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Made in China: The international supply of illicit Semaglutide and weight-loss medicines online

Luke A. Turnock^{a,*} , Evelyn Hearne^b , Lambros Lazuras^c 

^a School of Social and Political Sciences, University of Lincoln, Lincoln, UK

^b Public Health Institute, School of Public & Allied Health, Liverpool John Moores University, Liverpool, UK

^c School of Psychology, Sport Science & Wellbeing, University of Lincoln, Lincoln, UK

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ABSTRACT

Background: The use of GLP-1 medicines for weight-loss purposes is increasingly widespread. While these drugs are available as prescription medicines in the UK, there is an expansive illicit market for their supply operating online. This study investigates the scope and impact of illicit weight-loss medicines supplied online through a scoping review of an e-commerce platform – Made-in-China.com – where a large number of Chinese-based sellers are advertising GLP-1 medicines and related weight-loss drugs to European consumers.

Methods: The researchers undertook a preliminary examination of available product and supplier pages on Made-in-China.com through a search of 10 key terms relating to weight-loss medicines, and qualitative analysis of product and seller pages for the first 30 results returned for each term. Data from these pages was analysed thematically. All searches were conducted in a single month in 2024.

Findings: document how the platform operates, including ease of access, the extent of weight-loss medicine listings offered, and how product is promoted by sellers, including warnings of product being 'for research use', as well as physique-related promotional imagery. We explore the potential harms of counterfeit semaglutide being sold in branded packaging that suggests it may be 'legitimate', as well as how sellers advertise their 'legitimacy' to potential buyers through details of shipping practices, images of lab equipment, and claims of lab tests to verify product quality.

Discussion: We consider how public health policy should address the potential harms arising from this website, with particular focus on the easy access to counterfeit prescription-only medicines provided by platforms such as made-in-china.com, which are likely to be substandard and pose a potential risk to users. We also consider the difficulties of regulating international drug supply in the context of differing legal jurisdictions, and the need to educate the public on the risks of illicit market GLP-1 medicines.

Introduction

Semaglutide is a glucagon-like peptide-1 (GLP-1) receptor agonist recently approved as a prescription weight-loss medicine (Wegovy) in the UK (DHSC, 2023). It is an insulin-regulating compound (incretin) previously approved to treat type-II diabetes in a number of countries under the brand name Ozempic. However, since 2022, the drug has garnered a reputation online as a 'miracle drug' for weight-loss, with an explosion of social media interest and Google searches for the drug occurring that year (Kolovos, 2022; Han et al., 2024). This was partially fuelled by various public figures such as Elon Musk commenting on Semaglutide's effectiveness for weight-loss on social media platforms

(Han et al., 2024), which prompted social media interest in the drug's off-label use.

Kolovos (2022) notes how by May of 2022, posts using the hashtag #Ozempic had already reached 74 million views on TikTok alone, with many other hashtags associated with GLP-1 medicines being viewed across not only TikTok, but other social media platforms too. Han et al. (2024) show that interest in Ozempic exploded in 2022, with a Google Trends analysis showing a steep increase in relative search volume for the term, reaching approximately seven times its 2021 peak by December 2022. Consequently, a large number of social media users began to share their intent to use, or recommendations for using GLP-1 drugs on a variety of platforms. Basch et al. (2023) note that the 100

* Corresponding author.

E-mail address: LTurnock@lincoln.ac.uk (L.A. Turnock).

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most popular Ozempic-related videos posted to TikTok at this time most commonly featured discussion of using or intent to use the drug (69 %), with 57 % explicitly discussing its use for weight-loss. These videos collectively gained millions of views, and similar patterns were observed in a recent analysis of Reddit posts regarding the drug posted between April 2019 and December 2023 (Fong et al., 2024), where discussions of use were extremely prevalent (46,491 posts across three subreddits), but knowledge of potential harms limited.

Subsequent to this increased interest in the drug's potential off-label benefits, many users without a medical need began taking Semaglutide and related GLP-1 drugs off-label for lifestyle purposes, primarily to lose weight, but also for purposes such as anti-ageing and enhancing subjective feelings of youthfulness (Turnock et al., forthcoming). This explosion of interest in the drugs led to reported shortages in supply affecting those with a medical need for use, with Kolovos(2022) highlighting how this 'unexpected increase in consumer demand' for weight management was 'significantly affecting people using Ozempic for its approved use for type 2 diabetes' who were no longer able to acquire it. Notably, social media was flooded with a plethora of advertisements for online beauty and weight management clinics promising GLP-1 drugs at this time, which did not meet regulatory guidelines for advertising prescription-only medicines (MHRA, 2023; Hirst and Turnock, 2024), indicating the difficulties existing regulatory agencies faced in light of this explosion of interest in their off-label use.

The diversion of medicines to the illicit market is a common phenomenon, and low-level employees in healthcare and pharmacy related sectors, as well as transportation and warehousing, may be stealing or redirecting medicines intended for the legitimate supply chain (Duggan and Sidoti, 2022), with some off-label use thus drawing from stocks intended for prescription users of medicines (Kolovos, 2022). However, a significant proportion of illicit medicines may also be counterfeit, falsified, unlicensed or substandard medicines produced in countries like China, India and Russia, and sold illicitly to European markets (Hall and Antonopoulos, 2023), with the internet facilitating these transactions.

Prior research into the supply of illicit image and performance enhancing drugs (IPEDs) has documented how 'raw' hormone powders are often bought in bulk from suppliers in producer nations – principally China – and shipped to Europe, where they are repackaged and resold to end consumers (Turnock, 2020, 2021; van de Ven and de Zeeuw, 2021). Some of these producer labs may be creating actual medical or veterinary products containing the active pharmaceutical ingredient (API) listed, but which are simply being sold without licence to evade regulations and patents, while others may be operating illicitly and producing substandard medicines without oversight (Hall and Antonopoulos, 2023). Consequently, the international market for illicit medicines may be conceptualised as a 'semi-legal' market (Hall and Antonopoulos, 2016; Paoli and Donati, 2014; Coomber et al., 2014), in which initial producers may not be violating laws of their home nations in creating the drugs, but are supplying them illicitly to nations where they are scheduled or controlled, making supply-side interventions against producers difficult to enact.

