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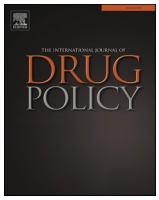

Research Paper

Off-label GLP-1 weight-loss medicine use among online bodybuilders: Folk pharmacology, risk and harm reduction

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ABSTRACT

Background: GLP-1 medicines (e.g. Semaglutide; Tirzepatide) are diabetes medicines that have recently been approved for weight loss purposes. These drugs are increasingly common, with many users accessing these medicines for off-label lifestyle-oriented purposes. While recent research has explored increased interest in these drugs, to date no studies have explored their use in bodybuilding cultures. With bodybuilders often at the forefront of experimental drug use, and diffusing knowledge of drugs to other populations, this research examines bodybuilders' understandings of use and risk of GLP-1 medicines, and community approaches to harm reduction.

Methods: This research adopted a netnographic approach, exploring 12,392 unique posts from 160 threads across two popular bodybuilding forums. Qualitative thematic analysis of posts was undertaken.

Findings: Bodybuilders frequently undertook experimental approaches to GLP use, including 'stacking' multiple compounds and 'cycling' between them, presenting risk. GLPs' utility for bodybuilding was questioned by some owing to their muscle-wastage effects, but many bodybuilders combined them with anabolic-androgenic steroids (AAS) to off-set these side-effects. In addition to their weight-loss properties, many users discussed the drugs' anti-ageing properties, and older men appear to be a significant emerging user population. While displacing potentially dangerous fat burners in bodybuilders' folk pharmacologies, GLPs nonetheless presented risks of hypoglycaemia when combined with AAS, and broader harms. Harm reduction information was frequently shared in forum spaces as part of bodybuilders' communal folk pharmacology, but some enabling behaviours likely to heighten risk were also identified.

Discussion: We examine the likely implications of these findings for public health, with particular reference to the practices of 'cycling' and 'stacking' GLP medicines and the risk this presents, particularly when combined with drugs such as AAS and far burners. We discuss the need for harm reduction services such as drug testing services, and the need for healthcare professionals to be aware of anti-ageing motivations for use among older men. Continued research into novel GLP use is needed.

Introduction

Semaglutide is a GLP-1 receptor agonist peptide, initially approved as a diabetes medicine (Ozempic) owing to its insulin and blood glucose regulating properties, and later approved by the UK national health service (NHS) as a weight loss medicine (Wegovy) in 2023 (Rackham, 2023). Semaglutide is the most prominent among a range of emerging compounds that operate on the body's GLP-1 receptors to regulate insulin levels, blood glucose levels and gastric emptying, which leads to appetite suppression and subsequent weight loss (Moore et al., 2023). Other emerging drugs in this category include the prescription drugs Tirzepatide (Mounjaro) and Liraglutide (Saxenda), as well as currently unapproved drugs like Retatrutide, hereafter grouped under the term 'GLPs' (Rosenstock et al., 2023).

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Semaglutide (under the brand names Ozempic and Wegovy) has received significant attention recently as an emerging 'miracle drug' for weight-loss, with prominent figures and celebrities endorsing its use (e.g. Blum, 2022; Thompson, 2023; Cox, 2024). The drug's effectiveness for weight-loss led to its going viral on social media platforms in 2022, with videos with the #Ozempic hashtag discussing its efficacy for fat loss receiving tens of millions of views at that time (Kolovos, 2022; Basch et al., 2023), and a significant rise in internet searches for Semaglutide and related GLP-1 agonist medicines occurring between 2021 and 2022 (Han et al., 2024). This increased awareness of Semaglutide's off-label uses for weight-loss caused widespread shortages of the medicine at this time (Fairclough, 2023; Duboust & Huet, 2023), with Bloomberg noting that prescriptions for Ozempic rose from 82,000 at the end of December 2018 to 1.2 million by the end of 2022, fuelled by off-label weight-loss use, which caused disruptions to the drug's supply (Court, 2022).

Access to GLP medications for weight loss is available through pharmacist-approved prescriptions for individuals who meet the eligibility criteria, typically based on BMI and/or obesity-related comorbidities (Moore et al., 2023). However, obtaining these prescriptions from private suppliers can be expensive, and while the NHS has begun offering these treatments for weight-loss, the eligibility requirements are strict, and waiting lists are lengthy (Bedfordshire, Luton and Milton Keynes Integrated Care Board (BLMK ICB), 2022). As such, there is an emergent issue of many GLPs being sourced through illicit digital marketplaces (Hirst & Turnock, 2024; Turnock, Hearne & Lazuras, 2025), meaning that they also come with the associated risks of substitution and contamination seen in illicit medicine markets more broadly (Coomber et al., 2014; Kimergård et al., 2014; Weber et al., 2017; Chakrabarty et al., 2021).

There is an emerging body of research investigating interest in GLP use across the general population (Basch et al., 2023; Fong et al., 2024; Martin et al., forthcoming). Analysis of social media content suggests many posts positively discuss the effects of GLPs and encourage others to take them, with 'before and after' images and similar positive stories relating to fat loss being popular among the most viewed social media posts relating to the drugs (Basch et al., 2023). However, Basch et al. (2023) also note that around 35 % of the most viewed 100 videos in their analysis included some discussion of common side-effects, or perceptions of toxicity. Similarly, Fong et al.'s (2024) analysis of Reddit posts found that experiences of weight loss and weight loss progress were popular topics, but a notable minority of posts also related to adverse side-effects (generally gastro-intestinal), suggesting that some users also experience some issues with GLP medicines.

Potential harms associated with off-label GLP use include nausea, vomiting, abdominal pain, gastrointestinal issues, headaches and fatigue/weakness, as well as risk of accidental overdose (Lambson et al., 2023; Wiener et al., 2024). Additionally, these drugs may be used in a harmful manner by individuals suffering from anorexia nervosa or body dysmorphic disorder, and taken to rapidly decrease weight by an unhealthy degree (Guerdjikova et al., 2024). Notably, Ashraf et al. (2024) identify that many GLPs acquired through the illicit market may be substandard, increasing risk of harms when used. They found that some Semaglutide samples tested as up to 39 % above the labelled dose, meaning even products containing the active pharmaceutical ingredient listed may still present a risk of overdose or broader harms.

Counterfeit medicines are often produced in China, where regulatory oversight is poorer (Hall & Antonopoulos, 2023), and bought at the wholesale level by resellers who may supply product under the guise of it being 'legitimate' pharmaceutical-grade medicine (Turnock & Gibbs, 2023a; Turnock, Hearne & Lazuras, 2025). This has led to harm among users, including several illicit market Semaglutide users being hospitalised with symptoms including hypoglycaemic shock and coma in 2023, in what may have been a case of insulin contamination of fake Ozempic pens (Thomas, 2023). There may further be harms linked to how information about drug use is sourced online, which can potentially be poor quality, inaccurate or otherwise harmful (Andreasson & Johansson, 2016; Tighe *et al.*, 2017; Brennan et al., 2018a; Turnock & Townshend, 2022), including when provided directly by suppliers like online 'beauty clinic' pages (Hirst & Turnock, 2024). Consequently, it is important to understand how these drugs are used off-label to form effective public health policy responses.

