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ARTICLE

''No pain, no gainz''? Performance and image-enhancing drugs, health effects and information seeking

Rachel Rowe[1], Israel Berger[1], and Jan Copeland[2]

[1]*Drug and Alcohol Multicultural Education Centre, Redfern, NSW, Australia and* [2]*National Cannabis Information and Prevention Centre, National Drug and Alcohol Research Centre, University of New South Wales, Randwick, NSW, Australia*

Abstract

Background: A range of indicators point to an international increase in the prevalence of performance and image-enhancing drugs (PIEDs) use, predominantly among young men. Attention to PIEDs-related benefits, adverse health effects, information and health service access are needed. *Methods*: A cross-sectional survey of 605 men who inject PIEDs was conducted at nine primary needle and syringe programme locations across five local health districts in Sydney. *Results*: Among anabolic–androgenic steroids (AAS) users ($n = 564$), anger, rage or irritability (27%, 95%CI: 23.4–30.6) and sexual or genital problems (26.4%, 95%CI: 22.9–30.0) were the most commonly reported adverse health effects. Taking regular, longer breaks between AAS cycles were associated with reduced reports of some adverse effects. Approaching two-thirds of participants had told a doctor about using PIEDs (63.1%, 95%CI: 59.1–67.1). However, as length of time since first injecting PIEDs increased, participants' perceptions of doctors as reliable information sources decreased (rho $= -0.10$, $p = 0.04$). Reliance on lay information sources was very common, particularly among people who spoke languages other than English. *Conclusions*: This study supports providing information on cycle lengths and break periods as part of standard PIEDs-related harm reduction guidelines. Safe injecting and dosage education through peer networks or steroid clinics may be useful strategies.

Keywords

Injection drug use, needle-exchange programmes, health care, performance and image-enhancing drugs, anabolic–androgenic steroids

History

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Background

A range of indicators point to an international increase in the prevalence of performance and image-enhancing drugs (PIEDs) use predominantly among young men (Harrison et al., 2014; Iversen, Topp, Wand, & Maher, 2013; Kanayama, Hudson, & Harrison, 2010; Sagoe, Molde, Andreassen, Torsheim, & Pallesen, 2014; Sagoe, Torsheim, Molde, Andreassen, & Pallesen, 2015a; Seear, Murphy, Fraser, & Moore, 2015a). Anabolic–androgenic steroids (AAS) tend to be the primary substances within typical patterns of PIED use (Hildebrandt, Langenbucher, Carr, & Sanjuan, 2007), though an emerging literature points to diversification in the global market involving synthetic human growth hormones and synthetic peptide hormones (Stensballe, McVeigh, Breindahl, & Kimergard, 2015). Recreationally used to enhance muscle growth, physical appearance and improve psychological well-being, much of what we know about the adverse effects of PIEDs focuses on AAS. Furthermore, most evidence has been extrapolated from clinical human or animal studies, or case studies involving professional athletes, particularly weightlifters and bodybuilders in Europe and the USA (Evans-Brown, McVeigh, Perkins, & Bellis, 2012; Oberlander & Henderson, 2012). Increasing use of PIEDs has the potential to deepen health inequalities (Evans-Brown et al., 2012). Therefore, there is a need to examine regionally specific PIED-use patterns among recreational users, alongside the ways that these groups recognise and respond to potential adverse effects, access PIED and injecting information and health care.

Adverse effects associated with synthetic testosterone and its derivatives (which fall into the category of AAS) include urogenital problems, acne, insomnia, injection site pain, cardiovascular disease and liver disease (Eklof, Thurelius, Garle, Rane, & Sjoqvist, 2003; McVeigh, Bates, & Chandler, 2015; Parkinson & Evans, 2005). High-dose AAS use is associated with hypertension (Grace, Sculthorpe, Baker, & Davies, 2003; Lane et al., 2006; Riebe, Fenhall, & Thompson, 1992), hyperlipidaemia (Lane et al., 2006; Severo et al., 2013) and raised inflammatory markers (Grace & Davies, 2004; Severo et al., 2013). Adverse mental health effects include sudden alterations of mood, aggression, depression during and/or upon ending a cycle (Eklof et al., 2003; Kanayama, Hudson, & Pope, 2008; Kanayama et al., 2010). The experience of adverse effects is not necessarily a matter of course (Chandler & McVeigh, 2014); and effects are known to

Correspondence: Rachel Rowe, Senior Researcher, Drug and Alcohol Multicultural Education Centre, 619 Elizabeth Street, Redfern, NSW 2012, Australia. Tel: 02 81131304. E-mail: research@damec.org.au

differ significantly in association with age and sex (Sagoe et al., 2015b). Furthermore, patterns of use, dose, drug combinations and the ambitions of AAS users (e.g. becoming leaner, putting on muscle) may be just as important for determining health risks, as measuring the intensity of use (Hildebrandt et al., 2007).

