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**Brennan, R, Wells, J and Van Hout, MC**

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### Article

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# “Raw juicing” - an online study of the home manufacture of anabolic androgenic steroids (AAS) for injection in contemporary performance and image enhancement (PIED) culture

Rebekah [Brennan](#)<sup>a,\*</sup>

[rebekahbrennan@live.ie](mailto:rebekahbrennan@live.ie)

John S.G. [Wells](#)<sup>a</sup>

Marie Claire [Van Hout](#)<sup>b</sup>

<sup>a</sup>School of Health Science, Waterford Institute of Technology, Cork Road Waterford, Ireland

<sup>b</sup>Public Health Policy and Practice, Liverpool John Moores University, Liverpool, United Kingdom

\*Corresponding author.

## 1 Introduction

New evidence of ‘home brewing’ anabolic-androgenic steroids (AAS) – where the individual manufactures AAS injectables at home using raw synthetic testosterone powders purchased online – was discovered in our online study on PIED injection, conducted in 2016, and is the subject of this paper. The phenomenon of lay production of performance and image enhancement drugs (PIED) such as AAS has rarely been empirically documented. One study, a single case study, has documented the case of AAS distributor “Mike”, who homebrewed over twenty different types of compounds for sale ([Kraska et al., Bussard, & Brent, 2010](#)). Other than this, there appears to be no published studies on the practice of homebrewing AAS for personal use, despite longstanding anecdotal evidence online.

### 1.1 The AAS market

The AAS market has been described as decentralized and dynamic with networks of sellers operating illegally both online and ‘on the ground’ in gyms and amongst bodybuilding communities ([Antonopoulos & Hall, 2016; Van de Vena & Mulrooney, 2017](#)). The online context of AAS sales includes thousands of operational vendor websites and unregulated companies, as well as entrenched online communities acting as information points, and has been documented by previous studies ([Brennan, Wells & Van Hout, 2017; Brennan, Kanayama, Pope, 2013; Kraska et al., 2010; McBride, Culley & Coward, 2016](#)). This AAS internet blackmarket can prove problematic for people who inject AAS. One study ([Kraska et al., 2010](#)) described how many vendor sites are fraudulent, known as ‘scammers’ within AAS consumer networks, and fail to deliver the product despite payment. Negative experiences with regard to sourcing are often discussed at length on PIED discussion forum threads ([Brennan et al., 2017](#)).

### 1.2 Home manufacture of drugs

Homebrewing AAS may be symptomatic of the emerging homemade drug subcultural phenomenon where sourcing of illegal or off label drugs is purposefully diverted from the drug dealer to the individual in their own home. The lay production of homemade drug solutions (‘home brewing’) is an emergent public health concern ([Van Hout, 2014](#)). Research on ‘home brewing’ of injectable drug solutions is growing in Eastern Europe and the U.S.A ([Hearne, Grund, Van Hout, & McVeigh; Van Hout & Hearne, 2017; Grund et al., Grund, Latypov & Harris, 2013; Zabransky, 2007](#)) particularly with regard to stimulants such as homemade methamphetamine substitute “Krokodil” ([Gahr et al., 2012](#)) and diverted pharmaceuticals such as codeine, pseudoephedrine, dextromethorphan and fentanyl ([Van Hout, 2014; Cone, 2006; Carlisle Maxwell, 2006](#)). A significant amount of harm arising from the injection of homemade psychoactive drug solutions has been described in previous studies ([Azbel et al., 2014; Dvoryak, & Altice 2014](#); Grund, Latypov & Harris, 2013 ; Skrowronek, Celinski & Chowanec, 2012 ; [Chintalova-Dallas, Case , Kitsenko, & Lazzarine, 2009](#)) to include transmission of bloodborne viruses; infectious disease; skin and soft tissue infections; chemical injuries and burns. This trend for what has been termed ‘kitchen chemistry’ has escalated through use of the internet, where raw ingredients, instructions and reports from people who have engaged in the home manufacture of drugs can be easily accessed ([Van Hout, 2014](#)). This includes access to cryptomarkets where raw synthetic testosterone powders can also be sourced ([Barrett, Ferris & Winstock, 2016](#)).

