Research Article

Exploring the Experiences and Perceptions of Young People's Recreational Nitrous Oxide Use

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Introduction. **This exploratory study investigated the experiences and perceptions of young people who use N_2O recreationally. This is the first qualitative research conducted in Australia with young people investigating this topic in detail. The aim of this study was to explore young people's perceptions, motives, and experiences of N2O use by exploring the positive and negative effects of N2O, motives for use, practices and methods, and suggested advice, to help defines targeted harm reduction messages.**

Methods. **Participants were recruited via hard copy posters, social media advertisements, and snowball sampling. Seven in-depth semi-structured interviews were conducted with young people aged between 18-25 years who had used N2O on at least ten occasions. The interview transcripts were analysed thematically. The study was completed in accordance with COREQ criteria for qualitative research.**

Results. **The findings identified four overarching themes about N2O use, *1) The nature of N2O use; 2) The appeal of N2O; 3) Influences on N2O use; and 4) Perception of risk and harms of N2O use.***

Discussion. **The findings indicated that perception of N2O harm was low amongst the young people in this study. The discussion identified three core factors that underpin N2O consumption: *1) Social influences; 2) Other substances and 3) Accessibility.***

Conclusion. **Young people in the study described their experiences as being largely pleasurable. However, several identified negative impacts although harms were primarily disregarded. Exploration of N2O effects alongside other substance use highlighted how N2O is a unique substance and should be considered as such when developing harm reduction strategies.**

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Introduction

Nitrous oxide (N2O) is a dissociative anaesthetic that was developed for recreational use in 1722 [1]. Now used to aid medical procedures, particularly in dentistry and childbirth [2], reports of physical, social and environmental problems associated with non-medical use are increasing around the world [3]. Problematic alcohol and drug (AOD) use is an enduring and complex issue that can negatively impact peoples' health and wellbeing [4]. Research has informed the implementation of safety measures to reduce substance-use related harm, such as drink driving laws and school-based prevention programs [5]. However, research on N2O has been limited with most published studies comprising individual case reports of hospital presentations [6][7]. Some studies have indicated that recreational use of N2O is increasing rapidly among young people and harms are also increasing as a result [8][9][10][11]. Recent commentaries have explored the 'addictive' nature of N_2O [7][12][13][14].

While existing harm reduction strategies for other recreational substances can guide harm reduction advice for N2O, they are not sufficient for this emerging health crisis and potential addiction [14]. The unique effects, and methods of N2O use require a more nuanced and contextualised approach.

N2O was rediscovered as an intoxicant in the emerging drug scene of the late 1960s [15]. In a recreational context, N2O is often referred to colloquially as 'nangs' (Australia) or 'whippits' (UK) and is generally inhaled directly through a whipped cream dispenser (known as a 'nanginator'), or through a balloon [3]. Once inhaled, users typically experience brief euphoria, relaxation, and mild perceptual changes for around one minute [16]. N2O use often takes place at parties, nightclubs, and festivals [11]. In most Australian jurisdictions, N2O is accessible and costs little [3]. N2O cannisters, which are inserted into whipped cream dispensers, are legal and can be purchased online and at most general stores and supermarkets for approximately $1 AUD [6][11].

Despite the increasing use of N2O and its euphoric effects, a range of health issues are associated with it [17]. These are emerging as prevalence of use increases [11]. For example, increasing numbers of nitrous- oxide-related emergency presentations in Australia have been reported [18]. Frequent use of N2O can result in low levels of vitamin B12, and because of this deficiency, users may suffer neurological disorders [19]. Some consequences include megaloblastic anaemia, (myelo) neuropathy, thromboembolic complications [17], and degeneration of the spinal cord [20]. If not treated early on, these effects can cause permanent disability [20].

N2O use may cause reproductive harms [21] and has been linked to serious road accidents including 63 deaths in the Netherlands in the past three years [22]. Death by asphyxiation has resulted from methods used to inhale N2O [23]. Recent research has also found that passive inhalation of N2O can affect bystanders known as 'accidental users' [24]. However, many people remain unaware of N2O harms and risks. While practitioners, decision-makers and young people remain uneducated about N2O, harm reduction strategies cannot be effectively established [6].

