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### Article

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1 **SHORT REPORT**

2  
3 **The modes of administration of anabolic-androgenic steroid users (AAS): Are non-injecting**  
4 **people who use steroids overlooked?**

5  
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15  
16 **Abstract**

17 *Introduction:* There is increasing public health concern about the use of anabolic-androgenic  
18 steroids (AAS). Understanding of drug use patterns and practices is important if we are to  
19 develop appropriate risk-reduction interventions. Yet, much remains unclear about the  
20 modes of administration adopted by AAS users.

21 *Methods:* We used data from a sub-sample of participants from the Global Drug Survey 2015;  
22 males who reported using injectable or oral AAS in their lifetime (n=1008).

23 *Results:* Amongst our sample, approximately one third (35.62%) reported using only  
24 injectable AAS during their lifetime while 35.84% reported using only oral, with less than one  
25 third (28.54%) using both.

26 *Conclusion:* These findings suggest there may be a sub-population of individuals who only use  
27 AAS orally. Needle and syringe programs (NSPs) are currently the primary point of health  
28 service engagement; forming the main healthcare environment for medical and harm  
29 reduction advice on steroids. Yet, NSP-based resources are unlikely to reach or be appropriate  
30 to those who do not inject AAS. While there is a general need for health services to be more  
31 accessible when it comes to AAS use, non-injectors are an overlooked group that require  
32 attention.

33  
34 **Keywords**

35 Performance and image enhancing drugs; PIED; IPED; anabolic-androgenic steroids; AAS;  
36 Global Drug Survey; needle and syringe programs; harm reduction

37  
38 **Words:** 2,580

39  
40 **1. Introduction**

41 While prevalence surveys suggest lifetime use of anabolic-androgenic steroids (AAS) and  
42 other performance and image enhancing drugs has remained relatively low over time, there  
43 is a growing body of evidence which suggests that the use of these substances is widespread  
44 across the globe (Sagoe, Molde, Andreassen, Torsheim, & Pallesen, 2014). Of particular  
45 concern is the use of AAS among young men (Home Office, 2017). There are various short-  
46 and long-term health harms associated with the use of AAS (Pope et al., 2014); non-prescribed  
47 AAS use is now a recognised public health concern (McVeigh, Evans-Brown, & Bellis, 2012).

48 People use AAS orally and via injection. Many individuals use both modes of  
49 administration during the same time-period (cycle) while others may shift from one mode to  
50 the other as their AAS using career progresses. Typically, a person's first experience using  
51 steroids, regardless of whether mode of administration is oral or injecting, occurs before the  
52 mid- to late-twenties (Begley et al., 2017). The onset of oral consumption of AAS is likely to  
53 be slightly earlier than the onset of the use of injectable substances. In some cases  
54 participating in certain sports (particularly power sports), negative body image and  
55 psychological disorders (e.g. body image disorders) may precede initiation of AAS use (Sagoe,  
56 Andreassen, & Pallesen, 2014). Use of legal sport supplements is also an important predictor  
57 of AAS use within fitness and sport contexts (Boardley & Grix, 2014). Yet, much remains  
58 unclear regarding patterns of AAS use, particularly our knowledge of typical patterns in modes  
59 of AAS administration is limited to specific sub populations of people who use AAS; i.e. oral  
60 or injection first, or simultaneous use of both forms of AAS. Given the link between modes of  
61 administration and health risks associated with AAS use, identifying various patterns of  
62 administration is vital to inform appropriate harm reduction strategies.

63 Data on AAS use is generally collected via ethnographic work (Christiansen, Vinther, &  
64 Liokaftos, 2017; Underwood, 2017; van de Ven & Mulrooney, 2017) and surveys (Begley et  
65 al., 2017; Zahnnow et al., 2018) within needle and syringe programs (NSPs) or  
66 gym/bodybuilding settings. Even with the limited diversity in recruitment samples, variation  
67 in motivations for use and associated health risk behaviours have been identified (van de Ven  
68 et al., 2018; Zahnnow et al., 2018). For example, the use of steroids by older men may be  
69 motivated by anti-ageing aims (Begley et al., 2017; Evans Brown, McVeigh, Perkins, & Bellis,  
70 2012), while police personnel may use AAS for recovery and/or strength purposes  
71 (Hoberman, 2005; Hoberman, 2017).