### 1.3 Rationale for the research

The manufacture of AAS carries significantly greater legal implications in most Western countries than possession ([Antonopoulos and Hall, 2016](#)). Despite this increased risk, concerns around the acquisition of contaminated and

harmful substances via the unreliable online market may act as an incentive to 'homebrew'. As individuals who use AAS have been seen to be motivated by physical and mental health and concerned with the quality of products they use (Griffiths et al., 2017), it may be the case that homebrewing becomes a viable option for many of the increasing numbers of AAS users worldwide (McVeigh & Begley, 2017; Sagoe, Molde, Andreassen, Torsheim, & Pallesen, 2014). Risk of infectious disease transmission associated with the injection of AAS, such as human immunodeficiency virus (HIV), Hepatitis B virus (HBV), Hepatitis C virus (HCV), and skin and soft tissue infections (SSTI) has been documented previously (Rowe et al., Berger, Yaseen, & Copeland, 2017; Hope et al., 2013). Given the potential for expansion of the trend of homebrewing, associated legal implications, high risk injecting practices described by researchers in relation to homebrewing of psychoactives, and a significant gap in the literature, the injection of homemade AAS warrants investigation.

## 2 Theoretical underpinning

Ritual theory (Grund, 1993) and risk theory (Rhodes and Simic, 2005) are central to the theoretical assumptions underpinning this research. Grund (1993) describes the pragmatic function of ritual to be embedded in its social and cultural value. Group norms and rules are established through ritual, through formal instruction and more subtly, through social learning processes such as modelling, evident in discussion forum threads where homebrewers exchanged advice and described their activity. Rituals such as these contribute to group cohesion, and they also serve a common purpose, which further unites the group. The common purpose here for people who homebrew is to circumnavigate the unreliable online market for AAS which they have experienced as fraught with risk, both financial and with regard to health. In this regard, Grund (1993) theorises that for a drug to acquire ritual value, limited availability plays a key role. It renders the substance more attractive, with heightened symbolism of subcultural group belonging and also increases the likelihood of 'opportunistic use patterns' where novel and innovative strategies are employed to ensure procurement and consumption of drugs.

Recent research has used risk environment theory as a conceptual framework to understand how the practices and perceptions of people who use AAS impacts on health risk (Hanley Santos & Coomber, 2016). Rhodes theory can also be applied to the practice of homebrewing AAS for injection as described in this study on a macro and micro level. Rhodes and Simic (2005) highlights the process of context dependant social meanings being ascribed to risk behaviours through community norms and values. One aspect of this theory which can be applied to the home brewing phenomenon is the concept of the physical environment where injection occurs – the individuals own home.

## 3 Method

This study was part of a larger online study of PIED injecting conducted in 2016. Passive ethnographic research has been conducted online by researchers studying new drug trends in recent years (Kjellgren, Henningsson, & Soussan, 2013; Soussan & Kjellgren, 2014; Van Hout & Hearne, 2016). Passive ethnographic researchers unintrusively observe uncensored and rich communication amongst forum discussants (Smith & Stewart, 2012). The benefit of passive 'netnography' is the generation of data on sensitive issues which are likely to inform the enhancement of individual and societal welfare without 'disturbing the synergy of the community' (Ulusoy, 2012).

### 3.1 Ethical considerations

In line with previous published studies which used discussion forums' postings, data collection and analysis within this study were regarded as observations of publicly accessible online behaviour. Where forums required registration and could not be conceptualised as a public space (Barrett & Aldridge, 2016; Bilgri, 2016), consent was requested from forum moderators (n = 1). Consent was denied by the forum that was not open. Only data from open forums which were publicly accessible through google search (n = 5) was then used. In order to uphold observational status. No contact was made with forum discussants (Kozinets, 2010; Soussan & Kjellgren 2014). Several steps were taken to protect forum members. Identifying details i.e. IP addresses, placenames, names and aliases were not collected, or were removed. This includes pseudonyms, and names of selected forums, in recognition of the potential value of online identities in the offline world (Bilgri, 2016; Barratt, 2011).

### 3.2 Methods

Systematic internet searches were conducted using specific key words, identified through google search, relative to generic, brand and "street names" of injectable AAS (see Table 1).

