for AAS use. The results indicated that a history of polysubstance use among the patients was frequent. Over half were using drugs of abuse and also taking various other pharmaceuticals. Almost half of the patients took human growth hormones, and almost half of the interviewed persons were drinking alcohol to a hazardous or harmful extent. The most common reason given for taking AAS and other hormones was to increase muscle mass and strength, but some participants also used insulin as a means of losing fat. Cannabis was used to improve sleep, heroin to decrease pain and amphetamine to increase endurance and burn fat. Our data suggest that most of the current AAS users who have been admitted to a treatment programme are multiple drug users with polysubstance dependence. The study stresses the importance of carefully examining total drug use as part of the assessment regimen for this group.

Copyright © 2009 S. Karger AG, Basel

Introduction

Anabolic-androgenic steroids (AAS), which are synthetic analogues of the male hormone testosterone [1], are known to exert strong effects on the human body. Users of AAS desire associated improvements in athletic performance and body appearance [2, 3]. One of the goals of the pharmaceutical industry during the 1960s had been to synthesize and modify the testosterone molecule to promote pure anabolic effects, without the associated androgenic effects. However, so far, attempts to minimize the androgenic effects have not been successful, and the available AAS retain the ability to promote masculine characteristics [4].

The use of AAS was historically confined to professional sports and bodybuilding [5], but recent data show that steroids are now also used by individuals not involved in sports [6]. Many young people are taking AAS for lifestyle purposes [7], and most current AAS users started taking the drug in their late teens [6, 8]. Use of AAS preparations that are not meant for human consumption (e.g., veterinary medication) also occurs [8].

Recently, AAS have received attention for their profound side effects. Studies have suggested that these steroids can induce aggression and addictive behaviour [8, 9] in addition to numerous physical side effects such as acne, sleep disturbance, gynaecomastia and testicular atrophy [6]. Cardiovascular changes (such as atherosclerosis

KARGER

Fax +41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

© 2009 S. Karger AG, Basel
1022-6877/09/0152-0099\$26.00/0
Accessible online at:
www.karger.com/ear

Ingemar Engstrom, MD, PhD
Psychiatric Research Centre, PO Box 1613
SE-701 16 Orebro (Sweden)
Tel. +46 19 602 58 88, Fax +46 19 602 58 86
E-Mail ingemar.engstrom@orebroll.se

sis, hypertension, cardiac hypertrophy, impaired cardiac function and sudden death) and hepatic problems (e.g., cholestasis, hepatocellular hyperplasia and elevations of transaminases, conjugated bilirubin, alkaline phosphatase and lactate dehydrogenase) have been reported [10].

It has been suggested that chronic intake of AAS can result in opioid-type dependence [11]. However, although AAS are widely abused, the potential for dependence and addiction still remains unclear [8].

Use of AAS may be a gateway to the use of other drugs [12], such as opioids [13, 14], opioid agonists/antagonists (e.g., nalbuphine or buprenorphine) [15], morphine [16] or alcohol [17]. AAS users have also been associated with polysubstance dependence [18], but information on total drug use patterns in AAS users is currently insufficient. The role of AAS in the development of polydrug use requires further clarification.

The effects of AAS can be enhanced by combination with other hormones such as human growth hormone (hGH), insulin, thyroid hormone and insulin-like growth factor 1 [6, 19], or sometimes, also including prohormones (e.g., androstadienone or dehydroepiandrosterone) [20, 21]. There is evidence that some dietary supplements can contain undeclared AAS – prohormones (e.g., nandrolone or testosterone prohormones) [22].

Various kinds of other drugs, such as ecstasy, marijuana, LSD [23], cocaine [7, 24, 25], amphetamine and γ -hydroxybutyric acid (GHB) [1, 6, 19], alcohol [26, 27] and dietary supplements (e.g., creatine, protein or ephedrine preparations) [9] have been used in combination with AAS.

Unfortunately, physicians are more likely to enquire about drugs such as heroin or cocaine than about AAS [8]. Some authors indicate that AAS users do not believe that their physician can provide reliable information about AAS. Therefore, it has been proposed that clinicians should learn more about and familiarize themselves with the lives of AAS users, so that they can supply beneficial counsel to their patients [2, 28].

The literature in this area is almost exclusively derived from the sporting community, and there is scarce information concerning people who attend addiction clinics. Therefore, we consider it scientifically relevant and of considerable clinical interest to further explore the patterns of total drug use in AAS users.

The aim of the study was to explore and describe the total lifetime and current use of drugs by AAS users recruited from an addiction clinic in Sweden, with the intention of providing beneficial input into the design of treatment programmes for AAS users.

Table 1. Reported lifetime and current use of drugs among 32 AAS users at an addiction clinic

Drugs/other preparations	Lifetime use	Current use
AAS	32 (100) ¹	32 (100)
hGH	15 (46.9)	2 (6.2)
Insulin	9 (28.1)	3 (9.4)
Insulin-like growth factor 1	5 (15.6)	0 (0.0)
Thyroid hormone (T3/T4)	4 (12.5)	1 (3.1)
Alcohol, hazardous or harmful use ²	15 (46.9)	13 (40.6)
Drugs of abuse	29 (90.6)	18 (56.2)
Cannabis	26 (81.2)	4 (12.5)
Amphetamine	25 (78.1)	16 (50.0)
Ecstasy	18 (56.2)	4 (12.5)
GHB	15 (46.9)	5 (15.6)
Cocaine	13 (40.6)	2 (6.2)
LSD	9 (28.1)	0 (0.0)
Heroin	8 (25.0)	4 (12.5)
Pharmaceutical drugs	31 (96.9)	16 (50.0)
Other drugs	5 (15.6)	0 (0.0)
Dietary supplements	31 (96.9)	12 (37.5)

Figures in parentheses are percentages.

¹ Twelve of these also used AAS as veterinary agents.

² Defined by the AUDIT criteria.

Methods

Selection of Subjects

AAS users were consecutively included in the study over 3 years; subjects were recruited from a psychiatric addiction centre in Örebro county, central Sweden, a county of 275,000 inhabitants. The users were attending the addiction centre for complications related to their AAS use or because of a wish to stop using AAS.

For inclusion, the participants were: (1) to be >16 years of age, (2) to be fluent in Swedish, (3) to be using non-prescribed AAS, alone or in combination with other illicit agents, within the last 4 months, (4) to have been using AAS for at least 4 consecutive months, and (5) to be under the care of the addiction clinic, where a decision to commence treatment for their AAS use was agreed upon based on the initial clinical assessment.

Thirty-two subjects, 30 men and 2 women, were included in the study. None of those approached declined to participate in the study.

Instruments

Before the face-to-face interview, the participants were asked to write down a report of their lifetime and current drug use (including AAS) and hand it to the interviewer. The semi-structured interview format was derived from published studies [29, 30] and based upon our experience with clinical interviews of about 100 AAS users. It comprised questions concerning 6 areas of interest: childhood, adolescence, school experiences, gym training, use of alcohol and illicit drugs, and criminality. Participants were ques-

tioned about all drugs and substances of abuse, including hormones, pharmaceuticals (including prescription drugs), drugs of abuse, alcohol and other substances. The questions concerning alcohol consumption were taken from AUDIT (the Alcohol Use Disorders Identification Test), developed by the World Health Organization [31], which has been translated into Swedish [32]. All interviews regarding drugs were carried out by one of the authors (K.S.), and an independent psychiatrist made the psychiatric diagnoses.

Ethical Approval

The study protocol was approved by the research ethics committee of Orebro County Council (No. 538/99).

Results

The mean age at first use of AAS was 19.7 years (range 15–28 years) in males and 20.5 years in females. The mean duration of total AAS use was 5.1 (range 1–16) years in males and 3.0 (range 2–5) years in females. Twenty-six (81.3%) individuals came in contact with AAS within a training facility, 3 through a friend, 2 while traveling abroad and 1 through the internet.

The reasons for starting AAS included wanting to get better results from training (13 users), wanting to improve their competitive chances (7 users) and wanting to increase muscle mass and strength (5 users).

All 32 participants had taken AAS intended for human use and 12 had also taken preparations intended for veterinary use (e.g., boldenone undecylenate and trenbolone acetate). The figures for lifetime and current use of drugs are shown in table 1.

In addition to AAS, the most common hormone used was hGH. This hormone had been taken by almost half of the patients. Insulin had been used by almost a third of the patients and almost half drank alcohol to a hazardous or harmful degree (as defined in AUDIT), including 2 patients who had injected alcohol intravenously.

The interviewed patients frequently took other drugs of abuse. Most had used cannabis (81%) and amphetamine (78%) and a quarter had used heroin. They also frequently took pharmaceutical drugs and dietary supplements. Other drugs included petrol, solvents or thinners and mushrooms.

The most recent period of AAS use involved AAS alone for 7 participants, AAS in combination with other drugs of abuse for 13, AAS, other drugs of abuse and high consumption of alcohol for 7, AAS and alcohol for 4, and AAS with testosterone releasers for 1 subject.

