Zahnow, R, McVeigh, J, Ferris, J and Winstock, A

Adverse effects, health service engagement, and service satisfaction among anabolic androgenic steroid users

Adverse effects, health service engagement and service satisfaction among anabolic androgenic steroid users

Abstract

There are a number of adverse health effects associated with the use of anabolic androgenic steroids (AAS) ranging from mood disturbances to gynaecomastia and impaired sexual function. Despite the potentially serious nature of adverse effects, evidence suggests that users are reluctant to seek medical assistance. This study explores factors associated with health service engagement and treatments related to service satisfaction among a sample of AAS users. The analyses are based on a sample of 195 respondents from the Global Drug Survey (GDS) 2015 who reported using steroids in the previous 12 month period *and* experiencing concerns about adverse health effects. The results indicate reluctance among AAS users to engage with health services with only 35.23% reporting that they visited a doctor when experiencing concerns about adverse effects. Concern about sexual function increased the likelihood that users engaged with health services while concern about changes in sexual organs decreased the odds of service engagement. Amongst AAS users who engaged with health services, individuals who received a mental health assessment or diabetes test rated the service as more helpful than those who did not; a finding that resonates with literature indicating a desire amongst AAS users to monitor the health impacts of their drug use and respond to issues as they arise. While more research is needed, the present results underscore a need for non-judgemental health services aimed at assisting AAS users to monitor adverse effects and minimize harm through early intervention.

Key words: steroids; PIEDs; help-seeking; Global Drug Survey; health services

Adverse effects, health service engagement and service satisfaction among anabolic androgenic steroid users

Introduction

The use of anabolic androgenic steroids (AAS) and associated performance and image enhancing drugs (PIEDs) is not new. In the past decade, efforts have been made to eliminate the use of PIEDs by professional sportspersons and elite athletes. Yet, there is some evidence of a concomitant increase during this time in AAS and PIEDs use in the general population (Iversen et al., 2013; McCabe et al., 2007; McVeigh & Begley, 2016; McVeigh, Beynon & Bellis, 2003). Estimated lifetime prevalence rates, based on population surveys in Australia (Dunn, 2010), Norway (Sagoe et al., 2015) and the USA (Pope et al., 2014), range from less than 1% to 6% depending on sample characteristics. A recent meta-analysis of 187 studies reports a global lifetime prevalence rate of 3.3% (Sagoe et al., 2014).

Whilst the prevalence of AAS use in the general population appears to be relatively low, the perception that use is increasing, particularly among young, recreational gym goers and non-athletes, is ubiquitous (Bojsen-Møller & Christiansen, 2010; Chandler & McVeigh, 2013; Kanayama & Pope, 2012b; Evans-Brown & McVeigh, 2009; Kimergård &McVeigh, 2014a; Sagoe et al., 2014). Recreationally, AAS are used to increase muscle mass, improve physical appearance and enhance strength or athletic performance (Brennan et al., 2016; Ip et al., 2011; Ip et al., 2015). Reasons for initiating use include body dissatisfaction (Kimergård, 2015); low confidence or poor self-esteem (Cohen et al 2007; Maycock & Howat, 2009); safety and security (Maycock & Howat, 2009); to improve social status (Griffiths et al., 2015; Maycock & Howat, 2009; Seear et al, 2015) or to fit in to a ‘fitness’ lifestyle or identity (Ravn & Coffey, 2016).

Whilst health and fitness pursuits are often cited as the main reasons for using AAS (Brennan et al., 2016; Ip et al., 2011; 2015), research has shown that the use of AAS is associated with a number of adverse health effects (Kanayama & Pope, 2012a). Some of these effects are acute in nature and naturally subside with cessation of AAS use while others are chronic health conditions that develop from long term AAS use (Pope & Kanayama, 2015; Pope et al., 2013). Physical side effects include cardiovascular damage, liver disorders (especially if administered orally), testicular atrophy, gynaecomastia and loss of sexual function (Pope et al., 2013). An association between AAS use and poorer mental health outcomes has also been reported (Lindqvust et al., 2013). Adverse effects are not only the purview of long term AAS use. Acute effects of AAS use are well described in the literature particularly in relation to 'stacking' (Sagoe et al., 2015), unsafe injecting practices (Dunn et al., 2014; Iversen et al., 2016) and/or the use of illicitly manufactured products (Evens-Brown et al., 2009). Research has also demonstrated a link between AAS use and negative psychological states including anger, depression and anxiety (Pope et al., 2005).

Despite the potentially serious nature of adverse effects, evidence suggests that AAS users are reluctant to seek medical assistance or to reveal their AAS use to their doctor (Pope et al., 2004). A recent purposive survey of 94 steroid and image enhancing drug (SIED) users in the UK found that only 6% reported seeking medical assistance when they experienced adverse effects related to AAS use. Users cited lack of understanding from their doctor as one of the reasons they did not engage with health services (Chandler & McVeigh, 2013). Similarly, a recent convenience study of injecting AAS users revealed only a minority (17%) of AAS injectors who experienced redness, swelling or tenderness around the injection site had ever sought treatment (Hope et al., 2015). While these studies, based on samples of bodybuilders (Chandler & McVeigh, 2013) and needle exchange attendees (Hope et al., 2015), provide some insight into the health service experiences of AAS users, this type of detailed

information on health service engagement and satisfaction is not currently available from general population drug surveys.

