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Abstract

This paper surveys the prevalence and correlates of anabolic androgenic steroids (AAS) use among Norwegian adolescents, and examines the degree to which sports participation is a mediating or moderating factor to well-known correlations between AAS use and problem behavior. The data comes from the "Ungdata" study, a cross-national youth survey system offered to all municipalities in Norway (response rate: 74%, N=77.572). The study demonstrates a lifetime prevalence of AAS use of 1.27% and a higher prevalence among boys (1.81%) than girls (.76%). The analyses show that AAS use is clearly related to problem behaviour such as violence and other substance use. When controlling for problem behaviour, there are no correlations between AAS use and exercising in a sports club or on one's own, whilst there is a weak positive correlation between AAS use and exercising in a gym or engaging in other forms of physical exercise such as dancing or martial arts. These patterns are more or less the same for boys and for girls. We conclude that adolescent AAS use is a low-prevalence phenomenon that primarily takes place in smaller subgroups of individuals who engage in other forms of problem behaviour as well.

Keywords

Anabolic-Androgenic Steroids, Doping, Adolescents, Problem behavior, Exercise Norway

Introduction

In many Western countries, the use of anabolic androgenic steroids (AAS) attracts significant public attention. Since the early 1950s, there have been reports on AAS use for performance-enhancing purposes in elite sport (Yesalis and Bahrke, 2002). In the late 1980s, reports emerged on the use of AAS outside of elite sport, particularly among young males wanting to enhance physical appearance and muscle size (Buckley, Yesalis, Friedl, Anderson and Wright, 1989). Correspondingly, there has been a growing recognition in many countries over the last decades, of AAS use outside of sport as a public health problem. With targeted state funding, anti-doping organizations in countries such as Denmark and Norway have extended their prevention and deterrence operations from organized elite sport to the fitness center industry and to some extent to schools, to combat AAS use in the general population (Christiansen, 2015).

There seems to be a particular concern for AAS use among adolescents. Long-term non-therapeutic AAS use without medical supervision can have serious health implications, with

brain and neurological disorders being particular risks for young people in rapid biological and psychological development (Cunningham, Lumia and McGinnis, 2013). More generally, long-term AAS use is associated with a range of severe medical consequences, notably cardiovascular complications including cardiomyopathy and atherosclerosis, effects on the reproductive system including libido changes and temporary infertility, and psychiatric complications such as depression and a possible link to aggressive and violent behavior (Hartgens and Kuipers, 2004; Kanayama, Hudson and Pope, 2008).

Reflecting this concern for adolescent users, several studies have surveyed the prevalence of AAS use among youth. Nordic studies published after 2000 with randomly selected samples within the age range of 12-18, report lifetime prevalence rates ranging from 0.3% to 2.1%. The studies survey both males and females or only males, mostly with findings of significantly higher prevalence rates for males (0.5-3.6%) than for females (0-1%) (Sagoe, Torsheim, Molde, Andreassen and Pallesen, 2015). In a meta-analysis, Sagoe and colleagues (2015) estimate the prevalence rate across 34 studies including samples from high school students to 0.9%. Overall, the estimates in Nordic studies are lower than the estimated lifetime prevalence of high school students "worldwide" of 2.3% (Sagoe, Molde, Andreassen, Torsheim and Pallesen, 2014), and similar to the findings in most surveyed European countries (EMCDDA and ESPAD, 2016; Sagoe et al., 2014) as well as the United States (Lorang, Callahan, Cummins, Achar and Brown, 2011) and Australia (Dunn and White, 2011).

The Nordic studies do not indicate an increase in the prevalence of adolescent AAS use over the last two decades. This point is supported by longitudinal findings in the European School Survey Project on Alcohol and Other Drugs (ESPAD), conducted every four years since 1995. The survey includes 15-16 year-olds and indicates that the prevalence of AAS use has remained stable at 1% in this age group across the Nordic countries in the period 1995-2015 (EMCDDA and ESPAD, 2016; Sagoe et al., 2015).

