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Research Paper

2,4 dinitrophenol; has the inferno drug burnt out?

Jennifer Germain^{a,*}, Ellie Williamson^a, Jane Harris^b^a Faculty of Health, Innovation, Technology and Science, Liverpool John Moores University, Exchange Station, Tithebarn Street, Liverpool L2 2QP, United Kingdom^b Public and Allied Health, Faculty of Health, Innovation, Technology and Science, Liverpool John Moores University, Tithebarn Building, Tithebarn Street, Liverpool, L2 2ER, United Kingdom

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ABSTRACT

2,4 dinitrophenol (DNP) is an industrial chemical first used during World War I within the manufacture of explosives and ammunition. Adverse experiences from human exposure to DNP were published shortly following the war, providing evidence for the links between DNP and weight loss. Despite being banned for human consumption in the 1930s, DNPs thermogenic properties resulting in weight loss caused it to be popular among bodybuilding communities. The increased availability of online marketplaces and web-based forums in the early 21st century saw a surge in interest around DNP for weight loss, which extended beyond bodybuilders into the general population. This resulted in increased reporting of DNP related harms and deaths in the scientific literature and media. However, in recent years, this interest in DNP has waned, coinciding with increased awareness of DNP's risks following its reclassification as a poison, and the rise in popularity of GLP-1 medicines such as Ozempic. Whilst longer-term risks are currently unknown, GLPs are generally not considered as risky to use when compared to DNP. Furthermore, they are heavily promoted and endorsed through media, social media and by celebrities, and legally available to purchase with a prescription. This commentary article reflects on academic research and media coverage of DNP before and after the introduction of GLP-1 medicines and considers whether the concerns over use of DNP have declined or whether use has reduced. It explores the history of DNP, its shifting user demographics and its current place alongside newer and potentially safer weight loss drugs. Finally, it postulates whether DNP use has simply diminished or as online communities have become more sophisticated, discussion relating to its use has become more hidden.

1. Introduction

This commentary explores historical and current use, reporting and regulatory focus of 2,4 dinitrophenol (DNP) as a weight loss drug. From 2014, the lead author of this commentary undertook netnographic studies which indicated that the growing accessibility and discussion of DNP in online communities had facilitated their use in increasingly varied populations (Germain et al., 2021, 2019; McLean & Germain, 2021; McVeigh et al., 2017, 2012). In particular, these studies highlighted the diffusion of DNP use from male bodybuilding communities, which had been the focus of previous research, into female populations as an alternative or accompaniment to traditional weight loss strategies. However, more recent research suggests a shift in DNP's popularity within these online spaces, where the drug is increasingly being treated with caution. Despite continued recognition of DNP's effectiveness as a fat burner among online communities, online discussions are

increasingly focused on how the substantial adverse health risks (including cardiac risk, cataracts and significant risk of death by hyperthermia) outweigh any benefits, with both traditional weight loss and body building communities shifting towards alternatives such as GLP-1 medicines and BAM15 (Turnock et al., 2025; Turnock & Piatkowski, 2026). Arguably the most significant of these shifts in terms of global media and public attention has been the increased availability of GLP-1 medicines, with prescriptions for the GLP-1 Semaglutide (commercially known as Ozempic or Wegovy) in the USA increasing from 82,000 at the end of December 2018 to 1.2 million by the end of 2022 (Court, 2022; Turnock et al., 2025). Commentators argue that this marked increase in prescriptions was fuelled by off-label weight loss drug use, which in turn was facilitated by online celebrity endorsement and viral attention on social media platforms (Basch et al., 2023; Kolovos, 2022).

The rising popularity of GLP-1 medicines represents a significant

* Corresponding author at: Faculty of Health, Innovation, Technology and Science, Liverpool John Moores University, Exchange Station, Tithebarn Street, Liverpool L2 2QP, United Kingdom

E-mail address: j.s.germain@ljmu.ac.uk (J. Germain).

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shift in online weight loss markets and communities. It therefore seems an appropriate time to reflect upon the historical trajectory of DNP to the present day, to understand how it now appears within the current online weight loss drug landscape. This commentary provides a historical overview of DNP before presenting trends in online, media and academic attention, covering the period from before our original research which began in 2014 through to the present day. GLP-1 medicines are used as a comparator in these trends to understand how shifts in global markets may have influenced the prevalence of DNP discussion in online communities. Our commentary highlights the need for additional investigation in this space, particularly to understand whether declining media and online trends equate to reductions in DNP use in all populations, or whether for some they represent a shift to more hidden or private online spaces.