In order to develop appropriate health service responses to AAS use, additional information on health service engagement, treatment and satisfaction is required from AAS users in the general population. The Global Drug Survey (GDS) is an online, anonymous survey designed to capture in-depth information about the use of alcohol, tobacco and illicit substances. The GDS includes a range of questions about the use of AAS including items relating to adverse effects, health service engagement and service satisfaction. Using a sample of respondents from the GDS 2015 who reported using steroids in the previous 12 month period, the current study identifies factors associated with health service engagement and examines treatments associated with health service satisfaction. Given the growing number and diversity of AAS users (Pope & Kanayama, 2015; Rowe et al., 2016; Seer et al., 2015), minimising harm associated with AAS use is an important public health concern. The aim of the current research is to better understand reasons for health service engagement among AAS users. This knowledge is vital to inform the development of health services that are aligned with the needs of AAS users, encourage health service engagement among this group and, in turn, minimise drug related harms.

Methods

Design

The Global Drug Survey (GDS) is an annual, international, online survey of drug use which is self-completed, largely by younger individuals, on a self-nominating, anonymous basis. The most recent survey (GDS, 2015) collected data between November 2014 and January 2015. A total of 89 509 responses were completed during this time. The survey was promoted in partnership with a range of media including national newspapers, magazines, web sites and social media outlets (GDS, 2015) and was available in 11 languages (English, German,

Greek, Polish, French, Italian, Spanish, Portuguese, Flemish, Hungarian and Danish). The GDS sample is opportunistic and not intended to be representative of any particular population group. Other publications provide details on the design, utility and limitations of the GDS (Barratt et al., 2014; GDS, 2015; Winstock et al., 2015).

GDS respondents were asked whether they had used injectable anabolic steroids or oral anabolic steroids in their lifetime and in the last 12 months. The total number of GDS participants who reported lifetime steroid use was 1000. This was 1.1% of the total survey sample. In the current study the analytic sample is restricted to those who: 1) indicated that they used anabolic androgenic steroids (AAS) during the 12 months prior the survey and, 2) experienced concerns about adverse effects related to AAS use (n=195).

Analyses and Measures

The analyses proceed in three stages. All measures are drawn from the GDS 2015. Stage 1 is a logistic regression analysis examining factors associated with health service engagement. The dependent variable is a dichotomous indicator drawn from an item in the GDS that asked respondents who reported using AAS in the last 12 months whether or not they had discussed health concerns related to their AAS use with their family doctor (yes/no). The key independent variables are 5 dichotomous indicators capturing concerns about: mood/mental health; image; sexual function; sexual organs; organ health. The 5 variables were constructed from 17 items on the GDS that asked individuals who reported using AAS in the last 12 months to report on a scale of 1 (not at all worried) to 3 (worried a lot) how worried they were about seven mental health and ten physical health issues associated with AAS use. For each of the 5 variables, respondents were given a score of 1 if they reported concern about the health issue and a score of 0 if they reported no concerns about the health issue. The construction of the 5 measures was based on existing literature that discusses the adverse effects of AAS use as comprising both physical and mental health components (Kanayama &

Pope, 2012a; Linqvist et al., 2013; Onakomaiya & Henderson, 2016; Quaglio et al., 2009). Physical health concerns were further delineated into those associated with sexual organs; sexual function and organ health as responses may be expected to vary by sex and method of administration respectively. Item groupings were confirmed using multiple components analysis (see Figure 1) and are reported in Table 1. Control variables including age; sex (1=female; 2=male); region of residence (1= Europe; 2=North America; 3=South America; 4=Australia/NZ; 5= Asia/Africa and Middle East); ethnicity (0= Caucasian; 1= other); poly-PIEDs use (0=no AAS only; 1= yes AAS plus at least 1 other PIED); and method of AAS administration (0=oral; 1= inject only; 2= both oral and inject), were also included in the logistic regression models.

Stage 2 of the analyses establishes the proportion of recent AAS users who engaged with health services about their AAS use and examines the bivariate relationships between treatments received and satisfaction with health services, measured using two items from the GDS. Individuals who reported using AAS in the last 12 months and indicated they had engaged with health services in the relation to their AAS use (n=68) were asked to rate their experience of raising their steroid use with their doctor on a scale of 1 (very poor) to 5 (very good). They were also asked to report on a scale of 1 (not helpful) to 4 (very helpful) how helpful their doctor was in addressing health concerns related to their AAS use. Aspects of treatment were assessed using eight individual items. Respondents were asked to indicate if the following investigations/ conversations were carried out by their doctor (yes/no): physical examination; blood pressure; assessment of my mood; blood tests to assess my liver function; diabetes test; ECG; screening for hepatitis B / C, HIV; discussion about safer injecting. The Wilcoxon-Mann-Whitney test[1] was used to assess statistically significant associations

[1] The Wilcoxon-Mann-Whitney test is a non-parametric analog to the independent samples t-test and does not require that the dependent variable is normally distributed.

between treatments received and each of the variables capturing satisfaction with health services. A two-sided p value of <0.05 was considered statistically significant.

Stage 3 of the analyses describes frequently reported reasons for *not* engaging with health services despite experiencing concerns about AAS related health issues. Those respondents who indicated that they did not visit their family doctor about health concerns related to their AAS use were asked whether this was for any of the following reasons (yes/no): shame/stigma; did not think the doctor would be able/knowledgeable enough to help; did not think the doctor would be willing to help; the concerns were not significant enough; worries over the impact on health insurance. All analyses were conducted using STATA 13.0. The results of each stage of the analyses are reported below.

