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RESEARCH REPORT

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The world's first anabolic-androgenic steroid testing trial: A two-phase pilot combining chemical analysis, results dissemination and community feedback

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Abstract

Background and Aims: The clandestine production and distribution of anabolic-androgenic steroids (AAS) poses health risks due to the uncertainty of their contents. This study aimed to test the chemical content of AAS samples and provide aggregate results back to the community, exploring how these results influenced usage decisions and risk management.

Design: A mixed-methods approach was used, combining chemical analysis of AAS samples with qualitative interviews. Participants submitted samples for testing, and the results were later shared with them. Semi-structured interviews explored participants' perceptions of AAS risks and the impact of testing results on their behaviour.

Setting: The study was conducted at CheQpoint drug checking service in Brisbane, Australia.

Participants: Thirty-two samples were submitted for testing between 19 April and 7 June 2024, with 23 samples analysed. A total of 25 active AAS users participated in interviews.

Measurements: Chemical analyses identified substances present and assessed active ingredient concentrations. Qualitative interviews gathered participants' perceptions, and these data were analysed through iterative categorisation, guided by the Health Belief Model.

Findings: Chemical analysis identified that 13% of samples contained substances different from what was expected. Concentrations of active ingredients were close to expected levels [e.g. testosterone propionate at 96.2 mg/mL (range = 91.39–101.01 mg/mL)]. Interviews identified four key theme categories. Participants sought testing primarily for substance verification, expressing concerns about contamination and dosage. Barriers to testing included limited access and fear of disclosure. While testing was seen as a valuable harm reduction tool, gaps in health guidance and follow-up support were identified as areas for improvement.

Conclusions: Thirteen percent of 23 anabolic-androgenic steroid (AAS) samples analysed contained substances different from what was expected. Interviews with active AAS users highlighted the need for reliable information, accessible testing services and tailored health approaches for AAS use.

KEYWORDS
anabolic-androgenic steroids, community-led, drug checking, harm reduction, image and performance enhancing drugs, steroid checking

INTRODUCTION

The rise of black-market anabolic-androgenic steroids (AAS) from unregulated underground laboratories poses significant health risks because of their unknown quality and composition [1]. Globally, approximately 3.3% of the population reports using AAS, with prevalence rates of 6.4% among men [2] and 4% among women [3]. Despite their widespread use for aesthetic and performance enhancement [4], AAS are associated with substantial physical [5], psychological and social harms [6]. Physical risks include cardiovascular complications [7], liver damage [8] and AAS-induced hypogonadism [9], which impacts reproductive health [10]. Injection-related risks, such as infections and the transmission of blood-borne viruses, are also critical concerns for some consumers [11, 12]. Psychological harms, including depression [6], anxiety [13], aggression [14] and dependence [15], further compound these risks, whereas stigma and isolation exacerbate the social impacts [16, 17]. Importantly, the clandestine nature of AAS production [18] means that a substantial proportion—over 66%—reportedly contain harmful or unidentified substances [19], which exacerbate the risks associated with their use. The risks of using AAS in combination with harmful adulterants [20, 21] underscores the urgent need for harm reduction interventions.

Globally, the lack of tailored harm reduction responses to AAS use presents a significant public health challenge [22, 23]. Although harm reduction strategies for people who use drugs have demonstrated efficacy in reducing risks without increasing use [24, 25], these approaches are often ill-suited for the unique needs of AAS consumers [4, 26]. People who use AAS are primarily motivated by goals related to body image, performance and health [4, 26]. As such, their specific risks—improper injection techniques, non-medical dosages and product contamination—are rarely addressed by existing interventions and frameworks [20, 27–29]. Therefore, it is crucial to implement targeted community interventions to reduce harms in this cohort. Providing comprehensive drug information empowers individuals to make informed health decisions [30], promoting safer practices.