All subjects underwent psychiatric assessment according to the DSM-IV system. Nine fulfilled the criteria for

Table 2. Lifetime use of oral and injected AAS (n = 32)

Chemical name	Patients	% of total population	Trade name and number of users
<i>Lifetime use of oral AAS (n = 32)</i>			
Methandrostenolone	30	93.8	Methandrostenolone (Russian), 28 Dianabol, 9 Anabol tab (Thai-5), 7
Stanozolol	22	68.8	Winstrol, 19 Stanozolol, 7 Stromba, 4
Oxymetholone	12	37.5	Anadrol, 10 Anapolon 50, 4 Oxymetholone, 3
Methenolone acetate	10	31.3	Primobolan S
Testosterone undecanoate	10	31.3	Andriol, 8 Undestor, 5
Oxandrolone	9	28.1	Oxandrolone SPA, 8 Anavar, 2
Fluoxymesterone	7	21.9	Halotestin
Prohormone	5	15.6	Androstadienone, 3 DHEA (dehydroepiandrosterone), 2
Methyltestosterone	3	9.4	Methyltestosterone, 3 Teston, 1
Ethylestrenol	1	3.1	Maxibolin
<i>Lifetime use of injected AAS (n = 32)</i>			
Nandrolone esters	27	84.4	Deca Durabolin, 26 Dynabolon, 3 Extrabolone, 2 Turinabol, 2
Testosterone blends (2 and 4)	26	81.3	Sustanon, 24 Omnadren, 18 Primoteston depot, 8 Testoviron, 5
Injectable testosterone: cypionate, enanthate, propionate, suspension	20	62.5	
Stanozolol	17	53.1	Winstrol depot, 17 Strombaject, 2 Parabolon
Trenbolone cyclohexylmethylcarbonate	10	31.3	
Methenolone enanthate	9	28.1	Primobolan depot
Boldenone undecylenate (veterinarian drug)	7	21.9	Equipose, 3 Boldone, 2 Drive, 2 Ganabol, 1
Methyltestosterone	5	15.6	Testosterone
Trenbolone acetate (veterinarian drug)	5	15.6	Finaject, 5 Finaplix-H (pellets), 1
Drostanolone propionate	4	12.5	Masteron, 3 Masteril, 1
Other testosterone	3	9.4	Testoderm (patches), 2 Androgel (gel), 1
Methandrostenolone	3	9.4	Dianabol injection
Methandriol dipropionate (veterinarian drug)	2	6.3	Filybol, 1 Spectriol, 1

Table 3. Lifetime use of pharmaceutical drugs in combination with AAS (n = 31)

Reason for use	Pa-tients	% of to-tal popu-lation	Drug
Stimulants			
Sympathomimetics	29	93.5	ephedrine, 29
Sedatives			
Benzodiazepine derivatives	20	64.5	flunitrazepam ¹ , 16 diazepam, 13 oxazepam, 4
Phenothiazine derivatives	7	22.6	promethazine, 5 fentiazin, 2
Benzodiazepine related	3	9.7	zolpidem, 3
Azaspirone derivatives	2	6.4	buspiron, 2
Diphenylmethyl piperazine derivatives	2	6.4	hydroxyzine, 2
Adrenergic drugs	18	58.3	clenbuterol, 15 salbutamol, 5 bromhexin/ephedrine, 3 ethylmorphine/ephedrine, 2
Testosterone releasers	16	51.6	human chorionic gonadotropin, 15 menotrophin, 1
Analgesics	15	48.3	acetylsalicylic acid, 9 codeine, 6 dextropropoxiphene, 5 morphine, 4 chlorzoxazone, 2
Antidepressants	15	48.3	paroxetine, 10 citalopram, 3 venlafaxine, 4 sertraline, 1
Anti-oestrogens	12	38.7	proviron, 8 tamoxifen, 6 clomiphene, 5 arimidex, 1
Anti-inflammatories, NSAIDs	4	12.9	naproxen, 3 ketoprofen, 1
Diuretics	4	12.9	spironolactone, 2 furosemide, 2
Anti-acne preparations	3	9.7	roaccutane, 3
Antihypertensive drugs	2	6.4	clonidine hydrochloride, 2
Miscellaneous			
Muscle oil	3	9.7	synthol, 3
Dopamine and decarboxylase inhibitors	1	3.2	levodopa, 1

NSAIDs = Non-steroidal anti-inflammatory drugs.

¹ Rohypnol used by 16 patients and flunitrazepam used by 9 patients.

AAS abuse and 8 for AAS dependence. Many also fulfilled the criteria for abuse or dependence on drugs of abuse, including 9 for amphetamine dependence, 7 for amphetamine abuse, 3 for GHB dependence and 2 for cannabis dependence. All 4 participants who were using heroin were diagnosed as heroin abusers. Almost half of the AAS users were also heavy alcohol consumers; 7 ful-

filled criteria for alcohol abuse and 5 for alcohol dependence. Seven patients who used pharmaceuticals fulfilled the criteria for abuse and 1 subject for dependence.

In response to a request to write down the kinds of AAS used, the patients named an average of 6 (range 2–28) different types. As shown in table 2, of the various oral AAS used, the most common were methandrostenolone (e.g., Methandrostenolonum) and stanozolol (e.g., Winstrol).

Of the injected steroid preparations, nandrolone esters (e.g., Deca Durabolin) and various testosterone blends were used most frequently (table 2). Most of the patients had used various types of testosterone (e.g., cypionate, enanthate) and stanozolol. Four patients had also used AAS formulated as pellets, patches and gel.

Table 3 shows a summary of all the pharmaceuticals ever used by the patients. Ninety-seven percent of the patients had taken pharmaceutical drugs. The drugs had been either prescribed by a physician or acquired on the street. The most common drug, ephedrine, had been used by over 93% of the patients. The most commonly taken sedative, flunitrazepam (e.g., Rohypnol), was used by more than 50% of the patients.

People training at gyms commonly use dietary supplements. Almost all patients in this study (97%) had used supplements, some of which are listed in table 4. Protein powder and creatine were the most common, but multivitamins, ephedrine preparations, hGH stimulators, fat-loss agents and stimulants were also taken.

Table 5 lists the reasons given for using the drugs. While many of these are well documented, some were surprising; for example, some patients stated that insulin not only increased muscle mass and strength, but also burned fat. The site enhancement oil Synthol was used by 2 patients before the summer holidays with the intention of increasing the strength and volume of some muscles.

Discussion

This study clearly indicates that the use of AAS is often combined with the use of other illicit drugs and high amounts of alcohol. This is in line with the findings of earlier studies investigating AAS use among athletes, adolescents and other users [6, 27, 29, 33], secondary and high school students [27, 34], as well as victims of suicide [12]. However, this study provides a much more detailed and comprehensive account of current and lifetime drug use patterns in AAS users than has been reported previously.

Table 4. Lifetime use of dietary supplements in combination with AAS (n = 31)

Dietary supplements	Patients	% of total population	Examples
Protein	30	96.8	weight gain protein and Super Mass Fuel
Creatine	27	87.1	
Multivitamins	18	58.1	
Ephedrine preparations	15	48.4	Ripped Fuel and Thermoprof
hGH stimulators	9	29.0	γ -aminobutyric acid, glutamine and fish oil
Fat-loss agents	8	25.8	conjugated linoleic acid and calcium pyruvate
Stimulants	6	19.3	caffeine tablets, ephedrine, caffeine, acetylsalicylic acid (ECA stack)
Plant steroid compounds	5	16.1	<i>Tribulus terrestris</i>
Anti-catabolics	5	16.1	β -hydroxy- β -methylbutyrate
Nutrition replacements	4	12.9	Meritene
Testosterone boosters	2	6.4	chrysin and testomin

Our study, which was based on interviews with patients seeking help at an addiction clinic for problems related to AAS, demonstrates that multisubstance use is widespread among these individuals. AAS use was commonly combined with the use of other hormones as well as with alcohol, drugs of abuse, pharmaceuticals and dietary supplements.

Many of the patients in this study combined their steroid intake with that of polypeptide hormones such as insulin and insulin-like growth factor 1. One of the reasons given for use of insulin, which to our knowledge has not been reported previously, was the belief that it could be used for both increasing muscle mass and burning fat, depending on the dose.

The use of a wide variety of pharmaceuticals was also very common. We found it particularly interesting that the patients frequently took central stimulants as well as sedatives. These drugs were often acquired on the street, but we also found several cases where the drugs were prescribed for physical reasons, probably by doctors who were unaware of the patients' drug situation.

Previous studies have suggested that alcohol abuse may appear as a consequence of or a combination with AAS use [35]. An animal study [17] demonstrated that use of AAS could lead to a progressively higher intake of alcohol. In our study, a substantial proportion of the patients currently took alcohol to a hazardous or harmful extent and almost half of them received a diagnosis of alcohol abuse or dependence according to the DSM-IV criteria.