>>>Figure 1 here <<<

Results

The total number of GDS respondents who reported using AAS in the 12 month period preceding the survey was 318. This sample of recent AAS users comprised 253 (79.56%) men and 59 (18.55%) women with a mean age of 29.8 years (SD=12.35).[2] Of those who reported using AAS during the last 12 months, 117 (36%) did not record any responses to questions asking about adverse effects. The 117 respondents who did not report any concerns about adverse effects were eliminated from the analyses leaving an analytic sample of 195. Chi-square analyses and independent samples t-tests were conducted to compare the demographic characteristics of the 117 participants who did not record any responses to questions about adverse effects to the analytic sample. There were no significant differences between the two groups of respondents in relation to age, employment status, ethnicity or

[2] Transgender individuals were dropped from the sample due to low numbers (n=6).

highest level of education. Females were more likely to be non-responders than males, $x^2(1, N = 201) = 49.92$ p<0.001). Prior research associates women's reluctance to divulge steroid use with their engagement in drug-tested body building competitions and stigma (Korika et al., 1996). Descriptive statistics are displayed in Table 1.

>>>Table 1 here<<<

Stage 1: Factors associated with health service engagement

Sixty-eight (35.23%) respondents reported visiting a doctor within the last year in relation to their AAS use. This sub-sample comprised 9 (13.24%) women and 59 (86.76%) men with an average age of 35.94 years (SD=13.33). Bivariate statistics revealed that women who experienced concerns about adverse effects were more likely to engage with health services than men $x^2(1, N = 195) = 5.13$ p<0.05). On average, AAS users who engaged with health services were significantly older than those who did not (t=-5.03, p<0.001).

Logistic regression models revealed that AAS users who were concerned about the effects of their drug use on sexual function were more likely to visit a doctor in relation to their AAS use than those who did not experience worry about sexual function (OR=4.02, p<0.01). Alternately, individuals who experienced concern about the impact of their AAS use on sexual organs were less likely to visit a doctor than individuals who did not experience this concern (OR =0.30, p<0.05). Males were less likely to report visiting a doctor about their AAS use than females (OR= 0.09, p<0.01). Because it is well known that oral steroid use is associated with liver problems but injecting use is not, an interaction between method of administration and concern about organ health was included in the model. The interaction was moderately significant and indicated that for injecting AAS users, worry about organ

health was associated with greater likelihood of visiting a doctor while the opposite was true for non-injectors.[3] Logistic regression results are reported in Table 2.

>>>Table 2 here<<<

Stage 2: Health service satisfaction among AAS users who visited a doctor

Ratings of health service helpfulness and overall experience did not differ by sex (p=1.00; p=0.75, FET) and were not significantly associated with age (b=0.03, p=0.18; b=0.25, p=0.15)[4]. Of the 68 AAS users who visited a doctor within the last year, 54 (79.41%) reported receiving a physical examination and 55 (80.88%) reported receiving blood tests to assess liver function. These were the most frequently reported treatments received. Alternately, only 23 (33.82%) respondents reported having a discussion with the doctor about their mood and 26 (38.42%) reported receiving an ECG to assess cardiac health (Table 3).

Individuals who reported discussing their mood with the doctor (z= -2.71, p<0.01) and those who were tested for diabetes (z=-2.10, p<0.05) were more likely than those who did not receive these treatments to rate the health service as helpful or very helpful. Individuals who were screened for hepatitis B/C and HIV were more likely than those who did not receive this treatment to rate their overall experience with the doctor as good or very good (z=-2.62, p<0.01). Other treatments including, physical examination, blood pressure check, ECG, safe injecting education and blood tests for liver function, were not significantly associated with health service satisfaction.

>>>Table 3 here<<<

[3] We also tested for interaction effects between method of administration (0=oral 1= inject only 2= oral and inject) and all other adverse health effects but none of the other interactions were significant.

[4] Sex differences were assessed using Fischer's exact test. The association between age and indicators of satisfaction were assessed using ordinal logistic regression.

Stage 3: Reasons for not engaging with health services

One hundred and thirty (67.36%) respondents did not visit a doctor despite being worried about adverse effects related to their AAS use. The most frequently cited reason for not engaging with health services was that the condition was not significant enough (n=70, 53.85%). Approximately one quarter of respondents reported that they did not engage with health services because they were not confident that their doctor had the knowledge to help (n=31, 23.85%) or they were concerned about stigma/ shame associated with AAS use (n=29, 22.31%). Eighteen respondents did not think their doctor would be willing to help them with an issue related to their AAS use (13.85%). Only three respondents cited concern about health insurance as a factor in their decision not to engage with health services in relation to their AAS use (2.31%) (Table 4).

>>>Table 4 here<<<

Discussion

In the current study we explored health concerns associated with visiting a doctor among a sample of recent AAS users and, among those who did not visit a doctor despite their health concerns, we looked at reasons given for not engaging with health services. Our findings show that only a minority of AAS users engage with health services when they experience health-related concerns about their AAS use, but receiving care specific to conditions associated with AAS use, as opposed to more generic treatments facilitated greater health service satisfaction. Overall, our findings suggest that to encourage help-seeking among AAS users, health service providers must demonstrate that they are both non-judgmental and knowledgeable about the use of AAS. These findings offer important insights in the context of AAS use being associated with a range of both chronic and acute physical and mental health issues (Kanayama & Pope, 2012; Lindqvist et al., 2013; McVeigh & Begley, 2016). The incidence and severity of these AAS-related harms may be ameliorated if users engage

with health services when concerns first arise. Yet, research suggests that AAS users are reluctant to engage with health services and little is known about the types of treatments that would encourage help-seeking among this group (Dunn et al., 2016; Kimergård & McVeigh, 2014b; Pope & Kanayama, 2015). Our study begins to address this knowledge gap.

The results reveal three key findings. First, in line with previous research we find that a minority of AAS users (36.23%) engage with health services when they experience concerns related to their AAS use. Commonly reported reasons for not engaging with health services reflected those documented in previous studies: the problem was not significant enough; lack of confidence in doctors' knowledge of AAS and concerns about stigma associated with AAS use (Chandler & McVeigh, 2013; Hope et al., 2015; Pope et al., 2004; Yu et al., 2015).