2. Historical overview of 2,4 dinitrophenol

DNP is an manufactured, odourless, industrial benzene-based chemical first used during World War I within the production of explosives and ammunition (Grundlingh et al., 2011; Sousa et al., 2020). Public attention was called to DNP, after munition factory workers fell ill, and, in some cases, died following exposure (Colman, 2007; Dunlop, 1934). Symptoms reported at the time included nausea, vomiting, diarrhoea and weight loss, leading Maurice Tainter, a Stanford pharmacologist, to explore DNPs potential as an anti-obesity medication (Colman, 2007). Tainter found that DNP increases metabolism through inhibiting the mitochondria from making adenosine triphosphate (ATP). This causes heat to be produced instead of ATP and this thermogenesis leads to weight loss (Colman, 2007; Masserman & Goldsmith, 1934; McFee et al., 2004; Tainter et al., 1935). Tainter treated nine obese individuals with 3–5mg/kg of DNP for approximately 10 weeks, with an average of 20 pounds lost and no side effects reported (Colman, 2007). These findings were published in 1933 at a time when remedies designed to enhance and improve people's bodies and minds were growing in popularity. As such DNP experienced a change in trajectory, no longer solely marketed as a chemical within the munitions industry but also as a 'miracle weight loss drug' (Aronson, 2023; Germain et al., 2021; McVeigh et al., 2017) with an approximate 100,000 Americans having taken the drug between 1933 and 1934 (Colman, 2007). Despite DNP's claimed miracle weight loss properties, harms continued to be identified including multiple cases of cataracts (Yen & Ewald, 2012), renal failure (Aronson, 2023) and eight deaths being attributed to DNP during this time (Bennett, 1988; Yen & Ewald, 2012). Use was predominately confined to the United States (US) as this is where it was heavily marketed and commercialised and as such DNP was banned for human consumption in 1938 by the US Food and Drug Administration (FDA) (Aronson, 2023). Following this ban, occasional case reports of harms or deaths were still identified (Grundlingh et al., 2011), including those linked to Dr Nicholas Bachynsky who during the 1980s, marketed and sold DNP under the brand Mitcal from his weight loss clinic in Texas, US (Aronson, 2023). However, overall reports of ill effects seemingly reduced.

At the turn of the 21st century, DNP saw another surge in interest, heightened by its inclusion in training regimes across bodybuilding communities (Bartlett et al., 2010; Dufayet et al., 2020; Türkay et al., 2014) and use by extreme dieters, (Hoxha & Petróczy, 2015; Petróczy et al., 2015). This was in part due to increased ease in accessibility via global online marketplaces as the internet became more sophisticated and online trading grew, via both licit and illicit means (Chary et al., 2020; Germain et al., 2021; McVeigh et al., 2017). Across the 2000's and 2010's, use of DNP became more widespread, and harms were seen outside of the US. Specifically, the United Kingdom's (UK) mainstream media reported on multiple cases of harms and deaths linked to DNP, both in bodybuilders where enhancement drug use is more frequent (BBC, 2012; Men's Health, 2017), and also in individuals who were considered to be more 'enhancement drug naïve' but drawn to the

weight loss properties. This included 21 year old Eloise Parry who died in 2015 (UK Shropshire) after being diagnosed with bulimia and who the media reported had taken eight 250 mg DNP tablets (Troup-Buchanan, 2015), and Bethany Shipsey (UK, Worcester), also aged 21 who died in 2017 after taking DNP. In Bethany's case medical responses were considered inadequate in providing appropriate care and treatment (Parmenter, 2018). Subsequently, DNP was called the 'inferno drug' (McVeigh et al., 2017), labelled by the media as 'toxic', 'dangerous' and 'lethal', with concerns raised about both regulatory shortcomings and emergency medical responses following these high-profile cases.

Between 2012 and 2017, there were a confirmed 14 deaths recorded across England and Wales, a considerable increase on the two reported in the previous 11 years (Office for National Statistics, 2018), with a further five deaths reported in 2018 (UK Health Security Agency, 2018). Deaths occurring outside of the UK during this time period are difficult to report upon, but research from Gziut and Thomas (2022) found that between 2010 and 2020 and across 38 countries, 456 cases of DNP exposure were reported to poison centres, and from the 33 countries able to share mortality data, 50 deaths were identified. It should be noted however that clinical outcomes are not always shared with poison centres, so this figure is likely to be an underreporting. In response and at a global level, Interpol issued an orange notice in 2015, declaring an imminent threat to those using DNP and highlighting the potential dangers of use (Gayle & Khomami, 2015; Sousa et al., 2020), and for the UK specifically, in 2023 DNP was added to the UK's 1972 Poisons Act under regulated poisons (Aronson, 2023).