Tailored AAS testing services are rare because of logistical and technical challenges, including the need for specialised facilities, methods and staff [31]. Globally, their absence highlights a major gap in harm reduction, worsened by stigma and discrimination that marginalise AAS consumers, perpetuate health disparities and deny equitable care [18]. In Australia, this gap is particularly evident, with harm reduction services lagging in addressing the specific needs of AAS consumers. Although drug-checking services like CanTEST in Canberra [32] and CheQpoint in Brisbane and Gold Coast [33] address other illicit drugs effectively, AAS remain largely untested, leaving consumers without crucial information and health guidance. This study addresses this gap by implementing an innovative program that tested the chemical content of AAS and provided aggregate results to the community, capturing their feedback.

METHOD

Design and ethics

This was an exploratory pilot study. Ethical approval was granted from the Griffith University Human Research Ethics Committee (approval: 2023/784). This study followed the COREQ checklist (see Supporting information, Data S1), and reporting guidelines outlined by this journal [34, 35]. Figure 1 depicts the two key phases of data collection that are outlined below.

Phase 1

Data were collected through chemical analysis of AAS samples. Participants were encouraged (see Figure 2) to submit their

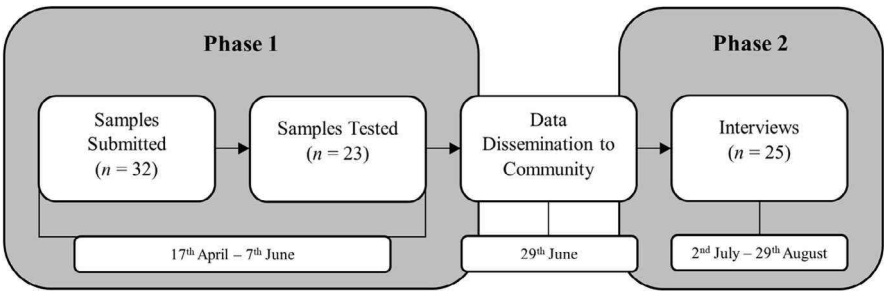

FIGURE 1 Exploratory mixed-methods pilot design and timeline.

FIGURE 2 Anabolic-androgenic steroids (AAS) sample advertisement used digitally and on site.

samples—including 'empty' vials with residual AAS, as well as AAS in tablet form—to CheQpoint in Brisbane, Australia. A spectral matching approach, including the use of Radian-ASAP direct mass detection, Orbitrap liquid chromatography mass spectrometry and Fourier transform infrared spectroscopy for tablet samples, was used to identify sample constituents. Solvent extracts of submitted samples were analysed using these advanced techniques, with spectral data compared against National Institute of Standards and Technology reference data and direct reference materials where available [31]. These results were compiled and aggregated, and results were disseminated to participants via posters at the collection site and through social networks facilitated by community partners (see Tables 1 and 2). Comprehensive analysis findings from this compilation (19 April 2024–7 June 2024) were shared with participants [36] via social media.

Phase 2

Participant recruitment

Following the dissemination of results, a sample of people who use AAS and had seen the disseminated results was recruited for interviews. Participants were drawn from the research team's community partnership networks, including The Loop Australia, Queensland Injectors Health Network and Queensland Injectors Voice for Advocacy and Action. Recruitment was voluntary, and participants could opt in by contacting the lead author, whose details were provided alongside the steroid checking results. Additionally, the lead author purposively recruited participants through established networks developed over years as a peer researcher, using social media promotion, word of mouth and snowballing. Informed consent was obtained verbally before interviews.

TABLE 1 Qualitative results of submitted samples.

Expected drug type	Samples submitted (*n*, %)	Expected drug detected (*n*)	Notes on unexpected/ inconclusive results	Expected carrier oil	Carrier oil detected
Injectable					
Testosterone propionate	1 (4.3)	1		Not provided = 1	MCT = 1
Testosterone cypionate	1 (4.3)	1		Not provided = 1	MCT = 1
Testosterone enanthate	4 (17.4)	3	Testosterone cypionate was detected in 1.	GSO = 1	GSO = 1
				Not provided = 3	MCT = 3
Methenolone enanthate [Primobolan]	1(4.3)	1		Not provided = 1	MCT = 1
Drostanolone enanthate [Masteron]	3 (13.0)	3		GSO = 1	GSO = 1
				MCT = 1	MCT = 1
				Not provided = 1	MCT = 1
Nandrolone phenylpropionate [NPP]	3 (13.0)	3		MCT = 2	MCT = 2
				Not provided = 1	MCT = 1
Nandrolone decanoate [Deca]	1(4.3)	1		Not provided = 1	MCT = 1
Trenbolone enanthate	4 (17.4)	4		GSO = 1	GSO = 1
				Not provided = 3	GSO = 3
Trestolone no ester [MENT]	1 (4.3)	0	Trestolone acetate	Not provided = 1	MCT = 1
Oral					
Mesterolone [Proviron]	1(4.3)	1			
Oxandrolone [Anavar]	2 (8.7)	1	1 sample = atanozolol [Winstrol] detected. 1 sample = testosterone and oxandrolone were detected.		
Stanozolol [Winstrol]	1(4.3)	1			
Total	23 (100)	20 (87%)			