Second, we found that two treatments, mood assessments and diabetes tests, were associated with higher ratings of service helpfulness and one treatment, screening for hepatitis B/C, HIV was associated with higher ratings of overall experience with the doctor. Treatments that aimed to assess health issues related to specific AAS side effects (i.e. diabetes test for insulin resistance, hepatitis B/C, HIV screening, mood assessment), as opposed to more generic treatments (i.e. physical examination, general blood test) were associated with greater service satisfaction. When AAS users receive treatments that can be associated with specific, well-documented side effects of AAS use, such as insulin resistance, depression (particularly during off-cycle) or blood-borne diseases, this may indicate to the user that the doctor is knowledgeable, non-judgemental and willing to monitor and manage their AAS-related health issues. Alternately, when AAS users receive more generic treatments, such as a physical examination or general blood test, they may perceive that the doctor has limited knowledge of health issues specific to AAS use and find the health service less helpful for their needs.

Additionally, screening for specific health conditions may be perceived as helpful because it allows AAS users to continue using the drugs while monitoring the impact on their health and countering adverse effects with medical interventions. For example, a diabetes test may lead to treatment to counter insulin resistance and prevent hyperglycaemia allowing the user to continue taking AAS while managing the adverse effects. Other studies have indicated AAS users' desire to take an active role in monitoring their health (Dunn et al., 2016) and highlight the importance of health service providers to be equipped with knowledge specific to the effects of AAS use (Holland-Hall, 2007; McVeigh & Begley, 2016). In interviews with AAS clinic attendees, Kimergård and McVeigh (2014b) found that AAS users appreciated regular medical testing to identify health issues associated with their AAS use as it enabled them to take action to counter adverse effects as they arose. This study also reported that steroid clinics were popular among users because service providers were non-judgemental and knowledgeable about AAS.

The third key finding is that AAS users who were concerned about the impact of their drug use on sexual function were more likely to visit a doctor while those who were concerned about the effects of AAS on their sexual organs (size increase/decrease) were less likely to engage with health services. A possible explanation for this finding is that AAS users engage with health care providers when they perceive the condition to be treatable. The second most frequently cited reason for not visiting a doctor to discuss concerns about AAS related health issues was a perception that a doctor would not be able to help. While it is commonly known that doctors can provide treatment for impotence in the form of prescription medication, users may perceive that doctors cannot do anything to treat changes in sexual organs and this may deter them from engaging with health services. The results also revealed that female users were more likely than males to visit a doctor to discuss health concerns related to their AAS use. This finding was not surprising given that AAS increase circulating levels of the male

reproductive hormone, testosterone, the potential for adverse health effects to arise from AAS use is greater for women than men (Rasmussen, et al., 2016). Greater potential for adverse effects may explain higher levels of engagement with health services among women.

There is limited research on interventions and harm reduction policies for AAS, especially on perceptions of treatment from the users' perspective. Existing studies that examine AAS users' engagement with traditional drug services (i.e. NSPs) suggest that AAS users are reluctant to attend these services for fear of being labelled as a 'drug user' (Brennan et al., 2016; Kimergård & McVeigh, 2014b). Further, NSP workers may be ill-equipped to provide advice on intramuscular injecting and AAS dosing given that they may be less familiar with steroids than other illicit substances (Dunn et al., 2014; Seer et al., 2015). Given the reluctance of AAS users to engage with traditional drug services (Brennan et al., 2016; Kimergård & McVeigh, 2014b), family doctors and general practitioners may be an important avenue for help-seeking among this group. Our findings suggest that doctors can better address the needs of AAS users by assisting them to monitor the impact of their drug use on their physical and mental health through regular screening for known side effects of AAS and countering health issues as they arise.

Our findings support the views of previous scholars who have called for better training and education for doctors so they can provide credible information to AAS users (Chandler & McVeigh, 2013; Pope et al., 2004). Two of the main reasons for *not* engaging with health services were lack of confidence in doctors' knowledge of AAS and stigma. To be perceived as a credible source of health advice, health service providers must acknowledge the benefits of AAS (Holland-Hall, 2007). While acknowledging the benefits of AAS use, providers should also offer advice on alternative avenues to achieving body and strength goals. Referral to a nutritionist, strength coach or mental health service may be appropriate (Holland-Hall, 2007). Education and training facilitated by current and/or previous AAS users may help to

challenge stereotypes of AAS users among health care providers and create an opportunity for service providers to learn about the experience of AAS use first-hand. Education should also focus on helping health service providers to find subtle ways to demonstrate a non-judgemental attitude and encourage open conversation about drug use with their patients. This may be achieved by engaging in open discussions about health, mood and wellbeing with patients presenting for non-drug related health issues who may be at high-risk of AAS use, for example, individuals presenting with sports/activity related injuries; individuals from high-risk industries (e.g. police, security) presenting for work-related physicals; young men reporting sexual dysfunction and/or body dissatisfaction. These types of discussions may also help to identify reasons for AAS use such as body dissatisfaction, insecurities, bullying and/or pressure to perform (Hanley Santos & Coomber, 2016; Holland-Hall, 2007 ; Ip et al., 2015; Kanayama et al., 2012; Kimergård, 2015; Maycock & Howat, 2009).