AAS are commonly used in ''cycles'' that can be administered either orally or via injection. Standard injecting sites are the buttocks or large thigh muscle (Brunsdon, 2011). Studies show that some AAS users engage in small muscle injecting (''spot injecting''), which aims to boost desired improvements in the specific muscle being injected (Hope et al., 2015; Larance, Degenhardt, Copeland, & Dillon, 2008). This practice increases the risk of damage to veins or nerves and can reduce drug absorption leading to swelling and injecting site pain (Nicoll & Hesby, 2002). Various strategies to minimise or mitigate some adverse effects associated with AAS include dosing single AAS with breaks to enable natural hormone recovery, ''blitz'' cycles where various different AAS are used for short periods to prevent developing tolerance; or ''bridging'' or ''blast and cruise'' where continuous cycles are undertaken with periods of high and low dose (Sagoe et al., 2015b). Practices also include ''stacking'' doses of multiple AAS and other PIEDs, ''pyramiding'' stacked doses of varying proportions, or using psychostimulant drugs and/or non-prescribed pharmaceuticals other than PIEDs to avoid, reduce or manage the adverse effects associated with particular drugs (Larance et al., 2005; Pope et al., 2013; Sagoe et al., 2015b).

Scant research has examined the relationship between PIED use practices and their social contexts. People who inject PIEDs are less likely to disclose their drug use to a doctor or other health professional compared to other groups who access the Australian NSPs (Islam, Topp, Day, Conigrave, & Maher, 2013). Barriers to health care experienced by PIEDs users include discouragement from health care providers coupled with perceived lack of knowledge about PIEDs (Dunn, Henshaw, & McKay, 2015; Pope, Kanayama, Ionescu-Pioggia, & Hudson, 2004). Increasing PIEDs-related attendance at the NSP has also presented new challenges in Australia (Dunn, McKay, & Iversen, 2014; Seear et al., 2015a) and elsewhere (Kimergard & McVeigh, 2014). Larance et al. (2008) found that while a majority of PIEDs users had accessed Sydney NSP outlets for equipment, a minority reported seeking information from NSP staff. This may reflect paucity of PIED-specific knowledge and resources; or uncertainty about the most useful approaches to harm reduction with PIEDs injectors (Kimergard & McVeigh, 2014; Seear et al. 2015a). There is an important gap in the literature concerning PIEDs injectors educational and help-seeking practices. Research addressing this may assist to tailor harm reduction interventions that reach and resonate with PIED injectors.

The aims of this study were to describe the following: (1) benefits and adverse effects that people experience following, during or in between using AAS, (2) relationships between AAS cycle and break length and the experience of adverse health effects, (3) healthcare access, (4) key information sources, perceptions of reliable sources as well as key motivational and constraining influences reported by men who inject PIEDs. While NSP workers in some areas have noted cultural diversity among PIEDs injectors (Khawar & Rowe, 2013; Iversen, 2013; Seear et al., 2015a,b), prior to this study, Australian research with PIEDs injectors had not considered cultural and linguistic background. Therefore, a final aim was to (5) explore whether factors associated with peer-group identity, such as cultural background, might be associated with particular help-seeking practices or access to healthcare.

Methods

Study design and procedure

A short, anonymous, self-complete survey was conducted at nine NSP sites across Sydney. NSPs within five of the eight local health districts (LHD) in metropolitan Sydney were involved. The sites were determined by liaising with harm reduction programme managers in NSW health about the volume of PIEDs-related equipment distributed at each NSP site. Together, the participating LHDs provide approximately 70% of all PIEDs-related injecting equipment distributed by the NSW NSP (Iversen, 2013).

To be eligible to participate in the study, participants had to identify themselves as men who had ever injected PIEDs and were at least 18 years of age. We did not seek to recruit women, because recent Australian NSP data (Iversen, 2013) and reviews of international research (Harrison et al., 2014) indicated that the anticipated sample of women would be too small to conduct the planned analyses. NSP staff advised people about the study if they requested any equipment that could be used to administer a PIED, including people collecting equipment for their friends or partners. Confirmation of PIED administration by injection was assumed in NSP attendance to collect the relevant injecting equipment. A poster, participant information sheet, hard copies of the questionnaire and pocket-sized cards with the online survey link were placed visibly at each recruitment site. This approach sought to avoid potential biases in recruitment towards particular physical appearances, ages or cultural groups.

Instruments

The 34-item questionnaire captured information on social, cultural and economic characteristics as well as PIEDs use. Cultural and linguistic diversity was measured by asking participants ''what cultural background/s best describe you?'' as well as asking where participants were born and what languages they speak. The instrument elicited a free text response for ''supplements typically injected'', adopting advice from consumers and NSP staff about commonly used terms for PIEDs. Categorical data on injecting sites and cycle and break lengths were collected, with cut-off points for the latter derived from existing research and clinical tools (Brunsdon, 2011; Parkinson & Evans, 2005). Benefits associated with participants' PIED use were collected as a free text response. Multiple response or binary categorical variables were used to capture adverse health effects, engagement with doctors, blood testing, motivational and constraining influences, as well as sources of drug and

injecting information. Perceived reliability of information sources was measured using a Likert scale.