As described in some recent studies, AAS use may be associated with severe social problems [36] and psychological and physical complications [26], while polysub-

stance use complicates the prognosis for recovery. It is well known that individuals using AAS are often susceptible to psychiatric complications such as depression, mania, psychosis, aggression and dependency on other drugs [37].

This study clearly indicated that the most frequently used drugs were cannabis, amphetamine and ecstasy; most patients admitted to taking these drugs. Central stimulants and sedatives also appear to be currently popular in this group. In contrast to lifetime use, the drugs most often used in combination with AAS at the time of the interview were amphetamine and alcohol. In addition, several users were currently dependent on amphetamine according to the DSM-IV criteria. In many cases, the patients initiated their use of amphetamine and/or heroin after attempting to withdraw from AAS, which raises the question of whether the use of AAS could lead to the use of addictive drugs such as amphetamine and/or heroin, as has previously been proposed [13, 14]. In fact, animal studies have indicated that AAS can sensitize rats to amphetamine [38].

The reasons given for taking pharmaceuticals in combination with AAS varied widely. Some of the reasons are well recognized, but some were new to us. Several individuals claimed that they were combining steroids with benzodiazepines, drugs of abuse (heroin, GHB and cannabis) or alcohol to improve their sleep. About two thirds of the patients combined AAS with benzodiazepines, mainly flunitrazepam. It has been reported that drugs such as flunitrazepam can induce aggressive behaviour and, in some individuals, lead to acts of violence [39]. High doses of AAS have also been associated with aggression; however, the behavioural effects of combining AAS with benzodiazepines have not yet been evaluated.

Table 5. Reasons given for taking accessory drugs

Group/drug	Reasons for use
Hormones	
hGH	increase muscle mass and strength
Insulin-like growth factor 1	increase muscle mass and strength
Insulin	increase muscle mass and strength, burn fat
Thyroid hormone	burn fat
Stimulants/fat loss	
Narcotics (amphetamine)	increase endurance, burn fat
Narcotics (cocaine)	increase endurance, burn fat
Alcohol	relaxing, improve sleep
Ephedrine	increase endurance, burn fat
Bronchodilators	increase endurance, burn fat
Ephedrine preparations	increase endurance, burn fat
Fat-loss agents	burn fat
Stimulants	increase endurance, burn fat
Plant steroid compounds	increase endurance
Sedatives	
Narcotics (cannabis)	improve sleep
Narcotics (GHB)	improve sleep, release GH
Narcotics (heroin)	improve sleep, decrease pain
Benzodiazepines	improve sleep, increase self control, sedation
Anti-depressants	relieve symptoms of depression, increase serotonin and noradrenaline levels
Opioids	
Analgesics	decrease pain from training
Drugs against side effects	
Testosterone stimulating	prevent testicular atrophy
Anti-oestrogens	prevent gynaecomastia
Testosterone stimulating drugs/anti-oestrogen (Clomid)	prevent gynaecomastia and prevent testicular atrophy
Anti-inflammatory, NSAIDs	treat inflammation, pain and fever
Anti-acne	reduce acne problems
Diuretics	reduce oedema
Anti-hypertensive drugs	lower high blood pressure
Miscellaneous	
Muscle oil (synthol)	cosmetic increase in size of some muscles
Levodopa	increase growth hormone
Protein	increase protein synthesis
Creatine	increase muscle mass
hGH stimulators	increase muscle mass
Anti-catabolics	improve hepatic protein synthesis and nitrogen economy
Nutritional replacements	over the counter food replacement
Testosterone boosters	increase blood serum levels of testosterone

NSAIDs = Non-steroidal anti-inflammatory drugs.

Analgesics such as morphine, codeine, dextropropoxyphene and acetylsalicylic acid were taken to decrease the pain associated with training. This can be risky behaviour, as previous studies have shown that AAS may facilitate addiction to opiates [14]. In a study of 88 heroin users, 25% had a previous history of using AAS [13]. Furthermore, animal studies have suggest-

ed that AAS could sensitize the brain to opiate dependence [16].

It is well known that sympathomimetic drugs are commonly used with AAS. In our study, more than 90% of the patients used ephedrine, and 58% used other adrenergic drugs (e.g., clenbuterol or salbutamol). The reason given for taking ephedrine was to increase endur-

ance and to burn fat. Similar reasons were given for taking bronchodilators (salbutamol) and central stimulants such as amphetamine and cocaine.

Testosterone stimulators, such as human chorionic gonadotropin, were used to prevent testicular atrophy, and anti-oestrogens (mesterolone, tamoxifen and clomiphene) were used to prevent gynaecomastia. Both these phenomena are known to result from the use of AAS.

The combination of AAS and dietary supplements was common among steroid users. In particular, creatine, vitamin preparations, ephedrine preparations and a variety of different proteins were used. Protein and creatine were taken by almost all of the patients, and the majority also used vitamins and ephedrine preparations. In addition to taking hGH (genotropin or somatotropin), some patients also took hGH stimulators. Anti-catabolics, nutrition replacement preparations and testosterone boosters were used to a lesser extent.

Overall, these findings suggest that often users of AAS not only take multiple steroids but commonly use other hormones, drugs of abuse, alcohol, pharmaceuticals and dietary supplements. The long-term consequences for the physiology and mental health of individuals combining AAS with all these agents are not easy to foresee. There

are a number of reports available in the literature showing that polysubstance use combined with AAS at high doses can result in severe complications [3, 8, 12, 40, 41]. The adverse effects of the drugs taken, the interactions associated with polypharmacy, the effects of the large dosages and the increased risk of addiction to other drugs of abuse and alcohol are all major health care concerns that require further study. The use of illicit drugs and heavy drinking also raise the issue of appropriate treatment approaches. Polysubstance use is a challenge for the clinician; it is questionable whether we have effective pharmacological treatments for all these addictions. Comparison of treatments for AAS use and treatments for abuse of other substances could be useful in this respect [1], with emphasis on psychosocial and psychological approaches in particular [42].

Our present results are based on a relatively small group of patients seeking help at an addiction clinic, which limits generalization of the results to a broader group of AAS users. However, we suggest that the results are important enough to stress the necessity for physicians and other clinicians to carry out a comprehensive inquiry into AAS use by their patients, with particular attention paid to the possibility of polysubstance use.

References

- 1 Brower KJ: Anabolic steroid abuse and dependence. *Curr Psychiatry Rep* 2002;4:377–387.
- 2 Pope HG Jr, Kanayama G, Ionescu-Pioggia M, Hudson JI: Anabolic steroid users' attitudes towards physicians. *Addiction* 2004; 99:1189–1194.
- 3 Pagonis TA, Angelopoulos NV, Koukoulis GN, Hadjichristodoulou CS: Psychiatric side effects induced by supraphysiologic doses of combinations of anabolic steroids correlate to the severity of abuse. *Eur Psychiatry* 2006;21:551–562.
- 4 Handelsman DJ: Testosterone: use, misuse and abuse. *Med J Aust* 2006;185:436–439.
- 5 Mottram DR, George AJ: Anabolic steroids. *Baillieres Best Pract Res Clin Endocrinol Metab* 2000;14:55–69.
- 6 Parkinson AB, Evans NA: Anabolic androgenic steroids: a survey of 500 users. *Med Sci Sports Exerc* 2006;38:644–651.
- 7 Simon P, Striegel H, Aust F, Dietz K, Ulrich R: Doping in fitness sports: estimated number of unreported cases and individual probability of doping. *Addiction* 2006;101:1640–1644.
- 8 Hall RC: Abuse of supraphysiologic doses of anabolic steroids. *South Med J* 2005;98:550–555.
- 9 Perry PJ, Lund BC, Deninger MJ, Kutscher EC, Schneider J: Anabolic steroid use in weightlifters and bodybuilders: an internet survey of drug utilization. *Clin J Sport Med* 2005;15:326–330.
- 10 Casavant MJ, Blake K, Griffith J, Yates A, Copley LM: Consequences of use of anabolic androgenic steroids. *Pediatr Clin North Am* 2007;54:677–690.
- 11 Le Greves P, Huang W, Johansson P, Thornwall M, Zhou Q, Nyberg F: Effects of an anabolic-androgenic steroid on the regulation of the NMDA receptor NR1, NR2A and NR2B subunit mRNAs in brain regions of the male rat. *Neurosci Lett* 1997;226:61–64.
- 12 Thiblin I, Lindquist O, Rajs J: Cause and manner of death among users of anabolic androgenic steroids. *J Forensic Sci* 2000;45:16–23.
- 13 Kanayama G, Cohane GH, Weiss RD, Pope HG: Past anabolic-androgenic steroid use among men admitted for substance abuse treatment: an underrecognized problem? *J Clin Psychiatry* 2003;64:156–160.
- 14 Arvary D, Pope HG Jr: Anabolic-androgenic steroids as a gateway to opioid dependence. *N Engl J Med* 2000;342:1532.
- 15 Wines JD Jr, Gruber AJ, Pope HG Jr, Lukas SE: Nalbuphine hydrochloride dependence in anabolic steroid users. *Am J Addict* 1999; 8:161–164.
- 16 Celerier E, Yazdi MT, Castane A, Ghozland S, Nyberg F, Maldonado R: Effects of nandrolone on acute morphine responses, tolerance and dependence in mice. *Eur J Pharmacol* 2003;465:69–81.
- 17 Johansson P, Lindqvist A, Nyberg F, Fahlke C: Anabolic androgenic steroids affects alcohol intake, defensive behaviors and brain opioid peptides in the rat. *Pharmacol Biochem Behav* 2000;67:271–279.
- 18 Gruber AJ, Pope HG Jr: Psychiatric and medical effects of anabolic-androgenic steroid use in women. *Psychother Psychosom* 2000; 69:19–26.
- 19 Evans NA: Current concepts in anabolic-androgenic steroids. *Am J Sports Med* 2004;32: 534–542.
- 20 Congeni J, Miller S: Supplements and drugs used to enhance athletic performance. *Pediatr Clin North Am* 2002;49:435–461.
- 21 Bahrke MS, Yesalis CE: Abuse of anabolic androgenic steroids and related substances in sport and exercise. *Curr Opin Pharmacol* 2004;4:614–620.