Limitations

This study has a number of strengths and limitations worth noting. The GDS is an established survey that collects data on drug use from an international sample of general population users. Information about health service engagement collected from general population AAS users is rare and access to the GDS data brings a unique aspect to this study. Most other surveys that have sought to explore behaviours, including the uptake of health services, have directly targeted steroid users in the gym environment (Davies et al., 2011; Lindqvist et al., 2013; Pope et al., 2004) through needle and syringe programmes (Coomber et al., 2015; Iversen et al., 2016; Kimergård & McVeigh, 2014a; b) via specialist online forums (Chandler & McVeigh, 2013; Cohen et al., 2007; Parkinson & Evans, 2005) or through high schools (Buckley et al., 1988; Dunn & White, 2011; Johnstone et al., 2015; Pallesen et al., 2006; Tanner et al., 1995). Further, few of these studies have explored treatments received and none have examined the association between different types of medical interventions and service

satisfaction from the AAS users' perspective. As AAS and PIEDs use amongst non-athletes increases, an important public health concern is to understand experiences of adverse health effects and related health seeking behaviours amongst general population AAS users. While the majority of surveys on AAS use collect only limited information about lifetime, past year and past month use with no information on experience of adverse effects and/or experience of health service engagement, the GDS 2015 survey tool measures a combination of patterns of AAS and PIEDs use and experience of adverse health issues and health seeking behaviours.

Thus the current study was able to investigate aspects of AAS use not well understood from previous research in a general population sample. Important limitations must also be considered. Despite the very large sample size of the GDS, respondents are self-nominating and the sample is opportunistic. Further, the sample reporting recent steroid use is relatively small and virtually all report using recreational drugs in addition to AAS. Consequently, the sample used in the current study should not be considered representative of AAS using population. Relatively small numbers also preclude greater exploration of use by country of residence and therefore cannot account for variation in legislation and health service provision across different settings. Questions were limited to asking respondents about whether or not they had visited a family doctor but did not capture other forms of health service engagement such as visiting an emergency room or accessing injecting services and therefore our findings cannot be applied to health seeking behaviours more broadly.

Despite these limitations, the current study provides some important insights into health service engagement among a general population sample of AAS users. The results suggest that health service providers can better assist AAS users by testing for specific side effects of AAS use. As a common reason for not engaging with services was stigma it is important that health service providers find subtle nuanced ways in which to demonstrate non-judgemental attitudes towards AAS use. This may be achieved by encouraging broader conversations

about mood, lifestyle and wellbeing. Providing access to information about injecting, steroid dosing and displaying information about steroid clinics in doctors' surgeries may also help to demonstrate to AAS users that doctors are non-judgemental and willing to assist with monitoring health conditions associated with use.

References

Aitken, C. and Delalande, C. (2002). A Public Health Initiative for Steroid Users in Victoria. *Australian Journal of Primary Health, 8*, 21-23.

Baggish, A.L., et al. (2010) Long term anabolic-androgenic steroid use is associated with left ventricular dysfunction. *Circulation Heart Failure, 2010*,109.

Barratt, M., Ferris, J.A. & Winstock, A.R. (2014). Use of Silk Road, the online drug marketplace, in the United Kingdom, Australia and the United States. *Addiction,109*, 774–83.

Bojsen-Møller, J. & Christiansen, A.V. (2010). Use of performance-and image-enhancing substances among recreational athletes: a quantitative analysis of inquiries submitted to the Danish anti-doping authorities. *Scandinavian Journal of Medicine & Science in Sports, 20,* 861-867.

Brennan, R., Wells, J. & Van Hout, M. (2016). The injecting use of image and performance-enhancing drugs (IPED) in the general population: a systematic review. *Health & Social Care in the Community*, doi10.1111/hsc.12326.

Buckley, W.E., et al. (1988). Estimated prevalence of anabolic steroid use among male high school seniors. *Journal of the American Medical Association,* 260, 3441-3445.

Chandler, M. & McVeigh, J. (2013). *Steroids and Image Enhancing Drugs 2013 Survey Results.* Liverpool: Centre for Public Health.

Cohen, J., Collins, R., Darkes, J. & Gwartney, D. (2007). A league of their own: demographics, motivations and patterns of use of 1955 male adult non-medical anabolic steroid users in the United States. *Journal of the International Society of Sports Nutrition, 4*, 12.

Coomber, R., Pavlidis, A., Santos, G.H., Wilde, M., Schmidt, W. & Redshaw, C. (2015). The supply of steroids and other performance and image enhancing drugs (PIEDs) in one English city: Fakes, counterfeits, supplier trust, common beliefs and access. *Performance Enhancement & Health, 3*,135-44.

Davies, R., Smith, D. & Collier, K. (2011). Muscle Dysmorphia Among Current and Former Steroid Users. *Journal of Clinical Sports Psychology, 5*,77-94.

De Souza., G.L. & Hallak, J. (2011). Anabolic steroids and male infertility: a comprehensive review. *BJU International, 108*, 1860-1865.

Dunn, M. (2010). The non-medical use of steroids in Australia: results from a general population survey. *Australian and New Zealand Journal of Public Health, 34*, 531-532.

Dunn, M., Henshaw, R. & McKay, F. (2016). Do performance and image enhancing drug users in regional Queensland experience difficulty accessing health services? *Drug and Alcohol Review, 35*, 377-382.

Dunn, M., McKay, F.H. & Iversen, J. (2014). Steroid users and the unique challenge they pose to needle and syringe program workers. *Drug & Alcohol Review, 33*, 71-7.

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*,10-4.

Evans-Brown, M., Kimergård, A. & McVeigh, J. (2009). Elephant in the room? The methodological implications for public health research of performance-enhancing drugs derived from the illicit market. *Drug Testing and Analysis, 1*, 323-6.

Gala, G.L., Griffith, E.H., Cahill, B.R. & Tuttle, L.D. (1994). Prevalence of anabolic steroid use among Illinois high school students. *Journal of Athletic Training, 29*, 216-222.

Global Drug Survey (GDS) (2015). http://www.globaldrugsurvey.com Accessed April 25 2016.