Abbreviations: GSO, grape seed oil; MCT, medium chain triglycerides oil.

TABLE 2 Quantitative results of submitted samples.

Expected drug type	Expected concentration	Detected concentration
Testosterone propionate	100 mg/mL	96.2 mg/mL [range = 91.39–101.01 mg/mL]

Data collection

The data collection process involved conducting semi-structured interviews with participants to explore their perceptions of AAS risks and the impact of the disseminated test results. These interviews were conducted by S.R. via a digital platform, with all sessions being recorded and transcribed for analysis. During the interviews, participants were asked a series of questions designed to elicit their thoughts and experiences related to AAS use, collaboratively designed by the research team and AAS community. They were asked several questions to gauge their perceptions and understanding their perceptions of quality. For example, they were asked questions such as: 'Can you tell me a little bit about why AAS testing is important? What do you think about the quality of AAS in circulation in general? How do you feel about the results of the AAS testing that were shared with you?' To assess the practical impact of the test results, participants were also asked, 'Has the information provided influenced your decision-making regarding AAS use? If so, how?' Additionally, the interview sought to identify potential obstacles to changing their AAS use, asking, 'What barriers do you face when considering changing your AAS use based on the new testing information?' Last, participants were asked about improvements they could suggest to the testing services, for example: 'How could AAS testing be improved in future, could you please provide us some recommendations?'

Data analysis

The qualitative data from the interviews were analysed using NVivo 12 (QSR), guided by the Health Belief Model (HBM) [37]. The analysis combined both deductive and inductive coding approaches [38] under the HBM framework. In the initial deductive phase, key categories and interconnections were identified and prioritised based on the core constructs of the HBM, including perceived susceptibility, severity, benefits and barriers related to AAS use and the testing

information provided. This conceptual phase was followed by an inductive line-by-line analysis using iterative categorisation [39] to refine and further develop codes. This iterative approach allowed the data to be systematically reviewed and organised into coherent narratives, whereas also ensuring that conceptual depth was reached [40]. Throughout the analysis, S.R., a PhD student without AAS experience, and T.P., a 'steroid peer researcher' with lived-living AAS experience, reflected on their positionality, integrating these perspectives to inform and enhance the interpretive process. The lead author actively engaged in abductive conceptualisation [39], drawing on participant data, his own experiences and the HBM theory to test and refine identified and developed themes. This approach aligns with evidence-making practices that recognise the value of lived experience in shaping interpretive insights. Recurring points were then organised into higher-order concepts, providing a structured framework for presenting the findings. The analysis process also involved critical engagement from the research team to challenge assumptions, reconcile diverse perspectives and ensure the findings captured the nuanced complexities of AAS use. This collaborative and iterative approach enhanced the depth and rigour of the analysis, yielding findings presented below in three key theme categories.