The study design, tools, and procedure were approved by the Nepean Blue Mountains Human Research Ethics Committee, and site-specific assessments were approved through Local Health District Research Governance Offices in Sydney, South Eastern Sydney, South Western Sydney, Western Sydney and Nepean Blue Mountains.

Data analyses

Participant residential postcodes were mapped to the Index of Relative Socio-economic Advantage and Disadvantage (IRSD) (Australian Bureau of Statistics, 2011), which was used as a proxy for socio-economic status (SES). Participants who reported ethnicities or cultures other than Anglo or Caucasian; or Aboriginal or Torres Strait Islander, were coded as culturally and linguistically diverse (CALD), the current preferred term used in Australian Government policy (National Health and Medical Research Council, 2006). On the basis that the dominant culture is an unmarked category (Berg, 2008; Pratto, Korchmaros, & Hegarty, 2007; Reid, Beyer, Aitken, & Crofts, 2001), those who did not respond to this question but stated that they were born in Australia or another Anglo–Saxon-dominant country were included in the comparison group. Benefits associated with PIED use were converted to categorical variables based on theme.

Of 644 completed surveys, only three were completed online and these were not separated for the purpose of analysis. Thirty-nine responses from men who were yet to commence injecting any type of PIED were excluded from the analysis. This group did not differ significantly in age, SES or cultural and linguistic background when compared with respondents who had already commenced injecting PIEDs. Participants who did not specify which PIEDs they injected but who responded to all cycle and break length questions relevant to AAS use were included in the analyses of AAS patterns and associated health effects. Participants who reported only synthetic peptide and/or hGH use were excluded from analyses of AAS use and health effects.

Participant characteristics, drug use, benefits and adverse health effects associated with AAS use, information-seeking practices, and influences on PIEDs use were first analysed using descriptive statistics. Mean and standard deviation (SD) are reported for participant age, and median and interquartile range (IQR) are reported for time since first injection. Fisher's exact test and relative risk (95% CI) were used to examine relationships between binary variables. The relationship between continuous variables and a range of adverse health effects was examined using binary logistic regression. Spearman's rho was used to examine correlations between age, length of time injecting and perceived reliability of information sources.

Results

Participants

Six-hundred and five men participated in the survey. The mean participant age was 28.8 years (SD 7.52). Participants from CALD backgrounds were more likely to live in the most disadvantaged SES areas ($N = 546$, 40.5% vs. 21.2%, $p < 0.001$). Likewise, participants who spoke languages other than English were more likely to live in the most disadvantaged areas ($N = 538$, 30.4% vs. 19.5%, $p = 0.005$). Other than English, the most common languages spoken were Arabic (including Arabic dialects) ($n = 54$, 9.6%) and Mediterranean languages (including Spanish, Greek and Italian) ($n = 46$, 8.2%). Table 1 reports participant characteristics.

PIED use

Two years was the median time since participants had commenced using PIEDs (IQR = 6 months to 4 years). A minority reported injecting PIEDs for over 10 years ($n = 36$, 6.1%). The mean number of PIEDs reported was 1.8 (SD = 1.02). Participants most commonly reported only injecting AAS ($n = 348$, 57.5%). In addition, approaching one-third of participants did not describe which PIEDs they typically injected but responded to all cycle and break length questions ($n = 181$, 32.1%). Combinations of AAS, synthetic human growth hormones (hereafter hGH) and other synthetic peptide hormones were reported by 5.8% (95%CI: 3.9–7.7). Others only injected synthetic peptide hormones (3%, 95%CI: 1.6–4.4) or hGH (1.7%, 95%CI: 0.7–2.7). Participants were asked to name the PIEDs they typically inject in their own words. AAS nomenclature included *Testosterone-Propionate,*

Table 1. Participant characteristics.