72 In contrast to the variability in motivations for using AAS, harm reduction responses  
73 tend to be limited to advice delivered through NSPs. Given individuals who use AAS report  
74 low levels of trust in medical professionals and a reluctance to seek advice or health care from  
75 doctors (Pope, Kanayama, Ionescu-Pioggia, & Hudson, 2004), in regards to their substance  
76 use, it is not surprising that NSPs are noted as their main source of healthcare (e.g. see  
77 Iversen, Hope, & McVeigh, 2016). While NSPs are an important avenue for AAS users to obtain  
78 credible information, these programs are primarily designed to deliver services to injecting  
79 drug users, such as distributing injecting equipment and promoting safe injecting practises.  
80 These services are neither relevant nor attractive to oral users of AAS who do not inject drugs.  
81 As such, a subset of people who use AAS may not be in contact with any form of intervention  
82 or health service provider. A better understanding of different drug use patterns may  
83 therefore provide new insights for planning harm reduction interventions and other public  
84 health initiatives aimed at AAS users. We will therefore explore patterns of AAS use in a  
85 sample of people declaring the use of psychoactive drugs derived from the Global Drug Survey  
86 (GDS). The GDS may be a valuable source to study this drug-using population as data on AAS  
87 use is generally collected via NSPs or gym/bodybuilding settings and this study therefore  
88 provides unique insights into the routes of administration of AAS users.

89

## 90 **2. Methods**

### 91 *Design and Measures*

92 The Global Drug Survey (GDS) is an online, anonymous survey designed to capture in-depth  
93 information about the use of alcohol, tobacco and illicit substances. Since its inception in 2009  
94 the GDS has been conducted annually. It is actively promoted via social networking sites such

95 as Twitter, Facebook and Reddit for a period of 1–2 months from its launch in mid-November  
96 each year. Here we use data from the GDS 2015, which was collected between November  
97 2014 and January 2015 from around the world. A total of 89,509 responses were completed  
98 during this time. The GDS survey is self-completed on a self-nominating basis. Other  
99 publications provide details on the design, utility and limitations of the GDS (Barratt et al.,  
100 2017). In this study we are interested in a sub-sample of the GDS; males who reported using  
101 injectable or oral AAS in their lifetime (n=1008). Demographics and prevalence of lifetime use  
102 (ever used) of a large number of substances including AAS were collected (see also Zahnow,  
103 McVeigh, Ferris, & Winstock, 2017). In addition, we assessed the average age of first use and  
104 modes of administration including oral, injection or simultaneous use of both forms of AAS.  
105

### 106 *Analysis*

107 Data were processed and analysed using Stata 14.0. Continuous variables were summarized  
108 with means and standard deviations while categorical variables were presented in  
109 frequencies and percentages. Student t-tests and Pearson’s chi-square were used to  
110 determine statistical significance between groups. We employed logistic regression analysis  
111 to examine whether the odds of injecting AAS at first use, compared to using AAS orally at  
112 initiation, was associated with demographic characteristics, age first used AAS, prior use of  
113 other psychoactive substances and two indicators of lifestyle behaviours; frequency of  
114 exercise and frequency of binge drinking. We adopted a stepwise method to first estimate  
115 the effects of demographic and drug use variables in Model 1 then assess the impact of adding  
116 two lifestyle variables in Model 2. The impact of the addition of variables was assessed using  
117 the Likelihood Ratio Test. All statistical tests were two tailed and significance level was set at  
118 0.05.  
119

## 120 **3. Results**

### 121 *Age of first AAS use*

122 The final analytic cohort comprised 1008 men who reported using AAS and at least one other  
123 psychoactive drug during their lifetime. The average age of the sample was 32.07 years  
124 (SD=11.41). The majority were employed (71.72%) and had engaged in post-secondary school  
125 education (75.8%). The average age of first use of AAS was 23.59 years (SD=9.02). There was  
126 a significant difference in the average age of first AAS between men who initially used AAS  
127 orally compared to those who used by injection; the average age of first use of injectable AAS  
128 was 24.33 years (SD=8.18) indicating that those who injected at first use tended to be older  
129 than those who used orally. The mean age of first use of other psychoactive substances  
130 among men who used steroids was significantly lower than age of first use of AAS (mean=16.9  
131 years, SD=5.22). This reflects age of first drug use reported in the broader male GDS sample  
132 (see Table 1). In terms of other psychoactive substances, the drug used most commonly by  
133 men who used AAS was cannabis (lifetime use: 90.8%), followed by ‘other’ drugs<sup>1</sup> (75.06%),  
134 cocaine (61.30%) and/or MDMA (58.56%).  
135

136 PLEASE INSERT TABLE 1 HERE  
137

### 138 *Modes of Administration*

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<sup>1</sup> Other drugs include ketamine, nitrous, GHB, GBL, PCP, hallucinogens, solvents, paint and glue.