RESULTS

Phase 1

Sample submission

Participants submitted samples to CheQpoint between 19 April 2024–7 June 2024. SPSS (v29, IBM) was used to analyse the demographic information submitted at time of sample drop off. A total of 32 samples were submitted. In this group, 87.5% of participants had submitted a sample they had tried before, and 81.3% did not report noticeable differences in their experiences with the submitted sample (i.e. no perceived differences in effects). Participants reported several reasons for submitting samples: (i) 'I'm just generally interested/curious' (78.1%); (ii) 'I think it is what was bought/acquired as, but I want more information or advice' (12.5%); and (iii) 'I suspect it isn't what was bought/acquired as but (submitting) for other reasons' (9.4%). Although there were several human growth hormone samples (25%) submitted this compound was excluded from the qualitative analysis of samples (n = 23) because of the study's focus on AAS. The second most frequently submitted compounds were nandrolone, testosterone enanthate and trenbolone (12.5% each). Among the remaining samples, drostanolone was submitted by 9.4% of participants, whereas oxandrolone and testosterone cypionate each accounted for 6.3%. Additionally, one sample (3.1%) each of mesterolone, methenolone, stanozolol and trestolone was submitted for analysis. We tested one testosterone propionate sample using quantitative methods because of availability of reference standards.

Phase 2

Interviews

Twenty-five participants (M_{age} = 35.92 years; 20 male, and 5 female), completed a semi-structured interview; the median length of interviews was 50 minutes (range = 30–77 minutes). All participants were using AAS, and predominantly reported using one (n = 8) or two types of AAS (n = 10). Participants reported acquiring their AAS through a combination of illicit and licit means, either through community networks (n = 13), on-line markets (n = 11) or through a combination of prescription and community networks (n = 5).

Balancing the benefits of AAS use

All participants identified uncertainty about the quality and source of AAS as a significant barrier to safer use. They balanced these barriers against the desired benefits of using AAS. The participant accounts reflected a common narrative among the group, where the physiological benefits of AAS use—such as reduced fatigue and quicker recovery—were framed as critical to achieving their enhancement goals. However, Markus' emphasis on heightened energy and libido also underscored how AAS use extends beyond physical performance, intersecting with broader aspects of wellbeing.

> Markus (37, male): 'The benefits are obviously I'm not as tired as I am when I'm not using [AAS]. Recovery from training, when I do train, is a lot better and then obviously your sex drive's a lot higher as well.'

Nonetheless, all respondents acknowledged the inherent risks associated with use, but accepted them as part of the trade-off for benefits. This mindset illustrates the perceived susceptibility to harm and a willingness to take risks for desired outcomes.

> Kreed (28, male): 'I know it's [AAS use] all pretty harmful. I mean, there's a price you have got to pay, right? It depends how hard you want to go.'

All participants highlighted the limitations of relying on subjective markers and blood work to detect the unwanted health effects of AAS use, revealing a critical gap in safety practices. Even with self-monitoring, participants acknowledged that harmful effects might only become apparent after significant damage has occurred.

> Larry (42, male): 'Unless you test it yourself, the only other markers you have are quite subjective. In writing down the side effects and the moods and the different levels, then doing blood work and sometimes that could be too late.'

These participants underscored the need for reliable, proactive testing measures to complement self-monitoring and blood work, providing earlier detection of risks and fostering a more comprehensive approach to harm reduction. This reflects their awareness of the seriousness of health risks and the need for tools to mitigate them. Approximately one-third of participants went on to underscore the importance of using emerging reagent 'steroid checking' options to ensure the quality of their substances. This practice reflects a proactive approach to harm reduction, showing how informed use can be a way of risk mitigation by verifying their products. The participants recognised the limitations of reagent kits for AAS testing, but still valued the ability to make informed decisions.

> Marceline (45, female): 'I guess I've always checked my own through the private steroid checking service. I have not had a single thing that I've used that I have not checked […] So I know that there's risks around potency and contamination, even with the steroid checking service, it does lend itself to being able to make an informed decision about what it is that I'm using.'

Less than one-third of participants felt confident about the quality of their products, but acknowledged that others may not have the same certainty. This concern was amplified by testing results that revealed contamination, such as oxandrolone being substituted with stanozolol. Participants noted that access to such testing results could encourage people who use AAS, or those considering use, to reassess their decisions and make more informed choices.

> Bode (29, male): 'So [by steroid checking] I know that the products that I'm using are always going to be the products that I want […] like I'm getting what I'm paying for. Not everyone has that or lucky enough to have that. So, I can see that anyone who does not have that at their disposal might look at these results and go, oh, I might think twice about this bottle of Anavar [oxandrolone] that could potentially be in this case Winstrol [stanozolol].'