Alongside harms, research during this time, explored individual experience and use of DNP, most often via netnographic methods capturing the active and plentiful information on regimes, outcomes and advice shared through online forums, social media, and surface and dark web online marketplaces (Ainsworth et al., 2018; Germain et al., 2021; McVeigh et al., 2017; Petróczy et al., 2015). At this point, research focused predominately on male, bodybuilding communities, however, as with media reporting, there was also evidence suggesting greater heterogeneity in users. Netnographic research undertaken by the lead author of this commentary between 2014 and 2018 identified use of DNP occurring across genders, age, weight, among those who both did and did not engage in other enhancement drug use, and among both those using for athletic or bodybuilding competitions and those using for health or aesthetic reasons (Germain et al., 2019). This research highlighted the differing motivations and user profiles for DNP use, and warned that harm reduction policies and interventions which make assumptions about an archetype DNP purchaser could exclude certain populations including women and those purchasing for health-related or aesthetic weight loss (Aronson, 2023; Gayle & Khomami, 2015; Sousa et al., 2020). It has now been over 10 years since researchers from Liverpool John Moores University began research in 2014 exploring DNP use across the UK. During this time both the weight loss product industry as well as online marketplaces and communities have hugely developed. Considering this, what has this meant for DNP and is its use still as prominent as it once was?

3. Current use of 2,4 dinitrophenol and introduction of GLP-1s

Current searches of online research databases including PubMed and PsychINFO were conducted by the authors of this commentary to provide crude estimates of current academic interest in DNP. These searches indicate that academic work concerning DNP is still prominent with circa 60–100 papers published per year, similar figures to those published ten years earlier. However, the current literature researching DNP for its weight loss properties has significantly reduced, for example recent literature has explored DNP's chemical properties, how it acts in water, and how to remove it from water (Lyu et al., 2025; Mafo et al., 2025) or reports on experimental use of DNP, for example in the treatment of Alzheimer's disease (Cardoso et al., 2024). Those papers which are reporting on DNP as a weight loss agent tend to focus on legislative

changes (Aronson, 2023), synthesis of existing evidence (Izidoro, 2022) and clinical case studies of overdose (Griffiths et al., 2021; Tuğcan & Kekeç, 2024) or related harms (Abdelati et al., 2023), with a paucity in new empirical research being produced. Similarly, media attention has also subsided, with reporting only taking place if there has been a specific incident. Searches of printed and online UK newspapers by the commentary authors using the Lexis Nexis database found that between 2013 and 2018, there were close to 300 news articles for DNP, compared to only 23 in the preceding eight years, and around 100 in the following seven years (Fig. 1). The most prominent story of recent years is that of Kyle Enos, who was jailed for three years in 2025 after selling DNP online (Sky News, 2025). In contrast, ten years earlier there were five time more media articles discussing DNP, many of which were not focused on specific individuals or incidents but instead aiming to raise awareness with questions posed such as ‘what is DNP?’, ‘how does it work and can it help with weight loss and conditions such as diabetes?’.

The commentary authors carried out searches for DNP on Google Trends. This is a publicly accessible service provided by Google which allows users to see how often a word or phrase is searched for online. Searches were conducted on 19th August 2025, and covered the period starting 1st January 2001 onwards. These searches also indicate that DNP interest has reduced, with DNP seeing its peak interest during 2015 and steadily decreasing to present day (Fig. 2). Recent research suggests a shift in online communities towards alternative drugs such as GLP-1 medicines (Turnock et al., 2025) since their use expanded in the UK in 2023 beyond the treatment of diabetes into the weight loss market (Fallows et al., 2023; Mao, 2025). In order to assess GLP-1 online interest, we conducted comparative Google Trends searches for the GLP-1 medicine Ozempic, (also known as Wegovy). As illustrated in Fig. 2, peak popularity for Ozempic occurred in mid-2024, coinciding with reports of Ozempic going viral online and videos attracting millions of views on social media (Turnock et al., 2025). Similarly, comparative searches for UK newspaper articles discussing Ozempic using the Lexis Nexis database show media reporting began in early 2023, with a surge of media reports taking place from mid-2024 onwards and continuing to rise to the present day.