Bodybuilding has long been associated with the use of a variety of image and performance enhancement drugs (IPEDs) for weight-loss purposes, including clenbuterol, ephedrine, T3 (Liothyronine) and 2,4 dinitrophenol (DNP) (Monaghan, 2002; Salinas et al. 2019; McVeigh et al., 2021a), yet bodybuilders' GLP use remains unexplored. Given the rapid rise of GLP medicines for weight-loss purposes, exploration of use by this population is imperative, since bodybuilders as a population are known to frequently experiment with emerging and novel forms of drug use, often 'stacking' drugs together in a manner which may present greater risks of harm (McVeigh et al., 2021a; 2021b; Sagoe et al., 2015). Consequently, bodybuilders' understandings of GLP use are important to examine, as their use may present differing risks to other GLP-using populations, requiring specifically tailored harm reduction advice and public health interventions.

Folk pharmacology and digital bodybuilding forums

Southgate and Hopwood (2001) introduced 'folk pharmacology' as an extension of the concept of 'social pharmacology' (Rhodes, 1996) to understand not only how knowledge dissemination and drug use practices (licit and illicit) operate within given populations, but also the cultural production of narratives around substance use effects and harm reduction. Their participants would share knowledge of drug use and effects to educate others on approaches and practices, including emerging forms of drug use, with 'network nannies' (experienced or expert peers) relied on to provide reliable information on drug effects and safe use within their networks. Notably, Southgate and Hopwood (2001) note how folk pharmacologies are affected by broader community attitudes to drugs, changes in drug markets, and by local sub-cultural factors such as the experiential knowledge of key individuals within drug-using networks, making them dynamic and subject to change.

One of the primary realms for the diffusion of substance-related knowledge among bodybuilders are digital bodybuilding forums. The phenomenon of communal folk pharmacology and indigenous harm reduction among lay experts within shared digital spaces such as drug forums is not new. Past research has underscored the fundamental role that understanding shared knowledge, experiences, and advice within these digital spaces has for groups of people who use drugs by highlighting new and emerging drug trends and dynamics between interested parties (Hearne & Van Hout, 2016; Southgate & Hopwood, 2001; Turnock & Hearne, 2024; Van Hout & Hearne, 2016; Kjellgren, Henningsson & Soussan, 2013; Móró & Rácz, 2013; Soussan & Kjellgren, 2015, 2016; Van Hout, 2014). Communal folk pharmacology within bodybuilding and steroid forums has traditionally focused on methods for attaining muscle enhancement, fat loss, youthful skin Brennan, Wells and Van Hout, (2019b); Van Hout and Hearne, (2016); McVeigh, Germain and Van Hout, (2017) and more recently, an emergence of communal discussions informing and encouraging the use of peptides for wellbeing and repair, anti-ageing among older adults, and issues with healthcare providers fuelling black market purchasing (Turnock & Hearne, 2024).

Although stigma against specific forms of IPEDs (e.g. anabolic androgenic steroids, peptides, weight loss drugs, Botox) persists (Richardson & Antonopoulos, 2019; Richardson et al., 2024), their use is normalised in contemporary society, particularly in relation to anti-ageing treatments and a range of beauty and wellbeing products (Hall, 2019; Turnock & Gibbs, 2023b; Hirst & Turnock, 2024). Among bodybuilders, these culturally normalised notions of aesthetic beauty and wellbeing enhancement combine with subcultural norms of drug

use to attain subculturally-idealised body goals, particularly a large, lean and muscular physique, for which the use of anabolic steroids and other drugs have long been employed (Evans, 1997; Monaghan, 2002; Sagoe *et al.*, 2015; Turnock & Gibbs, 2023b). Given these drugs are either illegal or subject to strict regulation in many countries, bodybuilders have long relied on embedded cultural knowledge to determine 'what works' in relation to these drugs, employing this 'bro science' in the (perceived) absence of reliable advice from authorities, such as healthcare providers (Monaghan, 2002; Underwood, 2017, 2024). Consequently, the dynamic folk pharmacology of bodybuilders, particularly in digital bodybuilding spaces, is important to understand, as it shapes approaches to drug use and encourages behaviours which may present particular risks in this population. This includes norms of self-experimentation with novel and emerging drugs (Turnock & Hearne, 2024) and the 'stacking' of multiple compounds in potentially risky manners (Sagoe et al., 2015), all of which can shape beliefs and use of GLP medicines and, therefore, are significant to understand for effective harm reduction interventions for this at-risk population.

Digital fitness cultures have been noted as posing particular risk of harms, since despite the prevalence of drug information in these spaces, there may also be misunderstanding or misinterpretation of this information (Tighe et al., 2017; Turnock & Townshend, 2022), which if shared uncritically by individuals perceived to be 'experts' by the community could result in widespread harms. Underwood (2024) highlights a potent example of this in relation to a group of bodybuilders' discussions of insulin, which poses a danger of hypoglycaemia if used incorrectly, but was discussed in some digital cultural spaces as being lower risk than anabolic steroids, for example. Consequently, the dynamic folk pharmacology and folk harm reduction advice shared by bodybuilders are essential to understanding user decision-making in relation to harm and risks (Gamble & George, 1997; Van Hout & Hearne, 2016; Hearne & Van Hout, 2016), particularly in relation to emergent drugs like GLP medicines, and how their use intersects with existing norms of anabolic steroids, insulin, or other drug use.

This is particularly important in the context of the increasing accessibility of emerging drugs like GLPs offered by the global connectivity of digital spaces (see Turnock & Gibbs, 2023a; Turnock et al., 2025), and the 'echo chambers' that digital spaces can create in relation to body ideals and IPED use, which leads Gibbs (2023: 101) to describing digital fitness spaces as 'the ultimate dopogenic environments' for encouraging the use of these drugs .

While online spaces may normalise or encourage IPED use, recent work has increasingly sought to understand how the folk pharmacologies of digital bodybuilding spaces positively shape understandings of risk and harm reduction behaviours (Tighe et al., 2017) and encourage the incorporation of community-led harm reduction practices (Turnock & Townshend, 2022; Andreasson & Henning, 2023; Turnock & Hearne, 2024). Underwood (2024), drawing on Duff (2009; 2010) discusses how 'enabling environments' that are supportive of health and harm reduction practices must be understood in the context of digital IPED users, with existing cultural practices around harm reduction important for public health policy to account for, and interact with. Importantly, Underwood (2024) notes the increasing incorporation of knowledge derived from scientific research into the folk pharmacologies of bodybuilders online, and how an increasingly scientifically-informed bodybuilding community shapes IPED harm reduction advice. While presenting some risk around potential misinterpretations of studies, Underwood (2024) highlights this as part of bodybuilders' communal attempts to enable *safe* drug use and notes the importance of understanding these practices and interacting with them beyond simply conceptualising folk pharmacologies as enabling use-related harms.