**Table 1** SEARCH TERMS search Terms.

| AAS                 | Generic Names   | Brand Names   | Other  |
|---------------------|---|---|--|
| Anabolic-Androgenic | "boldenone undecylenate" "Dromostanolone Dipropionate" Testosterone esters" | "Equipoise", "Ganabol", "Equigan", "Ultragan",                              | "Anabolic Androgenic Steroids" "AAS" "anabolic steroids" |
|                     | "Testosterone undeconate"   | "Masteron",   | "NPP"  |
|                     |   | "Testosterone Propionate" "Testosterone Enanthate" "Testosterone Decanoate" |  |

|          |                               |                             |                              |                                      |
|----------|-------------------------------|-----------------------------|------------------------------|--------------------------------------|
| Steroids | “Trenbolone Acetate”          | Winstrol Depot<br>“Averbol” | Nandrolone<br>Deca-Durabolin | “EQ”                                 |
|          | “Nandrolone Phenylpropionate” | “Primobolan Depot”          |                              | “Primo” “Deca” “Winny” “Test” “Tren” |
|          | “Methenolone Enantate”        |                             |                              |                                      |

Initial searches yielded a total number of 544, 048, 094 results. 406 urls in total were identified amongst the first thirty hits per search term. Websites were then screened according to specific inclusion and exclusion criteria (see Table 2)

**Table 2** INCLUSION AND EXCLUSION CRITERIA [Inclusion And Exclusion Criteria.](#)

alt-text: Table 2

| Inclusion Criteria  | Exclusion Criteria  |
|---|---|
| Website is in the English language  | Website is in a language other than English   |
| Website contains discussion forum   | Website did not contain discussion forum  |
| Forum is active   | Forum is no longer available, or not yet available  |
| Researcher can access forum through google search OR registration   | No means of access to forum (private forum)   |
| Website has a significant focus on the use of AAS in the general population (minimum one sub forum dedicated to their use)    | Website did not have a significant focus on the use of AAS in the general population  |
| Website is concerned with or contains discussion forum postings which are concerned with the non-medical (illicit) use of AAS | Website is concerned with or contains discussion forum postings which are concerned with the legitimate use of AAS licensed for medical purposes (e.g. testosterone for treatment of testicular cancer) |
| Total number of posts is displayed or can be calculated   | Level of AAS related activity on forum, or number of posts cannot be calculated   |

### 3.3 Data extraction and analysis

Once exclusions had been made (n= 356) fifty discussion forums remained. The top six of these with the most traffic were chosen for analysis. The first 25 threads from each relevant sub fora within these [fivesix](#) fora were downloaded in addition to a key word search across each site. Initial downloaded files (threads) relational to AAS totalled 4212. In order to maintain the study's focus on contemporary phenomena, posts dated older than 2014, incomprehensible text and data not relative to injecting AAS (n = 3275) were excluded and 937 files remained. The final data set of records was stored in an online, password-protected computer in an NVivo software file. For the purposes of this study, posts in relation to homebrewing (n = 14) were extracted from the final set of records for ethnographic content analysis.

Ethnographic content analysis was then conducted on the online discussion forum posts. Ethnographic content analysis focuses on the situations, context and meanings of narratives as experienced by the human actors and speakers involved (Krippendorf, 2004, pg. 16). Content analysis was conducted through repeatedly reading posts and identifying emergent themes which were then coded using NVivo software.

Pre-coding or open coding occurred first, identifying some general themes within the data. The second stage, provisional coding of data, was informed by the prior theoretical concepts and keyword searches, derived from the extant literature, which had guided data collection. Data was organized into structured categories based on these prior categories, also incorporating new categories which emerged from the text in the third stage of coding – ‘coding on’ (Krippendorf, 2004). In a fourth and final stage of coding, the initial coding framework was then refined to a higher level of abstraction, which through identifying similarities in categories and the use of reflexive notes, incorporated novel themes (Altheide & Schneider, 2013).

Three themes with 47 categories were generated (See Table 3). Finally, an additional higher level of abstraction above the theme level emerged, which centred on the concept of ritual in drug use (Grund, 1993) and on the risk environment (Rhodes and Simic, 2005) (Grund, 1993). All raw data was reread with [these](#) abstract concepts described by forum discussants in distinct ways.