While much research into illicit drug supply online has explored 'darknet' sites (Martin, 2014; Van Hout and Hearne, 2017), illicit drugs and prescription medicines are increasingly available through 'surface web' platforms (Moyle et al., 2019; Childs et al., 2022). This includes IPEDs being sold through a range of 'online pharmacies' (Hall and Antonopoulos, 2016), forums (Turnock, 2021) and social media apps (Cox et al., 2024). Notably, Turnock & Gibbs (2023) document how 'research peptides' not approved for human consumption are available through mainstream e-commerce websites, including surface web access to wholesale suppliers operating out of China mediated through Alibaba.com.

Buying through these unregulated online sources may pose a risk of acquiring substandard or illegitimate products. Testing of illicit peptide medicines seized in Europe has found that many do not match the doses

or even compounds stated on labels (Kimergård et al., 2014; Weber et al., 2017), and anecdotal forum data indicates a similar pattern with GLP-1 s like Semaglutide, where independent testing of GLP-1 products by forum posters has noted they do not always match the compound or dose stated on the label (Turnock and Hearne, 2024). While peptide medicines like GHRP-2 and CJC-1295 have been used by gym trainers for some time (Kimergård et al., 2014; Van Hout and Hearne, 2016), the explosion in popularity of Semaglutide and related weight-loss medicines like Tirzepatide and Liraglutide is likely leading to a growth in illicit medicine access among less-informed users, who will not have the subculturally-embedded knowledge of safe(r) drug use and harm reduction seen in e.g. bodybuilding subculture (see Gibbs et al., 2022). Whilst participants in subcultures such as bodybuilding with have existing norms of advice sharing around safe use of injectable drugs and minimising risks linked to illicit market product (see Van de Ven and Mulrooney, 2017; Turnock and Townshend, 2022), for those not embedded in these cultures who are simply seeking these medicines to lose weight (e.g. casual social media users), there may be a greater risk of using the drugs in a less-informed, and potentially harmful manner. This parallels the rise in Melanotan II use in the late-2000s, which was identified as a public health risk at the time as it spread to more mainstream users, beyond simply participants in bodybuilding culture (Evans-Brown et al., 2009).

Given the potential public health risks of illicit and potentially substandard or contaminated weight-loss medicines being accessed through online sources, it is important for research to monitor the international supply of illicit medicines, and the sources through which they are accessed. This research seeks to shed light on one means of accessing GLP medicines for off-label use through this international market, by documenting how supply operates over an e-commerce platform on which a number of Chinese producers of counterfeit GLPs are advertising products, and which research on bodybuilding and fitness forums (Turnock and Hearne, 2024; Turnock et al., forthcoming) suggests is a significant surface web source through which European resellers appear to be accessing these drugs: Made-in-china.com. Elucidating the structure of this market and the strategies employed by sellers to advertise, ship and evidence (supposed) legitimacy of their product will highlight the issues with existing regulations and potential areas of risk associated with buying through this illicit international market. This is in line with prior works that have sought to examine illicit medicine and IPED supply through emerging digital platforms (Hall and Antonopoulos, 2016; Van de Ven and Koenraadt, 2017; Koenraadt and Van de Ven, 2018) and e-commerce sites (Turnock and Gibbs, 2023). Following this analysis, the article will then consider the implications of the ease of online access to wholesale (counterfeit) weight-loss medicine supply through these sources for public health and policy.

Method

The website this article investigates was identified in the course of broader netnographic research into the use and supply of various weight-loss, muscle, and wellbeing peptides on digital health, fitness, and bodybuilding forums, including GLP-1 medicines (Turnock and Hearne, 2024; Turnock et al., forthcoming). Recommendations by forum posters regarding which peptide 'labs' had the best reputations and where to source product from pointed us towards Made-in-China.com, an emerging e-commerce platform, and upon seeing the ease with which both wholesale and individual peptide¹ orders could be purchased from Chinese suppliers at low prices, we decided to undertake an examination of available suppliers on the site.

While forum posters also discussed ordering from sources that were

¹ We use this term following how they are categorised within fitness communities, which includes receptor agonists that mimic chemical peptides (e.g. GLP-1 receptor agonists).

still listed on Alibaba.com, meaning Made-in-China was not the sole e-commerce platform referenced in the broader netnography, we chose to focus on this platform for this article as it is previously unexamined in the international IPED supply literature (whereas Alibaba has already been explored in Turnock & Gibbs (2023)), meaning exploration of the site would contribute new knowledge regarding how international supply of these drugs operates through different platforms, and the potential issues and harms linked to this. Additionally, with Alibaba now restricting the searching and listing of particular terms, including GLP medicine names, following a crackdown by the Chinese Healthcare Regulator (Yicai Global, 2023), Made-in-China appears to be emerging as the primary alternative site on which peptide and counterfeit medicine operators are listing their products for Western buyers, and notably listings for GLP medicines were still unrestricted on the site at the time of our research in 2024.

This market exploration involved a search of key terms based on the injectable weight-loss medicines most frequently named by users in our broader netnography, including Semaglutide; Tirzepatide; Liraglutide; Retatrutide; and Sibutramine. These search terms were selected after being identified as the most popular injectable weight-loss medicines among forum posters, and thus likely to be the most significant products to examine from a public health and international supply perspective. Given many users will also refer to these drugs by their brand names, we also searched for the most popular of these to see if doing so would return pre-filled pens or counterfeit branded products. These additional search terms were: Ozempic; Wegovy; Saxenda; and Mounjaro. This exploration of search results and product pages was followed by a sampling of seller ('lab') pages offering these products, including an in-depth exploration of a seller specifically recommended by forum posters as being 'legitimate', based on prior orders placed with them and third part testing undertaken by forum users. Searches took place in August 2024, with screenshots of key examples / pages taken at that time.

Pages analysed included the product pages for the first page of results returned for each of the above identified product searches (30 for each search). This number was chosen as it was believed the first page of results for each search was likely to contain the most popular products ordered (based on how e-commerce platform algorithms operated), and would give a good overview of the main listings that potential buyers would engage with. We then examined seller pages linked to these product pages to explore how sellers were promoting themselves on the

platform. The analysis of these pages was qualitative, following the protocols for thematic analysis (Braun and Clarke, 2006), and using inductive and constant comparative approaches the analysis of our data. This approach was chosen as it was believed a thematic analysis approach would offer the best account of the dataset. Broader knowledge from our forum netnography also helped to inform the construction of our findings section.

Since the research only sampled publicly viewable product pages listed on an e-commerce site, specific ethical approval was not required to undertake this exploration. Nonetheless, we were conscious to not directly interact with sellers and conducted only 'passive' searches of pages to minimise any risk (see Brennan et al., 2018; McVeigh et al., 2017). The broader netnography of forum posts received ethical approval from the University of Lincoln (reference 19,099), and also drew only on posts on publicly accessible sites (i.e. those not requiring account creation or log in to view).