Given the divide between understandings of drug use in healthcare settings and the motivations and ideals of bodybuilders (Underwood, 2024; Underwood *et al.*, 2021; Turnock, 2022), this group must inherently rely on folk pharmacology – often contextually termed 'broscience' – in their drug-using routines (Underwood, 2024). As community understandings of harm reduction become ever more informed through practices such as bodybuilders' incorporation of scientific research, along with broader harm reduction approaches such as engagement with community-led drug testing and health monitoring services (Underwood, 2024; Turnock & Townshend, 2022; Andreasson & Henning, 2023; Turnock et al., 2023), understanding of these practices is increasingly significant for formulating effective public health policy that actually engages with bodybuilders' needs (Harvey et al., 2019) and existing peer-led understandings of harm reduction (Duff, 2010; Piatkowski et al. 2024a).

Consequently, this article explores the advice, understandings and harm reduction information offered in relation to GLP medicines in digital bodybuilding spaces, to understand how their folk pharmacology shapes their approach to GLP use and harm reduction, and thus their interaction with and management of risk in relation to these emergent drugs.

Methods

Findings are based on 'passive netnography' (Kozinets, 2010; Brennan et al., 2018a) of two bodybuilding forums conducted in 2024, totalling almost 12,400 unique forum posts. The project launched in September 2024, with the bulk of data analysis occurring between October and early December 2024. The research focused on two key forums, identified as the most popular bodybuilding and steroid forums via a Google search.

Forums are valuable sites for research into norms of drug use and knowledge among digital cultures, since they act as spaces for communal knowledge exchange among drug-using populations (Hearne & Van Hout, 2016; Van Hout & Hearne, 2016; Tighe et al., 2017). Consequently, the discussions of drugs which occur in these spaces can be invaluable for researchers seeking to explore emerging trends in drug use, with the pseudonymity of forums facilitating honest discussions regarding use and harms experienced (Germain et al., 2019; Turnock & Townshend, 2022), albeit with the risk that some illegitimate actors may be posting for e.g. promotion of specific sellers (Turnock & Hearne, 2024).

After identifying the relevant forums, their built-in search functions were used to find threads discussing GLPs, using terms including 'GLP', 'Semaglutide', 'Ozempic', 'Wegovy', 'Mounjaro', 'Tirzepatide', 'Liraglutide' and 'Retatrutide' (and shortened versions of these, e.g. 'Sema'). Following this, relevant threads were sampled for data collection and analysis, with relevance determined by the first author using researcher discretion regarding titles and initial readings of threads. Eighty threads was chosen as the cut-off after sorting for relevance, given the large volume of unique posts in the most popular threads, with both forums notably hosting a 'mega thread' for posting questions and experiences relating to GLPs, each containing thousands of unique posts (3823 & 3737 respectively). This provided a substantial dataset to analyse, ensuring the work met Kozinets' (R.V. 2010) requirements for scale, interactivity and heterogeneity. Table 1 details the number of posts sampled from each forum, as well as well as the mean, median and range of posts per unique thread analysed.

Table 1
Summary of posts sampled from each forum.

Forum	Total posts analysed	Posts per thread (Range)	Mean Posts per thread	Median Posts per thread
Forum 1: UK bodybuilding forum	5683	2–3825	71	14
Forum 2: International (US) steroid forum	6709	2–3737	84	20.5
Total	12 392	2–3825	77.5	16

Threads with no replies, or which had been posted by GLP/peptide suppliers for business purposes were excluded from the sample, since the former would not offer insight into community interactions (see Kozinets, 2010), while the latter presented a heightened risk of including posts by fake accounts promoting the sellers in question (Turnock & Hearne, 2024). While the earliest thread discussing GLP medicines dated from 2012 (forum 2), the majority of threads (>90 %) were posted between 2021–2024 (including both 'mega threads'), reflecting the period during which awareness of GLPs grew among the general population.

Posts were analysed following the process for thematic analysis outlined by Braun and Clarke (2006). This approach was chosen owing to its flexibility and ability to offer a rich account of the dataset (Braun & Clarke, 2006; Campbell et al., 2021). The first author developed themes inductively on first reading of the threads, before refining these themes and coding the dataset using the constant comparative method, and re-reading of the data, using Microsoft Word and Excel for this analysis. While codes were developed inductively from the dataset, there was also some deductive coding based on our folk pharmacology framework, and two of the authors' prior research into novel enhancement drugs and harm reduction advice in digital spaces (Turnock & Hearne, 2024), reflecting an inductive-deductive approach. Analyses were then checked for accuracy by co-authors, to ensure their validity. Additionally, reflecting thematic analysis' emphasis on the value of researcher subjectivity (Campbell et al., 2021), the cultural, personal and academic expertise of the research team helped guide our analyses. Several members of the research team are either former participants in competitive strength sports (1st, 2nd and 6th authors) or have lived experience of prescription GLP use (2nd and 5th authors), and all have prior experience (both personal and academic) using forums. This familiarity with the cultures, drugs and platforms studied allowed us to use our existing knowledge and experiences reflexively to guide our analyses and enhance the validity of findings (Salinas et al., 2019; Turnock, 2021a).

All names and identifying characteristics (e.g. specific locations) have been anonymised, following standard ethical practice for netnographic research (Enghoff & Aldridge, 2019), though relevant data regarding posters' genders and ages was kept where it was felt to be significant to analyses (e.g. highlighting older posters' discussion of anti-ageing use). There were no researcher interactions to elicit data from posters or deception used, and all data was sampled from 'public' forum spaces (those not requiring log in credentials to view), meaning posters would not have a reasonable expectation of privacy (Enghoff & Aldridge, 2019; Grodzinsky & Tavani, 2010). Ethical approval for the research was granted by the University of Lincoln's research ethics committee (Reference 2024–19099).

Findings

Five key themes emerged which were: Perceptions of drug effectiveness and understandings of use; GLPs' utility for bodybuilding; Anti-ageing use by older forum posters; Comparisons to 'fat burners', and; Communal harm reduction advice.

Drug effectiveness, perceived risk and understandings of use

With GLPs having recently risen to prominence in online spaces and public consciousness, there was extensive discussion regarding their use and effectiveness by bodybuilders. Bodybuilders were interested in drugs that would help them lose fat without sacrificing muscle, with many already taking weight loss medicines such as clenbuterol to help them achieve their aims of a lean muscular physique. While several posters were competitive bodybuilders looking to lose fat for competition prep, most were recreational bodybuilders looking to embody the subculture's idealised physique for aesthetic and wellbeing motivations without actually stepping on stage. In both cases, drugs that would facilitate fat loss were of great interest, leading to a lot of discussion relating to the emerging category of GLP medicines.