## 4 Results

Demographic profiles of forum discussants could not be constructed due to the sporadic nature of details given e.g. gender, age. However, typically forum discussants self-identified as male through statements such as “As a man...” Discussion forums originated in the U.K and the U.S, however, geographical location of forum discussants could not be ascertained.

## 4.1 Theme 1: **M**otivation to homebrew in the online market

People who engaged in homebrewing described the unstable nature of the online AAS market and consequent reduced availability of good quality AAS as the primary motivator for home production of AAS. While pharmaceutical grade AAS was typically considered superior merchandise with regard to purity and quality, this was also described as a far more costly and elusive option. In this regard, underground labs (UGL) were the more commonly used sourcing route. Significant difficulties in securing a reliable UGL were reported, which initiated engagement in homebrewing for some,

*“Not asking for a source since a “true” one does not exist so we are left to search the interweb looking for shit. We know it's shit and put our ass on the line to get juice (anabolic steroids). 98% of the gear in circulation is some form of UGL or Counterfeit Pharma grade (anabolic steroids sourced from pharmaceutical companies<sup>1</sup>) is very **very** rare, expensive, and much lower dosed than UGL shit. some type of juice (i.e. Tren) is not even produced. The best I've ever seen is straight home cooked shit”.*

Rules around the acquirement of a ritualised drug ensure that established systems functioning to protect and meet the needs of individuals who use drugs are upheld (Grund, 1993). “Source checking” **—** where people enquire about the legitimacy of AAS sources on forum threads **—** was recognised as an unreliable and controversial practice. Many forums simply stated “no source checks” and issued warnings about how asking for source recommendations was likely to result in being contacted by scammers. Where source checks were allowed, they were subject to forum etiquette, e.g. only members who had posted over one hundred times could request a source check from established forum members considered to be trusted steroid ‘gurus’. Although the ‘no source checks’ rule may slow newcomers in their acquisition of AAS, it exists in reality as a ‘community positive rule’ which protects forum discussants from being scammed or ripped off.

Many forum discussants reported bad experiences with UGL AAS including being ‘scammed’, where money was exchanged but no goods arrived. Receipt of counterfeit or under dosed product and experiencing adverse side effects such as post injection pain, abscesses and swelling once product was injected were also reported and seen as indicating a poor quality or contaminated substance,

*“I have had massive lumps/abscesses, pip and bad swelling from; pharmacom, Baltic, Genesis, shree venkatesh and few other ugl labs I've tried, I have tried shooting in delta, quads and gluts and same thing. I have tried even splitting 1 ml and even that gave me pip (post injection pain). ONLY lab I'm using that is 100% pip and problem free for me is alpha pharma and I cannot get hold of them anymore as they are shut down or whatever”*

**Q**nce a UGL had been identified as trustworthy there were no guarantees that this would remain a reliable source, with the underground market in a state of constant change. Those who homebrewed AAS described it as a solution to the expense and hit and miss nature of sourcing from UGL, as once a reliable source for raw powder had been identified, the individual felt in control of the ‘brew’.

*“Once you find good powder source, you know what you are getting, because you brewed it. Man, since I tried for the first time, there is no way back for me. I now have years' worth of supply of good gear, since it doesn't take much”*

‘Homebrew’ product was stated as being better quality and more economical. Performance of a ritual can be enjoyable as it stimulates production of thought and emotionality through activity (Grund, 1993). The process of home brewing was a source of leisure for some,

*“Homebrew is the way to go IMO. It is almost like another hobby, like reloading ammo or making wine.”*

## 4.2 Theme 2: “Cooking” **P**practices

Within discussion forums, sharing of homebrewing practices and knowledge as ritualised drug behaviours strengthened group ties (Grund, 1993). Ritualised activities are also functional and practical in that they fulfil a purpose – in this case, providing the individual with good quality AAS. The effect of the ritual is to ensure the efficiency of the desired result. As may be seen in some ritualistic practices of psychoactive drug users, e.g. preparation of drugs for injection or insufflation (Grund, 1993) the practice of homebrewing is depicted as a sequenced event with room for individual stylisation, with varying methods described.

*“It fun to play around and make different concentrations, but you're not going to reinvent the wheel in your kitchen. Most of the concentrations you see out there, are what they are for a reason.”*

Basic equipment reported as essential for homebrewing included a beaker; some kind of carrier oil; benzyl alcohol (BA) for sterilization of the solution and a solvent such as benzyl benzoate (BB); dimethyl sulphoxide or polyethylene glycol. Heating the solution was reported as speeding up dissolution of the powder or for sterilization purposes, with use of a stove, hob, microwave, autoclave and pressure cooker amongst the methods reported.