139 Amongst our sample of men who use AAS and other psychoactive substances we found a  
140 relatively even split between oral use and intra-muscular injection. Approximately one third  
141 (35.62%) of the men in our sample reported using only injectable AAS during their lifetime  
142 while 35.84% reported using only oral AAS in their lifetime. Less than one third (28.54%) of  
143 the sample reported using both injectable and oral AAS within their lifetime. Of those who  
144 used both modalities the majority reported initial use of both oral and injectable AAS at the  
145 same age (n=179, 69.38%) (see Table 2). Transition between modes of administration, either  
146 from injecting to oral use of AAS or from oral AAS to injecting, occurred among approximately  
147 30% of individuals who reported using both injectable and oral AAS in their lifetime. Amongst  
148 those who did not initiate both oral and injecting AAS at the same time, those who injected  
149 AAS for the first time *after* they started using AAS orally, took an average of 2.69 years to  
150 adopt the modality while those who started out using injectable AAS took an average of 3.81  
151 years to take up oral use (see Table 2). The difference between time to transition was not  
152 statistically significant ( $t=-1.26$ , ns).

153

154 PLEASE INSERT TABLE 2 HERE

155

#### 156 **4. Discussion**

157 In this study we found that the majority of AAS users reported using a single mode of  
158 administration for AAS; either oral (35.84%) or injection (35.62%). This was surprising given  
159 the high prevalence of ‘stacking’, polydrug use (Sagoe et al., 2015), and the simultaneous use  
160 of both forms of administration (Begley et al., 2017), noted among the AAS-using population.  
161 While research notes a general reluctance among users of AAS to engage with health services  
162 (Zahnow et al., 2017), NSPs in the UK and Australia report the proportion of clients who use  
163 AAS has increased in recent years. NSPs are a primary source of clean injecting equipment  
164 (e.g. Dunn, Henshaw, & McKay, 2016; McVeigh, Beynon, & Bellis, 2003); other sources include  
165 friends, pharmacies, online and social suppliers (Kimergård, 2015; van de Ven & Mulrooney,  
166 2017). However, here we highlight a group who do not use injection as a mode of  
167 administration. These non-injecting AAS users (oral-only), who also use psychoactive drugs  
168 that are less commonly associated with injecting, are unlikely to engage with NSPs restricting  
169 their access to drug harm minimization and medical advice. This oral-only using group may  
170 therefore never come into contact with harm reduction information, advice and referrals  
171 regarding AAS use or any other form of drug use, or not until a late stage of their drug using  
172 career when/if transition to injecting AAS use occurs. Transition from oral to injecting AAS use  
173 occurs approximately 3 years after the initial experience with AAS. Delayed intervention in  
174 drug abuse is associated with greater adverse effects, dependence and risky patterns of use  
175 (Modesto-Lowe, Petry, & McCartney, 2008; Stockings et al., 2016). While oral-only users are  
176 not exposed to injection-related risks of blood-borne virus, oral AAS use may be associated  
177 with a number of adverse health effects, with liver toxicity particularly being an issue  
178 (Niedfeldt, 2018). It is therefore important for future studies to explore why people engage  
179 in oral-only use (e.g. requires less planning in sourcing equipment) and to explore the barriers  
180 to accessing healthcare services for this specific group.