While some threads included sceptical queries regarding whether GLPs were really the 'miracle drugs' media outlets portrayed them as being for fat loss, among those who had used GLPs many extolled their effectiveness, with discourse often paralleling broader cultural messaging regarding their 'miraculous' effects:

> *'Generic unlabelled Semaglutide is the best thing since sliced bread. You just forget to snack, and a 2 scoop whey shake fills you up.'*

> *'The stuff is nothing short of miraculous when it comes to weight loss.'*

While some posters noted they had experienced negative side-effects from use, including nausea, fatigue, gastrointestinal issues and cramping, these side-effects were often considered minimal compared to other bodybuilding drugs (e.g. anabolic-androgenic steroids (AAS); 'fat burners'), and the perception among GLP users was that the drugs were effective for suppressing appetite, and reducing bodyfat.

While GLPs were broadly seen as effective, one significant topic of discussion related to tolerance, and the perception that GLPs became less effective after prolonged periods of use. Many posters felt the benefits from GLPs diminished over time, and consequently several threads asked about approaches to altering one's dose when effectiveness declined:

> *'Just wondering if anyone has any experience with lowering Tirzepatide tolerance. I have been on 10mg/week for about 6 months now and I don't even think I feel it anymore… I'm wondering if stopping for about a month or maybe temporarily switching to or adding Semaglutide will help?'*

One emergent communal pharmacological approach to addressing this perceived tolerance was the process of 'cycling' between different GLPs, usually Semaglutide and Tirzepatide, to lessen tolerance to one drug by 'coming off' while using the other. The process of 'cycling' drugs to allow receptor sites to rest is common among AAS users (Monaghan, 2002; Sagoe et al., 2015), so the development of this approach to GLP use appeared to derive from existing subcultural understandings:

> *'I've noticed swapping GLP-1s when tolerance builds is also effective. Recently swapped from Tirzepatide to Semaglutide and it feels like a complete reset on tolerance and appetite suppression, so I'll be rotating back and forth between these going forward.'*

In addition to 'cycling' between compounds, some users also suggested 'stacking' (Sagoe et al., 2015) different GLPs as a means of addressing the perceived 'drop off' in efficacy one would see on a single compound:

> *'I've been using [Tirzepatide] over a year. At 12.5* mg *[per week]. Still works great for me… I'll take a low dose of 0.5* mg *Semaglutide somewhere in the middle when I start to get hungry again and it totally kills the appetite until my next Mounjaro shot. Killer combo.'*

While clinical protocols do not recommend 'cycling' or 'stacking' GLPs in this fashion, self-experimentation of this type is popular within the bodybuilding community as a means of discovering 'what works', and the results of such self-experimentation are frequently shared with others (McVeigh et al., 2021a; Underwood, 2024; Piatkowski et al., 2024a). Several forum posters remarked that they were able to maintain their weight-loss progress by following this pattern of 'cycling' between GLPs, leading to other posters suggesting they would do similar. Importantly, this illustrates how bodybuilders attempted to apply their existing folk pharmacologies of steroid use to emerging and novel compounds, in manners which did not draw on scientific understanding of these new drugs, but presupposed their existing 'tools' for effective use of other compounds would be applicable to them.

Despite the seeming effectiveness of 'cycling' between GLPs, however, one 'expert' user (see Christiansen et al., 2017) on forum 2 suggested that these commonly held perceptions of GLPs becoming less effective over time were based on a flawed understanding of their

mechanism of action, and that weight-loss slowing did not in fact represent building 'tolerance'. Expert users are those whose approach to IPED use is based on synthesising knowledge from a range of sources (online fora, scientific papers, experiential knowledge) to understand the pharmacological properties of drugs used and their effects on human physiology, often adopting a more scientific approach than other IPED users (Christiansen et al., 2017). On digital bodybuilding forums, these expert users often filled role of Southgate and Hopwood (2001) 'network nannies', disseminating understanding of best practice and scientific knowledge to other forum members, based on their research and experience. In this instance, the expert in question, a long-established forum member, used the analogy of a thermostat in a home to illustrate why stacking and cycling GLPs was not an optimal approach, despite its historic use by bodybuilders for other drugs:

'There continues to be a fundamental misunderstanding of how these drugs work. They're not diet pills that induce appetite reduction when you take them. They're hormones that set the body's weight regulating "thermostat" to a lower level… once the "setting" is reached appetite suppression weakens, then stops. … To lose more weight you have to increase the dose, effectively lowering the "thermostat" further.'

Evidencing this claim, the poster pointed to clinical studies showing that, following weight reduction in people who used GLPs, they did not 'rebound' to a higher weight if they stayed on the maintenance dose. This meant the drugs were continuing to work despite weight-loss slowing, or even stopping:

'Another long term study [on patients] using a Tirz maintenance dose [found they were] not regaining weight for the entire 3 year study period. Further evidence tolerance doesn't develop … It sounds plausible, so I can see why so many buy into it, but it's just not the case.'

When met with pushback on this claim, this expert poster pointed to testosterone replacement therapy (TRT) as a parallel example where tolerance does not develop, but gains from use decrease once the individual's new 'normal' is reached:

'And just like TRT, there is no tolerance that develops over time requiring a higher dose. If that were the case, we wouldn't see weight stabilized for years with subjects staying on the same dose.'

This indicates that examples of self-experimentation premised around addressing the development of tolerance, although seemingly effective in returning the individual to their desired weight-loss state, may in fact misunderstand the biochemical realities of GLPs. Expert users sharing findings from clinical studies as a means of complimenting the self-experimentation that forum posters were undertaking thus helped to refine their communal folk pharmacology. This reflects Underwood (2024) observations regarding how bodybuilders have moved beyond a simple 'what works' approach to also aiming to understand 'why', incorporating what scientific knowledge regarding IPEDs they are able to access into their folk pharmacology.

Despite the knowledge from clinical studies posted by this expert user, some form of drug 'tolerance' per lay understandings did seem to exist for GLPs, as those who did not gradually titrate their dose, or who returned to the same dose after a period off using, would experience notable negative side-effects:

'I jumped back in on my old dose which was too high, I spewed up in the night and next morning.'

While a scientific understanding of how GLPs work was important, posters also needed to be aware of the impact of reduced 'tolerance' to these drugs from a lay perspective, and consequently even among those who conceptualised decreasing efficacy in line with the thermostat analogy, new or returning users were still cautioned to 'start low, go slow'.

Utility for bodybuilding

A significant topic related to the potential utility of GLPs for bodybuilding, particularly regarding whether they were a benefit or detriment when it came to cultural goals of attaining a 'ripped', 'lean' muscular physique (Piatkowski et al., 2020). While many posters were positive about GLPs' abilities to aid their 'cutting' regimes (removing fat while maintaining as much muscle as possible), several posts discussed the muscle wastage associated with GLPs (see Blum, 2024), and suggested this made them unsuitable as bodybuilding aids:

'it's not good for bodybuilders as it literally totally removes any and all appetite … If you don't eat then your muscle will soon start to be used as fuel for the body.'