Findings

Platform overview

Visually, Made-in-China.com looks very similar to Alibaba.com (Fig. 1), and appears to simply be an alternative e-commerce platform along the same lines that is increasingly recommended on IPED forums and related spaces since a crackdown on peptide supply on Alibaba was announced by the Chinese healthcare regulator in 2023 (Yicai Global, 2023). Turnock & Gibbs (2023) previously identified Alibaba as a key site for sourcing peptides wholesale through 'labs' with seller pages on the site offering supposed veterinary pharmaceuticals or research intermediaries, and whilst Alibaba still appears to stock some 'weight-loss peptides', specific search terms (such as 'Semaglutide') no longer return results, suggesting the site is showing greater caution in its promotion since this time. Made-in-China follows the same layout and format as Alibaba regarding lab listing, and appears to simply be an alternative with less stringent restrictions on search terms, leading to its being more frequently recommended as a source for weight-loss peptides on forums in 2024.

Significantly, and paralleling Alibaba, Made-in-China is not specifically an 'online pharmacy' selling only illicit medicines, but is in fact a general e-commerce platform offering a variety of different products

The screenshot displays the Made-in-China.com search results for 'semaglutide'. The search bar at the top shows 'Products' and 'semaglutide'. Below the search bar, there are navigation options like 'All Categories', 'Secured Trading Service', 'Video Channel', and 'Top-ranking Products'. The search results are displayed in a grid format, showing two product listings. The first listing is for 'Peptide Tirzepatide Powder Retatrutide Lyophilized Semaglutide Weight Loss CAS: 910463-68-2' with a price of 'US\$ 90-120 / Piece (FOB Price)' and '50 Pieces (MOQ)'. The second listing is for 'Semaglutide CAS No. 910463-68-2 Semaglutide Powder for Weight Loss' with a price of 'US\$ 42-130 / box (FOB Price)' and '1 box (MOQ)'. The page also features a sidebar with category filters and a 'You May Like' section on the right.

Fig. 1. Search page for Made-in-China.com, showing how many weight-loss peptides are available through the site.

from a range of manufacturers based in China. Upon opening the front page, buyers are exposed to a variety of listings for products such as electronics, home furnishings, clothing and toys, in addition to chemical and manufacturing-related equipment. As such, the familiarity of the site as a general 'digital marketplace' may lead buyers to perceive it as less risky to buy (counterfeit) medicines through the platform than purchases made through e.g. illicit steroids websites. Indeed, a large number of sellers suggested they accepted payments by PayPal or credit card in addition to payment methods more typically associated with illicit sites like direct transfers or BitCoin, which is likely to lend a feeling of 'legitimacy' to transactions based on the familiarity of ordering through the platform feeling more like shopping on Amazon than a darknet site.

Availability of weight-loss medicines

A search for the term 'Semaglutide' on the platform returned over 12,000 results from hundreds of sellers, with other weight-loss medicines returning similarly high numbers of product pages (Table 1). While some are duplicate listings (i.e. the same seller listing their product in various vial sizes / doses), this speaks to the sheer volume of business likely occurring through this platform.

Sibutramine did not return any results, which suggested to us that withdrawn medicines were not being listed (sibutramine was withdrawn from markets in 2010 owing to health concerns (EMA, 2010), but remained popular with bodybuilders and other weight-loss drug users after this date (Germain et al., 2019)). To examine whether the e-commerce platform adhered to current regulations about controlled substances (i.e., substances that are labelled prohibited under the Prohibited List of the World Anti-Doping Agency, and/or are controlled by national legislation in different countries), we further searched for Pseudoephedrine – another controlled substance in many jurisdictions. Neither Sibutramine nor Pseudoephedrine returned any results, suggesting that the e-commerce platform adheres to some degree of regulation in not allowing controlled substances to be listed, despite selling prescription-only medicines openly to markets where their supply is restricted/regulated. This may be linked to which medicines they believe are likely to draw the attention of the Chinese healthcare regulator (Yicai Global, 2023), so it is interesting to note that prescription weight-loss medicines did not make this list.

Product promotion: Use of 'tags', imagery and descriptions

Similar to other e-commerce platforms such as Amazon, Made-in-China offers sellers the ability to 'tag' their product to appear under listings for different product categories, for example 'health care'. The most popular category for each of the generic compound searches noted above was 'pharmaceutical intermediate', however tags such as 'other medicine', 'weight management' and 'health care product' were also popular, and more prevalent for the 'branded' name searches. Table 2 shows a breakdown of the number of 'healthcare & medicine'-related tags

Table 1

Results for each search term relating to weight-loss medicines.

Search term	Results
Semaglutide	12,000+
Liraglutide	2900+
Tirzepatide	9000+
Retatrutide	13,000+
Sibutramine	0
Ozempic* (Semaglutide)	2045
Wegovy * (Semaglutide)	218
Saxenda * (Liraglutide)	167
Mounjaro* (Tirzepatide)	104

*Brand names for generics listed above

Table 2

Number of times a tag for the site's 'Health & Medicine' category was used by sellers for each product searched.

	Weight Management	Other Medicine	Pharmaceutical Intermediate	Pharmacy Stocks
Semaglutide	410	514	4358	16
Tirzepatide	544	179	422	33
Retatrutide	1659	187	2369	59
Liraglutide	102	100	235	4
Weight loss peptide	3519	205	7475	–

which appeared for each of the products listed in table 1 (excluding sibutramine):

While other tags for supposed industrial uses were present, and often more prevalent (e.g. 'organic intermediate'; 'chemical reagent'), the fact that the above health and medicine related tags appeared on a large share of products indicates that while most suppliers were selling these products under the guise of being for research or legitimate production purposes, many were also overtly looking to capture buyers seeking lifestyle medicines. In addition to the tags used, advertising imagery from some sellers makes clear they are aware their product is being bought for human consumption, and not as research or veterinary products. Fig. 2 shows a fairly typical promotional image of an in-shape woman juxtaposed with the GLP-1 vials being supplied, clearly promoting the idea that using the product will give the purchaser similar fat loss results.