All participants viewed the accessibility to reliable information as an important factor in safer AAS use. They appreciated the value of data that can inform consumers about product quality, suggesting that better access to testing information could significantly reduce harm.

> Quintin (40, male): 'Obtainability is the biggest thing, and this sort of data is amazing because it allows people to see what is out there, what's being tested and what's clean.'

However, it is important to note that although individual results provide valuable insights, the unregulated nature of the AAS market means that findings from one sample may not be representative of others, underscoring the need for caution.

Navigating the perceived uncertainty

All participants consistently expressed concerns about the seriousness of long-term health repercussions from using AAS, particularly potent compounds like trenbolone. Although these consequences remained speculative for many, the uncertainty itself heightened the perceived severity of their decisions.

> Harley (27, male): 'I assume there will be some kind of backlash…I've blasted Tren [trenbolone] at high dosages…I fully believe there'll be some kind of repercussions or damage being done.'

The unpredictability of individual reactions to AAS added further anxiety, with participants acknowledging that even educated guesses about safe usage could fall short. The unpredictability of these outcomes underscores the importance of access to accurate information and safe practices.

> Bode (29, male): 'Yes, absolutely everyone is prone to issues. It's just a matter of education and knowing […] someone who's using a dose of testosterone, they might use too much. Therefore, they go on to aromatize […] They might start to experience gynecomastia [growth of breast tissue] and all sorts of other issues.'

Many participants acknowledged that a small proportion of underground AAS supplies are 'pure', and this adds an element of fear to the consumption process because of risk of dosing beyond their intended usage. Some participants were aware that they are not always making fully informed choices regarding their health, which can lead to serious, even life-threatening, consequences.

> Kreed (28, male): 'I read in like some study that apparently only 60% of all underground lab stuff is like, good…So, it's only like 60% pure, the average of stuff. That's the scary thing.'

Even with efforts to mitigate risks, the unpredictability of AAS content can lead to serious health scares, as illustrated by the misrepresentation of substances which Monte was using. This mislabelling can push AAS consumers dangerously close to life-threatening health risks.

> Monte (34, male): 'I remember taking something once…Turns out, I did not have Masteron [drostanolone], I had boldenone […] My doctor's like, you need to stop now. You're gonna have a stroke.'

Some types of risks were also noted to be unique for women. For instance, Marceline voiced her concerns about virilisation:

> Marceline (45, female): 'It's not just about getting big; I want to be strong without losing my femininity. The

> fear of deepening my voice or facial hair is real, so I'm careful with doses and always check in with others who have used [AAS].'

This emphasised the need for tailored advice and shared experiences, particularly for women navigating these unique risks.

The role of testing and education in decision making

Participants consistently identified motivators—or cues to action—that drive their decisions around safer AAS use, focusing on quality control, education and accessibility of testing services. These cues were often tied to negative past experiences with poor-quality products, highlighting the need for reliable and accessible product testing to prevent adverse effects. For example, Harley reflected on the distress caused by his first AAS cycle, which involved a 'bad batch' (i.e. contaminated sample) of testosterone:

> Harley (27, male): 'The very first time I ever used testosterone ever was a bad batch. I did not know that I used about 6 mil out of the 10 and was just complaining nonstop for the whole 3 weeks about how much pain I was in and how everything was. It wasn't until I actually showed somebody [my leg] that went holy shit, dude, that is not OK or not normal.'

This highlights how peoples' experience can act as a powerful motivator for seeking safer practices, such as testing substances or adjusting dosages based on reliable information. Approximately four-fifths of participants acknowledged challenges in managing dosage and ensuring quality control, underscoring the critical role of education and access to testing in mitigating prolonged adverse effects.

> Harley (27, male): 'The more you'll use there is a very fine line to people between a good amount and too much. I find with things like testosterone, especially […] it's very easy to accidentally go over that line. You normally do not realise until it's happened, and you go fuck and kind of fix yourself back up by dropping dosage and then you can still take a few weeks to level out if that makes sense.'