References were made to celebrities who had used the drugs, and the gaunt or 'skeletal' appearance they had. Given this, opinions on GLPs were split, with some suggesting they would stick to more subculturally-conventional thermogenic and stimulant drugs (Clenbuterol; Ephedrine; T3) to ensure they did not lose too much muscle when cutting.

Despite this, a significant number of bodybuilders were using GLPs, and several argued that they were useful in curbing bad eating habits relating to food cravings and binge eating, allowing them to plan their meals more effectively:

'it's great for bodybuilding to make it easier for me to eat clean and not to binge'

Indeed, some advocates of GLP use noted there were solutions to getting in enough protein to minimise muscle wastage, even when eating very few calories:

'It's great during cutting. You can have three two-scoop whey protein shakes a day, a couple of omelettes. It even works for me in my late 50 s.'

Another argument in favour of GLPs for bodybuilding was that, despite muscle wastage being associated with use, for bodybuilders who were already taking AAS these effects would be offset by the anabolic/anti-catabolic effects of the steroids. Asked if he was sacrificing muscle by using GLPs to keep his calorie intake very low, one experienced older bodybuilder replied:

'If you are on a reasonable amount of AAS … I'm of the opinion (and in my experience) that muscle loss is not an issue.'

This approach was mirrored by several others, who suggested that a 'TRT dose' of Testosterone (see Underwood et al., 2021) would be sufficient to avoid muscle wastage when using GLPs:

'If you eat enough protein and add TRT Test or 250 mg Test you won't lose muscle.'

Referring to their pharmacological effects, one user highlighted how GLPs aren't catabolic, with muscle wastage coming from the restriction of calories. This made them preferable 'cutting' agents to stimulants, which are directly catabolic:

'There is no direct pathway [by which] GLP-1 causes catabolism. If anything it's the opposite since it enhances insulin sensitivity.'

Beyond their use for fat loss, there was interest among some of the expert bodybuilders in the broader health benefits of GLPs. Specifically, for bodybuilders using drugs like human growth hormone that affect blood glucose levels, the use of GLPs to counteract these effects was seen as a means of boosting health, even when not looking to lose weight:

'some people use it for other purposes as well, specifically those on HGH to reduce blood glucose and to increase insulin sensitivity.'

'Semaglutide seems to make a nice match with GH to combat the higher blood glucose levels.'

Significantly, owing to their effects on insulin sensitivity, some

bodybuilders suggested that GLPs could be beneficial to training and body goals outside of the 'cutting' period, and would be valuable during the mass gaining ('bulking') portion of their training routines, providing they were used in a low enough dose to not fully suppress appetite:

'Would like to hear some thoughts on using low dose Ozempic for bulking. On paper it seems like it is the same as running low dose insulin, with additional benefits of increased insulin sensitivity.'

Another poster replied to this query noting that Tirzepatide would be better if this was the intended use, since it is also a GIP (Gastric inhibitory polypeptide), meaning it actively stimulates insulin, beyond what is seen for other GLPs:

'Tirzepatide is a GIP and GLP-1 agonist. Everything else is only GLP-1.

GIP helps with insulin production and regulation.'

Tirzepatide being an insulinotropic compound is supported by clinical research (Rosenstock et al., 2023), meaning the poster's assertion that Tirzepatide is valuable to add if one wants the same effect as taking low-dose insulin is likely accurate. Insulin is a popular drug among bodybuilding communities, owing to its ability to stimulate muscle protein synthesis, enhancing muscular hypertrophy. Given the potential dangers of using insulin as an anabolic agent, most notably the risk of hypoglycaemic shock (Piatkowski & Cox, 2024; Underwood, 2024), the possibility of Tirzepatide fulfilling the same function as low-dose insulin for bodybuilders offered a potential safer alternative to integrate into their communal folk pharmacology. Indeed, with many bodybuilders stating they felt Tirzepatide was more effective for fat-loss than Semaglutide, it is likely that Tirzepatide will become an increasingly mainstream drug within this subculture for both purposes, and this knowledge will likely be disseminated to broader gym cultures as a result (McVeigh et al., 2021a). GLP use might consequently replace the use of more risky peptides like insulin among some users (older; more risk aware) as these drugs become increasingly understood within gym subcultures.

Anti-ageing and older bodybuilders' use

Several forum users were middle-aged or older adults (often in their 50s) who highlighted the potential for GLPs to be used for anti-ageing purposes, particularly regarding anti-inflammatory effects. When examining emerging drugs, their use in novel or unapproved ways is particularly significant to explore, since such use may present different risks, or highlight particular sub-populations in need of tailored harm reduction interventions (Hearne et al., 2024). While bodybuilders' use of enhancement drugs has traditionally focused on building muscle or losing fat, recent research has highlighted how, among older trainers, this intersects with wellbeing motivations relating to anti-ageing, such as a desire to reduce inflammation or increase subjective feelings of youth, in addition to appearing more youthful (Van Hout & Hearne, 2016; Turnock, 2022; Gibbs, 2023; Turnock & Hearne, 2024). While much research has noted GLPs use for weight loss purposes, there is limited research into their off-label use for anti-ageing among older populations, despite awareness of these potential applications now reaching mainstream outlets (see Hancock, 2024).

Turnock and Hearne (2024) note how the use of novel peptides to off-set the negatives associated with ageing is increasingly common among older gym trainers, and encouragement to use these emerging drugs for such purposes common in digital fitness forums. Building on this analysis, we found several posts by older individuals (40+) who used GLPs as part of their broader drug routines for the health and anti-ageing benefits they appeared to offer:

'Tirz is my go-to for painless knees.. not Deca, not NSAIDs. 1–2 mg *per week is all I (k)need:)'*

These motivations intersected with the above-noted benefits of GLPs to insulin sensitivity, which in addition to being important for those using human growth hormone (a common anti-ageing lifestyle medicine), was relevant to older trainers, for whom the risk of developing insulin resistance is higher:

'This is what I was alluding to with us older folks. You can be doing everything right but some people when they get older have poor insulin sensitivity. Semaglutide improves this enormously and makes your body operate like it's supposed to when you were young.'