	% (95%CI)
Sexual attraction	
Heterosexual	97.6 (96.4–98.9)
Gay, bisexual or other	2.4 (1.2–3.7)
Cultural background[a]	
Culturally and linguistically diverse backgrounds	71.1 (67.4–74.8)
Anglo-Australian background	28.9 (25.2–32.6)
Aboriginal and/or Torres Strait Islander	2.3 (1.1–3.5)
Languages spoken	
English only	77.0 (73.5–80.5)
Language/s other than English	23.0 (19.5–26.5)
Country of birth	
Australia	86.0 (83.1–88.9)
Born overseas (excluding UK, USA, Canada, NZ)	10.1 (7.6–12.6)
Born in UK, NZ, USA, Ireland, South Africa, Canada	3.9 (2.3–5.5)
Socio-economic status by residential postcode[b]	
Highest	19.2 (16.0–22.4)
Second highest	13.7 (10.9–16.5)
Mid	21.6 (18.3–25.0)
Second lowest	10.9 (8.4–13.4)
Lowest	34.6 (30.7–38.5)
Ever incarcerated	7.9 (5.7–10.1)
Current employment[a]	
Manual labour (including drivers, trades, construction)	43.0 (39.0–47.1)
Office (including administration, executives)	17.2 (14.1–20.3)
Retail	11.0 (8.4–13.6)
Sports	9.4 (7.0–11.8)
Security	8.3 (6.1–10.6)
Student	8.0 (5.8–10.2)
Hospitality, entertainment and caring professions	5.7 (3.8–7.6)
Unemployed	3.1 (1.7–4.5)

[a]Cultural background and current employment were multiple response items; as such, totals may exceed 100%.

[b]Index of relative socio-economic advantage and disadvantage (ABS, 2011).

Prop, Testosterone-Enanthate, Test, Trenbolone, Tren-Acetate, Sustanon, Sus 250, Deca, Decanol, Boldonore, Stanazol, Primobolin, Masteron, Redbacks, Rumadex, Anapolon, D-Ba and *Primoteston*. Other nomenclature included *TB500, Melanotan (1 or 2*, unspecified), *Mod GRF, GHRP-2, GHRP-6, IGF-1 IGFILR3, Mechano Growth Factor*, *insulin*, *human chorionic gonadotropin and hGH*. Table 2 reports AAS cycle length and break periods, and anticipated future AAS use.

Self-reported benefits and adverse effects of AAS use

A number of self-reported benefits and adverse health effects were reported by participants (Table 3). As the length of time-injecting PIEDs increased, the reported experience of breast growth significantly increased, yet ageing was not associated with increased reporting of this side effect. However, the length of time-injecting PIEDs and being younger were independently associated with experiencing anger. While no relationship was found between reporting liver disease and length of time injecting, older participants reported more liver disease than younger participants (Figure 1).

Table 2. Cycle and break lengths reported by AAS users.

	% (95% CI)[a]
How long is your usual cycle?	
4 weeks or less	6.2 (4.3–8.1)
5–12 weeks	59.5 (55.6–63.4)
More than 12 weeks	34.2 (30.4–38.0)
How long do you break between cycles?	
No break	7.1 (5.0–9.2)
2–4 weeks	18.5 (15.4–21.7)
More than 4 weeks	74.4 (70.9–77.9)
How many cycles do you intend to do in the future?	
0–1 cycles	18.6 (15.4–21.8)
2–9 cycles	52.0 (47.9–56.1)
More than 9 cycles	29.4 (25.7–33.1)

[a]Participants were not required to complete every question; as such, some items may have a smaller *n*.

Self-reported adverse health effects and correlation with AAS cycles and breaks

More frequent breaks between AAS cycles were associated with fewer reports of sexual or genital problems. Longer breaks were associated with fewer reports of breast growth (Figure 1).

Engagement with health services

Access to doctors and screening is reported in Table 4. Approaching two-thirds of participants had disclosed their PIEDs use to a doctor (63.1%, 95%CI: 58.0–68.2). Age, CALD background, SES or current occupations were not associated with having disclosed PIEDs use to a doctor. Participants who had been injecting for longer than a year were no more likely than newer initiates to have disclosed PIEDs use to a doctor.

Overall, men who had told a doctor about using PIEDs were more likely to have had PIEDs-related blood tests ($N = 551$, 82.2% vs. 29.1%, $p < 0.001$), and more likely to have ever been tested for hepatitis B ($N = 502$, 53.6% vs. 35.1%, $p < 0.001$), hepatitis C ($N = 502$, 52.1% vs. 35.1%, $p < 0.001$), or HIV ($N = 502$, 48.9% vs. 30.3%, $p < 0.001$). AAS users, who reported adverse health effects, were no more

Table 3. Health effects reported among AAS users, by length of time injecting and participant age.