Furthermore, a number of studies have explored correlates of AAS use in young populations. Several Nordic studies demonstrate a link between lifetime AAS use and lifetime use of other substances such as alcohol, nicotine, and cannabis and other narcotics (Mattila, Parkkari, Laakso, Pihlajamäki and Rimpelä, 2009; Nilsson, Spak, Marklund, Baigi and Allebeck, 2005; Pallesen, Jøsendal, Johnsen, Larsen and Molde, 2006; Wichstrøm, 2006; Wichstrøm and

Pedersen, 2001). Other reported correlates of adolescent AAS use are participation in power sports and regular exercise in gyms (Wichstrøm, 2006; Wichstrøm and Pedersen, 2001; Nilsson et al., 2005; Thorlindsson and Halldorsson, 2010), negative school experiences and truancy (Nilsson et al., 2005), immigrant background (Nilsson et al., 2005), and various forms of covert and overt problem behavior (Wichstrøm and Pedersen, 2001). In the Norwegian context, Wichstrøm and Pedersen (2001**,** p. 2) have compared the predicting value of power sport involvement, appearance and eating concerns, and various forms of covert and overt problem-behavior, concluding, "adolescent AAS-use seems primarily to be another type of problem-behavior and only secondary is it associated with strength sport participation and disordered eating".

The aim of the present study is twofold. First, the study surveys the prevalence of AAS use in a large sample of Norwegian youth. Second, it surveys correlates of AAS use. Previous research has thoroughly documented a positive correlation between AAS use and other forms of problem behavior. Thus, a particular aim for this study is to explore whether participation in organized sport and fitness sport respectively, are mediating or moderating factors to this correlation. Understanding the role of sport participation can be instrumental to the development of efficient preventive strategies. The study contributes to anti-doping practice with an improved understanding of relevant target groups as well as an indication of whether preventive measures are more relevant when implemented within or outside of the sport system. The present study is unique in terms of the size of the sample. A large sample is an advantage when studying the prevalence and correlates of a low-prevalence phenomenon like adolescent AAS use. Thus, the study gives an important contribution to the literature on adolescent AAS prevalence and correlates with new and extensive findings, particularly relating to the role of sport participation as a mediating or moderating factor.

Methods

Sample

The data comes from the “Ungdata” study, a cross-national youth survey system offered to all municipalities in Norway. The purpose of Ungdata is to map the living conditions among teenagers in a local context. The study is administered during a school lesson where students answer a web-based questionnaire under the supervision of teachers. The data contains self-reported information about a wide variety of young people’s life and life situations, such as

family background, exercise habits, substance use, and conduct problems. All parents and students were informed about the purpose of the study in advance, and that participation was voluntary and anonymous. Ethical approval of the study was obtained from the Norwegian Social Science Data Services.

Since 2010 the survey has been conducted in 403 of 428 Norwegian municipalities, and by 2017 440.000 students (age 13-19 years old) have participated. In the participating municipalities, students from all secondary schools are included. The response rate is 82 percent in lower secondary school and 66 percent in upper secondary. Thus, Ungdata constitutes almost a total population study of students in the age group 13 to 18. Ungdata is financed by Norwegian Directorate of Health as a means for the municipalities to fulfil the Norwegian Public Health Act, which requires monitoring of public health indicators at the municipality level. Ungdata is run by the Section of Youth Research at Oslo Metropolitan University, in cooperation with seven Regional Competence Centres for Substance Use (KORUS). Ungdata is free of charge for the municipalities to use.

The use of AAS was included in the questionnaire in 122 of the municipalities who participated during 2014 to 2017. Some of these municipalities participated more than once. To avoid individuals to be included more than once in the sample, only the last study within any municipality was included in the analyses. The analytic sample consist of 77.572 students, who had valid values on all the variables included in the analyses. Girls constitute 51.1 percent of the sample, and the mean school grade was 10.18 (SD 1.57).

An inspection of the municipalities included in the sample show that they are placed in more urbanized settings and have higher populations than an average Norwegian municipality. In addition, adolescents living in these municipalities report higher levels of alcohol use, are more exposed to violence and use gyms more frequently than adolescents in other municipalities. Because such a selection bias might lead to a slight overestimation of AAS use compared to a nationally representative sample, we weighted all the analyses based on the population size of the respondents' municipalities.