Peer-to-peer conversation about drug experiences, benefits and harms is typically how drug use techniques and safety measures are shared. A platform where recreational N2O use is frequently discussed is via the social news and discussion site, Reddit. A recent study by MacLean and colleagues [25] analysed conversation threads of Reddit users asking and answering questions related to N2O use and from this, identified existing strategies by users to *'minimise harms and maximise pleasures'*. Discussions included questions and advice on practices such as inhalation techniques, substances that enhance the effects of N2O, and ways to minimise harms according to user experiences. In formulating harm reduction advice and psychoeducation for young people, it is important to include these sources of communication as they offer insight, and the forums provide a dissemination point for health-related advice.

The aim of this study was to explore young people's perceptions, motives, and experiences of N2O use by exploring the positive and negative effects of N2O, motives for use, practices and methods, and suggested advice, to help defines targeted harm reduction messages.

Methods

This study used qualitative methods to explore the experience of young people using N2O. The study was completed in accordance with the COREQ criteria [26](see Appendix 1). Ethics approval was granted by the University of Wollongong Human Research Ethics Committee (2022/008).

Participants eligible for the study were aged between 18-25, who identified using N2O for non-medical purposes on at least ten occasions and resided in the Wollongong region. Wollongong is a regional town located one hour from Sydney with a population of 302,739. It is also a university town with a large cohort of young people. This age group was chosen as research indicates recreational N2O use is most common in young people [27].

Participant recruitment took place between April and August 2023, both online (social media) and in-person via posters advertised around student accommodation and a university bar. Snowball sampling [28] was also utilised to recruit participants outside the university community. This was done by asking initial participants whether they knew any other people who use N2O and inviting them to participate.

This research was purposively designed as a peer-led study whereby the primary researcher (HW) was a young adult and university student themselves. Peer researchers have an insider connection with the hidden practice of drug use and a more nuanced understanding of its socio-cultural environments [29]. Peer researchers can also build trust more quickly and effectively than outsider researchers [29]. As such, interviews were conducted by HW, with the support from another member of the research team. HW was supported by a supervisory team comprised of experienced qualitative researchers. The supervisory team were available to support HW if participants experienced any distress. No adverse events occurred. Interviews were conducted online via Zoom or in-person. All data including interview transcripts and the reflective journal were uploaded to qualitative analysis software 'NVivo' [30].

A thematic analysis was utilised to identify emerging themes while also ensuring that the research was guided rather than derived from assumption [31]. Clarke and Braun [32] highlight a six-step framework for thematic coding. This framework was followed during data analysis and encouraged modification and refinement of codes. HW conducted the initial deductive coding linking participant statements with literature review concepts [33]. HW brought examples to weekly supervision to discuss noting similarities and exceptions in each interview as it was coded. This iterative approach allowed for new concepts and themes to emerge from the data [33].

Results

A total of seven qualitative interviews were conducted at Wollongong University between April and August 2023. Six were in-person, and one was online. Interview duration ranged between 30-60 minutes with an average time of 43 minutes. Participants were asked to complete a short demographic survey (see Table 1) of age, gender, education, and patterns of N^2O use. Young people who participated in the study are referred to as "participants" and identified by their allocated number e.g. (#1) refers to participant 1.

Name	Date 2023	Age	Gender	Identify as First Nations	Education	N_2O frequency	N_2O use – alone/peers	Polysubstance N_2O use	Interview type
Participant # 1	13/4	25	Female	No	Bachelor	Once a month	Both alone and in company with others	In combination with another substance	In person
Participant # 2	14/4	24	Male	No	Bachelor	1-2 times a week at peak - now less than once a month	Both alone and in company with others	In combination with more than one substance	In person
Participant # 3	20/4	21	Male	No	Bachelor – current	3-4 times a week at peak - now less than once a month	In the company of others	In combination with another substance	In person
Participant # 4	20/4	25	Male	No – born overseas	Masters	1-2 times a week at peak - now less than once a month	In the company of others	In combination with more than one substance	Online
Participant # 5	21/4	23	Male	No – born overseas	Bachelor - current	Once daily at peak – now less than once a month	Both alone and in company with others	In combination with another substance	In person
Participant # 6	29/7	20	Male	No	Bachelor - current	Less than once a	Company of at least one	In combination	In person