Griffiths, S., Henshaw, R., McKay, F. & Dunn, M. (2015). Post-cycle therapy for performance and image enhancing drug users: A qualitative investigation. *Performance Enhancement & Health*, http://dx.doi.org/10.1016/j.peh.2016.11.002.

Hanley Santos, G. & Coomber, R. (2016). The risk environment of anabolic-androgenic steroid users in the UK: Examining motivations, practices and accounts of use. *International Journal of Drug Polocy*, http://dx.doi.org/10.1016/j.drugpo.2016.11005.

Holland-Hall, C. (2007). Performance-Enhancing Substances: Is Your Adolescent Patient Using? *Pediatric Clinics of North America, 54*, 651-662.

Hope, V.D., et al. (2015). Injection site infections and injuries in men who inject image-and performance-enhancing drugs: prevalence, risks factors, and healthcare seeking. *Epidemiology and Infection, 143*, 132-140.

Ip, E.J., Barnett, M., Tenerowicz, M. & Perry, P. (2011). The Anabolic 500 Survey: Characteristics of Male Users versus Nonusers of Anabolic-Androgenic Steroids for Strength Training. *Pharmacotherapy, 31*, 757-766.

Ip, E.J., Trinh, K., Tenerowicz, M., Pal, J., Lindfelt, T. & Perry, P. (2015). Characteristics and Behaviors of Older Male Anabolic Steroid Users. *Journal of Pharmacy Press, 28*, 450-456.

Iversen, J., Hope, V.D. & McVeigh, J.(2016). Access to needle and syringe programs by people who inject image and performance enhancing drugs. *International Journal of Drug Policy,31*,199-200.

Iversen, J., Topp, L., Wand, H. & Maher, L. (2013). Are people who inject performance and inage-enhancing drugs an increasing population of Needle and Syringe Program attendees? *Drug and Alcohol Review, 32*, 205-207.

Johnstone, L.D., et al. (2015). *Monitoring the Future national survey results on drug use 1975-2014: Volume 2, College Students & Adults Ages 19-55*. Ann Arbor: Institute for Social Research, The University of Michigan.

Kanayama, G. & Pope, H.G. (2012a). Illicit Use of Androgens and Other Hormones: Recent Advances. *Current Opinion in Endocrinology, Diabetes and Obesity, 19,* 211-219.

Kanayama, G. & Pope, H.G. (2012b). Misconceptions about anabolic-androgenic steroid abuse. *Psychiatric Annals, 42*, 371-375.

Kimergård, A. & McVeigh, J. (2014a). Environments, risk and health harms: a qualitative investigation into the illicit use of anabolic steroids among people using harm reduction services in the UK. *BMJ open, 4,* e005275.

Kimergård, A. & McVeigh, J. (2014b). Variability and dilemmas in harm reduction for anabolic steroid users in the UK: a multi-area interview study. *Harm Reduction Journal, 11,* 19-31.

Kimergård, A. (2015). A qualitative study of anabolic steroid use amongst gym users in the United Kingdom: motives, beliefs and experiences. *Journal of Substance Use, 20,* 288-294.

Korika, P., Lenehan, P. & McVeigh, J. (1996). Non-medical use of androgens among women. *Journal of Occupational Psychology, Employment and Disability,1*, 71-76.

Lindqvist, A.S., Moberg, T., Eriksson, B.O., Ehrnborg, C., Rosén, T. & Fahlke, C. (2013). A retrospective 30-year follow-up study of former Swedish-elite male athletes in power sports with a past anabolic androgenic steroids use: a focus on mental health. *British Journal of Sports Medicine,47,* 965-9.

Maycock, B. & Howat, P. (2009). The barriers to illegal anabolic steroid use. *Drug: Education, Prevention and Policy, 12,* 317-325.

McCabe, S., Brower, K., West, B., Nelson, T. & Wechsler, H. (2007). Trends in non-medical use of anabolic steroids by U.S. college students: results from four national surveys. *Drug and Alcohol Dependence,90,* 243-251.

McVeigh, J. & Begley, E. (2016). Anabolic steroids in the UK: an increasing issue for public health. *Drugs: Education, Prevention and Policy,* http://dx.doi.org/10.1080/09687637.2016.1245713.

McVeigh, J., Beynon, C. & Bellis, M. (2003). New challenges for agency based syringe exchange schemes: analysis of 11 years of data (1991-2001) in Merseyside and Cheshire, United Kingdom. *International Journal of Drug Policy, 14*(5-6), 399-405.

Pallesen, S., et al. (2006). Anabolic steroid use in high school students. *Substance Use & Use, 41,* 1705-1717.

Parkinson, A.B. & Evans, N.A. (2005). Anabolic androgenic steroids: a survey of 500 users. *Medicine & Science in Sports & Exercise, 38,* 644-51.

Pope, C.G., et al. (2005). Clinical features of muscle dysmorphia among males with body dysmorphic disorder. *Body Image, 2,* 395-400.

Pope, H.G., et al. (2004). Anabolic steroid users' attitudes toward physicians. *Addiction, 99,* 1189-1194.

Pope, H.G., et al. (2013). Adverse health consequences of performance-enhancing drugs: an Endocrine Society scientific statement. *Endocrine Reviews, 35*, 341-375.

Pope, H.G., et al. (2014) The Lifetime Prevalence of Anabolic-Androgenic Steroid Use and Dependence in Americans: Current Best Estimates. *American Journal of Addiction, 23*(4): 371-377.

Pope, H.G. & Kanayama, G. (2015). Treatment of Anabolic-Androgenic Steroid Related Disorders. In N. el-Guebaly et al (eds.) *Textbook of Addiction Treatment: International Perspectives* (pp. 621-636). Italy: Springer-Verlag.