Measures

Dependent variables

To measure the use of AAS, we asked the respondents “Have you ever used performance-enhancing drugs (e.g. anabolic steroids, growth hormones, insulin, testosterone)?”. Response options were “no”, “I used to use performance-enhancing drugs, but I´ve stopped now” and “I currently use performance-enhancing drugs”. The two last responses were collapsed into a

single measure of lifetime use. To minimise the danger of unserious reports, 0.6% of respondents, whom we expected to answer the questionnaire in an unserious fashion, were excluded from the sample (see Frøyland 2014 for more information on this "washing routine"). Students reporting AAs use were clearly overrepresented among this part of the sample.

Other measures

School grade was measured by asking what grade the students attended, ranging from 8th to 13th grade. To measure the respondent's socio-economic family background, we use self-reported information about parental education, the number of books at home and four items from the Family Affluence Scale (Currie, Molcho et al. 2008). Based on the average scores of these variables, we constructed a single socio-economic score and each respondent was placed on a scale ranging from 0-3 (Bakken, Sletten et al. 2016). We also measured the respondent's own perception of the economic situation of the family. We asked "Financially, has your family been well off, or badly off, over the past two years?", with five response options varying from "We have been badly off the whole time" [0] to "We have been well off the whole time".

To measure exercise habits, students were asked "How often do exercise or do the following activities? 1) Train or compete in a sports club, 2) exercise in a gym or a health club, 3) do other forms of organized physical exercise (dance, martial arts etc.) and 4) exercise on your own (running, swimming, bicycling, hiking)". For each of these items, the response options were: never [0], seldom [1], 1-2 times a month [2], 1-2 times a week [3], 3-4 times a week [4] and at least 5 times a week [5].

Violent behaviour was measured by asking how many times during the last year the respondent had been "in a fight (with or without weapon)", with five response options varying from "0" to "11 times or more" (Pedersen and Wichstrom 1995). Likewise, shoplifting was measured by asking how many times during the last year the respondent had "Taken something from a shop without paying". Exposure to violence was measured through four questions like being exposed to threats of violence, been injured because of violence (each item range 0-3) (Pedersen 2001).

We measured smoking habits by asking, "Do you smoke?" Response options were on a five-point scale from "I have never smoked" to "Daily smoking". To measure frequency of alcohol consumption, we asked, "Do you drink any form of alcohol?" Response options varied from "Never" [0] to "Use alcohol each week" [4]. In addition, we asked about

frequency of cannabis use during the previous 12 months on a 5-point scale varying from "0" to "11 times or more".

Statistics

First, we give an overall picture of the prevalence of AAS use, broken down by gender and school grade. To examine the characteristics of those using AAS, we conducted a series of multivariate logistic regression analyses using the XTLOGIT command (random intercepts only) in Stata version 13.1. A multilevel framework was used to capture the hierarchical structure of the sample (individuals at level one, municipalities at level two), thus giving more realistic standard errors (Raudenbush and Bryk 1992). In a first model, we included all variables indicating problem behaviour, including substance use and exposure to violence. In a second model, we included all variables measuring exercise habits, to examine whether the coefficients from Model 1 could be explained by these variables. In a third model, we included socioeconomic status, family economy and grade level to examine whether the other coefficients were confounded by these background characteristics. When comparing across models, the OR- or B-coefficients in logistic regression can be problematic to interpret, because they can reflect the degree of unobserved heterogeneity in the models (Mood 2010). To overcome this problem, we rescaled the results of the xtlogit model to the same scale as the intercept-only model, using the meresc-command in Stata (cf. Hox 2010 chapter 6.5). All regression analyses were conducted separately by each gender. We used a t-test to investigate whether the rescaled logistic coefficients in the final model differed between boys and girls. The level of significance was set to $p<0.01$ to account for the relatively large sample size used.

Results

In Table 1, we describe the sample by gender. While boys are more active in gyms and club-organized sports than girls are, girls exercise more on their own and are more active in other organised physical activities like dancing. Few adolescents are exposed to violent behaviour, but boys are more exposed than girls are. On average, boys are more involved in fights, shoplifting, cigarette smoking and cannabis use. There are only small gender differences in frequency of alcohol use.