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Name	Date 2023	Age	Gender	Identify as First Nations	Education	N_2O frequency	N_2O use – alone/peers	Polysubstance N_2O use	Interview type
						month	person	with another substance	
Participant # 7	7/8	19	Male	No	Bachelor – current	3-4 times a week at peak - now less than once a month	Both alone and in company with others	All of them - alone, combination with other substances	In person

Table 1. *Participant Characteristics*

We present four overarching themes about N2O use, *1) The nature of N2O use*; *2) The appeal of N2O*; *3) Influences on N2O use*; *and 4) Perception of risk and harms of N2O use.* An overview of the themes and how the coding was developed is presented in Table 2.

Codes	Groups/categories	Themes
• Social • Alone • Started • Environment • Habit • Other substances • Quantity • Frequency • Method • Perception of role	The environment and certain habits of N20 use What using N20 looks like How people use N20 N20 as an additive to night or night revolving around it	***The nature of N20 use***
• Appeal • Describing • Effects • Habit • Environment • Other substances • Family or role model stories	What attracts young people to N20 Good experiences and effects Common habits during N20 use Why continue to use N20	***The appeal of N20***
• Accessibility • Legalities • Perception of risk/harm • Perception of role • Other stories and sources • Family or role model stories • Safety • Started • Other substances	Impact of regulations and accessibility of N20 on use N20 and other substances Influence of stories from people they know Influence of stories and sources regarding N20 on first time use	***Influences on N20 use***

Codes	Groups/categories	Themes
• Quantity		
• Safety • Perception of risk/harm • Negative effects • Perception of role • Effects • Other substances • Future • Family or role model stories	Advice given for N20 use Negative experiences How young people perceive severity of risk and harm N20 and other substances Impact of risk on future use	***Perception of risk and harm associated with N20 use***

Table 2. *Theme Development*

Theme 1: The nature of N2O use

This theme relates to where and how participants use N2O, including the nature of settings and described methods of use. This theme has two subthemes: settings and method of use.

Participants cited regularly using N2O with *"small group[s] of friends"* (#1) sitting together in parks, cars, at "*home, house parties, small gathos*[1]*, or sessions* (#6)". This most frequently occurred in the evening, and at the end of the night:

> *If we had a night out, everyone wants to stay up a bit longer, then it sort of comes back to that small group after you've gone out (#6).*

Participants stated these environments facilitated the co-use of N2O with other substances like alcohol, marijuana, ketamine, LSD and MDMA for "*prolonging*" (#1) and "*intensifying*" (#4) N2O other substances' effects:

> *I would never do nangs by themselves because it would be a lot more fun and a lot more intense if you were on other substances...it feels like it lasts longer, the visual effects are more.*

Compared to like if you do it sober…it's a lot more dull (#4).

In the demographic survey (Table 1) all seven participants selected 'in combination with another substance' or 'substances' to describe their typical N2O use. Overall, this suggests that singular use of this substance is not typically condoned by participants.

Participants described inhaling N2O in two ways - by inserting a N2O canister into a whipped cream dispenser, dubbed a 'nanginator' or 'cracker' then inhaling from [1] the dispenser mouthpiece, or [2] a balloon inflated with N2O from the dispenser. When inhaling through the balloon, users stated they breathed the N2O to and from the balloon until they *"physically can't anymore"* (#6). This was the preferred method for the six participants because the nangs *"last[ed] longer"* (#2) and they obtained a stronger "*hit"* as "*inhaling and then exhaling into the same thing, there's gonna be very limited oxygen you're getting" (#7)* compared to a singular hit from a dispenser. Participant 6 cited favouring inhaling from the dispenser then incorporating a balloon, so as not to *"lose a lot of nitrous"* when fitting the balloon to the dispenser.