Rasmussen, J., Selmer, C., Ostergren, P., Pedersen, K., Schou, M., Gustafsson, F., Faber, J., Juul, A. & Kistorp, C. (2016). Former Abusers of Anabolic Androgenic Steroids Exhibit Decreased Testosterone Levels and Hypogonadal Symptoms Years after Cassation: A Case-Control Study. *PLOS One*. doi: org/10.1371/journal.pone.0161208

Ravn, S. & Coffey, J. (2016). 'Steroids, it's so much an identity thing!' perceptions of steroid use, risk and masculine body image. *Journal of Youth Studies, 19,* 87-102.

Rich, J., Dickinson, B., Feller, A., Pugatch, D. & Mylonakis, E. (1999). The Infectious Complications of Anabolic-Androgenic Steroid Injection. *International Journal of Sports Medicine, 20,* 563-566.

Rowe, R., Berger, I. & Copeland, J. (2016). No pain, no gainz? Performance and image-enhancing drugs, health effects and information seeking. *Drugs: Education, Prevention and Policy*, http://dx.doi.org/10.1080/09687637.2016.1207752.

Sagoe, D., McVeigh, J., Bjørnebekk, A., Essilfie, M.S, Andreassen, C.S. & Pallesen, S. (2015). Polypharmacy among anabolic-androgenic steroid users: a descriptive metasynthesis. *Substance Abuse Treatment, Prevention and Policy, 10*, 1.

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*, 383-98.

Santora, L.J., et al. (2006). Coronary calcification in body builders using anabolic steroids. *Preventive Cardiology, 9*, 198-201.

Seer, K., Fraser, S., Moore, D. & Murphy, D. (2015). Understanding and responding to anabolic steroid injecting and hepatitis C risk in Australia: A research agenda. *Drugs: Education, Prevention, Policy, 22*, 449-455.

Tanner, S., Miller, D. & Alongi C. (1995). Anabolic steroid use by adolescents: prevalence, motives and knowledge of risks. *Clinical Journal of Sports Medicine, 5*, 108-115.

Winstock, A., Lynskey, M., Borschmann, R., et al. (2015). Risk of emergency medical treatment following consumption of cannabis or synthetic cannabinoids in a large global sample. *Journal of Psychopharmacology*, *29,* 698–703.

Yu, J., Hildebrandt, T. & Lanzieri, N. (2015). Healthcare professionals' stigmatization of men with anabolic androgenic steroid use and eating disorders. *Body Image*, *15*, 49-53.