- 22 Geyer H, Parr MK, Mareck U, Reinhart U, Schrader Y, Schanzer W: Analysis of non-hormonal nutritional supplements for anabolic-androgenic steroids – results of an international study. *Int J Sports Med* 2004;25:124–129.
- 23 Nilsson S, Baigi A, Marklund B, Fridlund B: Trends in the misuse of androgenic anabolic steroids among boys 16–17 years old in a primary health care area in Sweden. *Scand J Prim Health Care* 2001;19:181–182.
- 24 Morrison CL: Cocaine misuse in anabolic steroid users. *J Perform Enhancing Drugs* 1996;1:10–15.
- 25 Blue JG, Lombardo JA: Steroids and steroid-like compounds. *Clin Sports Med* 1999;18:667–689.
- 26 Eklof AC, Thurelius AM, Garle M, Rane A, Sjoqvist F: The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology. *Eur J Clin Pharmacol* 2003;59:571–577.
- 27 Nilsson S, Baigi A, Marklund B, Fridlund B: The prevalence of the use of androgenic anabolic steroids by adolescents in a county of Sweden. *Eur J Public Health* 2001;11:195–197.
- 28 Brown JT: Anabolic steroids: what should the emergency physician know? *Emerg Med Clin North Am* 2005;23:815–826.
- 29 Evans NA: Gym and tonic: a profile of 100 male steroid users. *Br J Sports Med* 1997;31:54–58.
- 30 Malone DA Jr, Dimeff RJ, Lombardo JA, Sample RH: Psychiatric effects and psychoactive substance use in anabolic-androgenic steroid users. *Clin J Sport Med* 1995;5:25–31.
- 31 Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M: Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption – II. *Addiction* 1993;88:791–804.
- 32 Bergman H, Kallmen H: Alcohol use among Swedes and a psychometric evaluation of the Alcohol Use Disorders Identification Test. *Alcohol Alcohol* 2002;37:245–251.
- 33 Kindlundh AM, Hagekull B, Isacson DG, Nyberg F: Adolescent use of anabolic-androgenic steroids and relations to self-reports of social, personality and health aspects. *Eur J Public Health* 2001;11:322–328.
- 34 Kindlundh AM, Isacson DG, Berglund L, Nyberg F: Factors associated with adolescent use of doping agents: anabolic-androgenic steroids. *Addiction* 1999;94:543–553.
- 35 Lukas SE: CNS effects and abuse liability of anabolic-androgenic steroids. *Annu Rev Pharmacol Toxicol* 1996;36:333–357.
- 36 Skarberg K, Engstrom I: Troubled social background of male anabolic-androgenic steroid abusers in treatment. *Subst Abuse Treat Prev Policy* 2007;2:20.
- 37 Talih F, Fattal O, Malone D Jr: Anabolic steroid abuse: psychiatric and physical costs. *Cleve Clin J Med* 2007;74:341–344, 346, 349–352.
- 38 Steensland P, Hallberg M, Kindlundh A, Fahlke C, Nyberg F: Amphetamine-induced aggression is enhanced in rats pre-treated with the anabolic androgenic steroid nandrolone decanoate. *Steroids* 2005;70:199–204.
- 39 Daderman AM, Fredriksson B, Kristiansson M, Nilsson LH, Lidberg I: Violent behavior, impulsive decision-making, and anterograde amnesia while intoxicated with flunitrazepam and alcohol or other drugs: a case study in forensic psychiatric patients. *J Am Acad Psychiatry Law* 2002;30:238–251.
- 40 Wilson-Fearon C, Parrott AC: Multiple drug use and dietary restraint in a Mr Universe competitor: psychobiological effects. *Percept Mot Skills* 1999;88:579–580.
- 41 Kanayama G, Pope HG, Cohane G, Hudson JI: Risk factors for anabolic-androgenic steroid use among weightlifters: a case-control study. *Drug Alcohol Depend* 2003;71:77–86.
- 42 Corcoran JP, Longo ED: Psychological treatment of anabolic-androgenic steroid-dependent individuals. *J Subst Abuse Treat* 1992;9:229–235.

STUDY IV

Is there an association between use of anabolic-androgenic steroids and criminality?

Kurt Skarberg^{a,b}, Fred Nyberg^c and Ingemar Engstrom^a

^aSchool of Health and Medical Sciences, Psychiatric Research Centre, Orebro University,

^bAddiction Centre, Orebro County Council, Orebro and ^cDepartment of Pharmaceutical Bioscience, Uppsala University, Uppsala, Sweden

Running title: Anabolic-androgenic steroid users and criminality

Correspondence should be directed to:

Ingemar Engstrom, MD, PhD,

Mail address: Psychiatric Research Centre,

P.O. Box 1613, SE-701 16 Orebro, Sweden.

Phone: +46 19 602 58 88

Fax: +46 19 602 58 86

E-mail address: ingemar.engstrom@orebroll.se

Keywords: Anabolic-androgenic steroids · Drugs of abuse · Alcohol · Pharmaceuticals · Criminality · Violence · Sweden

Abstract

The aim of this study was to improve understanding of the proposed association between anabolic-androgenic steroids (AAS) and criminality. The study was based on interviews and data from The Swedish National Council for Crime Prevention (BRÅ) involving 32 users of AAS who had sought treatment at a psychiatric addiction clinic in Sweden. A score derived from the number of crimes, their level of severity and the relevant time periods was computed to allow comparisons between subgroups sorted according to type and timing of drug use. The criminal activity level increased significantly for 69% of the participants after beginning to use drugs. This was particularly obvious in the two subgroups who started their involvement with drugs by using AAS. Crimes of violence and weapon offences showed the greatest increases in incidence after drug use was initiated. The study also showed a significant decrease in criminality after treatment, particularly among participants who started their drug use with AAS. The results suggest that there is an association between use of AAS and criminality, in particular with respect to crimes of violence and weapon offences, and that this criminality is enhanced when AAS are combined with other drugs of abuse.

Introduction

Anabolic-androgenic steroids (AAS) are synthetic derivatives of the male endogenous sex hormone testosterone [1]. These steroids were originally used by athletes but are now used by a far wider range of groups outside of sport and athletics [2, 3]. The majority of users are male [4, 5]. It has been shown that the use of AAS is often combined with the use of alcohol [6-8] and other drugs of abuse [9-11]. This finding was substantiated by a recent study in which we noted that the combination of AAS with alcohol, other drugs of abuse and pharmaceuticals was very common in a group of AAS users who sought treatment at an addiction clinic (AC) [12].

Several studies have suggested the possibility of an association between the use of AAS and aggressive and/or criminal behaviour. Animal studies have found AAS-related neurochemical changes in areas associated with stress, behavioural and reward responses and have also noted a greater incidence of biting behaviour associated with AAS administration [13]. AAS-treated animals have also demonstrated increased aggression and decreased time and provocation to bite [14].

In humans, AAS are used in supraphysiological doses to enhance the effects of physical training [15, 16]. A correlation has been found between the dose of AAS and the severity of psychiatric side effects, especially aggression, which may contribute to an increase in violent crimes [17]. Psychiatric side effects associated with AAS misuse and possibly leading to violence, including homicide, have also been described (e.g. depression, mania, psychosis, suicide and marked aggression [18] or irritability, mood swings and decreased impulse control [19]). There are also reports of AAS users being more likely to show high-risk behaviour such as carrying a weapon or fighting [20] or dangerous behaviour [21] than seen in non-users.

Testosterone has long been suspected of increasing aggression and violence in man. High testosterone levels were found as early as the 1980s to be significantly connected with violent crimes [22]. More recently, it was found that subjects with higher serum testosterone levels were significantly more violent than those with lower serum testosterone levels [23]. In addition, an association was found between AAS use and heightened levels of violent behaviour after the effects of key demographic variables, previous violent behaviour, and

polydrug use had been controlled for [24]. More violence towards women has also been reported when their significant others were using AAS [25].