	Association with length of time injecting (β)	*p*	Association with age (β)	*p*	% (95%CI)[a,b]
Beneficial					
Increased physical size		n.s.	−0.052	0.001	54.6 (50.2–59.0)
Increased physical strength		n.s.		n.s.	16.7 (13.4–20.0)
''Faster results'' and performance enhancement		n.s.		n.s.	12.2 (9.3–15.1)
Improved mood		n.s.	0.054	0.006	12.0 (9.1–14.9)
Increased self-confidence, self-esteem, pride and self-satisfaction		n.s.		n.s.	9.8 (7.2–12.4)
Improved health and fitness		n.s.	0.049	0.007	8.3 (5.9–10.7)
Increased motivation to train		n.s.		n.s.	6.5 (4.3–8.7)
More energy		n.s.		n.s.	6.3 (4.2–8.4)
Weight loss		n.s.		n.s.	4.3 (2.5–6.1)
''Treatment'' for injury		n.s.	0.119	0.001	2.4 (1.1–3.8)
Anti-aging		n.s.	0.081	0.04	1.7 (0.6–2.8)
Improved sex life		n.s.		n.s.	1.3 (0.3–2.3)
Adverse[c]					
Anger, rage, irritability	0.005	0.01	−0.040	0.02	27.0 (23.4–30.6)
Sexual and genital problems		n.s.		n.s.	26.4 (22.9–30.0)
Hair loss		n.s.		n.s.	16.5 (13.5–19.5)
Depression		n.s.		n.s.	14.9 (12.0–17.8)
Fat gain		n.s.		n.s.	8.3 (6.1–10.5)
Feeling high		n.s.		n.s.	8.2 (6.0–10.4)
Musculoskeletal problems		n.s.		n.s.	7.8 (5.6–9.7)
Breast growth	0.008	0.007		n.s	7.4 (5.3–9.5)
Cardiovascular disease		n.s.		n.s.	5.1 (3.3–6.9)
Liver disease		n.s	0.111	0.01	4.0 (2.4–5.6)
Kidney disease		n.s.		n.s.	3.1 (1.7–4.5)

[a]This table reports multiple response items; as such, totals exceed 100%.
[b]Participants were not required to complete every question, as such some items may have a smaller *n*.
[c]Median reported adverse health effect categories was 1.3 (range 0–8).