All participants believed that having access to reliable testing would motivate AAS consumers to test their substances more regularly. This underscores the importance of designing accessible and consumer-friendly services to encourage safer practices. Markus, for instance, highlighted the need to reach target audiences like powerlifting and bodybuilding communities:

> Markus (37, male): 'Yeah, I think, it'll just hopefully start making people test stuff more. But yeah, again, it's reaching out to the people that are actually gonna do it. Like, I really think it needs to be sent through to coaches within both powerlifting and bodybuilding industries and then they disseminate it.'

All participants were pleased with the testing results, and believed they were helpful to prevent health risks and ensure that people receive what they expect.

> Jaxx (37, male): 'No, I do not think. I do not think there's any gaps. When you look at it logically, you go OK is the compound what the compound says it is and then is the compound dosed to what it says it is. That's how I look at it.'

This demonstrates the perceived reliability and utility of AAS testing for consumers, who value accurate results as a foundation for safer usage. However, the extent to which this influences behaviour remains contingent on individual priorities and thresholds for risk. For instance, others expressed hesitancy to change their behaviour unless larger-scale data emerged about contaminants.

> Larry (42, male): 'If there was more contaminants detected in a higher sample size I would. Probably reconsider where I'm getting it from.'

All participants agreed there was a need for better knowledge about the substances they are using. They stressed that knowing specific substances and dosages was vital for safety, underscoring the need for detailed AAS testing and education.

> Cormac (39, male): 'Yeah, like I think it's like, you know, like the more people are educated, the probably, like, the less that they would take and that sort of thing. And then probably like taking the right things, you know like if they are taking something that they do not know what it is.'

This highlights the role of public health campaigns in amplifying cues to action through increased visibility of testing outcomes. Integrating testing with accessible educational resources could address gaps in knowledge, reinforcing safer practices over time.

Enablers and barriers to safer use programs

All participants acknowledged that ongoing monitoring and adjustment are crucial for managing AAS use. Larry discussed managing risks through regular blood work and monitoring. He underscored the importance of a proactive approach to harm reduction, which can be further supported by AAS testing providing additional data on substance quality:

> Larry (42, male): 'Regular blood work, monitor the doses, monitor the quality […] goes a long way to minimising those risks.'

This highlights a key enabler: the use of proactive monitoring to mitigate harm. Testing services could complement such individual practices by offering objective data to guide adjustments, particularly for those lacking access to clinical blood work. Contrastingly, there was an intersectionality regarding how knowledge, trust and practices influence harm reduction and safer use. For instance, Harley emphasised the common practice of adjusting dosages based on subjective feelings:

> Harley (27, male): 'Yeah, I know people will actually use black market stuff, not find it's feeling as good as in the past. So just up the dosage 'cause, they'll just assume it's lower dose—the concentration's lower.'

In this way, Harley underscored a barrier: reliance on methods grounded in lived-living experience and peer knowledge exchange in the absence of reliable testing. Although these practices reflect experiential knowledge within the community, they may increase risks, reinforcing the importance of accessible testing to bridge the gap between perception and reality. However, trustworthy advice from experienced peers in the community is highly valued. Marceline highlighted the role of knowledgeable peers in guiding informed decisions:

> Marceline (45, female): 'Having somebody that you can talk to about it [use] […] having somebody who's got that knowledge and experience to speak to.'

Harm reduction initiatives could benefit from integrating peer support to create a relational foundation for health conversations. Testing services alone may not be enough; embedding them within trusted networks could enhance their impact. Education emerged as another key enabler in reducing risk. Celina noted that increased education leads to safer use:

> Celina (28, female): 'The more people are educated, the probably less [AAS] that they would take.'

This reinforces the need for harm reduction programs to pair testing with comprehensive education, enabling users to make informed choices about substances and dosages. The need for actionable evidence to change behaviour was also noted. Participants like Tori saw testing results as a catalyst for safer practices:

> Tori (44, female): 'If you guys through your research, came up with, you know, information that alerted us to some potential issues, then it would make me go, oh fuck, let us look a little bit closer for sure.'

This highlighted a critical enabler: the potential for testing results to foster AAS literacy and act as a gateway for deeper engagement with harm reduction practices. Public health campaigns could amplify this by showcasing anonymised testing outcomes to build trust and visibility.