In Table 2, we show lifetime prevalence of AAS use for boys and girls by their grades in school. In the sample as a whole, 1.34% have ever used AAS. Boys report AAS use more frequent than girls do (1.81% vs. .76%). There are gender differences in AAS use across all

grades, with a slightly higher difference between girls and boys from 10th grade. In general, the prevalence of AAS use do not vary much with age, with a slight increase from 8th to 10th grade, following by a slight decrease.

In Table 3, we report a series of multilevel logistic regression analyses where use of AAS was dependent variable. The first three columns show the results for the sample as a whole. Model 1 shows that the use of AAS is clearly related to problem behaviour, violence and substance use. The clearest association is found between exposure to violence and AAS, but the prevalence of AAS use is much higher both among those who are themselves involved in fights and/or shoplifting compared to those who are not engaged in such behaviour. There are also clear and strong associations between use of AAS and smoking, alcohol use and cannabis use, respectively.

In Model 2, we tested whether exercise habits could explain these patterns. The analyses show that the odds ratios for neither of the problem behaviour variables did change much. When controlling for problem behaviour, the relationship between exercise and AAS use was generally weak. While there was no relationship between exercising in a sports club or on one's own and AAS use, there was a small, but positive association between exercising in a gym and use of AAS and between AAS use and other forms of physical exercise, like dancing or martial arts.

In Model 3, we tested whether the relations between AAS use and the other variables were confounded by social background factors, gender and age (school grade). These factors did not change the general pattern. Neither family SES nor perceived family economy was related to AAS use, controlled for the other variables. School grade was negatively associated with AAS use, and the gender difference was still in favour of boys.

Results from the separate analyses by gender show that the above patterns are more or less the same for boys and for girls. All associations go in the same direction, with almost the same magnitude of the odds ratios. One exception is that school grade, when controlling for all the other variables, was negatively associated with AAS use among girls, but not among boys.

Discussion

This study set out to explore prevalence and correlates of lifetime AAS use in Norwegian adolescents, and the degree to which sports participation is a mediating or moderating factor to correlations between AAS use and problem behavior. The study has several strengths, including that the data stem from an almost total population survey of students in the age

group 13-18 including a large scale of background variables. A large number of respondents is important when studying low-prevalence phenomena such as adolescent AAS use, and in particular when examining correlates. However, some limitations should be noted.

Limitations

AAS use is a criminal offence in Norway and a sensitive topic, and, as such, there are concerns with under-reporting when results from a self-report survey are not validated against data from other sources. A different limitation is the possibility of over-reporting due to unserious responses. Controls in our material indicate that among 0.6% of respondents who answered the survey in a non-serious fashion, 22% reported AAS use. The control routine can be considered like a 'filter' that identified the most obvious cases of non-serious answering, but probably not all. The possibility of further non-serious reporting of AAS use in the data material is present. Furthermore, possible exaggeration of AAS use prevalence rates stemming from respondents misunderstanding questions or confusing “steroids” with other substances such as corticosteroids or nutritional supplements, is present in our study (Kanayama et al. 2007).

Prevalence

The lifetime prevalence of Norwegian adolescent AAS use in the present study (1.27%) is in the upper range of reported estimates in the Nordic countries and considerably higher than the estimates of 0.8% and 0.3% reported by Wichstrøm and Pedersen (2001) and Sagoe et al. (2014). It is also higher than the estimate of 1% reported in all ESPAD surveys from 1995-2015. It is lower, however, than the estimate of 2.1% reported by Pallesen (2006). The study supports previous findings on gender differences in adolescent AAS use, reporting significantly higher prevalence among males (1.81%) than females (0.76%).

Decrease of lifetime prevalence of AAS use from 10th grade (1.68%) to 13th grade (0.88%) is contrary to the logic of lifetime prevalence rates, which in most cases are expected to increase with age. Among Nordic studies reporting on differences according to age, Thorlindsson and Haldorsson (2010) reported lifetime prevalence estimates of 0.3%, 0.6%, and 1.7% in the age groups 15-16, 17-18, and 19-24 respectively. Wichstrøm and Pedersen (2001) and Mattila et al. (2009) found that lifetime prevalence did not differ significantly according to age. The decrease in reported AAS use from 10th through 13th grade can partly be explained with other findings such as the correlation between AAS use and other problem behavior that relate to

truancy and dropping out from school (Hansen, 2005; Sletten, 2007). The present study is based on a school survey and is susceptible to selective dropout relating to truancy and school dropouts.