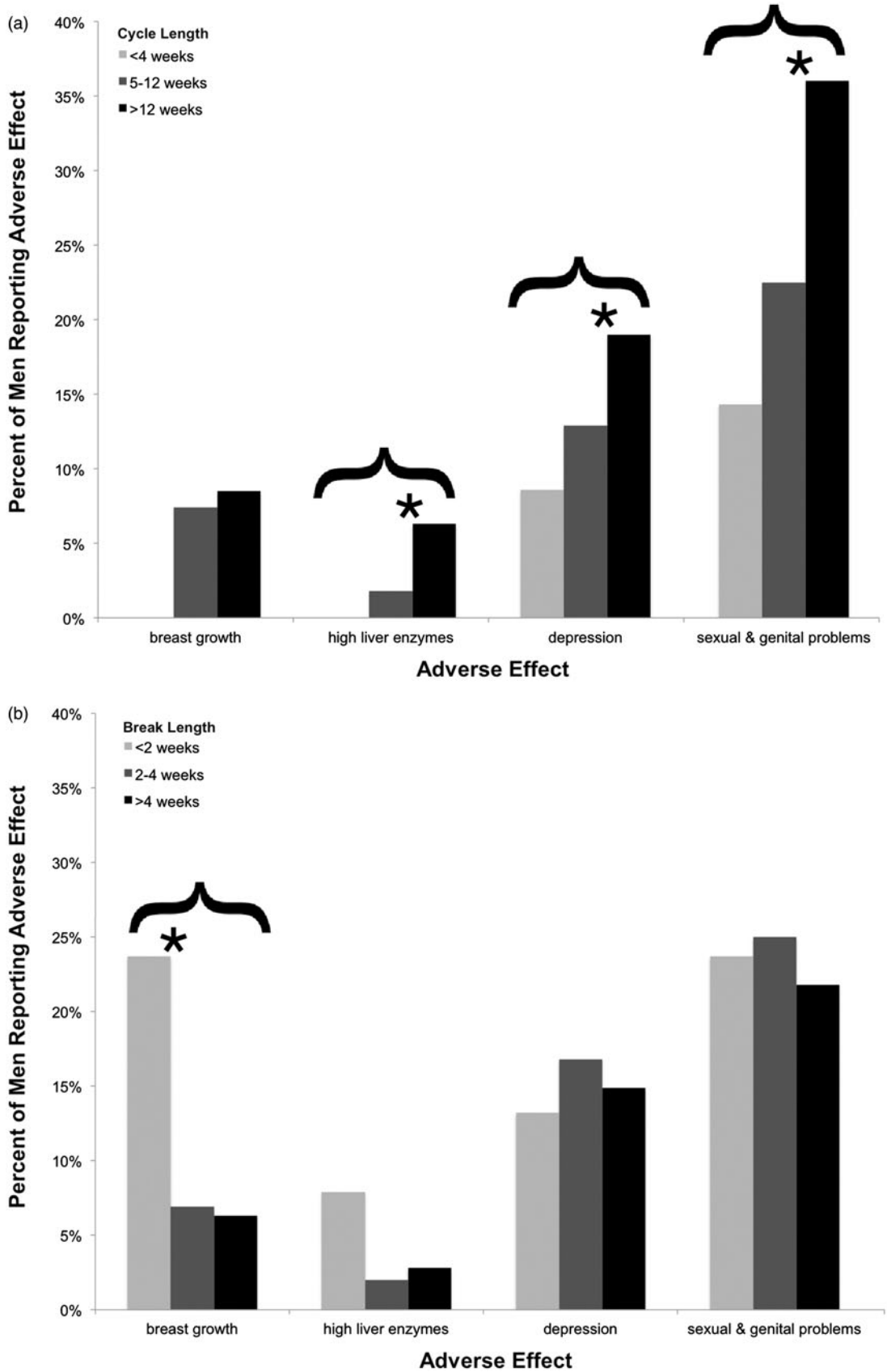

Figure 1. Associations between cycle and break lengths and adverse effects (a) Associations between cycle length and adverse effects: Cycles >12 weeks were associated with reporting sexual and genital problems (RR = 1.66, 95%CI: 1.26–2.18), depression (RR = 1.52, 95%CI: 1.02–2.28), and high liver enzymes (RR = 3.81, 95%CI: 1.45–9.99), but not breast growth. (b) Associations between break length and adverse effects: Breaks <2 weeks were associated with reporting breast growth (RR = 3.67, 95%CI: 1.89–7.12), but not sexual and genital problems, depression or high liver enzymes.

Table 4. Health information sources and service access among PIEDs injectors.

	% (95%CI)[a]	Perceived reliability M(SD)
Who do you go to for PIEDs and injecting advice?		
NSP staff	21.2 (17.8–24.6)	3.37 (0.89)
Nurses	15.7 (12.6–18.8)	3.24 (0.99)
Doctors	33.9 (29.9–37.9)	3.21 (1.03)
Internet	40.1 (36.0–44.0)	2.69 (0.89)
Mates	42.9 (38.7–47.1)	2.51 (0.89)
Personal trainers	12.5 (9.7–15.3)	2.45 (0.92)
Suppliers	12.4 (9.6.15.2)	2.36 (0.92)
Other sources	4.6 (2.8–6.4)	
Accessing healthcare		
Visited a doctor within 1 month	51.6 (47.6–55.6)	
Visited a doctor over 1 year ago	10.7 (8.2–13.2)	
Never visited a doctor	5.8 (3.9–7.7)	
Ever told a doctor about using PIEDs	63.1 (59.1–67.1)	
Blood tests related to PIEDs	62.5 (58.5–66.5)	
Ever tested for HCV, HBV and/or HIV	47.6 (43.4–51.8)	
Reasons for accessing NSP		
Free service	68.4 (64.5–72.3)	
Friendly staff	61.2 (57.1–65.3)	
Safe	56.6 (52.5–60.7)	
Knowledgeable staff	42.0 (37.9–46.1)	
Privacy	38.9 (34.8–43.0)	
Unlimited equipment	22.3 (18.8–25.8)	
Close to home	21.8 (18.4–25.3)	
People I know use it	19.9 (16.6–23.2)	
Can't get it elsewhere	17.5 (14.3–20.7)	
Other	2.6 (1.3–3.9)	

[a]This table reports multiple response items; as such, totals exceed 100%.

likely to have visited a doctor than those not reporting such effects.

Seeking information about PIEDs

Participants most frequently reported seeking advice about PIEDs from friends, followed by web-based sources and doctors (Table 4). Participants, who spoke languages other than or as well as English, were more likely than English-only speakers to seek information from their friends ($N = 521$, 52.0% vs. 39.7%, $p = 0.02$); nurses ($N = 521$, 22.0% vs. 13.7%, $p = 0.03$; and personal trainers ($N = 521$, 18.7% vs. 11.3%, $p = 0.045$). Among participants who injected AAS, seeking information from suppliers was associated with injecting small muscle groups (e.g. inner thighs, calves) ($N = 476$, 18% vs. 82%, $p < 0.001$). No other information sources were associated with injecting these non-standard AAS sites.

NSP workers were perceived to be the most reliable source of information on PIEDs and injecting, followed by nurses and doctors (Table 4). As the length of time-injecting PIEDs increased, participants' perceptions of doctors as reliable information sources decreased (rho $= -0.10$, $p = 0.04$). Older participants were more likely to trust web-based information (rho $= 0.113$, $p = 0.03$). However, after controlling for the length of time-injecting PIEDs, participant age was not correlated with trust in any particular information sources (all $p > 0.05$). Although suppliers and friends were generally not considered to be reliable sources of information, people, who spoke languages other than and/or English, were more likely to report that they had trust in information from suppliers ($N = 352$, 59.0% vs. 39.4%, $p = 0.002$). There was a trend that approached significance among people who spoke languages other than English to trust information from friends ($N = 391$, 63.2% vs. 51.0%, $p = 0.51$). These different perceptions of source reliability among linguistically diverse participants and English-only speakers were unaffected by age, SES or being born overseas.