DISCUSSION

This study tested the chemical content of AAS and shared aggregate results with the AAS-using community, highlighting the misrepresentation of AAS and users' strong desire for accurate information to mitigate risks. Although not a full drug-checking service, these findings underscore the critical need to develop comprehensive AAS checking to support safer, informed use. Participants highlighted a range of perceived benefits from AAS use, reflective of extant work globally, including improved energy, enhanced recovery and increased sex drive [4, 26, 41]. International research aligns with these findings, demonstrating similar motivations for use across regions such as Europe and North America, where AAS use has also been associated with body enhancement, improved athletic performance and perceived psychological benefits [42–44] Despite these perceived benefits, concerns about quality and sourcing remain consistent, underscoring the risks inherent in unregulated markets [20, 31]. For example, research from the United Kingdom and reports widespread misrepresentation of substances, mirroring our findings in Australia [31].

Our study also showed that people who use AAS use a pragmatic risk management approach, consistent with global literature. This approach often involves weighing the perceived benefits against known health risks, a phenomenon documented in qualitative studies in Europe and the United States [45, 46]. Participants' reluctance to engage with health services is similarly reflected internationally, with stigma, perceived judgment and a lack of medical expertise cited as common barriers to service use among international samples of AAS consumers [47]. Further, qualitative research specifically highlights a lack of confidence in doctors' ability to provide informed advice about AAS use [18, 48], often leading consumers to seek guidance through informal networks or on-line communities [49–51]. This lack of information perpetuates a cycle of disengagement, with consumers turning to do-it-yourself practices and alternative health management strategies, as has been observed in both Australian and international contexts [49–51]. A notable finding from this study was that participants were aware of the limitations of relying on subjective health markers and blood work for assessing the unwanted health effects of AAS. This gap in safety measures highlights the critical need for rigorous and reliable substance checking to better inform users about potential risks. The participants' proactive use of emerging reagent 'steroid checking' options reflects an attempt to mitigate these risks by ensuring substance quality. Despite recognising the limitations of these kits, users valued them as a tool for making informed decisions and reducing harm.

People who use AAS are aware that mislabelling and contamination can lead to serious, even life-threatening, health risks. This study identified that 13% of samples submitted contained unexpected compounds, such as testosterone cypionate substituted for testosterone enanthate. These substitutions can have significant clinical implications, as slight differences in chemical composition may affect metabolism, mood and outcomes, including androgen-induced erythrocytosis, aromatisation and central nervous system effects [52–54]. Further, the study builds on previous work [20], which has demonstrated that underground manufacturers often replace oxandrolone with other substitutions (i.e. methandienone, stanazolol) with particularly egregious clinical consequences, especially for women. Unlike stanazolol, oxandrolone is also metabolised renally rather than exclusively hepatically, making it a preferred choice for many consumers [55]. However, for people with undiagnosed kidney conditions, ingesting oxandrolone unknowingly could lead to severe renal harm [56]. Experiences with poor-quality batches highlight the critical need for reliable testing, which participants believed would enhance safety, prevent adverse effects and support informed decision-making through regular, accurate checking.

Alliances between quality medical care and public health systems are hindered by inadequate knowledge and mixed receptivity to education from those without lived-living experience [28, 47, 48]. AAS testing offers a chance for change, with participants in the current study emphasising its potential to foster safer practices through actionable evidence. Participants highlighted the value of combining testing with ongoing monitoring to mitigate risks and promote safer consumption [23, 57, 58]. A well-implemented program could combine education with reliable testing to enhance harm reduction, mitigate risks and address existing therapeutic barriers.