There were also varying reports of which oils were best to use during the home brewing process. Many were in agreement that the best option was pure grape seed oil, sold as “sterile grape seed oil”, purchased on Ebay or Amazon. However, other oils mentioned included canola oil; ethyl oleate; MCT oil (medium-chain triglycerides); peanut oil and cotton seed oil. One individual enquired whether he could use “massage or salad oil” as an alternative to

these. The use of benzyl alcohol and benzyl benzoate for sterilization was also debated, with variants in dosages reported. Further processes of sterilization included filtering the resulting liquid through a syringe filter, and baking the vials in a pressure cooker or autoclave.

Decision making with regard to choosing types of equipment and oil used was grounded in personal preference, and beliefs regarding the outcome potential of using particular objects. Grund (1993) describes the symbolism attached to preferred type of instruments or drug paraphernalia. Certain favoured instruments may symbolize a positive outcome for the individual, hence, the use of certain objects served to reduce stress during the ritual sequence. Choice of carrier oil was also motivated by which type was likely to cause post injection pain (pip). One function of ritual in drug use is to seek to control “secondary” effects, potential negative side effects (Grund, 1993).

Ritual is symbolic in group and social situations as it strengthens relationships and facilitates group bonding (Grund, 1993). Ritual is also vital to educate newcomers on the rules of drug use. This can be demonstrated through delivering explicit directions to novices on how and why certain rules exist, seen where home brewers utilised the discussion forum space to seek advice when encountering problems or experiencing concerns with regard to the cooking process. On the advice disseminated in the forum, homebrewers employed various techniques for measuring the quality of the ‘gear’ such as Labmax testing, getting blood tests pre and mid cycle and self-surveillance of side effects and reactions once the product had been injected.

While underdosed raw powder was also sold online, homebrewers in this study maintained a stance that once a ‘settling in’ period of testing the strength of their raw powder and adjusting their recipes had been overcome, they were guaranteed full strength AAS. This involved experimenting with dosages,

*“I will just change up my brew a little more to comp for underdose. I did that with tren and it seems to be working great for me can't change the bed sheets fast enough”*

One home brewer admitted to the temptation to dose higher with home brewed product once physique results became apparent.

As a ritual, homebrewing in this study was seen to be a process of inherent value to its players, the homebrewers (Grund, 1993). Despite opposing views on details of the home brewing process, home brewing was described by many as a relatively simple task. Moreover, it was an enjoyable task, experienced by many as fun, one in which most home brewers took great pleasure, care and pride,

*“I trust myself and a couple others I know to do it right. I can't figure out how ugl's can screw gear up so bad. All I can say is that I have never had pip or any problems with home brew ever”*

### 4.3 Theme 3: Injecting

Home brewers presented as longterm users of AAS who had opted out of the UGL consumer base to increase the quality and cost effectiveness of their use, and so were typically experienced injectors. The concept of home brewing as a skilled practice for knowledgeable and careful individuals emerged from the rhetoric of forum discussants. Negative comparisons were made between individuals who inject or manufacture psychoactive drugs and homebrewers,

*“Shut the fuck up with your theories before you get somebody to hurt themselves this is not Meth you're cooking you dumbass”.*

However, negative health outcomes arising from injecting homebrew were documented and included accidentally injecting pieces of rubber membrane from a vial stopper, post injection pain (pip), knots, and allergic reaction to solvent,

*“I did a shot and had crippling pain and a knot for a few weeks. Well, I drew another shot as I figured I hit a nerve or something.... Looked in the barrel of the syringe, and fuck me! There were little bits of the stopper floating around. I'm still convinced I injected a little piece of rubber into myself...”*

Although experimentation with such things as sterilization techniques, dosages and oils was not condemned, a certain level of respect was demonstrated for the tried and tested formulas of “vets” (longstanding forum members). These formulas were developed over time through the exchange of subjective individual experiences (Grund, 1993) in the discussion forum network. Grund (1993) discusses how ritual in drug use can be a hybrid of rational and irrational rules, as the ritual is passed through networks of individuals over time. This was seen in homebrewing, where many instructions for homebrewing were contradictory in nature, each one insisting upon itself as the tried and tested, original or best formula. The validity of such claims can be ambiguous and difficult to ascertain (Grund, 1993).