Swedish studies have added to the data suggesting an association between increased aggression and illicit use of AAS. One study described five young men who got heavily involved in criminal activities (e.g. assault, illegal threat and drug-related crimes) after starting AAS use [26]. In another study, it was noted that one subject who used AAS in a cyclic “on-off” pattern was in an “off” phase at the time of the crime [27]. In a retrospective cohort study it was found that there was a higher risk of being convicted for weapon offence or fraud among AAS users than among non-users [28]. A study from the same research group investigated 55 deceased individuals who were AAS-positive at the time of the post-mortem medico-legal examination. It was found that use of AAS, especially when combined with other illegal drugs, was associated with a higher rate of violent crime [29].

Other authors have also found a connection between AAS and violent death. Pope and Katz (1990) described three men who impulsively committed violent crimes, including murder, while taking AAS [30]. Another study describes interviews with males associated with cases of criminal behaviour caused by AAS misuse, one of which involved firing a gun after injection of AAS [31]. In an investigation of the causes of death among 34 males who misused AAS, nine were found to have died by homicide [10]. In another mortality study, AAS was found to be an indicator for increased risk of premature death [32].

The substantial evidence in the cited studies indicates an association between use of AAS and violent/criminal behaviour. Yet there are few systematic studies based on clinical samples that have studied this association in detail. As far as we are aware, no study has described the association between the development of drug use and the development of criminal behaviour or has attempted to disentangle the association between these two factors over time.

The aim of this study was to improve understanding of the association between criminality and use of AAS with or without the use of other drugs of abuse. The research questions were as follows: a/ is there a connection between AAS and criminality, b/ is this connection influenced by the use of other drugs and c/ is criminality influenced by treatment of AAS users?

Methods

The study is based on 36 users of AAS (34 men and two women) who were consecutively included from a psychiatric addiction centre (AC) in Orebro county, central Sweden, a county of 275 000 inhabitants. All subjects were attending the AC to seek help for what they believed to be AAS-related side effects. The mean age of the AAS users was 27.6 years (range 19.0-42.0 years).

The inclusion criteria for participants were that they must: a) be over 16 years of age, b) be fluent in Swedish, c) be using non-prescribed AAS, alone or in combination with other doping agents, d) have been using AAS for at least four months and e) be under the care of the addiction clinic where a decision to commence treatment for their AAS use had been agreed upon following an initial clinical assessment. The lower limit of four months was chosen to include more than one AAS cycle, thus indicating regular use.

In the interview described below, 34 of the 36 participants stated that they had been convicted of a crime. We compared these figures to data from The Swedish National Council for Crime Prevention (Brottsförebyggande rådet; BRÅ) by running the subjects' social security numbers through BRÅ's database on legal proceedings against individuals. BRÅ is a centre for research and development work within the justice system and all persons sentenced for any crime in Sweden have been included in this database since 1974 [33]. 32 of the 34 subjects were found in the database, indicating that they had been convicted of at least one crime. Thus, all persons found in the database admitted having carried out crimes, but an additional three persons claimed crime sentences that could not be found in the official database. This study is based on the 32 individuals found in the database.

Interviews

Prior to an interview, each participant was asked to write down a narrative of how their drug use had developed over the years, including the names of the drugs they had used and when they began using them. A semi-open face-to-face interview [34] was then conducted and carried out as a conversation in which the participants were given considerable freedom on how to tell their stories. The interview comprised two main parts: firstly, a description of the temporal development of their use of drugs; secondly, a description of their history of criminal activities. This questionnaire was partly derived from published studies [2, 35] but

was also based upon our experience with clinical interviews of some one hundred AAS users in other studies. The interviews took between one and three hours per participant. The subjects were then given the opportunity to read and comment on these texts and to assess whether they seemed reasonable and whether they wished to remove any parts.

Definition of crimes

The database used in the study includes all types of crime; the crimes were grouped by us according to previous research concerning drugs and criminality [28, 36-38] but also with reference to the Swedish law. The groupings were as follows:

Crimes of violence: battery, unlawful encroachment, unlawful restraint, unlawful detention, assault, trespass, robbery, negligence constituting a public danger, court assault, violence or threat against civil servant, violent resistance and promotion of escape.

Weapon offences: possession of firearms, possession of knives and possession of explosives.

Crimes against property: larceny, pilfering, theft of a vehicle, unlawful dispossession, receiving stolen goods and smuggling.

Fraud: fraud, unlawful use, forgery and false charge.

Drug-related offences: possession of narcotics, possession of AAS, possession of goods dangerous to the health, possessions of syringes and crimes against the alcohol laws.

Traffic crimes: dangerous (reckless) driving, using a vehicle without lawful authority, drunken driving and hit-and-run.

Other offences: offences against damage laws, law and order, compulsory military service law and various vehicle laws.

Code system for scoring perpetrated crimes.

In order to assess total criminality over time, we developed a code system based on the maximum sentence for each crime according to Swedish law to score the crimes. Crimes that don't lead to deprivation of liberty were given 1 point. Crimes with a maximum sentence of 0.5 years received 2 points; maximum 1 year: 3 points; maximum 2 years: 4 points; maximum 3 years: 5 points; maximum 4 years: 6 points; maximum 6 years: 7 points; and maximum 10 years: 8 points (table 1). The code system thus divided the crimes into eight groups depending on the severity of the crime according to the law.

The score for each individual was then divided by the relevant time period in order to yield a weighted value which expressed a) the total number of crimes, b) the level of severity of the crimes, and c) the intensity of criminal acts based on time. The computed crime scores were compared within four periods: period one comprised the time from criminality start to drug start, period two from drug start to first treatment contact with AC, period three from the start of treatment at AC to the time when treatment was terminated, and period four the time from termination of treatment to the endpoint of the study (December 31, 2007; figure 1).

Insert Fig. 1 about here

Groups of users

One of the aims of the study was to disentangle the association between different drug use patterns and criminality. The population sample was therefore divided into four groups depending on how the pattern of drug use had developed over time according to the interview. In the groups, AAS are symbolised as A and other drugs of abuse (narcotics) are symbolised as O.

Group 1: AAS were the only drugs used (A) n=7.

Group 2: AAS were the debut drugs, later combined with other drugs of abuse (A+O), n=10.

First period, AAS were the only drugs (A).

Second period, AAS were combined with other drugs of abuse (AO).

Group 3: Other drugs of abuse were the debut drugs, later combined with AAS (O+A), n=11.

First period, other drugs of abuse were the only drugs (O).

Second period, other drugs of abuse were combined with AAS (OA).

Group 4: AAS and other drugs of abuse were started at the same time (AO/OA), n=4.

The mean ages of the participants in these subgroups were: group 1, 26 years; group 2, 28 years; group 3, 30 years; and group 4, 23 years.

The mean time from when the subjects were discharged from AC to the cut-off date was 5.0 (range 2.1-7.0) years for the whole population. For the subgroups, these values were: group 1,

5.4 (range 4.1-6.1) years; group 2, 5.4 (range 4.0-7.0) years; group 3, 4.5 (range 1.2-6.1) years; and group 4, 4.3 (range 4.0-5.0) years.

Ethical approval

The study protocol was approved by the Ethics committee of Orebro County Council (No.: 538/99) and the Regional Ethics Vetting Board in Uppsala (No.: 2004: M-316) in accordance with the Swedish law concerning approval of medical research. The participants all gave their informed consent.

Results

The sample consisted of 32 persons, all of whom had been convicted of various crimes, as verified in the BRÅ database.

Insert table 1 about here

Twenty of these 32 persons had been convicted of crimes before the debut of drugs (period 1). Ten more persons were convicted after the debut of drugs but before commencement of treatment (period 2). The number of persons convicted for each type of crime at some time during the study period is reported in table 1, which also indicates the absolute number of crimes. Twenty persons (63%) were convicted of crimes of violence and eighteen persons (56%) of weapon offences. Other common types of crime were crimes against property (mostly theft and pilfering) and drug-related offences.

The level of criminality increased among 22 participants (69%) after they started using drugs of any kind (table 2).

Insert table 2 about here

This was especially obvious in group 1 (only AAS use), where criminality increased in all seven persons (100%). In group 2 (mixed drugs starting with AAS), this was the case in eight out of eleven cases (73%). In groups 3 and 4, who were involved with other drugs from the start, the level of criminality increased in half (50%) of the cases.

After termination of treatment at the AC, the level of criminality decreased in 24 persons (75%) (table 3). This occurred fairly equally across the subgroups, except in group 1 (only AAS use), where criminality decreased in all participants (100%).

Insert table 3 about here

The criminality scores in absolute figures are shown in figure 2 and table 4. The level of criminality before the debut of drugs was quite low, except in group 3 (started with other drugs of abuse). There was a considerable increase in criminality after the debut of drugs in the sample studied. Clear differences between the subgroups can be seen in figure 2, where especially group 1 (only AAS use) and group 4 (mixed drug use) showed a radical increase in criminality after starting drugs. Group 3 (started with other drugs of abuse) were already fairly deeply involved in criminality before the debut of drug use. Their criminality level increased only slightly after starting drugs.