Correlates

Our study supports previous research highlighting the strong correlation between lifetime AAS use and use of other substances such as alcohol, nicotine, and cannabis. The strong correlation between AAS use and exposure to violence and violent behavior is consistent with Wichstrøm and Pedersen's (2001) study, as is the correlation between lifetime AAS use and shoplifting. These clear and strong correlates suggest that adolescent AAS use primarily takes place in smaller subgroups of individuals who engage in other forms of problem behavior as well. This is consistent with Wichstrøm and Pedersen's suggestion that more than having to do with the sportive ideal of "winning" or the widespread ideal of "looking good", adolescent AAS use responds primarily to the subcultural ideal of "being bad". As has been pointed out by Pallesen and colleagues (2006, p. 1711), these findings indicate "that use of anabolic steroids may be part of a general pattern of drug use and risk-taking behavior, thus weakening the myth that use of anabolic steroids is associated with a healthy athletic lifestyle". Our study further strengthens this claim as it demonstrates a generally weak relationship between AAS use and exercise, when controlling for problem behavior..

Implications for practice and further research

Overall, the present findings contrast with popular views in the media, in politics, and in anti-doping organizations, of adolescent AAS use as a relatively wide-spread (and increasing) phenomenon and a consequence of "normal" adolescents' susceptibility to social pressures and body image concerns. Bilgrei and Sandøy (2016) have commented on the scientific basis of a dominant understanding of AAS use as a major public health problem in the Nordic countries:

> "...instead of viewing AAS use as a major public health problem, we ask; would it be more productive to view it as a problem among smaller subgroups with highly different perspectives towards AAS use? Would it be more beneficial to engage with this group of people and with their shared cultural apparatus?"

The present study supports this view, which indicates that strategies for prevention and harm-reduction would benefit from a focused approach towards the most relevant subgroups. As Bilgrei and Sandøy (2016) notices, these subgroups may have very different perspectives

towards AAS use than those found in the general population (see Christiansen, Vinther and Liokaftos 2017 for a useful typology of (male) AAS users). In particular, the messages communicated in preventive education could tone down the perceived relation between AAS use and "normal" adolescents' sport or fitness endeavors and susceptibility to social pressure and body image concerns. For most adolescent users, AAS use belong to a wider pattern of problem behavior and respond primarily to the subcultural ideal of "being bad" (Wichstrøm and Pedersen 2001). As the effects of AAS are closely tied to exercise (i.e. strength training), more research is needed to explore the relationship between problem behavior, exercise and AAS use in relevant subgroups.

Moreover, further research on AAS use in the Nordic countries could shift focus from adolescents to general populations in order to determine i) in what age groups AAS use is more prevalent; ii) the normal age-of-onset; and (iii) the extent to which characteristics of AAS users with a later age-of-onset are similar to the characteristics of adolescent users. The current focus on adolescent use is important, but does not shed light on the question of whether AAS use in general ought to be considered a public health problem or, if so, whether it is an increasing problem. Research from Australia, the United Kingdom and the United States, indicates that only 6% of AAS users initiate use before the age of 18 (Pope, Kanayama, Athey, Ryan, Hudson and Baggish 2014). As such, AAS use is possibly a more widespread phenomenon in older age groups. Research in the Nordic countries is scarce. One Swedish general population study has reported lifetime prevalence estimates of 0.7% among males and 0.002% among females (Hakansson, Mickelsson, Wallin and Berglund 2012). In other words, the study does not reflect research from other regions and suggests that AAS use in Sweden is a marginal phenomenon in older age groups as well. More research is needed in this area.

References

Bakken. A.. M. A. Sletten and L. R. Frøyland (2016). Sosiale forskjeller i ungdomstiden. Hva viser Ungdata-undersøkelsene [Social inequalities during adolescence. Results from the Ungdata surveys]. NOVA-rapport Oslo. NOVA. Oslo Met.

Bilgrei, O. R. & Sandøy, T. A. (2015). Should the use of anabolic androgenic steroids be considered a major public health problem in the Nordic countries? *Nordi Studies on Alcohol and Drugs, 32*, 25-26.