## 5 Discussion

This is the first known study of homebrewing AAS, which signifies an additional layer of risk for people who use AAS. It is important to examine the macro-structural space where homebrewers have identified this risk as they carry out their everyday lives as people who inject AAS. In response to this sociocultural risk, they have created a micro risk environment (Rhodes, 2005) through which to conduct their AAS procurement and use, the homebrewing

space.

## 5.1 The homebrewing macro risk environment

Recent studies (Underwood, 2017; [et al. Hanley, Santos & Coomber, 2016](#)) highlight how the prohibitionist landscape where AAS is situated impacts on health risk for people who use AAS as they are forced to source from an illicit market. The enforcement of societal drug legislation will often initiate formation of subcultures, which will then produce their own indigenous rituals which facilitate the successful procurement and use of drugs (Grund, 1993). The basic need of the individual injecting AAS is to acquire good quality and affordable product. Many forum discussants in this study lamented the dangers of sourcing AAS products from the unregulated online market. This 'hostile environment' (Grund, 1993) provokes a response from individuals who then develop their own channels and means to meet their need [in](#) in this case, homebrewing.

The decision to home manufacture drugs also been made by individuals who inject opioids and stimulants. Displacement patterns from sourcing psychoactive drugs through sellers and pharmaceutical sources to home production has been described as being dependent on a lack of availability of the desired substance through policing and prescribing practices, ease of access to cheap ingredients and low level awareness of associated harms with the home manufacture of drugs (Van Hout, 2014). Similarities can be drawn from this conclusion in the homebrewing of AAS, where the unlegislated online market for AAS may have diversified a portion of its consumer base to the arena of 'kitchen chemistry' (Van Hout, 2014).

The stigmatisation of drug use which accompanies prohibition also encourages a disconnect between people who inject drugs and social structures (Grund, 1993). This deviant labelling serves to instigate adherence to sets of subcultural and novel strategies, such as homebrewing, which support the continuance of drug use where society hinders and condemns. Such a subcultural group is likely to become self-reliant and independent from mainstream culture, to the extent that health promotion messages can be received with scepticism (Grund, 1993).

## 5.2 The homebrewing micro risk environment

The micro risk environment (Rhodes, 2005) in this case is the individual's own home, where familiar surroundings and self-confidence is intrinsic to risk perception and navigation. In line with [Rhodes and Simic \(2005\)](#), the social meanings attached to manufacturing AAS in the home dictate that homebrewing is a safer method of injecting AAS than buying from an unknown source online.

This helps to shape the person who injects drugs perception of risk. In home brewing the familiar surroundings of an individual's own home is the environment where the drug is both manufactured and injected. The home environment often provides an individual with a sense of security and hence potentially reduces risk perception on the part of the home brewer. Thus individual retains autonomy through the home brewing process from the beginning, where the raw powder and oils are blended, to the end, where the AAS is injected, often over years of experience. Self confidence in the ability to produce a good quality and safe product is high amongst home brewers as a result.

[Hanley Santos and Coomber \(2016\)](#) call this risk navigation strategy the "rhetoric of competency" where people who use AAS perceive their own ability to make healthy decisions to be high and predict that they will circumvent risk in terms of negative health outcomes where others have failed. [Rhodes and Simic \(2005\)](#) identifies another element of risk behaviour as risk priorities, or risks which are considered more important and given more attention than others [in](#) "the main risk". Consequences which are felt immediately tend to become risk priorities, whereas risks where the benefits are seen to outweigh the cost are rationalised and therefore are not prioritised. Within this context of risk priorities risk perceptions may be shaped by social norms and what is negotiated within a group of individuals.

This theory can be applied to home brewing groups, who in this study prioritised minor side effects such as post injection pain. In line with [Rhodes and Simic \(2005\)](#), post injection pain is also prioritised as a consequence which would interfere with subsequent injection of AAS. The same priority would then be given to abscesses and skin infections, as they pose an immediate threat to future successful injecting. The focus on relatively minor side effects because of their potential impact on PIED use rather than discussion of more serious outcomes which may occur is comparable to the concept of "denial of harm" as described by [Hanley Santos and Coomber \(2016\)](#). Here the authors found that people who used AAS described their use as beneficial to their health rather than detrimental. This is also evident in this study, where home brewers expressed confidence that home brewed AAS was of a very high quality and safe to use.