Insert figure 2 and table 4 about here

The decrease in criminal behaviour during and after treatment is also shown in figure 2 and table 4; criminality almost disappeared in most of the subgroups. The decrease in criminality began during treatment but reached its lowest level after termination of treatment and during the follow-up period (mean five years).

The data presented so far are crude data, involving a wide range of crimes. The data were therefore assessed in more detail with respect to the kinds of criminality found in the database.

Insert table 5 about here

Table 5 shows the total criminality scores according to the eight crime groups presented earlier, and table 6 shows how many persons were convicted of each kind of crime. In both cases, data are presented for the different study periods.

Insert table 6 about here

In general, crimes of violence, weapon offences and drug-related crimes showed the sharpest increase after the debut of drug use. Crimes against property decreased through the whole period studied. During period 2, almost half of the participants were sentenced for crimes of violence.

These crimes were more frequent when AAS and other drugs of abuse were combined (table 7).

Insert table 7 about here

There was also an increase in the incidence of weapon offences during period 2 (table 6). Two participants were convicted of weapon crimes before drug use and twelve were convicted in period two, after the debut of drug use. In the total sample, over half of the participants were convicted of weapon offences at one point or another during period 2.

After the termination of treatment, there was a significant decrease in all kinds of criminality except for drug-related crimes and traffic crimes.

Discussion

This study was carried out in AAS users who sought treatment at a psychiatric AC. The results show a clear increase in criminality after starting drug use in the majority of persons. More specifically, the most dramatic increase was found in crimes of violence, weapon offences and drug-related crimes. The crimes of violence included battery, assault, unlawful detention and threats of violence. The increase was most obvious in the two subgroups (1 and 2) that started their drug use with AAS. This was especially obvious in the subgroup that never used any drugs other than AAS (group 1). Further, the subgroup that started with other drugs of abuse (group 3) were already involved in criminal activity before the debut of drug use. Because the increase in criminal activity occurred after rather than before the debut of AAS use in groups 1 and 2, we suggest that it is probable that the use of AAS is highly associated with criminality.

An exception from the general pattern was observed concerning crimes against property, for which almost half of the participants had been sentenced already before drug debut. The type

of drug used initially didn't seem to be relevant for crimes against property, but was important for crimes of violence and weapon offences.

The increase in criminal activities was initiated by the debut of drugs, irrespective of the type of drug. The addition of another drug type only seemed to cause a slight increase in criminality. We therefore find it probable that the association between AAS and criminality is at least as significant as that between drugs of abuse in general and criminality.

No person in our study was sentenced for drug-related crimes before their own debut of using drugs. Most participants were, however, sentenced for drug-related crimes during period 2, when they were active users of drugs. In group 2, none were sentenced for drug-related crimes while they were only using AAS, but most of the individuals in this group were sentenced for these crimes, usually for possession of narcotic drugs, when other drugs of abuse were added.

Special attention should be given to crimes of violence, since earlier studies have pointed out a specific association between AAS and such crimes. In this study, AAS was found to be clearly associated with crimes of violence, both with regard to the number of convictions and the degree of severity, compared with other drugs of abuse. Our results therefore support those of earlier studies indicating a possible association between AAS and crimes of violence e.g. [17, 26, 29, 39].

The risk of being convicted of weapon offences has been shown earlier to be high in AAS users [28]. These findings were corroborated in our study, where the number of persons convicted of weapon offences increased from two to twelve after the debut of drug use. We propose that the use of AAS is associated with weapon offences, and that this association is stronger when other drugs of abuse are also being used. Based on our clinical experience, we believe that the widespread use of weapons in connection with AAS is related to the drug-related mistrust and suspicion shown towards other people, leading to a feeling of the necessity to protect oneself with the help of weapons.

The criminal activities were strongly reduced during and after treatment at the AC. This was especially obvious in the subgroup of participants using only AAS, where all individuals showed a reduced rate of criminality post-treatment. The greatest effect was seen concerning crimes of violence and crimes against property. The smallest effect was seen in relation to

drug-related crimes and traffic crimes. Initially, possession of narcotics was the most common cause of conviction for drug-related crimes but later we also found that crimes such as possession of AAS, possession of goods dangerous to the health, and possessions of syringes were involved. We believe this to be a consequence of the fact that the police were not initially especially knowledgeable about AAS. The level of awareness has now improved, resulting in more sentences.

One possible explanation for the finding that traffic crimes were not substantially reduced with treatment could be that fifteen subjects in this sample began to use alcohol in a hazardous or harmful manner, as previously described [12]. Earlier research [7] has proposed that AAS use “is a part of a risk behavior syndrome”, one of the components of which is an increased tendency to drive drunk.

Conclusion

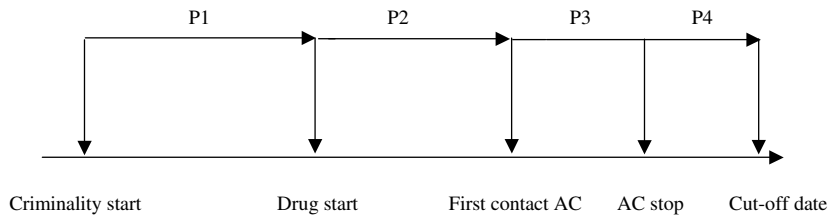
This study has clearly indicated an association between the use of AAS and criminality, especially in relation to crimes of violence and weapon offences. These findings support Pope’s conclusion that “steroid use is a significant factor in criminal behavior” [31]. It is, however, important to remember that while this appears to be the case on an aggregated level, there remain considerable individual differences among patients. The association between AAS and criminality is enhanced when other drugs of abuse are added.

The study has also shown that treatment has a clear effect on the levels of criminality. This is not usually a primary goal of treatment, but could be used as a proxy for treatment outcome. It should be emphasized, however, that there is a considerable risk that use of AAS is transferred to use of other drugs and/or alcohol after treatment. Thus, while AAS can be viewed as a problem in itself, it can also be a gateway to the use of other drugs.

This study was based on a small group of individuals, but this is often the case in studies in this therapeutic area because of considerable difficulties in getting consent from affected individuals for research. We are well aware of the fact that this sample is a highly selected sample, since all of the participants were recruited from an AC. This means that the results should be extrapolated to other AAS users only with great caution. Nevertheless, we believe that the results will be of great interest in the clinical setting.

Tables and figures

Figure 1. Overview of lifeline divisions, covering time from start of criminality to start of drug use (including AAS), start of treatment at the addiction clinic (AC) and the end of the study (20071231). (The period P2 includes P2A, P2O and P2AO/OA)



P1 = time from start of criminality to drug start

P2 = time from drug start to treatment start

P2A = time from starting AAS to starting other drugs of abuse

P2O = time from starting other drugs of abuse to starting AAS

P2AO= time from drug start to treatment start

P3= AC treatment period

P4 = time from finishing treatment to 20071231

Table 1. Summary of crimes for which study participants (n=32) were convicted					
Type of crime	Crime			Number of individuals	Number of crimes
		Maximal sentence (years)	Score based on max. sentence (see methods)		
Crimes of violence	<i>Total</i>			20	87
	Gross battery	10	8	1	1
	Battery	2	4	12	35
	Unlawful encroachment	0	1	3	3
	Unlawful restraint	2	4	1	1
	Unlawful detention	10	8	1	1
	Assault	1	3	6	8
	Trespass	0	1	2	3
	Robbery	6	7	1	3
	Negligence constituting a public danger	0.5	2	1	1
	Court assault	4	6	1	3
	Violence or threat against civil servant	4	6	7	12
	Violent resistance	0.5	2	7	13
	Promotion of escape	1	3	1	2
Weapon offences	<i>Total</i>			18	48
	Possession of firearms	1	3	9	24
	Possession of knives	0.5	2	12	20
	Possession of explosives	1	3	2	4
Crimes against property	<i>Total</i>			26	138
	Theft	2	4	17	64
	Pilfering	0.5	2	11	29
	Theft of a vehicle	2	4	7	15
	Unlawful dispossession	0.5	2	2	3
	Receiving stolen goods	2	4	9	17
	Smuggling	2	4	8	10
Fraud	<i>Total</i>			9	26
	Fraud	2	4	4	14
	Unlawful use	1	3	3	5
	Gross forgery	6	7	1	1
	Forgery	2	4	4	5
	False charge	2	4	2	2

Drug-related offences	<i>Total</i>			22	168
	Possession of anabolic androgenic steroids	2	4	14	25
	Possession of narcotics	3	5	18	139
	Crimes against the alcohol laws	2	4	2	2
	Possession of goods dangerous to health	0.5	2	1	1
	Possession of syringes	1	3	1	1
Traffic crimes	<i>Total</i>			18	134
	Dangerous (reckless) driving	0	1	8	12
	Using a vehicle without lawful authority	0.5	2	13	82
	Drunken driving	0.5	2	14	38
	Hit-and-run	0.5	2	2	2
Other offences	<i>Total</i>			15	28
	Against damage laws	0.5	2	9	12
	Against law and order	0	1	1	2
	Against compulsory military service	1	3	2	4
	Against various vehicle laws	0	1	8	10