Gym buddies and friends were the most common supportive influences, while participants most commonly reported older family members, parents and friends influencing them not to use PIEDs (Table 5).

Table 5. Influential relationships.

	% (95%CI)[a]
Who influences you to use PIEDs?	
People at the gym	33.0 (29.0–37.0)
Friends	29.6 (25.7–33.5)
People in the media	9.9 (7.4–12.4)
Workmates	8.8 (6.4–11.2)
People in the community	6.7 (4.6–8.8)
Parents/older relatives	3.7 (2.1–5.3)
Siblings	3.4 (1.9–4.9)
Who influences you *not* to use PIEDs?	
Parents/older relatives	31.4 (27.2–35.6)
Friends	24.9 (21.0–28.8)
Siblings	16.5 (13.1–19.9)
Other influences	11.6 (8.7–14.5)
People at the gym	8.9 (6.3–11.5)
People in the media	8.4 (5.9–10.9)
Workmates	8.8 (6.2–11.4)
People in my community	5.2 (3.2–7.2)

[a]This table reports multiple response items; as such, totals may exceed 100%.

Discussion

Among a large sample of NSP attendees, anger, rage, irritability and/or sexual and genital problems were commonly reported by people who use AAS. Self-reported sexual/genital problems, high liver enzymes and depression were each associated with undertaking AAS cycles of more than 12 weeks in duration. Taking longer breaks between AAS cycles was associated with reduced likelihood of breast growth. Consistent with other reports of PIED use among Australian NSP attendees (Iversen & Maher, 2015; Iversen, 2013), participants were predominantly recent initiates to injecting. It follows that reported chronic or more serious conditions among AAS users in this study were few, we would expect to see some of these increase with length of time using AAS or for people experiencing these conditions to stop using or reduce AAS use.

The proportion of participants who had disclosed PIED use to a doctor was consistent with findings from earlier Australian studies with people who inject PIEDs (Larance et al., 2008), but higher than has been reported in England and Wales (45%) (Hope et al., 2013) and in the USA (44%) (Pope et al., 2004). Among participants who reported disclosing PIED use to a doctor, almost all had seen a doctor in the past year. We found no evidence that the presence of adverse health effects prompted disclosure of PIED use to a doctor. Assuming that participants had injected PIEDs continuously

or intermittently since their first injection, with experience they tended to perceive doctors as less reliable sources of information about PIEDs. This adds to findings of recent interviews with men who inject PIEDs and live in regional areas in Australia (Dunn et al., 2015), where frustration with the lack of practitioner knowledge about PIEDs, negative judgements from practitioners and even discontinuation of service after disclosure of PIED use were reported. A review of European research on general practitioner attitudes towards doping in sport found dramatic inconsistencies in practitioner knowledge; as well as a potential gap in attention to recreational PIED use among athletes (Backhouse & McKenna, 2011). We found, more optimistically, that access to doctors was linked to increased screening for BBVs and diagnostic screening for PIEDs-related health effects. However, it is plausible that participants may have prompted their doctors to undertake screening. Evidence suggests that general practitioners could take a more active role in harm reduction with PIEDs injectors, particularly in providing appropriately timed blood tests, educating about infection transmission and safer dosage patterns.

It has been suggested that NSP staff may be ill-equipped to respond to the rise in PIED injecting in Australia (Seaar et al., 2015a,b; Dunn et al., 2014), particularly as the range of adverse, non-transmittable, health effects associated with PIEDs is outside the focus of the traditional harm minimisation response to drug injecting. Yet, in our study, one in five PIEDs injectors reported seeking information from NSP staff and a greater proportion attended the NSP because they value the knowledge of NSP workers. It may indeed be the case, as others have argued, that the harm minimisation response to PIEDs injecting requires greater attention to the specificities of PIED use practises because these differ significantly from other injecting drug use practises (Seaar et al., 2015a,b). We contend that a public health response to PIEDs involving peer-led education will best address this gap and enhance current harm reduction strategies.

Despite participants citing NSP staff, nurses and then doctors as the more reliable sources of information, peer-based education (e.g. internet forums, blogs) was the most commonly accessed source of information. Friends and people at the gym most influenced participants' PIEDs use; and friends were also a commonly reported constraining influence on PIED use. There may also be a link between where people obtain information about PIEDs and their injecting practices, as evinced by AAS users who sought advice from suppliers being more likely to inject sites that increase risk of injury. Of particular interest to us here is the potential for risk reduction through enhanced information, delivered in ways that respond to, or can tap into, the influences, motivations, gendered cultures and social practises, which may underlie the increasing prevalence of PIEDs injecting among predominantly young men in Australia and elsewhere.