Buckley, W.E., Yesalis, C.E., Friedl, K.E., Anderson, W. A., Streit, A.L., and Wright, J.E. (1988). Estimated prevalence of anabolic steroid use among male high school seniors. *JAMA, 260*(23), 3441-3445.

Christiansen, A. V. (2015). Drug use in gyms. In V. Møller, I. Waddington & J. Hoberman (eds.), *Routledge Handbook of Drugs and Sport* (pp. 421-438). Abingdon: Routledge.

Christiansen, A. V., Vinther, A. S., & Liokaftos, D. (2017). Outline of a typology of men's use of anabolic androgenic steroids in fitness and strength traning environments. *Drugs: Education, Prevention and Policy, 24*(3), 295-305.

Cunningham, R. L., Lumia, A. R. & McGinnis, M. Y. (2013). Androgenic-anabolic steroid exposure during adolesence: Ramifications for brain development and behavior. *Hormones and Behavior, 64*, 350-356.

Currie. C.. M. Molcho. W. Boyce. B. Holstein. T. Torsheim and M. Richter (2008). "Researching health inequalities in adolescents: The development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale." Social Science & Medicine **66**(6): 1429-1436.

Dunn, M., & White, V. (2011). The epidemiology of anabolic–androgenic steroid use among Australian secondary school students. Journal of Science and Medicine in Sport, 14(1), 10–14.

EMCDDA and ESPAD (2016), ESPAD Report 2015 — Results from the European School Survey Project on Alcohol and Other Drugs, EMCDDA–ESPAD joint publications, Publications Office of the European Union, Luxembourg.

Frøyland, Lars Roar (2014). Ungdata 2010-2013 - Metode og dokumentasjon. [Ungdata 2010-2013 – Methods and documentation]. Oslo: NOVA, Norwegian Social Research.

Hakansson, A., Mickelsson, K., Wallin, C., & Berglund, M. (2012). Anabolic androgenic steroids in the general population: user characteristics and associations with substance use. *European Addiction Research, 18*(2), 83–90.

Hansen, M. N. (2005). Ulikhet i osloskolen: rekruttering og segregering. [Inequality in Oslo Schools: recruitment and segregation.] *Tidsskrift for ungdomsforskning, 5*(1), 3-26.

Hartgens, F. & Kuipers, H. (2003). Effects of androgenic-anabolic steroids in athletes. *Sports Medicine, 34*(8), 513-554.

Hox. J. (2010). Multilevel Analysis: Techniques and Applications. New York. Routledge.

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,* 156–62.

Kanayama, G., Hudson, J. I. & Pope, H. G. (2008). Long-term psychiatric and medical consequences of anabolic-androgenic steroid abuse: A looming public health concern? *Drug and Alcohol Depencence, 98,* 1-12.

Lorang, M., Callahan, B., Cummins, K. M., Achar, S. & Brown, S. A. (2011). Anabolic androgenic steroid use in teens: Prevalence, demographics, and perception of effects. *Journal of Child and Adolescent Substance Abuse, 20*(4), 358-369.

Mattila, V., Parkkari, J., Laakso, L., Pihlajamäki, H., & Rimpelä, A. (2009). Use of dietary supplements and anabolic-androgenic steroids among Finnish adolescents in 1991–2005. *European Journal of Public Health, 20*(3), 306–311

Mood. C. (2010). "Logistic Regression: Why we cannot do what we think we can do. and what we can do about it. ." *European Sociological Review,* 26: 67-82.

Nilsson, S., Spak, F., Marklund, B., Baigi, A., & Allebeck, P. (2005). Attitudes and behaviors with regards to androgenic anabolic steroids among male adolescents in a county of Sweden. *Substance Use and Misuse, 40*(1), 1–12.

Pallesen, S., Jøsendal, O., Johnsen, B.-H., Larsen, S., & Molde, H. (2006). Anabolic steroid use in high school students. *Substance Use and Misuse, 41*(13), 1705–1717.

Pedersen. W. (2001). "Adolescent victims of violence in a welfare state - Sociodemography. ethnicity and risk behaviours." *British Journal of Criminology 41*(1): 1-21.

Pedersen. W. and L. Wichstrom (1995). "Patterns of delinqency in Norwegian adolescents " *British Journal of Criminology 35*(4): 543-562.