As previously discussed, recent research suggests increased caution towards DNP among online communities due to adverse side effects and speculate that alongside changes in its legal status, the increased availability of alternatives such as GLP-1 may be one factor influencing this (Turnock et al., 2025; Turnock & Piatkowski, 2026). Whilst our rapid scoping searches of online and media activity cannot confirm these claims, they equally do not refute them and suggest trends in relation to a decline in DNP attention which warrants further formal investigation from the perspective of those continuing, contemplating or ceasing DNP use.

Given the small but established body of netnographic evidence around DNP, this could be a potentially promising method of investigation to explore these trends further. The study of online communities can be of value to researchers particularly when populations are undefined or unclear, behaviour is illicit or high risk and where individuals may wish to hide their behaviours due to fear of judgment or repercussions (Germain et al., 2018; Harris et al., 2020). As such, academic research exploring DNP use has often incorporated netnographic methods, in particular in-depth qualitative analysis of online forums and social media, as well as exploration of online drug marketplaces, via both the surface and dark web (Ainsworth et al., 2018 Germain et al., 2021; McVeigh et al., 2017; Petróczy et al., 2015). However, research exploring the use of DNP has reduced in recent years, and similarly, online forums discussing DNP also seem to have declined. At the peak of DNP’s interest in the mid to late 2010’s, our previous research identified there was an abundance of online communities available where individuals discussed DNP. This included both specific DNP forums or subforums, as well as other broader online forums where DNP discussion took place, most notably bodybuilding, drugs, weight loss and parenting communities. Research at this time by the lead author of this commentary (Germain, 2018) found these communities to be highly active (average circa 2 million members) with posters sharing advice on dosing regimen, experiences of use, outcomes and in some instances where to purchase. However it should be noted that comments were not necessarily always in support of DNP use, with some users warning others of the dangerous side effects. Of the ten forums originally included in the analysis, which was conducted between 2015 and 2017, four have now closed and for those which are still open, a further three have been inactive for months or years, or show a declining trend in the discussion of DNP, with most threads posted between five and ten years ago. Forums which are still used to discuss DNP tend to be bodybuilding-focused, with DNP being discussed alongside other enhancement drugs, rather than individuals interested solely in losing weight. There is growing acknowledgement among body building communities of the risk of DNP with some seeking out what they perceive to be ‘safer alternatives’ such as GLP-1 medications (Turnock et al., 2025). However, DNP is still regarded by some in online bodybuilding communities as an effective drug for both rapid weight loss before a bodybuilding competition or as part of longer regimens alongside anabolic androgenic steroids (AAS) and other muscle building or weight loss drug use. Compared to the active forums in the mid 2010’s, DNP discussion in online communities today suggest a shift in those interested in using, with DNP seemingly reverting to being predominately a ‘bodybuilding drug’ only with reduced online discussion among populations using DNP for more traditional weight loss purposes.