Additional methods participants described to extend the short-lived euphoric effects of N2O including "chaining" (#6) or unremittingly breathing N2O through a series of balloons:

> *You do the nang and as you're breathing in and out, you get someone to load a second one for you…don't take a breath, and then go to the second one. And you can go for as long as you want. I guess it's stronger…it just keeps you in that peak state longer" (#6).*

Or inflating the balloon from more than one cannister, colloquially known as a '*double or triple nang*':

> *You can put a few in one balloon, so you could do three at once…it just makes it last longer and the feelings are more intense…the more you do the quicker you lose oxygen and there's been times where I've gone really blue …. you're pretty much passing out (#2).*

Highlighted here is the elevated risk with seeking prolonged N2O effects, or as stated by some participants achieving a high like their first N2O use because they reached "a point where you only ever do two at a time because one would do nothing" (#4). While no one linked peer pressure with their initial uptake, some associated competition with N2O use. According to participant three this surrounds the longitudinal *"unwritten rule"* when breathing through a balloon whereby users *"don't want to be the first to stop"*. This is almost *"a competition…I remember a lot of the boys passing out just to try and beat each other"*. Participant 1 also recalling observing *"who's gonna be lasting the longest"*.

These reflections from both male and female participants, demonstrating the competitive nature of N2O may not be gender specific. Overall, we found N2O rarely occurred alone and in combination with other substances. This was consistent regardless of age, social groups, and location. Finally, the quest for stronger 'highs' led to innovative practices which increased risk.

Theme 2: The appeal of N2O

The second theme surrounds why people use N2O in the short and long term. Whilst participants struggled to explain what using N2O specifically feels like due to its *"distinct unique feeling"* (#3), they labelled it as: *"euphoric"* (#1, #2, #4), producing *"dizziness"* (#1, # 2, #4), *"disorienting"* (#1, #3), *"a fifth dimension"* (#5), *"numb[ing]"* (#6), *"dissociated"* (#1, #3, #7), an *"echo feeling"* (#1, #7) almost like a "*wahwahwahwah noise in your head"* (#6), and *"feeling like you're trying to chase something that you can't actually get a hold of"* (#4). Most participants claimed they enjoyed its short-lived buzz, disorientation and connection but highlighted this may not be the case for everyone due to its intense, short-lived effect.

Most participants stated their favourite aspect of N2O use is its sociability. Whilst five in seven participants had used N2O alone, most preferred doing it with others for social reasons. Some emphasised they would not use N2O alone:

> *I guess I will smoke pot when I'm alone. And I will drink when I'm alone. But I wouldn't do nangs alone...I kind of like how social it is...nangs are bringing us together (#1).*

This social aspect to nangs was reflected in rituals surrounding its use:

> *You'd wait for everyone to crack theirs and you'd hold on to the balloon and then all do it at once (#3).*
>
> *You'd kind of all just do it at the exact same time together... You always wait for like the perfect part of a song or do it to a specific song that everyone would agree on (#4).*

In this sense nangs were perceived to be *"communal"* (#3), something linguistically exemplified in the phrase "*cheers a nang"* (#1), which is where users cheer a Nang balloon before inhaling in the same ways others cheer alcohol before drinking.

Only two participants described regularly using N2O alone. This was for its dissociative and numbing effects:

Depriving your brain of oxygen…everything that you thought that matters doesn't matter anymore (#5).

Theme 3: Influences on N2O use

Theme three further explores social facilitation, accessibility, and substances co-usage as key factors in the N2O experience.

Before using N2O, participants stated they learnt about the drug from peers, family and/or independent research. Peers were the most common point of contact, providing verbal commendation or practical demonstration, as explained by participants 1 and 5.

I was introduced by a friend, she'd just gotten back from Vietnam… in Vietnam they actually do it in the night clubs, it's very normalised she was saying…and they take it like in huge balloons (#1).

The first time I really thought about it was I went on this holiday with a guy, and he brought 500 nangs with him and we were just like away for a week… And so eventually I started (#5).

These statements highlight social initiation, but participants also cited online sources.