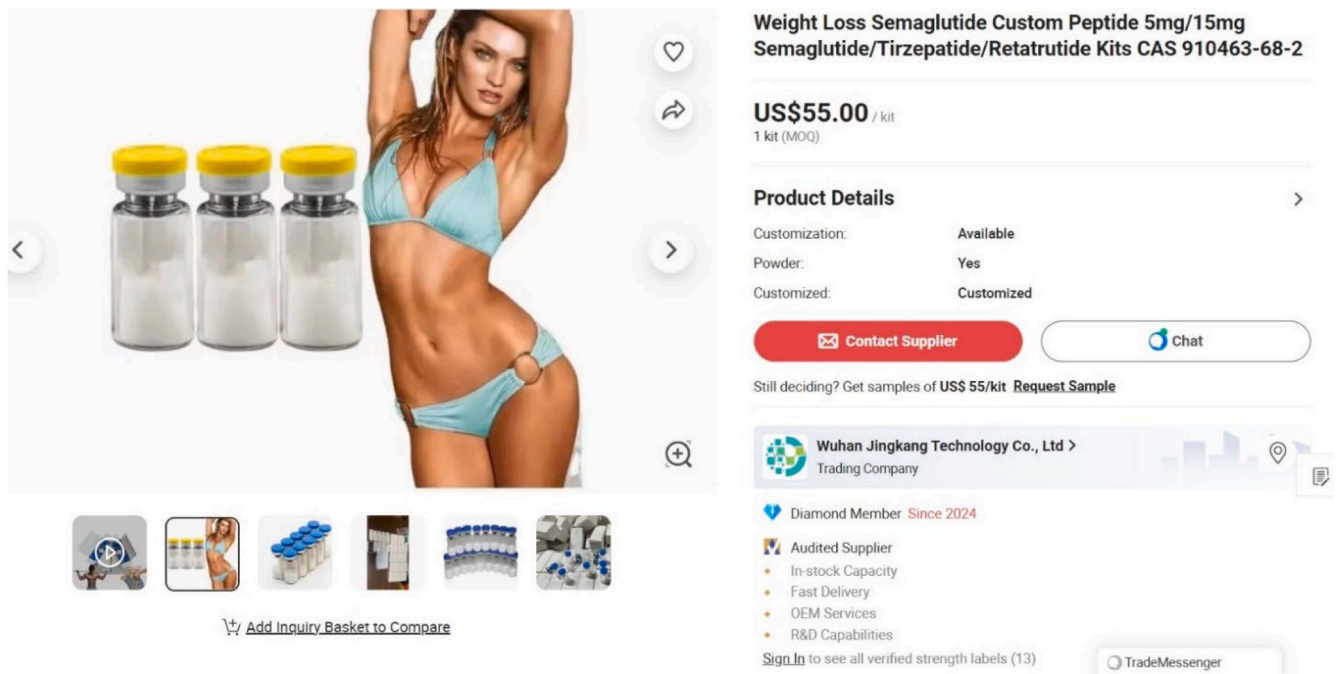
Other listings would similarly highlight the weight-loss or aesthetic effects of the drugs, though with imagery targeted more towards non-bodybuilding consumers, as seen in Fig. 3. This suggests some awareness by sellers that the traditional market for weight-loss peptides was expanding, and they were attempting to appeal to those with general health and weight-loss goals beyond those already embedded in gym cultures.

Despite the prevalence of such advertising imagery on many product pages, images of packaging and product vials would frequently show 'for research use only' on labels (Fig. 4), indicating sellers are attempting to evade existing regulations in countries they are shipping to, where supply of these products for human consumption is restricted. This is potentially also seen in the partial blurring of product names for the prescription medicines listed in Fig. 3 (Tirz and Sema rather than Tirzepatide and Semaglutide), whereas the unscheduled Retatrutide is listed in full, indicating a further attempt to evade restrictions on the sale of the former two.

An analysis of the first page of results (top 30) returned for Semaglutide, Liraglutide, Tirzepatide and Retatrutide showed a significant number using the 'research use' terminology in their product pages or images. Table 3 compares the prevalence of 'research use' terminology with the number of products featuring imagery similar to Figs. 2 and 3 directly denoting products are intended for human consumption on the first page of results, i.e. the most popular selling listings (note some product pages advertised multiple GLPs or peptides in a single listing, as seen in Figs. 2 and 3).

While product pages not featuring imagery relating to either category (usually depicting blank vials) would still include descriptions or tags indicating they were being sold under either research or health and beauty related premises, the occurrence of these themes in product images on the first page nonetheless demonstrates that a significant proportion of sellers were either directly promoting their products for human consumption, or were employing 'research use' language and imagery in line with that often seen for other peptide drugs sold in grey markets (as explored in Turnock and Gibbs, 2023).

Notably, some of the products that were explicitly tagged or labelled as being for 'research use only' still included key words in their titles such as 'for obesity' or 'for weight loss', reinforcing that the use of this terminology was a cynical attempt by sellers to evade restrictions on



Weight Loss Semaglutide Custom Peptide 5mg/15mg Semaglutide/Tirzepatide/Retatrutide Kits CAS 910463-68-2

US\$55.00 / kit
1 kit (MOQ)

Product Details

Customization:	Available
Powder:	Yes
Customized:	Customized

[Contact Supplier](#) [Chat](#)

Still deciding? Get samples of US\$ 55/kit [Request Sample](#)