Consistent with our Google analytic and media searches, active

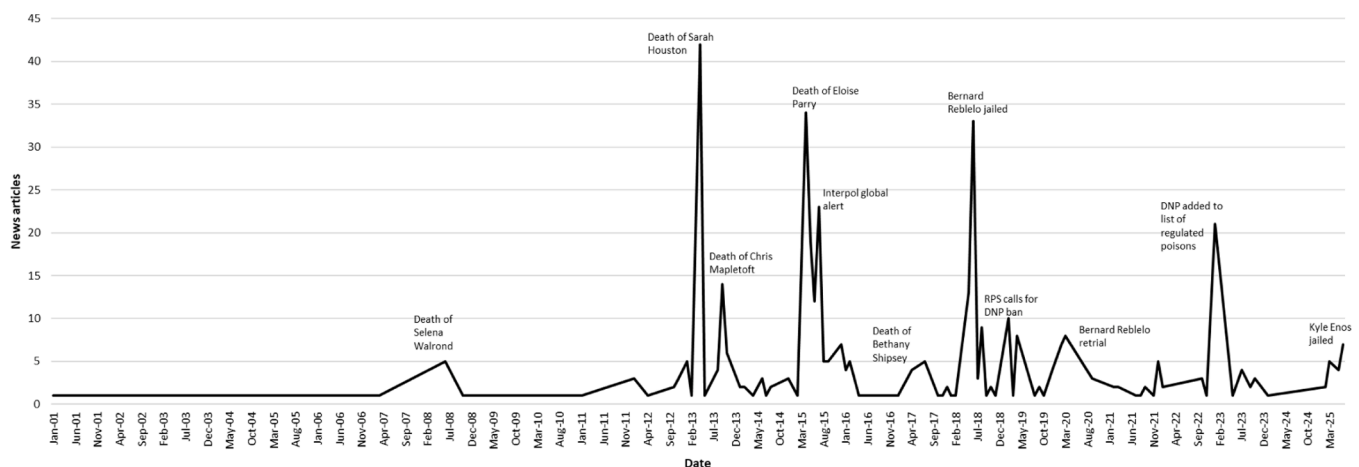


Fig. 1. Newspaper articles for 2,4 dinitrophenol over time.

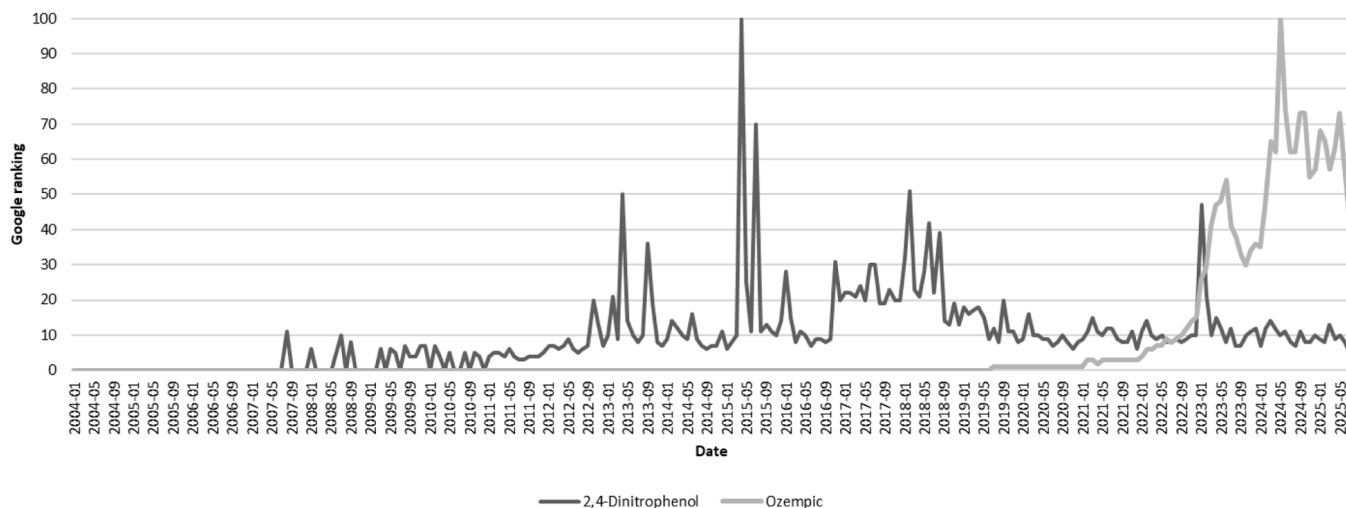


Fig. 2. Google hits for 2,4 dinitrophenol and Ozempic over time.

forums discussing GLP-1 medicines Ozempic, Wegovy and Mounjaro are in abundance and easily identified, unlike those discussing DNP. Scoping searches for the purpose of this commentary identified many open forum discussions of GLP-1 medicines by populations seeking to use it for weight loss. Forum conversations often consist of users seeking advice, praising the effects of GLP-1 medicines, showing weight loss comparisons, and discussing symptoms with fewer negative discussions about the side effects, long-term harms, or advising people against their use. This is a stark difference to what is seen in open forums discussing using DNP for weight loss which acknowledge the 'benefits' but often warn of the dangerous side effects. This difference may indicate a shift in interest by non-bodybuilding individuals who are looking to lose weight.