Subjective feelings of youthfulness is a major factor motivating off-label enhancement drug use (Hearne et al., 2024), and the prevalence of these narratives among bodybuilders suggests that such motivations will be important to public health research, as understandings of GLPs' potential anti-ageing benefits lead to more individuals taking them for these off-label purposes. One clear example was a discussion of cholesterol and fatty liver disease, where one poster who had been using Tirzepatide noted its benefits for these purposes, which again supported the suggestion that older individuals – and particularly bodybuilders using steroids – would see benefits to using these drugs beyond just weight control:

'At this point 15 mg *Tirz maintenance has kept LDL/HDL near perfect. Once I switched from Sema to Tirz (specifically based on the early stage research showing GIP's liver benefits) liver fat cleared and completely reversed the liver scarring caused by stage 1 Non alcoholic fatty liver disease.'*

This poster suggested to others that if they had long-term high cholesterol, they likely had undiagnosed fatty liver disease, and recommended they use Tirzepatide, again reinforcing that many anti-ageing users were taking these drugs for health and wellbeing motivations beyond those for which they are clinically approved and prescribed, as the folk pharmacology of bodybuilders integrated these alternative uses.

Notably, some posters cited ongoing studies into the broader health and anti-ageing effects of GLPs, suggesting that this indicated they likely had benefits for older users beyond fat-loss and insulin regulation:

'there is much more to Semaglutide/GLP-1 agonists apart from their diabetic features. In US, they are being clinically studied for heart insufficiency which peaked (sic) my interest.'

Informed posters sought to integrate scientific knowledge into the forums' communal folk pharmacology, linking to studies that highlighted potential benefits of use in ways that were not presently fully understood. With several recent publications indicating that GLPs could have beneficial effects on cardiovascular health (Dalsgaard et al., 2017; Ferhatbegović et al., 2023) and combatting neurological degeneration (Hölscher, 2022), older bodybuilders' posting of such studies illustrates how it was not only young men at the forefront of experimental approaches to use, but that those with anti-ageing motivations were similarly engaging in self-experimentation with compounds beyond their currently-approved uses, based on what clinical information was accessible.

Notably, many posters also voiced a preference for GLPs because they did not have the same negative effects, such as strain on the heart, as other 'cutting' compounds used in bodybuilding, which posed a heightened risk when older:

'I'm a bit old for Trenbolone'

These findings highlight the benefits GLPs were felt to have for bodybuilders beyond reducing appetite, and further support the suggestion that research must seek to understand older men's motivations for drug use specifically, as a historically under-explored, yet important, population in IPED research (Hearne et al., 2024). With an increase in lifestyle medicines for wellbeing and anti-ageing purposes occurring (Turnock & Gibbs, 2023a; Turnock, 2022), linked to broader cultural messaging around wellbeing and the pharmaceuticalisation of what was

once considered 'healthy ageing' (Dunn et al., 2021; Walley, 2002; Hall, 2019), the use of GLPs for attaining these goals of subjective feelings of wellbeing when older is important to account for in public health policy formation.

Comparisons to 'fat burners'

Another key discussion topic related to how GLPs compared to 'fat burners' including ephedrine, clenbuterol, T3 and 2,4 dinitrophenol (DNP). While these drugs have long been used by bodybuilders as part of their 'cutting' routines and have spread to recreational trainers (Sagoe et al., 2015; Germain et al., 2019; 2021), rising GLP availability and understanding of their utility appeared to be disrupting existing understandings of 'fat burner' utility. Notably, when posters who appeared less experienced with 'cutting' compounds and protocols asked which drugs they should use, they were increasingly directed towards GLPs:

'I was told by someone on Reddit to use T3 and Adderall for big results'

'You're taking Adderall… To suppress appetite?… Take some Semaglutide.'

Beyond recommending GLPs as a safer alternative to stimulants, there were further reasons why posters recommended them over 'fat burners' relating to their physiological effects:

'GLP1's aren't catabolic. T3 is.'

While numerous stimulants were discussed, the main drug GLPs were compared to was the metabolic drug DNP, which is often regarded by bodybuilders as the most effective means of cutting fat (McVeigh et al., 2017; Petróczi et al., 2015). However, DNP is also one of the most dangerous fat-loss drugs, owing to its severe side-effects and risk of fatality (usually by hyperthermia) on overdose (Grundlingh et al., 2011; Petróczi et al., 2015). The forums, hosting several bodybuilders who had used DNP, consequently featured significant discussion regarding how GLPs compared to DNP when it came to removing visceral fat:

'DNP blitzes fat like there's no tomorrow, visceral fat also which is very difficult to do on just a calorie deficit [as Semaglutide facilitates].'

'Of course you must first be aware of the safety profile, but DNP is probably more suited to BB purposes … This is absolutely NOT a suggestion, however.'

Despite several experienced bodybuilders suggesting that DNP was the most effective drug for reducing bodyfat, many considered the risks to far outweigh its positives compared to GLPs, especially among older or less experienced users:

'I'm just about to turn 50 myself so nice to hear of a potentially safer compound for losing bodyfat (Clen is bad for the heart, Ephedrine and other stims ALSO bad for the heart, DNP just a stupid suicidal drug that literally NO ONE with a brain would go near!)'

Consequently, GLPs were increasingly recommended more frequently than DNP, with generic 'cutting advice' or fat-loss advice threads nearly always featuring GLPs as the main recommendation, upending historic forum norms. As one poster noted in a thread debating the use of DNP compared to Semaglutide:

'Now that generic Semaglutide is cheap and widely available on steroid websites [DNP's] likely to fall out of use.'

Even among experienced bodybuilders who had used DNP previously, the rising availability of GLPs led to a shift in their approach to fat-loss drugs:

'I had run a number of DNP cycles in the past and let me tell you it comes with its own bag of negatives. Overall I'm more happy with Sema/Tirz for my particular usecase, i.e. *not having food to dominate my thoughts, be able to function both in daily life and in the gym, and lower my body fat at the same time.'*

With this shifting understanding of effective fat-loss compounds, GLPs were increasingly preferenced in the folk pharmacology of bodybuilding forums over DNP, despite the latter's acknowledged effectiveness. The emergence of new drugs that were also effective but much lower risk compounds thus led to a shift in communal understandings of 'best practice' for weight cutting, even if DNP was still accepted as having a role for experienced, informed users.

Communal harm reduction advice

With bodybuilding forums popular among experienced IPED users, there was a significant degree of knowledge dissemination related to perceived 'best practice' when using GLPs, and the offering of dosing and harm reduction advice. While forums may facilitate or encourage IPED use, their status as sites for knowledge production and diffusion regarding safer approaches to use has been documented (Turnock & Townshend, 2022; Andreasson & Henning, 2023; Turnock & Hearne, 2024; Underwood, 2024). With GLPs being emerging drugs, the role of such harm reduction advice is therefore significant to understand.

One way of minimising harms was recommending the 'start low, go slow' approach already espoused by experienced users in relation to AAS:

'The only recommendation I could offer is start low, titrate your dosages.'

With AAS having worse side-effects when used in greater doses (Piatkowski et al., 2024b), existing norms of advising individuals to 'taper on' to their cycles were carried across to GLP advice, to avoid harms occurring from use when unsure of how one's body would react to the drugs. Similarly, users were discouraged from increasing their dose too rapidly, with posters suggesting they should use the 'lowest effective dose' for their goals:

'As with any drug, take the lowest effective dose. If you feel it is still effective enough, I would not increase the dose. If you feel like the effect is diminished so much that it isn't doing the job anymore, then up it.'