[Rhodes and Simic \(2005\)](#) describes how people who use drugs may normalise what society deems risky behaviour as it becomes routine and habitualised in their trajectory. This can be seen in the trivialisation of any difficulty involved in the home brewing process itself, despite a complex range of sterilization, heating and filtering techniques described. This potentially high risk series of steps in this context is "normalised activity" ([Hanley Santos & Coomber, 2016](#)). A benefit outweighing the costs is an overarching theme in the rhetoric of homebrewers, with many describing great results from homebrewed gear, and less dialogue evident on risk by comparison.

## 5.3 Potential health harms associated with homebrewing

### 5.3.1 Sterility

Disagreement over the necessity of recommended sterilization steps was evident in this dataset. Many home brewers contested the need for filtering and use of heat, preferring other longstanding techniques to ensure sterility. One perception documented was that UGL cut corners also during the sterilization process. This may have acted as justification for a high risk home brew. Concerns with regard to the injection of homebrewed AAS were largely centred on the successful manufacture of an effective and full dosed product. While sterility was a conversation point, dialogue was dominated by issues of quality control.

### **5.3.2 Dosing**

While high dosing occurs amongst injectors of AAS who do not home brew (Brennan et al., 2016; Chandler & McVeigh, 2013), those who buy from UGL are likely to be sold understrength products (KreskeClement et al., 2012; Evans-Brown, McVeigh, Perkins, & Bellis, 2012; Clement et al., 2012; Kraska et al., 2010; Cordaro, Lombardo & Cosentino, 2011). Control over dosing is in the hands of the homebrewer who can manipulate the recipe to ensure a high strength product. Pathology such as body dysmorphism and appearance anxiety has been noted in individuals who use PIED (Mooney et al., 2017). In this regard, the ability to create stronger and more concentrated doses of AAS may have clinical implications.

### **5.3.3 Injecting harms**

Some injecting issues for concern described by home brewers included post injection pain knots in the muscle; an acute allergic reaction to a solvent and accidentally injecting pieces of a vial membrane. Injecting AAS in this regard is a self-directed practice with high risk of skin and soft tissue infection (SSTI) as evidenced in the data for this study. High risk of transmission of bloodborne virus (BBV) has been indicated in home brewers of psychoactive drugs (Hearne et al., 2016) and evidenced in people who inject PIED (Rowe et al., 2017). These findings highlight the potential for significant risk of harm among AAS home brewing groups.

### **5.3.4 Isolation from health services**

Similarly to the communal folk pharmacology described in the literature with regard to psychoactive drug home manufacture (Van Hout & Hearne, 2016) home brewers viewed themselves as conscientious and educated practitioners. While respect for the process and protection for the safety of individuals who home brew was expected, the view that home brewing was a relatively simple task was expressed multiple times. In this regard, home brewers expressed a high level of self confidence in the task of manufacturing and injecting a high quality and sterile AAS product at home. When comparisons were drawn with home cooks of methamphetamine, comments were of a disparaging and dissociative nature. This reaction would suggest that AAS home brewers may be a hard to reach group with regard to harm reduction information.

Reticence to engage with medical professionals has been documented in the literature with regard to people who inject AAS (Pope, Kanayama, Ionescu-Pioggia, & Hudson, 2004; Zanhov, McVeigh, Ferris, & Winstock). This positions online communities, AAS 'gurus' and veterans as the primary sources of information regarding dosing, sterilization and injecting drug use, a phenomenon similarly documented in the homemade illicit drug literature (Van Hout & Hearne, 2015). Due to the contradictory suggestions made within discussion threads, advice given may complicate existing drug use patterns, escalate dosing or put people who home brew at risk of engaging in unsafe practices leading to SSTIS and BBV.