Figure 1. MCA of items measuring worry about adverse effects of AAS use

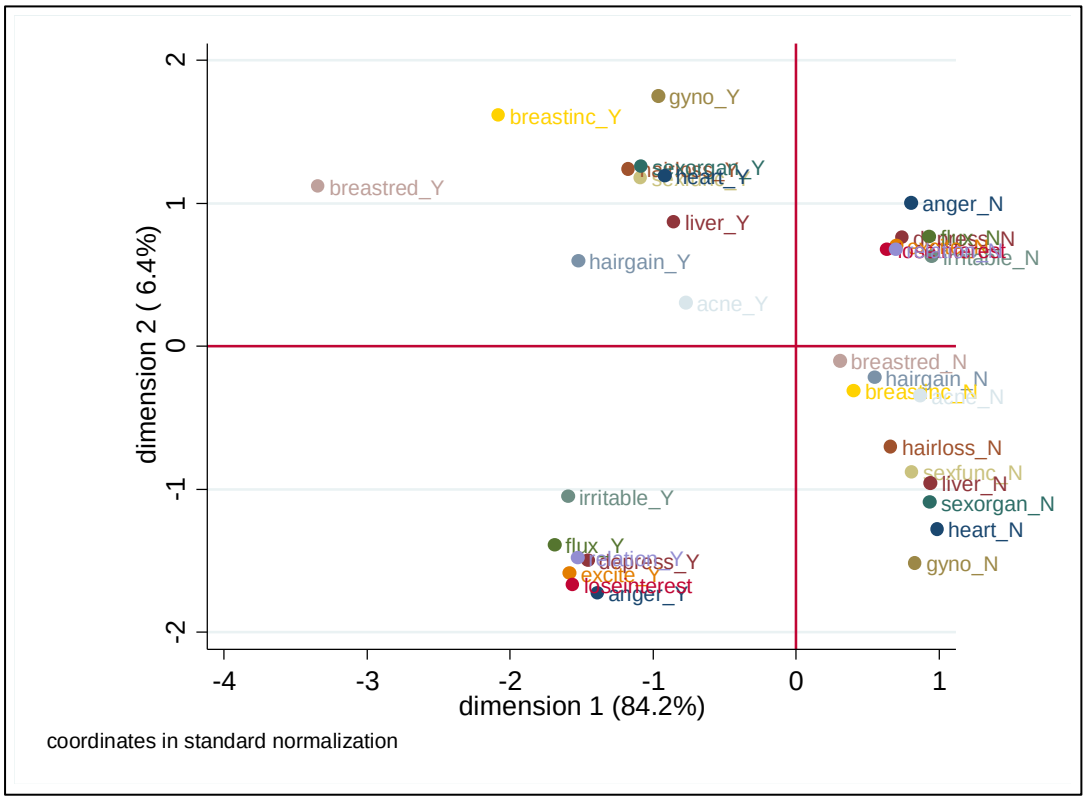

Table 1. Summary statistics

Characteristics	N	%
Age *mean*=29.8 *min* =17 *max.*=72		
Sex		
Male	253	(79.56)
Female	59	(18.55)
Region of residence		
Europe	166	(52.20)
North America	34	(10.69)
South Americas	61	(19.18)
Oceania	51	(16.04)
Asia, Africa/Middle East	6	(1.89)
Ethnicity		
White	263	(82.70)
Non-white	55	(17.30)
Poly-PIED use last 12 mths		
No AAS only	174	(54.72)
Yes AAS plus at least 1 other	144	(45.28)
Method of use		
Oral only	63	(28.13)
Inject only	81	(36.16)
Both oral and inject	80	(35.71)
Worry about adverse effects		
Mood/Mental Health		
Anger/aggression		
Not at all worried	122	(61.31)
Worried a little or a lot	77	(38.69)
Depression/low mood		
Not at all worried	125	(63.45)
Worried a little or a lot	72	(36.55)
Rapid fluctuation in mood		
Not at all worried	118	(60.51)
Worried a little or a lot	77	(39.49)
Irrational excitability/elevation in mood		
Not at all worried	129	(65.48)
Worried a little or a lot	68	(34.52)
Restlessness/irritability		
Not at all worried	114	(57.58)
Worried a little or a lot	84	(42.42)
Loss of interest in other things;		
Not at all worried	141	(72.31)
Worried a little or a lot	54	(27.69)
Quality of relationship with others		
Not at all worried	130	(66.67)
Worried a little or a lot	65	(33.33)
Image		
Hair loss		
Not at all worried	119	(61.98)
Worried a little or a lot	73	(38.02)
Hair gain		
Not at all worried	135	(71.43)
Worried a little or a lot	54	(28.57)
Skin conditions		

Not at all worried	84	(43.75)
Worried a little or a lot	106	(56.25)
Sexual function		
Sexual function		
Not at all worried	106	(53.81)
Worried a little or a lot	91	(46.19)
Sexual organs		
Effect on sexual organs		
Not at all worried	98	(50.78)
Worried a little or a lot	95	(49.22)
Reduction in breast size		
Not at all worried	164	(91.11)
Worried a little or a lot	16	(8.89)
Growth of breasts*		
Not at all worried	103	(54.50)
Worried a little or a lot	86	(45.50)
Increase in breast size		
Not at all worried	148	(82.68)
Worried a little or a lot	31	(17.32)
Organ Health		
Heart		
Not at all worried	87	(45.08)
Worried a little or a lot	106	(54.92)
Liver function		
Not at all worried	86	(44.79)
Worried a little or a lot	106	(55.21)

* We note this item is only applicable to male participants.

Table 2. Logistic regression predicting doctors visit (n=186)

	Full Model		Interaction Model	
	OR	95% CI	OR	95% CI
User characteristics				
Age	1.03	(0.82,1.31)	1.03	(0.81,1.32)
Age *Age	1.00	(0.99,1.00)	1.00	(0.99,1.00)
Male	0.10**	(0.02,0.40)	0.10**	(0.02,0.47)
Region of residence (ref: Europe)				
North America	6.26**	(1.36,28.8)	5.11**	(1.08,24.2)
South Americas	1.58	(0.63,3.95)	1.51	(0.60,3.82)
Oceania	1.49	(0.50,4.41)	1.42	(0.45,4.46)
Asia, Africa/Middle East	0.34	(0.03,4.12)	0.31	(0.02,4.01)
Poly-PIEDs use in last 12 mths (ref: AAS only)	0.76	(0.34,1.68)	0.80	(0.35,1.83)
Method of administration (ref: oral only)				
Inject only	3.39	(1.09,10.6)	1.41	(0.18,10.9)
Both oral and inject	3.14	(1.01,9.75)	5.36	(0.78,36.7)
Worry of adverse effects				
Mood/mental health	0.65	(0.34,1.68)	0.60	(0.25,1.44)
Image	1.29	(0.50,3.31)	1.14	(0.41,1.61)
Sexual function	4.02**	(1.56,10.3)	4.09**	(1.56,10.7)
Sexual organs	0.30*	(0.11,0.86)	0.32*	(0.11,0.91)
Organ health	1.05	(0.43,2.60)	0.41	(0.11,1.51)
Interaction: Method of admin.*Organ health				
Oral only*organ health			2.42	(0.26,22.6)
Inject only*organ health			7.93*	(1.23,51.3)
Model information				
Constant	3.25	(0.03,351)	3.05	(0.03,348)
Wald χ^2	58.34		63.32	
LR test of improvement	-89.22		-86.73	

Significant: *p<0.05, **p<0.01, ***p<0.001

Table 3. Treatment received and service satisfaction

	N=68	%	Helpfulness (z)	Overall experience (z)
Physical Examination				
Yes	54	79.41	1.42	1.00
No	14	20.59		
Blood pressure				
Yes	50	26.47	-0.47	0.48
No	18	73.53		
Assessment of mood				
Yes	23	33.82	2.71**	1.50
No	45	66.18		
Blood tests to assess liver function				
Yes	55	80.88	0.05	0.19
No	13	19.12		
Diabetes test				
Yes	28	41.18	2.10*	1.09
No	40	58.82		
ECG				
Yes	26	38.24	1.37	0.98
No	42	61.76		
Screening for hepatitis B/C, HIV				
Yes	28	41.18	1.68	2.62**
No	40	58.82		
Discussion about safer injecting				
Yes	27	39.71	0.97	0.90
No	41	60.29		

Table 4. Reasons for not visiting a doctor

	N=130	%
Shame/stigma		
Yes	29	22.31
No	101	77.69
Did not think the doctor would be able to/ knowledgeable enough to help		
Yes	31	23.85
No	99	76.15
Did not think the doctor would be willing to help		
Yes	18	13.85
No	112	86.15
Concerns were not significant enough		
Yes	70	53.85
No	60	46.15
Worry over the impact on health insurance		
Yes	3	2.31
No	127	97.69