Raudenbush. S. W. and A. D. Bryk (1992). Hierarchical linear models. Applications & data analysis methods. Newbury Park. Sage Publications.

Sagoe, D., Molde, H., Andreassen, C. S., Torsheim, T., & Pallesen, S. (2014). The global epidemiology of anabolic-androgenic steroid use: A meta-analysis and meta-regression analysis. *Annals of Epidemiology, 24*(5), 383-398.

Sagoe, D., Torsheim, T., Molde, H., Andreassen, C. S., & Pallesen, S. (2015). Anabolic-androgenic steroid use in the nordic countries: A meta-analysis and meta-regression analysis. *Nordic Studies on Alcohol and Drugs, 32,* 7-20.

Sletten, M. A. (2007). Utsatt familieliv – dårlig råd og problematferd blant ungdom. [Exposed family life – poverty and problem behaviour in youths.] *Tidsskrift for ungdomsforskning,*

7(1), 53-75.

Thorlindsson, T., & Halldorsson, V. (2010). Sport, and use of anabolic androgenic steroids among Icelandic high school students: a critical test of three perspectives. *Substance Abuse Treatment, Prevention, and Policy, 5*(1), 1–11.

Wichstrøm, L. (2006). Predictors of future anabolic androgenic steroid use. Medicine and Science in Sports and Exercise, 38(9), 1578–1583

Wichstrøm, L., & Pedersen, W. (2001). Use of anabolic–androgenic steroids in adolescence: Winning, looking good or being bad? Journal of Studies on Alcohol and Drugs, 62(1), 5–13.

Yesalis, C. E. & M. S. Bahrke (2002). Anabolic-Androgenic Steroids and Related Substances. *Current Sports Medicine Reports, 1*(4), 246-252.

Table 1 Descriptive statistics by gender. Means and standard deviations

	Boys		Girls		Total		
	Mean	SD	Mean	SD	Mean	SD	Eta
School grade (8-13)	10.14	1.55	10.22	1.59	10.18	1.57	0.021
Family background							
Socio-economic status (0–3)	2.02	0.57	2.04	0.57	2.03	0.57	0.017
Perceived family economy (0–4)	3.19	0.90	3.03	0.95	3.11	0.93	0.080
Exercise habits							
Sports club (0–5)	2.00	2.02	1.61	1.92	1.80	1.98	0.100
On your own (0-5)	1.56	1.74	1.40	1.59	1.48	1.67	0.051
Gym (0-5)	0.56	1.24	0.93	1.52	0.75	1.40	0.130
Dancing. marital arts (0-5)	2.04	1.59	2.20	1.43	2.12	1.51	0.051
Problem behaviour and violence							
Shoplifting (0-4)	0.19	0.63	0.08	0.40	0.13	0.53	0.104
Violent behaviour (0-4)	0.43	0.84	0.11	0.44	0.27	0.69	0.235
Exposure to violence (0-3)	0.17	0.39	0.09	0.28	0.13	0.34	0.116
Substance use							
Smoking cigarettes (0-4)	0.40	0.86	0.29	0.72	0.34	0.79	0.076
Alcohol use (0-4)	1.23	1.24	1.25	1.22	1.24	1.23	0.004
Cannabis use (0-4)	0.18	0.68	0.09	0.45	0.13	0.58	0.082
N=	37896		39676		77572		

Table 2 Prevalence of AAS use by gender and school grade. Means and number of respondents (N)

	Boys		Girls		Total	
	%	N	%	N	%	N
8th grade	1.33	7368	0.65	7515	0.98	14883
9th grade	1.60	7192	1.10	7174	1.35	14366
10th grade	2.48	7417	0.90	7526	1.68	14942
11th grade	1.89	7577	0.77	7964	1.32	15541
12th grade	1.92	5497	0.48	5620	1.19	11117
13th grade	1.46	2846	0.44	3876	0.88	6723
Total	1.81	37896	0.76	39676	1.27	77572

Table 3. Multilevel logistic regression analysis predicting AAS use, separate for boys and girls. Rescaled logistic regression coefficients