Table 2. Summary of changes in criminality in subgroups of participants between periods 1 (predrugs) and 2 (using drugs), n=32

Group	Number of participants	Period	Drugs	Criminality (number of participants)		
				Increased	Decreased	Unchanged
1	7	P1-P2	(A/-)	7	0	0
2	11	P1-P2	(A+O)	8	3	0
		P1-P2A	(A/-)	6	4	1
		P2A-P2AO	(A+O)	5	6	0
3	10	P1-P2	(O+A)	5	5	0
		P1-P2O	(O/-)	4	5	1
		P2O-P2OA	(O+A)	5	4	1
4	4	P1-P2	(AO/OA)	2	1	1
All groups	32	P1-P2	Any	22	9	1

Table 3. Summary of changes in criminality in subgroups of participants between periods 2 (using drugs) and 4 (end of study), n=32

Group	Number of participants	Period	Drugs	Criminality (number of participants)		
				Increased	Decreased	Unchanged
1	7	P2 – P4	(A/-)	0	7	0
2	11	P2 – P4	(A+O)	4	7	0
3	10	P2 – P4	(O+A)	2	7	1
4	4	P2 – P4	(AO/OA)	1	3	0
All groups	32	P2-P4	Any	7	24	1

Figure 2. Median scores in periods 1- 4 for each group (1,2,3 and 4) and the total population

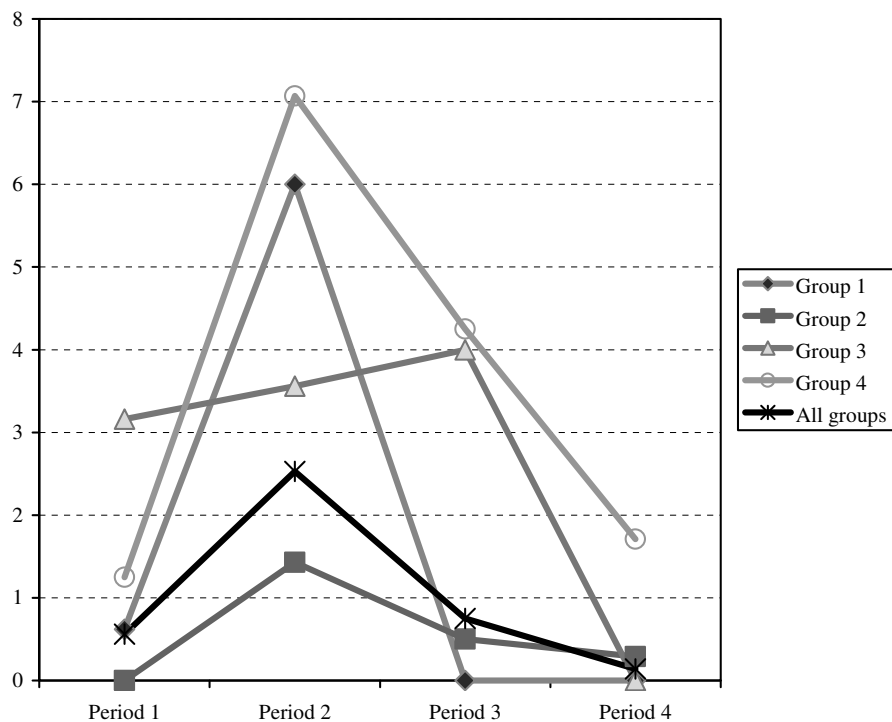


Table 4. Weighted criminality scores^a for periods 1-4, n = 32

Group	Drugs	Number of participants	Period 1	Period 2	Period 3	Period 4
1	A/-	7	0.62	6.00	0.00	0.00
2	A+O	11	0.00	1.43	0.50	0.29
3	O+A	10	3.16	3.56	4.00	0.00
4	AO/OA	4	1.25	7.07	4.25	1.71
All groups	AO/OA	32	0.56	2.53	0.75	0.14

^{a/} Computed according to description in methods section.

Table 5. Total weighted criminality scores^a in periods 1-4 according to type of crime, n=32

Type of crime	Period 1	Period 2	P1 – P2 (differences)	Period 3	Period P4	P2 – P4 (differences)
Crimes of violence	19.0	36.9	+17.9	26.7	1.7	-35.2
Weapon offences	5.3	10.8	+5.5	4.0	4.5	-6.3
Crimes against property	56.0	43.7	-12.3	15.3	7.1	-36.6
Fraud	2.0	5.6	+3.6	0.0	6.5	+0.9
Drug-related crimes	0.0	54.9	+54.9	119.7	64.1	+9.2
Traffic crimes	8.5	9.5	+1.0	14.5	20.5	+11.0
Other offences	0.5	2.1	+0.6	6.0	0.5	-1.6
Total	91.3	163.7	+72.4	186.2	104.9	-58.8

^{a/} Computed according to description in methods section.

Table 6. Summary of rates of conviction for various types of crime according to study period, n = 32										
Type of crime	Period 1		Period 2		Period 3		Period 4		Totals	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Crimes of violence	6	(18.7)	15	(46.9)	6	(18.7)	2	(6.2)	20	(62.5)
Weapon offences	2	(6.2)	12	(37.5)	2	(6.2)	3	(9.4)	18	(56.2)
Crimes against property	12	(37.5)	21	(65.6)	6	(18.7)	4	(12.5)	26	(81.2)
Fraud	1	(3.1)	7	(21.9)	0	(0.0)	3	(9.4)	9	(28.1)
Drug-related crimes	0	(0.0)	16	(50.0)	10	(31.2)	11	(34.4)	22	(68.7)
Traffic crimes	9	(28.1)	13	(40.6)	4	(12.5)	10	(31.2)	21	(65.6)
Other offences	1	(3.1)	7	(21.9)	3	(9.4)	1	(3.1)	11	(34.4)
Total	20	(62.5)	30	(93.7)	16	(50.0)	16	(50.0)	32	(100)

Table 7. Summary of rates of conviction for various types of crime according to participant subgroup

	Group 1, n=7		Group 2, n=11		Group 3, n=10		Group 4, n=4		Total, n=32	
Type of crime	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Crimes of violence	3	(42.8)	5	(45.4)	8	(80.0)	4	(100.0)	20	(62.5)
Weapon offences	1	(14.3)	8	(72.7)	7	(70.0)	2	(50.0)	18	(56.2)
Crimes against property	4	(57.1)	9	(81.9)	9	(90.0)	4	(100.0)	26	(81.2)
Fraud	1	(14.3)	2	(18.2)	5	(50.0)	1	(25.0)	9	(28.1)
Drug-related crimes	3	(42.9)	9	(81.8)	6	(60.0)	4	(100.0)	22	(68.7)
Traffic crimes	5	(71.4)	7	(63.0)	6	(60.0)	3	(75.0)	21	(65.6)
Other offences	1	(14.3)	3	(27.3)	6	(60.0)	1	(25.0)	11	(34.4)

References

1. Kuhn CM: Anabolic steroids. *Recent Prog Horm Res* 2002;57:411-434.
2. Evans NA: Gym and tonic: a profile of 100 male steroid users. *Br J Sports Med* 1997;31:54-58.
3. Nilsson S, Baigi A, Marklund B, Fridlund B: The prevalence of the use of androgenic anabolic steroids by adolescents in a county of Sweden. *Eur J Public Health* 2001;11:195-197.
4. Miller KE, Hoffman JH, Barnes GH, Sabo D, Melnick MJ, Farell MP: Adolescent anabolic steroid use, gender, physical activity, and other problem behaviors. *Subst Use Misuse* 2005;40:1637-.
5. Gruber AJ, Pope HG, Jr.: Psychiatric and medical effects of anabolic-androgenic steroid use in women. *Psychother Psychosom* 2000;69:19-26.
6. Ambrose PJ: Drug use in sports: a veritable arena for pharmacists. *J Am Pharm Assoc* 2004;44:501-514.
7. Middleman AB, Faulkner AH, Woods ER, Emans SJ, DuRant RH: High-risk behaviors among high school students in Massachusetts who use anabolic steroids. *Pediatrics* 1995;96:268-272.
8. Eklof AC, Thurelius AM, Garle M, Rane A, Sjoqvist F: The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology. *Eur J Clin Pharmacol* 2003;59:571-577.
9. Sjoqvist F, Garle M, Rane A: Use of doping agents, particularly anabolic steroids, in sports and society. *Lancet* 2008;371:1872-1882.
10. Thiblin I, Lindquist O, Rajs J: Cause and manner of death among users of anabolic androgenic steroids. *J Forensic Sci* 2000;45:16-23.
11. Brower KJ, Blow FC, Beresford TP, Fuelling C: Anabolic-androgenic steroid dependence. *J Clin Psychiatry* 1989;50:31-33.
12. Skarberg K, Nyberg F, Engstrom I: Multisubstance Use as a Feature of Addiction to Anabolic-Androgenic Steroids. *Eur Addict Res* 2009;15:99-106.
13. Johansson-Steensland P, Nyberg F, Chahl L: The anabolic androgenic steroid, nandrolone decanoate, increases the density of Fos-like immunoreactive neurons in limbic regions of guinea-pig brain. *Eur J Neurosci* 2002;15:539-544.
14. Harrison RJ, Connor DF, Nowak C, Nash K, Melloni RH, Jr.: Chronic anabolic-androgenic steroid treatment during adolescence increases anterior hypothalamic