I wouldn't say we heard about it through them (peers). I feel like a lot of it is like the Internet…there's this one YouTuber…and he talked about nitrous. He talked about the dangers…but he was addicted at some point and just kind of used that to justify his addiction (#7).

Participant one's father *"normalised it"* by sharing stories about his own use when he was younger. Participant three similarly was introduced by his boss' stories of taking it whilst working in hospitality, aged 14.

I think knowing that people you look up to and care for and trust have experienced it, you'll be okay. So, I think that really takes a lot of that risk off. (#3).

Social stories also appear to have mitigated knowledge of side effects for some,

I was pretty scared because when you look up online, you see cases of people that have done them, and it's really affected their health. I was like, oh I'm never gonna try this…but then a few friends did it and they're like oh this is awesome (#6).

As is evident in quotes above, the normalisation of N2O use via family members and role-models appeared prominent amongst participants, who described socialisation processes that infer N2O use to be a safe and acceptable transition into adulthood.

Participants also liked the accessibility and cost of N2O which can be bought through local cooking stores, petrol stations and online delivery services. All participants in this study noted N2O is both *"accessible"* (#3) and *"easily obtained"* (#2). None could recall having purchases denied although some suppliers asked usage questions such as,

> *I got 2 packets and she said 'what for?'. .And I said, ohh, my mum's baking a cake. (#1).*

Participants also ordered N2O 24/7 online delivery services that delivered, facilitating orders at night when shops were closed. These delivery services were stated to be so easy to use: *Whenever we start doing nangs someone's like 'oh let's order more' (#1).*

Notably nangs were claimed by some participants to be easier to source than alcohol, particularly if they were under 18 years-of-age, "You can get like 50 for $50...or like a box of 10 for $11.00" (#2)

The legal dichotomy surrounding N2O was acknowledged by participants:

> *It's funny because I know they're legal for purchase if they're for cooking uses, but they're illegal for recreational uses...I went to a cooking goods store. So, I was under 18 and I bought them because I said I needed cream chargers (#5).*

Although some stated illegality may not affect them trying to access them.

> *If I actually knew a place to illegally source them, I probably would (#7).*
>
> *It was also noted that being able to "just go get them anywhere", took "part of the fun away" because "there's something fun about knowing you're not supposed to do it" (#3).*

This suggests at least some participants do not consider N2O a serious recreational drug and may deem it as less harmful than illicit substances. It also highlights that young people's use of N2O is not entirely driven by its accessibility.

Theme 4: Perception of risk of harm associated with N2O use

The final theme relates to participants' perceptions of N2O risk, and the strategies used to mitigate this. Participants recounted several negative effects experienced by themselves and peers. These

included the urge for more, loss of control, reduced concentration, and memory, and burns and infections.

The short-lived effects of N2O were described by some participants as leaving them wanting more.

> *You get the next one but like, if you just stop, you crave another one... you'll always want the next one until you run out (#2).*

> *Nangs are a trap...as soon as you inhale that nitrous oxide, you're like man I just want another Nang (#5).*

Whilst this was not seen by participants as a dependence in themselves, they recognised it as such in others.

> *My friend did hundreds of nangs back-to-back for a whole week. He ended up skipping out on work...it's definitely used as an escape... so, I'd say it is quite easy to get addicted (#5).*

Feelings of euphoria and dizziness also came with a lack of control and risk of falls, with Participants reported *"falling over"* (#6), *"spasming"* (#2), and falling *"unconscious"* (#4) when using N2O. Many attributed this to reduced oxygen.

> *"I've gone really blue and cause I'm not breathing in any oxygen, you just like stop and you're like pretty much passing out ...There's been a few times during a nang I've thrashed around. I think my body seized up a lot" (#2).*

Others described observing their friends' induced reactions:

> *"She would stand up while she was in this Nang state of mind, and then she would just fall over...we had to make sure that she wasn't gonna hurt herself...it looked like she was possessed" (#5).*

Regardless participants acknowledged continued use of N2O. This suggests indifference towards observed negative consequences.