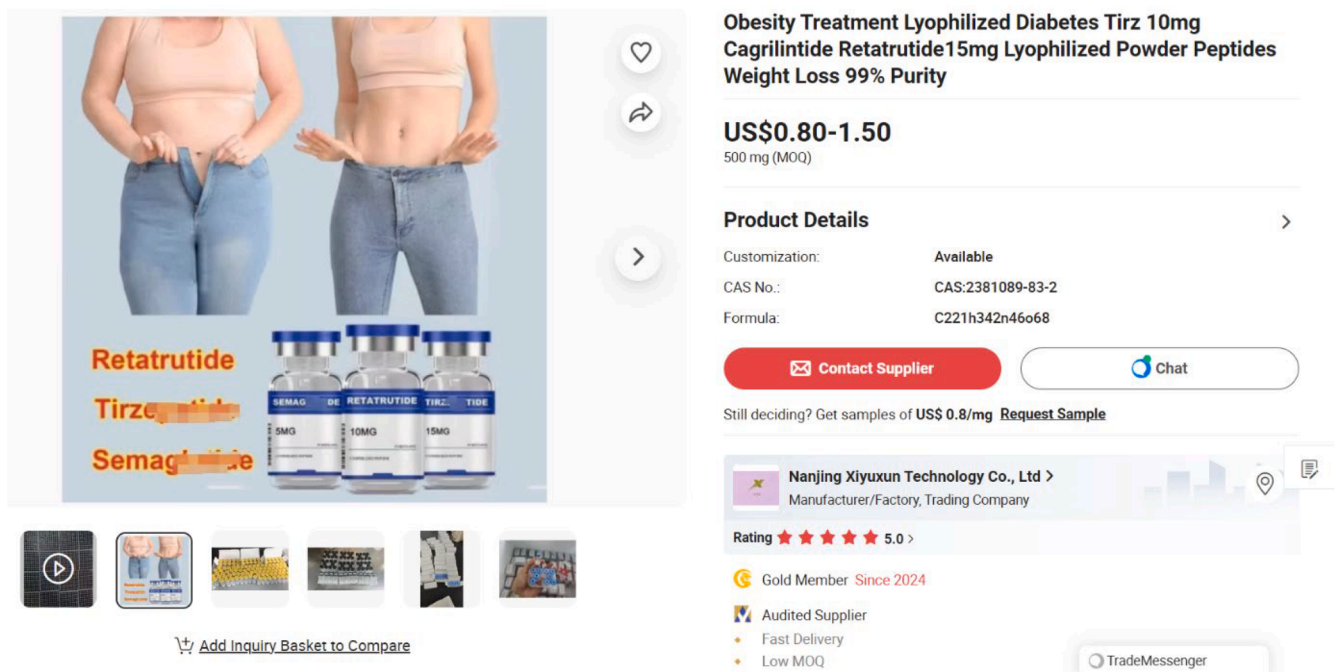
Wuhan Jingkang Technology Co., Ltd
Trading Company

Diamond Member Since 2024

- Audited Supplier
- In-stock Capacity
- Fast Delivery
- OEM Services
- R&D Capabilities

[Sign In](#) to see all verified strength labels (13) [TradeMessenger](#)

Fig. 2. example product page and promotional imagery used by sellers.



Obesity Treatment Lyophilized Diabetes Tirz 10mg Cagrilintide Retatrutide 15mg Lyophilized Powder Peptides Weight Loss 99% Purity

US\$0.80-1.50
500 mg (MOQ)

Product Details

Customization:	Available
CAS No.:	CAS:2381089-83-2
Formula:	C221h342n46o68

[Contact Supplier](#) [Chat](#)

Still deciding? Get samples of US\$ 0.8/mg [Request Sample](#)

Nanjing Xiyuxun Technology Co., Ltd
Manufacturer/Factory, Trading Company

Rating ★★★★★ 5.0 >

Gold Member Since 2024

- Audited Supplier
- Fast Delivery
- Low MOQ

[TradeMessenger](#)

Fig. 3. example of weight-loss related imagery targeting buyers from outside of bodybuilding / gym cultures.

their international supply, rather than denoting the actual intended use of the product by the supplier / purchaser (Fig. 5).

While the tag 'research use only' has frequently been used by peptide and SARM sellers to evade restrictions on their supply as medicines or supplements (Chakrabarty et al., 2021; Turnock and Gibbs, 2023), it is notable that many GLP-1 s differ from these drugs (in the UK) in being scheduled prescription-only medicines (Semaglutide; Tirzepatide; Liraglutide), meaning they cannot be legally supplied under the guise of being for 'research use' regardless. However, it is clear that this practice – based on the supply of unlicensed, unscheduled peptides by these and other sellers – is still being followed in an attempt to evade regulations in

receiving countries, and plausibly to deny any cause of harm or injury among those ordering them. Notably, a BBC investigation into illicit market GLP-1 drugs in the UK found that existing sellers of 'research peptides' are responsible for some recent illicit market supply of Semaglutide, and appear to be using the same strategies to avoid restrictions that they employed previously for non-scheduled drugs (BBC, 2023).

Pre-filled pens and counterfeit branded products

A particularly significant finding was the prevalence of GLP-1 products being sold in the form of pre-filled pens, including some with



Fig. 4. Example product packaging images for tirzepatide. Note the ‘for research use only’ label.

Table 3
prevalence of ‘research use’ labels or imagery vs physique-based advertising on the top 30 results (first page) for each product searched.

	‘Research use’ text or imagery	Physique / aesthetics related imagery
Semaglutide	33 % (10)	30 % (9)
Tirzepatide	30 % (9)	23 % (7)
Retatrutide	30 % (9)	30 % (9)
Liraglutide	7 % (2)	53 % (16)

Novo Nordisk / Eli Lilly brand names given on product boxes/images. While peptide sellers have historically sold vials requiring reconstitution to use (as seen in Figs. 4 & 5), several of the labs on made-in-china.com were selling pre-filled pens, clearly indicating they are shipping a human medical product intended for end users (Fig. 6).

Fig. 6 offers a stark example of the potential for harm stemming from the operation of this digital marketplace. The supposed Ozempic pens being offered by this company (operating on the site since 2020) are rated the #1 most popular selling item on the website in the ‘weight management’ category, with the Ozempic branding suggesting the product is an official Novo Nordisk pen. However, in reality, this is a Chinese-produced counterfeit in a legitimate-appearing Ozempic box, as the product specification makes clear (Fig. 7).

Whilst many of the pens shown by sellers have Chinese labels, some have labels that state ‘Ozempic’ (the Novo Nordisk brand) on them, with official-appearing ‘batch numbers’. This may explain why a large percentage of people who use off-label Semaglutide believe it to be legitimate product (Martin et al., forthcoming) despite evidence that much is counterfeit. This could lead to harms among users who are unaware they are not using a product created to the regulatory standards of Denmark (and therefore the EU), and which may consequently be contaminated, incorrectly dosed, or even a different peptide substitute.

Shipping and international regulations

Several suppliers included photographs or descriptions of their packaging and shipping processes, including showing the range of

different containers product could be shipped in and which carriers could be used, likely to evidence the different methods for evading customs detection they employed (Fig. 8). This parallels the ‘stealth shipping’ advertised by steroid suppliers operating in digital spaces (Turnock, 2021; Gibbs, 2023a), where sellers shipping products they know are restricted in the receiving countries evidence their ability to get product past customs checks as part of their broader promotion.

Significantly, a number of sellers would advertise on product pages their ability to get packages through customs in receiving nations (Fig. 9). Naturally, a company operating entirely legitimately would not need to evidence that it could get its packages safely through customs, again evidencing the suggestion that sellers were aware the products they were shipping were restricted medicines in receiving countries, and that they were knowingly shipping them to countries where their sale without prescription is not permitted.