- vasopressin and aggression in intact hamsters. *Psychoneuroendocrinology* 2000;25:317-338.
15. Hall RC: Abuse of supraphysiologic doses of anabolic steroids. *South Med J* 2005;98:550-555.
 16. Pagonis TA, Angelopoulos NV, Koukoulis GN, Hadjichristodoulou CS: Psychiatric side effects induced by supraphysiological doses of combinations of anabolic steroids correlate to the severity of abuse. *Eur Psychiatry* 2006;21:551-562.
 17. Pagonis TA, Angelopoulos NV, Koukoulis GN, Hadjichristodoulou CS, Toli PN: Psychiatric and hostility factors related to use of anabolic steroids in monozygotic twins. *Eur Psychiatry* 2006;21:563-569.
 18. Brower KJ: Anabolic steroid abuse and dependence. *Curr Psychiatry Rep* 2002;4:377-387.
 19. Casavant MJ, Blake K, Griffith J, Yates A, Copley LM: Consequences of use of anabolic androgenic steroids. *Pediatr Clin North Am* 2007;54:677-690.
 20. Middleman AB, DuRant RH: Anabolic steroid use and associated health risk behaviours. *Sports Med* 1996;21:251-255.
 21. Hall RC, Hall RC, Chapman MJ: Psychiatric complications of anabolic steroid abuse. *Psychosomatics* 2005;46:285-290.
 22. Dabbs JM, Jr., Frady RL, Carr TS, Besch NF: Saliva testosterone and criminal violence in young adult prison inmates. *Psychosom Med* 1987;49:174-182.
 23. Brooks JH, Reddon JR: Serum testosterone in violent and nonviolent young offenders. *J Clin Psychol* 1996;52:475-483.
 24. Beaver KM, Vaughn MG, Delisi M, Wright JP: Anabolic-androgenic steroid use and involvement in violent behavior in a nationally representative sample of young adult males in the United States. *Am J Public Health* 2008;98:2185-2187.
 25. Choi PY, Pope HG, Jr.: Violence toward women and illicit androgenic-anabolic steroid use. *Ann Clin Psychiatry* 1994;6:21-25.
 26. Thiblin I, Parklo T: Anabolic androgenic steroids and violence. *Acta Psychiatr Scand Suppl* 2002;412:125-128.
 27. Isacson G, Garle M, Ljung EB, Asgard U, Bergman U: Anabolic steroids and violent crime-an epidemiological study at a jail in Stockholm, Sweden. *Compr Psychiatry* 1998;39:203-205.

28. Klotz F, Garle M, Granath F, Thiblin I: Criminality among individuals testing positive for the presence of anabolic androgenic steroids. *Arch Gen Psychiatry* 2006;63:1274-1279.
29. Klotz F, Petersson A, Isacson D, Thiblin I: Violent crime and substance abuse: a medico-legal comparison between deceased users of anabolic androgenic steroids and abusers of illicit drugs. *Forensic Sci Int* 2007;173:57-63.
30. Pope HG, Jr., Katz DL: Homicide and near-homicide by anabolic steroid users. *J Clin Psychiatry* 1990;51:28-31.
31. Pope HG, Jr., Kouri EM, Powell KF, Campbell C, Katz DL: Anabolic-androgenic steroid use among 133 prisoners. *Compr Psychiatry* 1996;37:322-327.
32. Petersson A, Garle M, Granath F, Thiblin I: Morbidity and mortality in patients testing positively for the presence of anabolic androgenic steroids in connection with receiving medical care A controlled retrospective cohort study. *Drug Alcohol Depend* 2006;81:215-220.
33. Andersson J: The Swedish National Council for Crime Prevention: a Short Presentation. *Journal of Scandinavian Studies in Criminology and Crime Prevention* 2005;6:74-88.
34. Rubin H, Rubin I: *Qualitative Interviewing: The Art of Hearing Data*. Thousand Oaks, Sage Publications, 2004.
35. Malone DA, Jr., Dimeff RJ, Lombardo JA, Sample RH: Psychiatric effects and psychoactive substance use in anabolic-androgenic steroid users. *Clin J Sport Med* 1995;5:25-31.
36. Warren JI, South SC, Burnette ML, Rogers A, Friend R, Bale R, Van Patten I: Understanding the risk factors for violence and criminality in women: the concurrent validity of the PCL-R and HCR-20. *Int J Law Psychiatry* 2005;28:269-289.
37. Degenhardt L, Day C, Hall W, Conroy E, Gilmour S: Was an increase in cocaine use among injecting drug users in New South Wales, Australia, accompanied by an increase in violent crime? *BMC Public Health* 2005;5:40.
38. Messer LC, Kaufman JS, Dole N, Herring A, Laraia BA: Violent crime exposure classification and adverse birth outcomes: a geographically-defined cohort study. *Int J Health Geogr* 2006;5:22.
39. Thiblin I, Kristiansson M, Rajs J: Anabolic androgenic steroids and behavioural patterns among violent offenders. *J Forensic Psychiatry* 1997;8:299-310.

PUBLIKATIONER *i serien* ÖREBRO STUDIES IN MEDICINE

1. Bergemalm, Per-Olof (2004). *Audiologic and cognitive long-term sequelae from closed head injury.*
2. Jansson, Kjell (2004). *Intraperitoneal Microdialysis. Technique and Results.*
3. Windahl, Torgny (2004). *Clinical aspects of laser treatment of lichen sclerosus and squamous cell carcinoma of the penis.*
4. Carlsson, Per-Ingé (2004). *Hearing impairment and deafness. Genetic and environmental factors – interactions – consequences. A clinical audiological approach.*
5. Wågsäter, Dick (2005). *CXCL16 and CD137 in Atherosclerosis.*
6. Jatta, Ken (2006). *Inflammation in Atherosclerosis.*
7. Dreifaldt, Ann Charlotte (2006). *Epidemiological Aspects on Malignant Diseases in Childhood.*
8. Jurstrand, Margaretha (2006). *Detection of Chlamydia trachomatis and Mycoplasma genitalium by genetic and serological methods.*
9. Norén, Torbjörn (2006). *Clostridium difficile, epidemiology and antibiotic resistance.*
10. Anderzén Carlsson, Agneta (2007). *Children with Cancer – Focusing on their Fear and on how their Fear is Handled.*
11. Ocaya, Pauline (2007). *Retinoid metabolism and signalling in vascular smooth muscle cells.*
12. Nilsson, Andreas (2008). *Physical activity assessed by accelerometry in children.*
13. Eliasson, Henrik (2008). *Tularemia – epidemiological, clinical and diagnostic aspects.*
14. Walldén, Jakob (2008). *The influence of opioids on gastric function: experimental and clinical studies.*
15. Andrén, Ove (2008). *Natural history and prognostic factors in localized prostate cancer.*
16. Svantesson, Mia (2008). *Postpone death? Nurse-physician perspectives and ethics rounds.*

17. Björk, Tabita (2008). *Measuring Eating Disorder Outcome – Definitions, dropouts and patients' perspectives.*
18. Ahlsson, Anders (2008). *Atrial Fibrillation in Cardiac Surgery.*
19. Parihar, Vishal Singh (2008). *Human Listeriosis – Sources and Routes.*
20. Berglund, Carolina (2008). *Molecular Epidemiology of Methicillin-Resistant Staphylococcus aureus. Epidemiological aspects of MRSA and the dissemination in the community and in hospitals.*
21. Nilsagård, Ylva (2008). *Walking ability, balance and accidental falls in persons with Multiple Sclerosis.*
22. Johansson, Ann-Christin (2008). *Psychosocial factors in patients with lumbar disc herniation: Enhancing postoperative outcome by the identification of predictive factors and optimised physiotherapy.*
23. Larsson, Matz (2008). *Secondary exposure to inhaled tobacco products.*
24. Hahn-Strömberg, Victoria (2008). *Cell adhesion proteins in different invasive patterns of colon carcinoma: A morphometric and molecular genetic study.*
25. Böttiger, Anna (2008). *Genetic Variation in the Folate Receptor- α and Methylenetetrahydrofolate Reductase Genes as Determinants of Plasma Homocysteine Concentrations.*
26. Andersson, Gunnel (2009). *Urinary incontinence. Prevalence, treatment seeking behaviour, experiences and perceptions among persons with and without urinary leakage.*
27. Elfström, Peter (2009). *Associated disorders in celiac disease.*
28. Skårberg, Kurt (2009). *Anabolic-androgenic steroid users in treatment: Social background, drug use patterns, and criminality.*