Fora members have been described in studies as disseminating pragmatic harm reduction tactics (Boyer et al., 2007; Lapen, Macalino, & Hibberd, 2008; Friedman et al., 2007; Holt and Treloar, 2008) and this study sought to explore the harm reduction measures, perceptions of risk and injecting practices of homebrewers in this regard. Recent netnographic research has underscored the need for a shift of policy focus away from prohibition to facilitate enhanced knowledge of safer use of PIED thereby promote harm reduction and better public health outcomes (Underwood, 2017). In this context, it may be argued, that targeted harm reduction interventions intended to protect the safety and health of high risk groups such as home brewers are warranted.

## **6 Limitations**

This paper reports on the first study of the practice of home brewing AAS as described in online discussion forums. Nevertheless, it has some limitations. It was not possible to explore a demographic profile, for example gender and age, of the fora discussants due to the sporadic nature of details given and sometimes the ad hoc nature of participation in discussions. Textual data collected may be confounded by self-reporting. However, to address this latter issue verification was strengthened through cross checking of vertical and horizontal similarities across reporting of home brewing experiences within forum activity.

## **7 Conclusion**

This study aimed to understand an under researched phenomenon in the contemporary culture of PIED injection and also within the context of new trends in homemade drugs; namely the experiences of home brewing AAS amongst a distinct group of individuals through an exploration of their exchanges in internet forums. A subcultural leaning towards home chemistry and the lay manufacture of drugs for personal use in a prohibitionist landscape underpins the broader risk environment for people who are confronted with poor quality PIEDs and financial losses from UGL. For people who inject AAS, home brewing may present as a rational alternative to a problematic climate for purchasing well sourced and high quality AAS products. Diversification of the AAS online market in this regard increases legal and clinical implications regarding infection, contamination and high strength dosing. Policy makers and treatment providers should be cognisant of the presentation of harms associated with homemade PIED production and use. Further research in this area will be of benefit to healthcare workers, treatment providers and policy makers particularly as this relates to evidence informed and targeted harm reduction policies and effective public health interventions.



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## Footnotes

<sup>1</sup>Parentical clauses added by the author/s for clarity.

## Queries and Answers

**Query:** The author names have been tagged as given names and surnames (surnames are highlighted in teal color). Please confirm if they have been identified correctly.

**Answer:** Yes

**Query:** Please check the presentation of authors affiliation and correct if necessary.

**Answer:** Correct

**Query:** Please provide keywords and abstract.

**Answer:** Keywords - performance and image enhancing drugs, anabolic androgenic steroids, injecting drug use, home manufacture of drugs

**Abstract** Background: New evidence with regard to an under documented practice – the home manufacture of anabolic androgenic steroids (AAS) for injection, known as 'homebrewing' - in contemporary injecting performance and image enhancing drug (PIED) culture is the subject of this paper.

**Methods:** Data was collected from five publicly accessible internet discussion forums and coded using NVivo software. For the purposes of this study, threads in relation to homebrewing (n= 14) were extracted from the final set of records for ethnographic content analysis.

**Results:** Motivation to perform homebrewing was largely grounded in the circumnavigation of unreliable online sourcing routes for AAS products, financial losses and potential harms associated with contaminated and counterfeit injectables. Instructions on how to perform homebrewing were found within discussion threads. Identified areas of concern included potential for sterility and dosing issues, injecting harms, isolation from health services

**Conclusion:** This study provides a snapshot of online communal activity around practice of homebrewing AAS amongst individuals who inject AAS. Further research in this area is warranted, and will be of benefit to healthcare workers, treatment providers and policy makers particularly as this relates to evidence informed and targeted harm reduction policies and effective public health interventions

**Query:** Please note that Refs. "Latypov & Harris, 2013, Celinski & Chowanec, 2012, Lombardo & Cosentino, 2011, Zabransky, 2007, Grund, Latypov & Harris, 2013, Clement et al., 2012, Gahr et al., 2012" are cited in the text but not provided in the reference list. Please provide these references or else delete the citation from the text.

**Answer:** Delete "Latypov and Harris, 2013" , "Celinski and Chowanec, 2012" "Lombardo & Cosentino, 2011" from text Additional references have been added to the reference list

**Query:** Please note that citation of Table 3 has been provided in the text but the table for the same is missing. Please provide table 3 or delete the citation from the text.

**Answer:** removed this citation

**Query:** Please check the presentation of Table 1 and correct if necessary.

**Answer:** correct