These tactics highlight the attempts by sellers to evidence their shipments would get through, and that they were not ‘scamming’ customers, but in evidencing their legitimacy in this manner, suppliers were also tacitly acknowledging that they were not legally supplying pharmaceuticals, paralleling the cynical ‘for research use only’ warnings analysed above.

Attempts to evidence legitimacy

Finally, there were numerous images on supplier pages of pharmaceutical labs, in an effort to evidence the legitimacy of their operations. This could include pictures of specific chemical equipment, and broader shots of buildings and technicians, to attempt to demonstrate their ‘legitimacy’, in the form of showing they ran large and seemingly well-funded operations (Fig. 10).

Naturally, the existence of these images does not prove that the product was actually produced in the labs shown, and could be photographs of different lab sites in China or other places in the world, used by sellers to deceive in a manner similar to methods employed by IPED sellers in local markets to feign legitimacy or pharmaceutical quality (Coomber et al., 2014; Gibbs, 2023b), albeit at a larger scale. However, it is also likely that many are using the equipment shown, and legitimate chemical manufacturers could be sub-letting or renting labs to the

Fig. 5. Product page for Retatrutide / Tirzepatide vials marking them as ‘for research use only’ yet including the terms ‘for obesity’ and ‘for weight loss’ in the product title.

Fig. 6. Page selling brand name pens for Ozempic and Saxenda.

companies producing these products for profit, or indeed producing these products for international sales themselves. China in particular has had extensive issues with manufacturers creating IPEDs for the international market, and there have been several crackdowns in relation to this previously (see Icarus, 2017; Turnock, 2020).

Based on our broader netnographic observations, some product is clearly actual GLP-1 medicines, with some established forum members posting product test results where they have sent it to third party testers to verify its legitimacy (for more on this practice see Turnock and

Townshend, 2022; Andreasson and Henning, 2023). Specific labs were recommended by forum posters following this testing, which was often undertaken by a respected community-embedded tester who had been operating since at least 2014, whose results were often used by body-builders to evidence the legitimacy of particular labs (see Turnock, 2021).

Notably, however, some sellers would seemingly engage directly with this tester, and would post test results from products they had sent him directly on their product pages as a means of evidencing their

Product Description		Company Info.		
Overview	Product Description	Packaging & Shipping	Company Profile	FAQ
Basic Info.				
Transport Package	Box	Specification	1 pen per box	
Trademark	/	Origin	China	
Production Capacity	50000PCS/Months			

Fig. 7. Product description for 'Ozempic pre-filled pen' noting that it is produced in China, and not by Novo Nordisk.

Product Description		Company Info.	
Overview	Detailed Photos	Packaging & Shipping	Company Profile
			
			
			

Fig. 8. Different packaging options offered on a Semaglutide product page depending on volume bought and buyer preference. This was one of three images relating to packaging options.

supposed legitimacy (Fig. 11).

The fact that sellers showed familiarity with third party testing services that already have a reputation in bodybuilding spaces demonstrates their awareness of community-embedded harm reduction services, and the value that verification by these could have for advertising their product (see Turnock, 2021). However, it must be noted that test results posted directly by sellers could also be fraudulent, even if the verification code showed the test itself was conducted on real product. For example, a seller could take a legitimate report from another manufacturer's product and pass it off as their own, or send a higher quality sample product to testers without this necessarily evidencing all their product was of this same quality. This speaks to the importance of community testing being conducted beyond what sellers themselves advertise, including by 'secret shopper' purchases (Turnock and Townshend, 2022; Andreasson and Henning, 2023), but offers further indication of how sellers attempted to evidence legitimacy for buyers through seemingly engaging with such services.

While some sellers were recommended by forum users as having high quality product following members' own testing, however, other sellers were identified as sending different peptides to those listed on labels

(Turnock and Hearne, 2024), indicating the poor quality regulation and lack of oversight in much of this market. Given the prevalence of anecdotal experiences of harm using illicit market Semaglutide, including seeming contamination of fake Ozempic pens with insulin (Thomas, 2023; BBC, 2023), there is reason for concern regarding product quality even if it is produced in seemingly well-equipped labs.

Indeed, recent publications investigating the quality of illicit market Semaglutide purchased online have noted that product doses and purity often do not match claims given on vials, with some tested as containing substantially higher amounts of Semaglutide than advertised (up to 39%), or being of lower purity than advertised (7.7–14.4% compared to claims of '99% purity') (Ashraf et al., 2024a, 2024b). This points to a risk of overdose or incorrect dosing even in cases where actual Semaglutide is acquired from these illicit market sources, even beyond the risks of contamination or substitution with more harmful products like insulin. Given recent reported cases of harm linked to illicit market product that was confirmed in testing to contain Semaglutide as the API (Barry, 2024), it is clear that risk extends beyond cases of compound substitution to encompass issues of purity and incorrect dosing that may well be prevalent among these less-regulated suppliers.



Fig. 9. Image from a seller suggesting they have successfully delivered products to the USA, Mexico, Europe and Australia. This was posted on a Tirzepatide product page.

Discussion

The ease of access to restricted medicines (e.g., GLP-1 agonists) in bulk over surface web sites, such as e-commerce platform Made-in-China.com, is likely leading to a greater number of actors entering the 'grey market' of illicit medicine resales. Whereas once IPED resellers needed specific connections or referrals via word-of-mouth on bodybuilding forums to enter this market (Kraska et al., 2010; Llewellyn and Tober, 2010; Turnock, 2020), restricted medicines can now easily be bought directly from wholesalers operating on surface web e-commerce platforms. This is likely what is fuelling the prevalence of illicit Semaglutide resellers on social media platforms including beauty pages, influencers, and other unlicensed operators (Walsh and Rai, 2023; Hirst and Turnock, 2024). Notably, the prices listed on the site are often significantly cheaper than pharmaceutical grade product (as seen in Fig. 2, where 5 mg of Semaglutide is just \$55 a kit), and the ease of access presented by the ability to search different sellers and pay through means such as credit cards and PayPal are all likely to make the site more attractive to those who would not have traditionally sourced illicit meds through sites such as illicit steroid selling platforms (Turnock and Gibbs, 2023). With the site offering users the ability to easily search out and engage with manufacturers based in China, this platform offers a far more direct means of sourcing counterfeit medicines than seen historically for online pharmacies and steroid websites, and as sites like

Temu and AliExpress normalise ordering from manufacturers directly in the licit market, sourcing medicines in this manner is likely to feel less separated from legal activities, and more 'normal'.