Implications and future directions

By demonstrating the feasibility and impact of the world's first AAS testing trial, this innovative program sets a precedent for integrating AAS testing into harm reduction efforts. We acknowledge the existence of other recent international attempts at AAS testing [59] and believe the global introduction of AAS checking services opens avenues for proactive community engagement. For example, the potential for issuing community notices and alerts based on testing outcomes exists for other drugs [60] and could significantly enhance public awareness about the risks associated with contaminated AAS products. Such alerts would not only inform AAS consumers about immediate risks, but also foster a culture of well-informed use. In contexts where front-of-house testing services remain politically or operationally unfeasible, alternative models such as back-of-house testing—where samples are analysed without direct interaction with consumers—offer critical opportunities for harm reduction. This approach enables the dissemination of timely alerts via community networks, social media or early warning systems, thereby enhancing public health responses while addressing stakeholder concerns about direct service provision. These models have served as valuable stepping stones to the establishment of fully public drug-checking services internationally [61]. Looking ahead, the development and trial of health interventions and conversations is important to transition to more direct testing and interaction with AAS consumers. Integrating comprehensive health interventions, training for health professionals and technical solutions would bring AAS checking in line with the equitable offerings of drug-checking services for other illicit drugs [30]. Combining front-of-house and back-of-house approaches has the potential to address diverse community needs while advancing the broader goals of harm reduction.

Limitations

Although the release of future 'waves' of data aims to overcome the current weaknesses of this research, there are notable limitations and challenges. The analytical chemistry team faced challenges, particularly in developing and refining methods for qualitative and quantitative analysis. Qualitative work required concentrated efforts to test and optimise equipment and preparation processes, ensuring robust methodologies. However, quantitative testing proved more challenging because of the time-intensive and costly process of acquiring reference standards. These standards could not be obtained until compounds were identified, and delivery delays from both local and international suppliers further hindered progress. As a result, only one quantitative sample was successfully tested during this pilot. Next steps involve more targeted efforts in quantitative testing, expanding the range of samples analysed and exploring strategies to incorporate AAS checking into standard drug-checking service offerings.

CONCLUSIONS

This research marks a significant advance in harm reduction by testing AAS and sharing aggregate results with the community. It revealed critical insights into AAS quality and use while highlighting the urgent need for equitable drug-checking program offerings for AAS consumers. Such programs are essential to addressing both the physical and psychological impacts of AAS use, as consumers often lack reliable information and access to quality control measures. Addressing these issues requires urgent global responses, as unregulated AAS markets and associated harms are a growing international concern. Expanding AAS testing services and tailoring interventions to meet AAS consumer needs are critical next steps. Ultimately, these targeted efforts can enhance public health outcomes and strengthen the global harm reduction framework for people who use AAS.

AUTHOR CONTRIBUTIONS

Timothy Piatkowski: Conceptualization; formal analysis; funding acquisition; investigation; project administration; writing—original draft; writing—review and editing. **Ross Coomber:** Conceptualization; formal analysis; investigation; writing—review and editing. **Cameron Francis:** Conceptualization; funding acquisition; investigation;

resources; writing—review and editing. **Emma Kill:** Conceptualization; funding acquisition; investigation; project administration; resources; writing—review and editing. **Geoff Davey:** Funding acquisition; investigation; project administration; resources; writing—review and editing. **Sarah Cresswell:** Formal analysis; investigation; methodology; project administration; resources; writing—review and editing. **Alan White:** Formal analysis; investigation; methodology; project administration; resources; supervision; writing—review and editing. **Madeline Harding:** Formal analysis; investigation; methodology; writing—review and editing. **Karen Blakey:** Formal analysis; investigation; methodology; project administration; supervision; writing—review and editing. **Steph Reeve:** Data curation; formal analysis; investigation; project administration; writing—review and editing. **Brooke Walters:** Funding acquisition; investigation; project administration; resources; writing—review and editing. **Cheneal Puljevic:** Formal analysis; investigation; methodology; writing—review and editing. **Jason Ferris:** Formal analysis; investigation; methodology; supervision; writing—review and editing. **Monica Barratt:** Conceptualization; formal analysis; investigation; methodology; supervision; writing—review and editing.

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DECLARATION OF INTERESTS

T.P., C.P., M.B., J.F., E.K., A.W., M.H. and K.B. are volunteer members of The Loop Australia, which is a national organisation for drug-checking and drug-checking research. C.F. is the CEO of The Loop Australia. G.D. is the CEO of Queensland Injectors Health Network. E.K. is the CEO of Queensland Injectors Voice for Advocacy and Action and T.P. is on the Board of Directors of the organisation.

DATA AVAILABILITY STATEMENT

Data available from the corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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