The aftereffects of usage reported by several participants include *"brain fog"* (#2, #3, #4), *"short term memory loss"* (#2), , *"super dumb and a haze over my head"* (#3), and *"a little less human"* (#5). Effects were described as lasting up to a week:

Sometimes you'd have a big weekend and then like the following few days when you're trying to do an assignment... nothing's happening in your head (#4).

These effects were stated to occur when N2O was frequent, with use most weekends. Others experienced *"brain zap[s]"* (#2, #4), which lasted from days to weeks when using large quantities of N2O over short periods:

It feels like an electric shock in my brain... as I'm trying to fall asleep or do something (#2).

A genuine zap in your mind and would last for 2-3 weeks (#4).

The use of smaller Nang crackers by many participants, rather than whipped cream dispensers, whilst *"convenient and inconspicuous"* (#5), was understood to risk cold burns on hands and lips:

We were using those really shitty cheap eBay crackers and that often required you to have your hands on the metal canister thing... the boys would have these blisters on their hands or on their mouth (#3).

Participant seven displayed resulting scars.

I think those marks there are from it because like, especially with longer fingers, you have to grip it...and I would have freeze burns there for ages (#7).

Although most participants reported receiving cold burns, only one participant (#3) recalled a friend seeking medical advice when their hand became infected.

Other concerns identified by participants related to general health – "Overtime we realised that every single time she did Nangs, she had to get more antibiotics" (#7).

While another was concerned about usage by-products.

We started getting black stuff hitting us in the back of the throat and it was disgusting...I'm like washing out the nanginator...I've never seen that much gunk in my life, and so if any of that was going to our lungs it definitely wasn't good (#5).

Despite describing a range of negative effects, participants' perceptions of N2O risk were low. Participants linked this to a lack of information regarding N2O harms,

I wouldn't say that nangs are dangerous. I don't do a Nang and think oh this could go badly. I never thought that once... I mean I really don't know the dangers of nangs (#5).

Moreover, some participants considered N2O a lower risk because it is legal.

> *The fact that it's so easy to get, you know if the government hasn't deemed it to be too dangerous and ban it then it must be ok (#3).*

When reflecting on N2O's negative effects of use, most did not appear concerned.

> *I remember hearing my friend say, 'he's going really blue, should we stop him?' And them being like 'Nah, he'll stop when he's ready'. And I did (#2).*

Several participants found negative instances humorous.

> *We were all so spaced out all you could really do is laugh…the fact we've experienced it before I don't think there's too many alarm bells ringing (#3).*

Despite participants stating they use Nangs in the car, many did not think it affected their driving ability.

> *Yeah, we drove. Obviously felt super spaced out and airy, but yeah, didn't feel like too incapacitated to drive (#3).*

The only time participants identified where they would consider seeking medical assistance was where a friend was unconscious.

> *I knew if anything bad were to happen I would have people to call an ambulance. So yeah, if anything did happen, which I don't think it would (#2).*

Yet, this appears paradoxical, given that most acknowledged co-partaking of N2O - meaning everyone present is concomitantly high or passed out.

Many participants advised ways to reduce N_2O harms, including being seated and in a comfortable environment, administering it via balloons, inhaling smaller quantities, moderating use over time and having a 'sober' person present.

> *Definitely not something you should be doing while dancing or in a mosh…it's definitely a sit-down drug (#6)*
>
> *Just be safe, just do one at a time. Not multiple cause you'll lose oxygen and struggle to breathe (#2)*

If someone did have a bad experience or someone was in trouble and everyone is numb and can't move, how are you supposed to help a mate? (#6)

When asked if participants would do nangs, in the future most answered yes.

Ohh yeah, 100% (#5)

Those who responded with no, associated this with changed responsibilities or perspectives towards drug taking.