Building on the arguments set out in Turnock & Gibbs (2023), the proliferation of easy digital access to these drugs and their growing popularity among non-culturally embedded user populations is likely leading to harms, as increasing numbers of both buyers and resellers will likely be unaware of the risks that come with illicit market medicines, since they lack the culturally-embedded knowledge of supply chains that underpin norms of bodybuilding culture like third party testing and reputation mechanisms (Turnock and Townshend, 2022; Van Hout and Hearne, 2016). Historically, many weight-loss meds were used specifically by bodybuilders, and other subcultural participants (e.g. powerlifters; MMA fighters) with cultural norms of information sharing around the off-label use of medicines to reduce harms (Van de Ven and Mulrooney, 2017). However, with the spike of interest in GLP-1 medicines in the general population (Basch et al., 2023; Han et al., 2024), the ease of access presented by an e-commerce platform like Made-in-China many encourage individuals without access to this cultural knowledge to engage in the purchase, use, and even supply of these drugs. Given the stigma associated with broader harm reduction sites such as needle and syringe programmes (Simmonds and Coomber, 2009; Turnock and Mulrooney, 2023), this is likely to present a public health risk, given the risks of contamination, substitution or incorrect dosing presented by

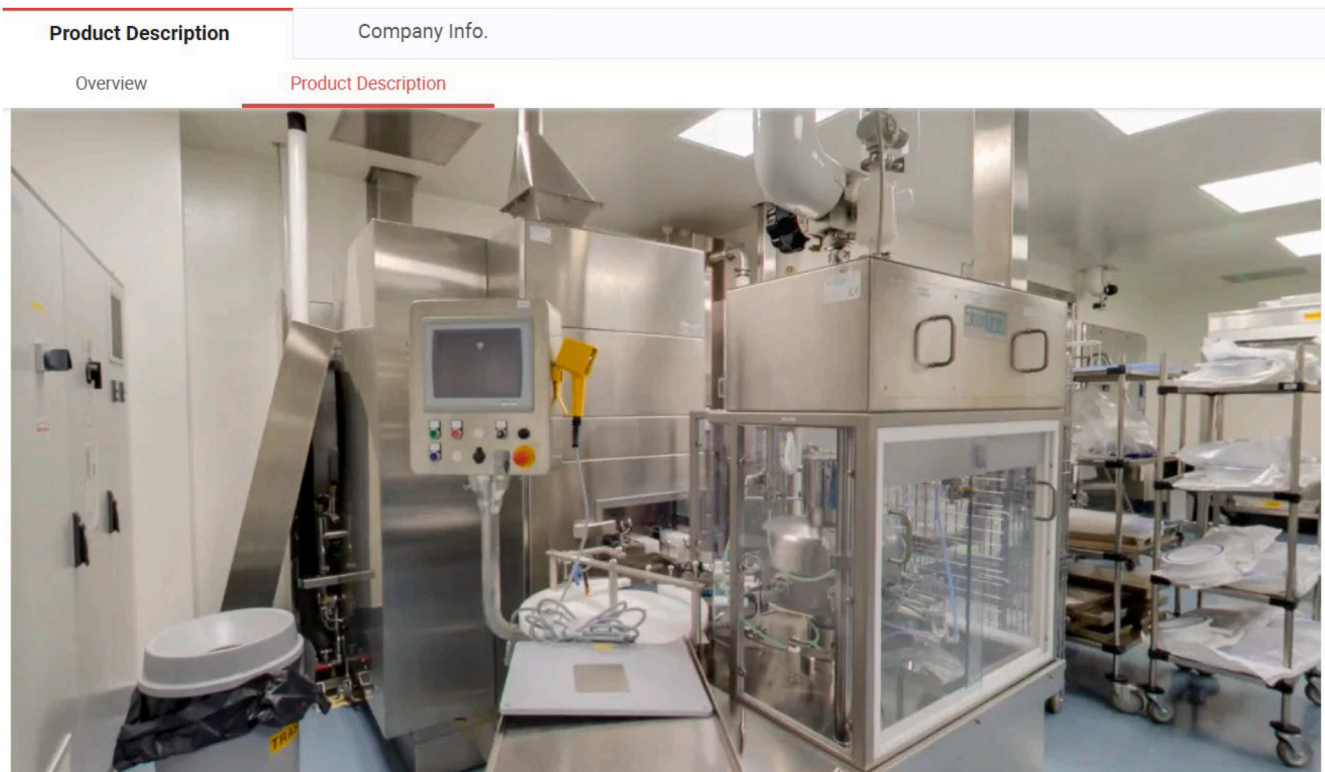


Fig. 10. Example of a seller's supposed lab on a product page to evidence (or suggest) legitimacy.

illicit market medicines (Kimergård et al., 2014; Turnock and Hearne, 2024; Ashraf et al., 2024a). With serious adverse health outcomes already being documented among off-label GLP medicine users (Thomas, 2023; Easedale, 2024; Barry, 2024), it is clear that any normalisation of access through surface web platforms should be a concern for public health policy.

Surface web e-commerce platforms such as Made-in-China.com notably do not offer a discussion forum or 'members' area which is often where communal knowledge exchange regarding substances (e.g. quality, vendor reliability, positive and negative effects experienced) takes place (Van Hout and Hearne, 2016, 2017; Hearne and Van Hout, 2016). Whilst these forums are not without problems - such as suppliers with alternative motivations for 'vouching for' the substances they are selling (Turnock and Hearne, 2024; Gibbs, 2023b) - and that they are not a medically verified or approved means to harm reduction, research has provided ample evidence to support the theory that harm reduction does take place within these spaces (Turnock and Townshend, 2022; Underwood, 2024). That those who access product being resold from Made-in-China.com are likely from non-culturally embedded user populations, means they are likely to be at higher risk for harms than those who are embedded within these online spaces. This is evidenced in the rates of illicit market Semaglutide purchasers who believe they bought legitimate pharmaceutical product (Martin et al., forthcoming), when this is in reality unlikely if accessing through online 'beauty clinics' and similar sources, which likely source counterfeit product through suppliers like those found on Made-in-China.