181 Furthermore, although bloodborne viruses (BBVs), such as HIV, hepatitis B and  
182 hepatitis C, are an issue of concern among this population (Hope et al., 2013; van de Ven et  
183 al., 2018), AAS users tend to have lower levels of BBVs compared to other psychoactive drug  
184 users. Adding to this, levels of sharing or reuse of injecting equipment, which is a significant  
185 risk factor for BBV transmission, is much lower amongst user amongst this population when

186 compared to those injecting psychoactive drugs (Larance, Degenhardt, Copeland, & Dillon,  
187 2008). This is not to say that educating AAS users about safe injection practises is not  
188 important but due to health services being largely delivered through NSPs this seems to be  
189 the only focus of attention. Yet, recent research indicates that AAS users report having other  
190 personal health priorities and needs, such as better access to medical and clinical advice,  
191 general health monitoring, post-cycle therapy and referrals for endocrinologists and  
192 psychologists, that are currently not being met (Griffiths, Henshaw, McKay, & Dunn, 2017;  
193 Kimergård & McVeigh, 2014; Tighe, Dunn, McKay, & Piatkowski, 2017). A wider range of  
194 interventions and health services are therefore needed; not just to ensure that non-injecting  
195 users are reached but also to address the wider range of medical services important to people  
196 who use AAS.

197 Although NSPs offer services to AAS users, even experienced drug workers report to  
198 have minimal, if no knowledge at all to meet the needs of users (Dunn, McKay, & Iversen,  
199 2014; Kimergård & McVeigh, 2014) and specialised services, such as the SWEAT program in  
200 the UK and the Steroid Education program run by Kay Stanton in Australia, are marginal. In  
201 addition, although strategies to minimize risks associated with the use of AAS - through both  
202 oral and injection modes of administration – have been reported in the last decade (Bates et  
203 al., 2017; Kimergård & McVeigh, 2014), research is yet to establish the merit of these  
204 approaches empirically. The absence of a clear evidence-base has resulted in inconsistent  
205 education and advice for AAS users. Although there is a general need for health services that  
206 target those who use AAS, to be more accessible, engaging and well-informed, non-injectors  
207 face additional barriers to obtaining harm reduction advice from a medical source. We  
208 suggest future research should focus on evaluating, targeted public health strategies that  
209 involve the AAS using community in all of their development. Given that peer-to-peer  
210 information sharing (both online and face-to-face) is high amongst steroid users (Tighe et al.,  
211 2017; van de Ven & Mulrooney, 2017), engaging with and involving steroid communities in  
212 designing and implementing harm reduction interventions could prove a fruitful strategy to  
213 spread evidence-based health information on a large scale. Programs focussed on harm  
214 reduction need to go beyond injecting related risks to provide advice on how to use more  
215 safely, recognising adverse effects early, and facilitating engagement with healthcare.

216 There are several limitations to our study. Firstly, steroid use in our dataset refers to  
217 lifetime drug use with a sample that has a mean age of 32. As such, while many AAS users  
218 only inject or use orally, it may be that throughout their lifetime users will transition to other  
219 modes of administration or simply stop using before adopting an additional mode of  
220 administration. The sample employed in this study is comprised of people who have declared  
221 their use of psychoactive drugs in the GDS and have also stated the use of AAS at some point  
222 in their lifetime. While generalising results to other sub-groups of AAS users such as athletes  
223 and bodybuilders is not warranted, this study provides unique insights into a group of people  
224 using AAS that are typically not studied. The survey seeks participants from across 174  
225 countries worldwide, 58 of which are represented in the AAS using sub-sample employed  
226 here. However, due to small numbers from individual countries we could not control for  
227 international variation in ease of access to oral/injection AAS, culture of drug use and/or drug  
228 policies or legislation.

229

## 230 **Conclusion**

231 The risk of adverse health implications from using AAS depends on various factors; one of  
232 them being the mode of administration. Our data illustrates a population of AAS users who

233 tend to stick to one mode of administration - either oral or injectable steroids. Given the  
234 dominant approach to providing services and advice for people who use AAS is through NSPs,  
235 there is a need to better understand the propensity for oral use *only* and develop avenues for  
236 reaching this sub-population of users. Given that risks associated with AAS use can be reduced  
237 through strategies that are unrelated to safe injecting, such as shorter cycles and limited  
238 dosages and reduction of polypharmacy, it is important to develop strategies to disseminate  
239 this information systematically to AAS users and potential users outside of NSPs.

240

#### 241 **Contributors**

242 All authors contributed to and have approved the final manuscript.

243

#### 244 **Conflict of interest**

245 The Global Drug Survey is a commercial entity, which is owned by one of the authors of this  
246 publication (Adam Winstock).

247

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