Alongside these dosing recommendations, the advice of 'just stop' when experiencing unexpected or particularly severe side-effects was commonly shared:

'I would stop the Sema for a couple weeks to see if that is the culprit.'

These approaches to harm minimisation are normal among experienced IPED users, where tapering onto drugs, and stopping if unexpected side-effects present are common practice (Turnock, 2018). The prevalence of such advice being offered in relation to this emergent category of drugs highlights the position that harm reduction holds in bodybuilders' communal understandings of drug use. This is in contrast to less-informed user cultures (e.g. general aesthetics and lifestyle trainers), where riskier approaches to use may be more prevalent (Christiansen *et al.*, 2017; Turnock, 2018).

An interesting divide in advice offered related to the debate over whether clinical dosing protocols should be followed when using GLPs for bodybuilding. With clinical trial data on GLP effectiveness accessible, in contrast to other IPEDs, where self-experimentation and 'broscience' must be relied upon (Underwood, 2017), bodybuilders discussed whether the protocols recommended from these trials should be followed, rather than the community self-experimentation that is typically relied on for AAS:

'I personally would only dose as high as any study that has been done in a large clinical trial. For semaglutide that's 2.4 mg max *I think.'*

When one user raised the potential of 'microdosing' with 100mcg five times over the course of a week rather than 0.5 mg once a week per the medical guidelines, this was met with the suggestion that the clinical

protocol of injecting once a week might be the optimal way to dose GLPs:

> *'A lot of people here feel benefits from microdosing TRT/gear, so microdosing all medicine should be better. Maybe for some drugs, but there are a lot of actual clinical trial data for weekly dosing of GLP1s. Not just broscience & anecdotes.'*

This highlights how bodybuilders are increasingly looking to incorporate scientific information on the drugs they use into their folk pharmacologies (Underwood, 2024) and base their drug dosing routines on such research. Despite these suggestions, however, some posters recommended going beyond clinical guidelines, noting that these were designed around 'normies' without experience of using IPEDs, and that experimenting to find what were perceived to be more 'optimal' drug routines was beneficial to bodybuilders, reflecting their historic experimentation with other drugs (principally AAS) to find 'what works':

> *'You're much less likely to get nausea with two 0.25* mg *shots a week. Bodybuilders… can titrate our dose much better than "normies" on the NHS.'*

The development of a folk pharmacology combining self-experimentation with discussion of clinical guidelines and emerging studies therefore led to significant discussion and information sharing regarding what was felt to reduce the side-effects and other harms associated with GLP use most effectively, paralleling the ways in which forums have previously been observed to encourage informed use of AAS (Underwood, 2024).

Beyond dose-related discussions, harm reduction advice also focussed on the potential polypharmic risks of compound combinations. With many bodybuilders taking GLPs alongside AAS (and indeed, advising doing this to counter muscle wastage), one expert user pointed out that, although GLPs have relatively low risk profiles, there were potentially synergistic effects on insulin sensitivity between GLPs and steroids like Trenbolone:

> *'All AAS are insulin sensitizing and, in fact, a standard warning with GLP-1 & GIP agonists is to be careful to adjust dose down when combining androgens with them (because of hypoglycaemic risks) … they are synergistic in insulin sensitizing effects. Tren & Superdrol are clearly very potently insulin sensitizing (reduce blood glucose).'*

While not telling bodybuilders to avoid mixing AAS and GLPs, this expert poster nonetheless made sure the forum was aware of these risks by sharing information in the main GLP 'mega thread'. This knowledge dissemination was clearly needed, since later in the thread someone queried whether anyone had experience of combining these drugs, and one poster reported harms from the identified synergistic effect:

> *'Anyone used Semaglutide with Tren?'*

> *'[Member] did and he suffered from hypoglycaemia. He had to take a few days off of work. I warned him.'*

This post generated interest from several forum members, since Trenbolone is a favourite drug for 'cutting' among many bodybuilders, so knowing GLPs could potentially cause harm if 'stacked' with this drug was important to informing communal understandings of drug protocols:

> *'First I'm hearing about drug interactions with Sema. Is it just Tren?'*

> *'Sema increases insulin secretion. Tren increases sensitivity. I want to say he was on metformin (Glucophage) too … It's not just interaction between drug-drug but also the effects on the body.'*

While these posts highlighted a potential risk of using this combination of drugs, several others noted they had successfully used GLPs alongside Trenbolone, and simply had to moderate their doses. It therefore seems this risk was only present among those using both drugs at a moderate-to-high dose, however the sharing of such harm reduction information regarding under-promoted compound synergy is important in spaces like forums, where the use of novel compounds in experimental ways occurs. The advice-sharing norms of forums thus helped to identify potentially harmful practices and diffuse this information to those at risk of harm.

Discussion

Given the increasing popularity of GLP medicines, and their rising off-label use and illicit market access, this research offers novel insights and significantly contributes to knowledge regarding how these drugs are used within digital bodybuilding cultures, which is important to understanding the particular risk practices and harm reduction needs of this population. GLP use among bodybuilders had been unexplored, and given bodybuilders' norms of self-experimentation with novel compounds, forms of use, and polysubstance use (Sagoe et al., 2015), as well as their dissemination of folk pharmacological knowledge to others (McVeigh et al., 2021a), this work significantly improves our understanding of off-label GLP use.

Forums commonly recommend GLPs for weight-loss, and most weight-loss advice threads on the two forums studied featured frequent recommendations to use GLPs. Importantly, the polysubstance use of multiple GLPs was commonly recommended to address perceived 'tolerance' building up. These recommendations appeared rooted in self-experimentation, and recommendations to 'cycle' and 'stack' GLPs were linked to the development of similar strategies among bodybuilders for the use of AAS previously (Monaghan, 2002; Sagoe et al., 2015), based on self-experimentation. While these methods appeared effective in restoring the intended weight-loss state, the use of GLPs outside of clinical doses and in combination with one another presents potential risks, heightened further if these folk understandings of use are popularised and disseminated through these digital platforms. Given the potential synergistic effects between drugs, and the risk of events such as hypoglycaemia being posed by GLP overdose, norms of 'stacking' GLPs are important to be aware of from a public health perspective, and the dangers of such practices must be explored further if they are as commonplace as our findings indicate.