Significantly, the existence of this supply over a new e-commerce platform highlights the inherent issues with attempting to regulate international marketplaces. Alibaba was previously identified as a primary point of access to wholesale suppliers of these drugs (Turnock and Gibbs, 2023), and whilst the Chinese healthcare regulator ostensibly began cracking down on these activities in 2023 (Yicai Global, 2023), it is clear that labs are continuing to advertise and supply prescription-only medicines and 'research peptides' through international e-commerce platforms. Indeed, even concerns regarding the crackdowns among

buyers (peptide resellers) appear to have simply led to them recommending going through Made-in-China.com instead of Alibaba, where supply is still operating at scale. This is reminiscent of the efforts to shut down the Silk Road, only for other cryptomarkets to replace it (Tzane-takis & South, 2023). It therefore seems that tackling the demand side of the equation - through education on how illicit markets operate and the risks of using illicitly-sourced weight-loss medications - is likely to have a greater immediate impact on reducing harm than inherently limited 'supply side' interventions.

There is an increasing focus on the harms of off-label GLP medicine use appearing in news media, as individuals experience harms from these drugs (Thomas, 2023; Barry, 2024; Easedale, 2024). In addition to crackdowns on the promotion and advertising of these products by regulatory bodies like the MHRA and social media regulators, in order to combat the perceived normalisation of accessing these medicines online more broadly (MHRA, 2023; Hirst and Turnock, 2024), it is therefore also significant that public health policy seeks to educate the population on these risks, and the dangers of illicit market medicines. This is particularly important to focus on, since unlike bodybuilders and more traditional IPED users, the broader population now accessing illicit market GLP medicines are unlikely to be using existing harm reduction services like needle and syringe programmes or steroid clinics, and likely access their drugs, needles and information entirely online. Education campaigns and similar harm reduction policies which can reach these broader, non-culturally embedded populations will therefore be important to consider as a public health response, likely needing digitally delivered and widespread interventions. This can include policies that seek to educate both the users of these e-commerce platforms themselves, who may not know the substances they are buying and reselling are not necessarily legitimate - especially when branded packaging for Ozempic or Saxenda is used - as well as those who access the resold product through beauty and lifestyle social media pages. A public health campaign to educate these populations on the risks of illicit medicines and how the market for counterfeit products operates internationally will likely be a good initial step for public health policy

Product Description | **Company Info.**

Overview | Product Description | Company Profile

TEST REPORT | **JANOSHIK** | E-mail: info@janoshik.com | Web: www.janoshik.com

Task Number #42025 | Testing ordered > 28 APR '24
Sample received > 13 MAY '24

Client: other pharmaceutical
Sample: Tirzepatide 10mg
Manufacturer: other pharmaceutical
Batch: 001

Sample description >
Pictures not included.

Tests requested >
Assessment of a peptide vial or vials.

Results >

Tirzepatide	10.23 mg
Purity	99.914%

Comments >

Analysis conducted > 15 MAY 2024 | Signature >

Verify this test at www.janoshik.com/verify/ with the following unique key
TY731HSXVUBZ

Fig. 11. Recent test results from a product page apparently showing the seller had sent samples of their 10 mg Tirzepatide vials to a respected third party tester for verification. The 'key' has been left in the screenshot for potential buyers to verify for themselves that a test occurred.

makers to consider, through online tools and social media campaigns or similar. However, we must also acknowledge that demand exists for these products, and therefore consider whether liberalising access to legitimately produced pharmaceutical grade product in-person through pharmacies, as seen for Sildenafil in 2017, will also help to reduce harms (Hirst and Turnock, 2024).

Similarly, those working in medical fields or working with individuals at risk of using GLP medicines off-label must be aware of the prevalence of suppliers offering these drugs online, and capable of educating clients on the risks of access drugs through these means, in addition to current guidance regarding misuse of prescription products (MHRA, 2024). Notably, recent publications on anabolic steroid users have discussed programmes aimed at educating GPs and other healthcare professionals on risks and how to address client concerns (Atkinson et al., 2021), and such knowledge-based programmes should consider integrating education on the risks of illicit market GLP medicines too. This may also include community pharmacies, where individuals considering using illicit medicines for weight-loss may initially present, and can offer effective preventative education and harm reduction advice (Piatkowski et al., 2024).

Finally, it is worth noting that, while the present research was specifically focussed on weight-loss medicines, there were also a range of injectable body fillers, tanning drugs and other beauty products on the platform that pose a clear potential for harm when used without the supervision of healthcare professionals. This points to the broader need

to address the over-pharmaceuticalisation of health and beauty in everyday life, again through educational campaigns relating to body image, health, and social media literacy (e.g. Tamplin et al., 2018; Tiggemann and Anderberg, 2020), along with potentially greater enforcement action against pages which promote or normalise these behaviours (Hirst and Turnock, 2024). However, specific guidance for healthcare professionals and other practitioners interacting with users of illicit weight-loss medicines will also be important to develop to address these broader image-related concerns (see Brennan et al., 2019), in line with the above policy recommendations.

There is a gap in the existing research landscape regarding the use, safety and efficacy of illicit market GLP medicines. While some recent research has sought to address this gap in our understanding (Ashraf et al., 2024a; Turnock et al., forthcoming), it is clear that continued research into use, access and harms related to these drugs is important to pursue, as the off-label use of these drugs rises. While market explorations like the present research highlight potential areas for public health policy to address, it is clear that in-depth qualitative research into user practices, experiences of harm and user approaches to harm reduction will be needed in order to form appropriate policies relating to these drugs. Additionally, researchers must continue to monitor online discussion of illicit medicines, to be able to respond to emerging trends such as the use of new drugs (as seen for Retatrutide in the present study) and means of access.

Naturally, this market exploration comes with limitations, including

the fact that not all seller pages could be verified as legitimate (i.e. actually shipping products) without direct engagement with them, and our reliance on algorithmic sorting of search results, which naturally biased our exploration towards the pages promoted by Made-in-China.com itself. Nonetheless, these pages are likely still representative of those most likely to be accessed by potential buyers, and therefore our analysis of them still offers insight into this e-commerce market, and how users will see the site. Additionally, as a 'passive' piece of research, our suppositions about likely product quality are drawn from existing explorations like Ashraf et al. (2024), and no samples of products actually being supplied on the site were actually analysed. Naturally, further work conducting such quantitative testing on products from these sources would be beneficial to actually quantify our suppositions.

Finally, although the research was conducted based on findings from recent (2024) netnographic research, the illicit medicine market online is constantly evolving, and emergent drugs and methods of supply will always be ahead of academic research in this area. Continued monitoring of trends is therefore needed, as findings will inevitably be 'outdated' to some extent by the time research in this field is published.

CRedit authorship contribution statement

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

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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