I understand how silly it is now ...I know that I would feel shit after and have that brain fog ... it's not something I'd wanna do again... like it's trivial now (#3)

[1] *Gathos*: means small gatherings

Discussion

This study set out to examine the experiences and perceptions of young people who use N2O recreationally with an aim to develop relevant harm reduction strategies. This study highlights a range of reasons why young people are using N2O. The participants reflect how N2O use is related to both personal and public factors. The results indicate that young people are not fully aware of the harmful consequences of N2O use and their perception of risk is low. Similar to two previous studies [3][34] seeking relaxation with friends, easy access, and minimal negative aftereffects are some motives for N2O use. However, the findings from the present study identify three core factors (Figure 1) that underpin N2O consumption. This discussion will focus on *1) Social influences*; *2) Other substances and 3) Accessibility.*

1) Social Influences

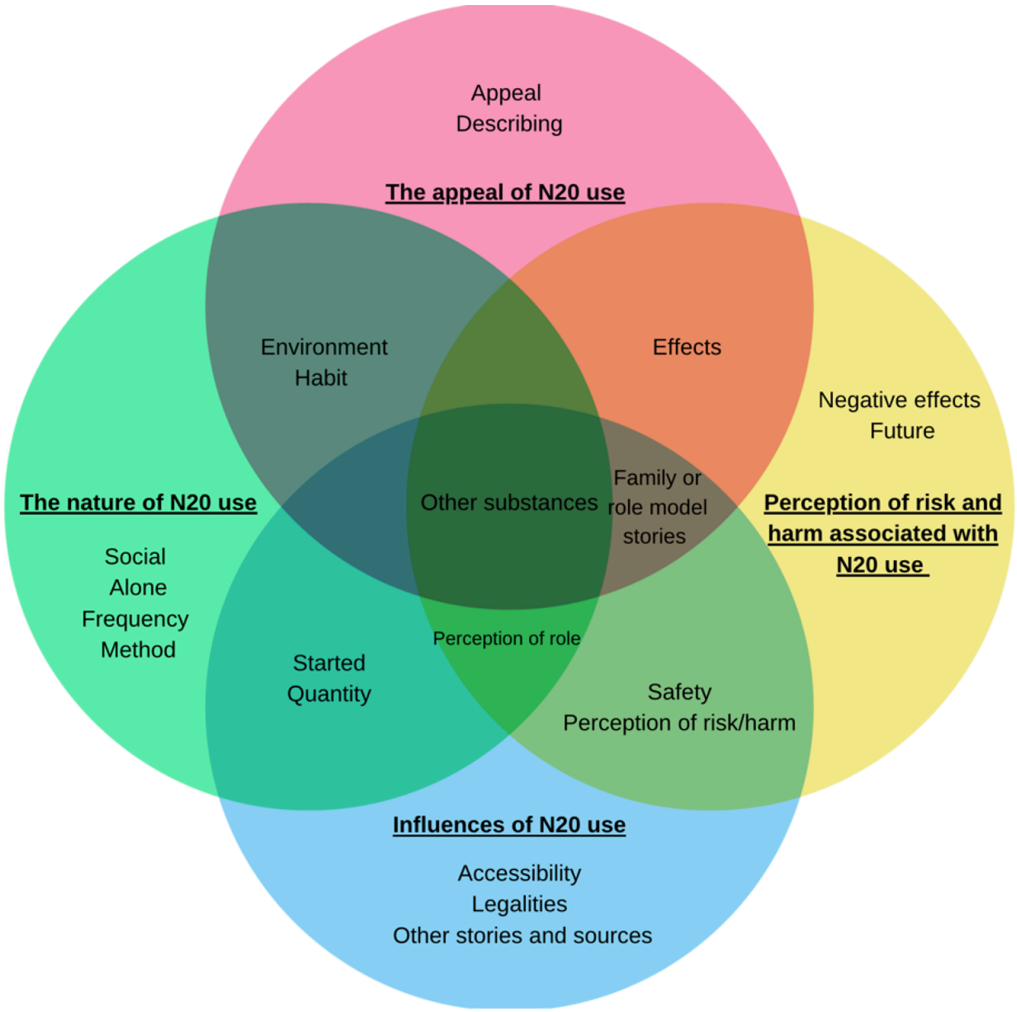

Figure 1. Core Factors of use

A key finding in this study identified that using N2O was social in nature. While existing literature [6] highlights recreational aspects of N2O, the social influences of use have not been thoroughly investigated. N2O use is almost always reported as being conducted in the company of at least one other person and the study findings suggest this is primarily due to the amusing effects of watching friends use N2O or the act of doing a nang at the same time. Among the seven participants[2], this social factor is identified as the most appealing feature of N2O use and suggests that further research is needed to gain a deeper understanding of the habits and positive perceptions young people have toward N2O.