	Total sample			Boys only			Girls only			
	Model 1 OR	Model 2 OR	Model 3 OR	Model 1 OR	Model 2 OR	Model 3 OR	Model 1 OR	Model 2 OR	Model 3 OR	Gender difference
Problem behaviour, violence and substance use										
Shoplifting (0-4)	1.183**	1.183**	1.167**	1.149**	1.148**	1.143**	1.266**	1.286**	1.250**	NS
	[1.09,1.28]	[1.09,1.28]	[1.08,1.27]	[1.04,1.27]	[1.04,1.26]	[1.04,1.26]	[1.08,1.48]	[1.10,1.51]	[1.07,1.46]	
Violent behaviour (0-4)	1.313**	1.301**	1.221**	1.288**	1.279**	1.265**	1.246*	1.203*	1.137	NS
	[1.21,1.43]	[1.20,1.41]	[1.12,1.33]	[1.17,1.41]	[1.16,1.41]	[1.15,1.39]	[1.04,1.50]	[1.00,1.44]	[0.95,1.36]	
Exposure to violence (0-3)	1.816**	1.811**	1.783**	1.702**	1.699**	1.687**	2.233**	2.201**	2.076**	NS
	[1.58,2.09]	[1.57,2.09]	[1.55,2.05]	[1.44,2.01]	[1.44,2.01]	[1.43,2.00]	[1.70,2.92]	[1.69,2.87]	[1.59,2.71]	
Smoking cigarettes (0-4)	1.365**	1.380**	1.363**	1.321**	1.320**	1.315**	1.416**	1.470**	1.432**	NS
	[1.25,1.49]	[1.27,1.51]	[1.25,1.49]	[1.19,1.46]	[1.19,1.47]	[1.18,1.46]	[1.21,1.65]	[1.26,1.72]	[1.22,1.68]	
Alcohol use (0-4)	1.124**	1.110*	1.176**	1.126*	1.109*	1.142*	1.112	1.115	1.273**	NS
	[1.03,1.22]	[1.02,1.21]	[1.08,1.28]	[1.02,1.24]	[1.00,1.23]	[1.03,1.27]	[0.96,1.28]	[0.96,1.29]	[1.09,1.49]	
Cannabis use (0-4)	1.424**	1.422**	1.408**	1.397**	1.391**	1.396**	1.483**	1.501**	1.528**	NS
	[1.32,1.53]	[1.32,1.53]	[1.31,1.52]	[1.28,1.52]	[1.27,1.52]	[1.28,1.52]	[1.29,1.71]	[1.30,1.73]	[1.33,1.76]	
Exercise habits										
Sports club (0–5)		1.020	0.999		0.991	0.986		1.070	1.048	NS
		[0.98,1.07]	[0.96,1.05]		[0.94,1.05]	[0.93,1.04]		[0.99,1.16]	[0.97,1.14]	
On your own (0-5)		0.980	0.986		0.960	0.958		1.061	1.059	NS
		[0.93,1.03]	[0.94,1.04]		[0.90,1.02]	[0.90,1.02]		[0.96,1.17]	[0.96,1.17]	
Gym (0-5)		1.056*	1.059*		1.049	1.056		1.044	1.076	NS
		[1.01,1.11]	[1.01,1.11]		[0.99,1.11]	[1.00,1.12]		[0.95,1.14]	[0.98,1.18]	
Dancing, martial arts (0-5)		1.068*	1.083**		1.074	1.073		1.121**	1.098*	NS
		[1.01,1.13]	[1.02,1.14]		[1.00,1.16]	[1.00,1.15]		[1.03,1.22]	[1.01,1.20]	
Social background										
Socio-economic status (0–3)			0.945			0.980			0.888	NS
			[0.81,1.10]			[0.82,1.18]			[0.69,1.15]	
Perceived family economy (0–4)			0.996			1.005			1.005	NS
			[0.91,1.08]			[0.90,1.12]			[0.87,1.16]	
School grade (8–13)			0.863			0.915			0.747**	*
			[0.79,.94]			[0.83,1.01]			[0.66,0.85]	
Gender (boys=0, girls=1)			0.642**							
			[0.54,0.77]							
N=	78153	78153	78153	38100	38100	38100	40053	40053	40053	

Note: OR: odds ratios, rescaled using meresc-command in Stata [99% confidence intervals in brackets]. significance level: * p<.01. ** p<.001. NS Non significant