4. Regulatory considerations

In order to understand these changes in DNP use, particularly among populations contemplating using these medications for weight loss, further insight is needed into whether regulatory changes in the legal status of DNP both in the UK and internationally would have been sufficient in isolation as a preventative measure to divert interest. DNP is now classified as a poison in the UK, and it is also a criminal offence to sell it without an Explosive Precursors and Poisons (EPP) licence (Food Standards Agency, 2025). In contrast, GLP-1 medicines are available in the UK through NHS prescription for those meeting eligibility criteria (based on BMI/obesity related conditions). This raises the unanswered question of to what extent would the change in DNP's legal status have been adhered to by these groups if GLP-1 medicines had not been introduced as a legal-to-purchase alternative weight loss drug? Furthermore, there is evidence to suggest that in the UK, the long waiting times, strict eligibility criteria and high cost of authorised private sellers, has led to the establishment of an illicit marketplace for GLP-1 medicines (Turnock et al., 2025). This suggests the fear of legal sanction alone may not be sufficient to deter weight loss drug use.

Our commentary suggests that perceptions of harm, visibility and changes to online spaces may also have played a role in DNP's decline. GLP-1 medicines do not have the same longer-term evidence for harms as DNP (Thomsen et al., 2025). The implications of using DNP have been recognised for decades, and the sharp influx of media-reported DNP-related deaths following its rise in use reinforced this in the public consciousness. In contrast, some harms in using GLP-1 have been identified, but these have thus far been mainly limited to administrative errors in dosage due to patient and prescriber knowledge deficits (Wiener et al., 2024), and have not been reported in the media with the same intensity as those from DNP ten years earlier. This may go some way to explain the decline in DNP interest and purchasing, as GLP-1's are

considered as newer and potentially safer drugs. The extent to which media representations of DNP has increased public awareness of the associated risks versus raised awareness of it as a weight-loss medicine has often been reflected in historical accounts of DNP (Aronson, 2023; Germain et al., 2021; McVeigh et al., 2017), and the media landscape surrounding GLP-1 medicines may present a useful comparator to guide future intervention.

Finally, it is important to acknowledge that online spaces have changed considerably in the ten years since DNP use was at its peak. GLP-1 medicines such as Ozempic have been made highly visible due to a surge of promoting discourse on social media with newer platforms such as TikTok and celebrity and influencer endorsements piquing public interest and potentially driving subsequent demand whilst also implicating it as a safe method of weight loss due to these individuals platforms and influence (Basch et al., 2023; Fong et al., 2024; Han et al., 2023). Whilst our commentary has highlighted declining visibility and public interest in DNP, we would caution against interpreting this as declining use amongst all populations without further research. The high visibility of GLP-1 medicines among those seeking traditional weight loss may assist in obscuring smaller sub-populations such as the bodybuilding community where DNP use could remain prevalent and harms are unaddressed. Furthermore, the functionality, scale and reach of newer social media platforms and changes in online medication purchasing behaviours in recent years have not been explored in the context of DNP and require further research to establish their potential impact upon purchasing.

5. Conclusions

Across the 2010s, there was a plethora of academic research focused on exploring experiences, use and harms of DNP as a weight loss agent. Over the last ten years however, this interest has significantly reduced, alongside both media reporting and online interest. The reasons for this however are unclear. Attention has seemingly moved to GLP-1 medicines which, at the present time and without the long-term use evidence base, are generally considered to be less risky. This coupled with the changes to DNP's legal status meaning DNP is now less accessible, may have shifted public interest towards more regulated and less harmful weight loss solutions. However, this shift has not been across all groups and communities as whilst bodybuilding communities are now discussing GLP-1 medicines, they are still doing so alongside their traditional weight loss and cutting agents, including DNP. Media attention concerning DNP intensified when use and fatalities occurred outside of bodybuilding communities as this highlighted broader public health concerns at that time, and as such incidents became less common, media

and scientific interest waned. This raises important questions, has use, attention and regular focus concerning DNP genuinely diminished, or is it simply being overlooked? Online communities have advanced with illicit activity now easier to hide via more sophisticated online methods of communication and beyond this, it is unclear why some individuals are continuing to use DNP despite the known risks. Furthermore, are traditional netnographic methods which are primarily focused on surface web forums and social media still sufficient in identifying the full scope of DNP use or do we risk ignoring or missing certain user groups? Whilst the inferno of DNP has seemingly dimmed in recent years, its cyclical resurgence over the last 100 years means we cannot confidently say it has ever been fully extinguished.

CRedit authorship contribution statement

Jennifer Germain: Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Ellie Williamson:** Writing – review & editing, Writing – original draft, Investigation. **Jane Harris:** Writing – original draft, Investigation.

Declaration of competing interest

There are no conflicts of interest

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