2) Other Substances

The 'other substances' code is the single code that overlaps across all four themes. Qualitative research [35] in Denmark highlights how some young people would use N2O in combination with alcohol and cannabis but finds that other illicit substances are not commonly used with N2O, although MacLean and colleagues [25]identified use with psychedelics.. In the present study, while several participants recall using alcohol and cannabis with N2O, most of the interviewees indicate that other illicit substances such as ketamine, LSD and MDMA are mostly used with N2O.

Similarly, recent research [25] analyses online Reddit discussions and identifies that users would often use a range of psychedelic substances concurrently with N2O. Ketamine is a particularly prevalent substance among participants in the present study and one participant (#7) describes the subjective effects of N_2O to mirror a strong dose of ketamine. This may be due to ketamine being a dissociative substance, similar to N^2O, making it more appealing to users who seek this effect. Contrary to these findings, a recent study in France by Inquimbert and colleagues [36] finds that N2O users do not use ketamine in combination with N^2O but instead alcohol and 'poppers' (Amyl Nitrate) are significantly associated with lifetime N^2O use. Further support for N2O use being contextualised according to cultural practices in a specific geographic location.

3) Accessibility

Another key element related to N2O consumption is accessibility. Access to N2O is depicted as effortless and inexpensive by participants, with many reflecting on obtaining N2O through online delivery services late at night. This finding is consistent with the work of Grigg and Lenton [37] who also note easy accessibility. There has been limited research interrogating N2O accessibility, the participants in this study outline this as a key factor in their consumption.

In contrast to the findings of Winstock and Nutt [38], who explore recent UK government bans of N2O to stop recreational use, several of the participants in the present study identify that making N2O illegal would not change their motivation to access it. These findings support the validity of a harm reduction approach toward N2O use.

Understanding why young people use N2O and the different factors that influence its use will ultimately assist in development of harm reduction knowledge such as target populations and specific habits and motivators. To extend on this knowledge, further investigation on social influences,

concurrent substance use, and accessibility perceptions needs to be conducted to identify those at most risk of harms.

Strengths & Limitations

A key strength of this study was the peer-led approach that utilised a peer researcher to conduct the interviews and lead the data analysis and interpretation. This allowed a more nuanced understanding of the participants' lived experience. Semi-structured qualitative interviews provided flexibility to modify interview questioning to explore new curiosities. Resultingly interviews can be more explorative and interview questions produce richer data. This is exemplified in the interview times, which increase as the study progresses and researcher confidence grows. A limitation of this study is its sample size. The original aim was to conduct ten interviews, however due to time constraints, seven interviews were conducted. The demographics table presented indicate similar characteristics among all participants. For example, all participants had completed a bachelor's degree or are current university students, several participants do not frequently use N2O anymore, and six out of seven participants identify as male. These factors limit generalisability of the study's findings. Despite the limitations, this study presents innovative findings that can inform future research and contributes to the evidence base regarding N2O use among young people.

Conclusion

This is the first qualitative research conducted in Australia exploring the experiences of young people's recreational N_2O use and contributing to harm reduction strategies. The findings from this study identify that young people use N_2O to enhance the effects of other drugs, add to the social activity of an occasion, and to reach a state of intoxication in an accessible and cheap way. Young people in the study describe their experiences as positive for the most part. However, several identify negative impacts. Regardless, perception of N_2O risk is low among young people in the study, with social risks overriding physical risks, and accessibility and short-lived effects of N_2O suggesting that N_2O is normalised. Through analysis of N_2O effects and consideration of previous harm reduction advice for other substances, N_2O is unique to any other recreational substance and must be thought of as separate. Appropriate harm reduction strategies and psychoeducation must be employed in ways that are accessible to young people to ensure they can mitigate harms.

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