Findings regarding GLPs' utility for bodybuilding further highlighted how prevalent norms of 'stacking' GLPs with other drugs – principally AAS – are within this community, building on prior works regarding polysubstance use among IPED users (Sagoe *et al.*, 2015; Salinas *et al.*, 2019; Turnock, 2021b). Bodybuilders frequently 'stacked' GLPs with AAS to minimise the muscle wastage effects of GLPs, with forum folk pharmacology encouraging GLP users to take testosterone and other AAS when 'cutting' to maintain their muscle mass. While an unsurprising finding by itself, the fact that GLPs potentially interact with insulin sensitising AAS like Trenbolone highlights a potential risk that encouraging such norms of polypharmacy may present to bodybuilders and others looking to use GLPs to achieve a 'ripped' physique. Additionally, the use of GLPs as a means of regulating blood glucose levels when using human growth hormone is another common form of polypharmacy that is not currently understood clinically, but may pose a potential risk. Continued research into polypharmic practices among GLP using populations, and health monitoring of off-label users like bodybuilders will therefore be important to pursue, with initial data from our netnographic research already indicating harms occurring through such drug 'stacking'.

Additionally, it is notable that a preference for 'generic' (counterfeit) versions of these drugs was highlighted by several bodybuilders, owing to the ease of access and cheapness of these illicit market products compared to pharmaceutical-grade branded product (see Turnock, Hearne & Lazuras, 2025). Given prior instances of harmful GLP substitution in the illicit market (Thomas, 2023), and risks that product bought through these means may be incorrectly dosed (Ashraf *et al.*, 2024), the prevalence of recommendations to use these products poses a potential risk to public health. In addition to education regarding the

dangers of 'stacking' GLPs, it may also be important to consider policies such as drug checking services (Piatkowski *et al.*, 2023; 2024c) to highlight any potentially dangerous or poor-quality products being sold through these illicit channels. These policies are important to reduce harms to users, given the challenges of attempting to regulate supply in a globalised marketplace (Turnock & Gibbs, 2023a).

Anti-ageing was a significant motivation for use identified in the research, and paralleling the existing literature on other novel peptide compounds (Van Hout & Hearne, 2016; Turnock & Hearne, 2024), older bodybuilders are experimenting with GLPs to offset inflammation, everyday pains, and subjective feelings of ageing. Anti-ageing treatments are increasingly popular, as broader cultural messaging promotes the notion that we must feel – and look – 'well' in older life (Cederström & Spicer, 2015; Hall, 2019), with natural ageing processes increasingly pharmaceuticalised (Dunn et al., 2021). As with the use of illicit market testosterone for the purpose of self-medicated TRT (Turnock, 2022; Underwood et al., 2021), our findings point to the need to monitor older men's use of enhancement drugs specifically, as a population with their own motivations and understanding of use, and therefore risk profile (Hearne et al., 2024). With recent news articles discussing the potential benefits of GLPs for anti-ageing (e.g. Hancock, 2024), it is clear that this is an emergent form of drug use, and likely significant to monitor going forward.

One area where the transition towards GLP use may reduce harms among illicit market buyers is in relation to the use of 'fat burners' – most notably DNP – which were once staples of bodybuilders' drug routines, but posed significant risk (Petróczi *et al.*, 2015). With the rising popularity and accessibility of GLPs, posters in our research felt these would replace the use of DNP for many, other than the most experienced and competitive bodybuilders, which could lead to DNP falling out of popularity, and becoming less accessible. While this will need continued monitoring, the increasing emphasis on GLP use could thus result in less harms relating to riskier drugs like DNP, should other populations interested in weight-loss similarly transition towards GLP use as an alternative. This again highlights the potential benefits of forums in disseminating advice that serves to reduce harms and promote health (Underwood, 2024), highlighting the need for policy to interact with existing communal understandings of drug use.

Finally, the role of forums as sites where information on 'best practice' regarding the use of emerging drugs is shared highlights the importance of understanding their role in knowledge production and dissemination. Bodybuilders used both their self-experimentation with compounds, and their interpretation of scientific publications to advise on the most appropriate doses and drugs to use, and how to minimise perceived harms when using GLPs. This highlights the importance of acknowledging the harm reducing potential of forum spaces (Turnock & Townshend, 2022; Underwood, 2024), though our findings also point to potential risks presented by the advice offered in these spaces. Notably, we recorded some users recommending running AAS alongside GLPs to off-set their muscle wasting effects, while other posters highlighted the risks of 'stacking' GLPs with AAS in this manner. Consequently, those exposed to positive messaging relating to the use of GLPs without accessing the information regarding harmful polypharmic effects highlighted in forum 2's 'mega thread' could potentially harm themselves following what appeared (from the earlier threads) to be agreed 'best practice'. It is therefore clear that public health policy must account for the fact that these spaces are the primary resources many IPED users will consume, and may encourage harm reduction behaviours, but also present a risk of encouraging potentially harmful behaviours. With polysubstance use identified as one of the encouraged practices most likely to cause GLP-related harms, it is important to ensure knowledge on their interactions with other drugs are incorporated into any efforts to educate IPED users on risk, with engagement with existing forum-based harm reduction norms a potential area on which to focus such efforts.

Limitations

This research was an in-depth netnography of two forums, and is thus specific to the culture of the forums studied, meaning findings may not be generalisable beyond the specific populations explored (users of these online bodybuilding forums). Notably, forum 1 was a UK-based forum and forum 2 US-based, and while users from across the globe may access either, there is a strong possibility that understandings of GLP use will vary depending on geographic and cultural locale, in addition to sub-cultural affiliation.

Additionally, given the pseudonymous nature of digital forums, claims regarding e.g. age of participants or their experiences are based solely on the claims of these individuals being taken for granted, and naturally cannot be verified as true. While such data is likely still indicative of the experiences of forum users, it is possible for anonymous forum users to invent stories or make unverifiable claims, which must be kept in mind when extrapolating from such data.

Finally, given we did not select any women's-only forums for the research, our data overwhelmingly focusses on male bodybuilders' understanding of GLP medicine use, with most posters in these forum spaces being male. Given both men and women are likely to have an interest in these drugs, it is clear that further research looking specifically at female bodybuilders and fitness enthusiasts would be valuable to pursue to ensure their experiences are not sidelined in and harm reduction policy formation (see Van Hout & Hearne, 2016)

Conclusion

This study has highlighted the complexities surrounding the off-label use of GLP medicines within bodybuilding communities, providing insights into the folk pharmacological practices, harm reduction strategies, and emerging norms within these spaces. As GLPs gain popularity, their integration into bodybuilders' drug routines underscores the need to address potential risks, particularly those arising from polysubstance use and illicit market access. Forums play a dual role, fostering harm reduction while simultaneously amplifying experimental practices that may carry unforeseen dangers. A nuanced public health approach, incorporating the realities of digital bodybuilding spaces and the motivations of their users, is essential to mitigate harms and better understand the implications of this evolving trend.

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Luke A. Turnock: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Evelyn Hearne:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Jennifer Germain:** Writing – original draft, Validation, Formal analysis. **Mikey Hirst:** Writing – original draft, Validation, Formal analysis. **Honor D. Townshend:** Writing – original draft, Validation, Formal analysis. **Lambros Lazuras:** Writing – original draft, Validation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors have no competing interests to declare.

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