Despite anecdotal observations of the cultural and ethnic backgrounds of PIEDs injectors who currently access the NSP in Australia (Dunn et al., 2014; Iversen, 2013; Seear et al., 2015b); data on the characteristics of PIEDs injectors and the significance of social and cultural factors both shaping and potentially shaped by PIED-use practices is very limited. Participants in our study, who spoke languages other than English, typically southern European languages and Arabic, were more likely to access and/or trust information from friends, personal trainers and suppliers. To our knowledge, only one other study (van Hout & Kean, 2015) has explored the ways that people from particular migrant communities access information about PIEDs. That qualitative study noted a similar use of lay information sources among men in North England from South Asian backgrounds; with participants commonly reporting blurred distinctions between suppliers, gym buddies and friends. In our study, the associations between speaking a language other than English and information seeking preferences remained even after controlling for socio-economic factors and country of birth. We suspect that shared language, in the urban Australian context of our study, may indicate a quality and density of connection among some groups who use PIEDs. While this needs to be explored further, it is important to note that the major CALD groups engaged in this study have rarely historically accessed the NSP or drug and alcohol treatment services (Iversen & Maher, 2015; AIHW, 2014) and may not be reached by existing harm reduction strategies. Health promotion, particularly to the groups highlighted here, could benefit by working with peer-networks to deliver accurate information on how to recognise and reduce PIED-related harms. Safe injecting practices and education about the transmission of infections, such as hepatitis C, should also be part of these interventions.

To our knowledge, there has been only one peer-led government-funded programme addressing PIEDs use specifically, the steroid peer education programme (SPEP) in Victoria (Aitken et al., 2002). More research needs to be undertaken to determine the effectiveness of programmes designed specifically for PIEDs users (Kimergard & McVeigh, 2014). However, programmes focussed on increasing PIEDs users' injecting and dosage safety, ability to recognise and reduce adverse effects early, and access referrals to healthcare may be an effective strategy to grapple with the effects of access to lay sources and distrust of doctors.

It is worth considering the limitations of this study. Firstly, in using a self-administered survey, we were not able to collect detailed data on drug types or quality, dosage, exercise levels, biological factors associated with aging, or social and environmental factors. We also did not collect data on the additional use of orally administered PIEDs. These factors may confound the incidence of adverse health effects (Harrison et al., 2014). Secondly, it is possible that participants may have underreported experiences that they did not associate with their PIEDs use. For example, hair loss and breast growth may not have been reported by older men, because they had other explanations for their conditions. Alternatively, the experience and perception of adverse health effects may lead people to cease injecting PIEDs or to balance effects by taking other drugs. Longitudinal research is necessary to examine the long-term health effects of AAS use, such as atherosclerosis and cardiomyopathy (van Amersterdam, Opperhuizen, & Hartgens, 2010) and how people respond to these over time. AAS dependence is thought to develop among some 30% of AAS users

(Harrison et al., 2014). As such, given that the majority of AAS users in this study foresaw their cessation within less than ten cycles, it would be useful to know more about the trajectories of this group of predominantly recent initiates. Finally, relatively few participants in this large sample injected synthetic peptides and hGH, which confirms earlier reports of AAS being more common internationally (Australian Customs and Border Protection Service, 2014; Hope et al., 2013; Larance et al., 2005). Future studies specifically targeting people who inject synthetic peptide hormones and/or hGH may be able to address the current gap in evidence on the health effects associated with these drugs.

An unusually large sample of men who inject PIEDs and access the Australian NSP was engaged in this study. Previous research samples had been relatively small, and engagement of PIEDs injectors in routine NSP surveillance surveys has also been limited (Iversen, 2013). Criminalisation of many PIEDs, as well as discrimination and stigma related to injecting drug use, make estimating the prevalence of PIEDs use in the general population difficult, and the practises of groups of PIEDs injectors who do not access the NSP may differ to those of NSP attendees. While our findings highlight that people who inject PIEDs come from a range of cultural backgrounds, we did not seek to capture a representative sample of PIED injectors in Australia. Recruiting from NSP outlets with high proportionate distribution of PIED equipment may lead to an oversampling of cultural groups who live in these areas. Furthermore, the degree to which participants were fluent in English or other languages was not assessed, and nor was the non-participation rate of NSP attendees who inject PIEDs but who were unable to complete the survey because it was only offered in English. Furthermore, the present study did not include women. For these reasons, the findings should be generalised with caution and with consideration of potential biological differences associated with sex; and social differences associated with gender, urban, regional and rural settings; and colonial and migration histories. Nonetheless, the evidence presented in this study of a very large group of PIEDs injectors can be used to inform both the content and modes of health promotion delivery targeting PIED use.

Conclusion

Monitoring the interplay between positive and negative health effects, injecting techniques and injury rates, as well as potential blood-borne infection transmission is a necessary part of responses to AAS and other PIEDs injecting. The evidence strongly supports providing information on cycle lengths and break periods as part of standard AAS-related harm reduction guidelines. Common access and trust in lay information sources should inform attention to peer networks to provide safe injecting and dosage education, particularly as these may have greater reach and resonance among underserved populations.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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