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Cannabis research in context: The case for measuring and embracing regional similarities and differences

Considerable differences in the types of cannabis products, methods of use, social norms and cultures and legal climates surrounding use exist among regions, resulting in distinct cannabis use contexts. Research examining and accounting for these contextual differences is crucial to further understanding cannabis use and cannabis use disorder, and for developing and refining context sensitive strategies for prevention, treatment and harm reduction.

The past two decades have seen increased legalization of recreational cannabis use across the globe, increased prevalence of use and emerging evidence of increased cannabis-related harms [1]. We argue that precisely how cannabis impacts people who use cannabis, as well as who is likely to use cannabis and why, may vary substantially depending upon variation in legislation, products, promotion, methods of use, social acceptability and norms around use. These factors create unique and regionally specific 'cannabis contexts'. Although contextual and broader cross-cultural considerations apply to all addictions we believe they are particularly important for cannabis, given the global changes towards more lenient cannabis policies. We aim to increase awareness and stimulate research and debate regarding how cannabis contexts may shape the processes underlying cannabis use disorder (CUD) and associated outcomes.

POTENCY AND ROUTE OF ADMINISTRATION

The percentage of Δ^9 -tetrahydrocannabinol (THC) in cannabis products has been increasing internationally [1], but there are substantial differences among regions, markets and type of product [1]. Use of higher-potency cannabis products appears to have risen in the United States and may be more common in states that legalized cannabis [2]. These temporal and regional differences may have health implications [3]. Further increasing regional and individual differences in cannabinoid exposure, new THC products are rising in popularity in the US market, with one in six cannabis users reporting Δ^8 -THC use [4]. Δ^8 -THC produces fewer psychoactive effects than Δ^9 -THC, and may be preferred among those seeking medicinal benefit, indicating a potential difference in attitudes towards use.

Common routes of administration (ROA) also differ throughout regions and impact the bioavailability of cannabinoids. Cannabis combustion results in faster onset of action and higher blood cannabinoid

levels relative to oral ingestion [5]. While smoking is still the most prevalent ROA in the United States and Canada, edible products are rising [6] and smoked cannabis flower combined with tobacco is still most common in European countries [7]. Nicotine and cannabinoids may have compensatory and synergistic neurobiological effects [8], and nicotine–cannabis co-users may have more severe CUD prognoses [9]. These regional variations may result in differential effects of frequent cannabis use on CUD and other physical, cognitive and mental health outcomes.

LEGAL AND SOCIAL ENVIRONMENT

Cannabis policies, as well as perceived norms surrounding it, may also influence trajectories of cannabis use, and probably contribute to regional differences in the prevalence of use and CUD. More permissive community attitudes are associated with heightened cannabis use [10]. The interplay of policies and social attitudes may feed into and interact with perceptions of one's own use, producing different outcomes across cannabis contexts. In the United States, increased perceptions of cannabis availability and declining perceptions of harm parallel increasing use rates [11]. Despite such increases in use, self-reported CUD rates are declining [12]. Some argue that, rather than reflecting a legitimate decline in CUD, this seemingly contradictory pattern may reflect reduced treatment-seeking among some types of cannabis users (e.g. [13]). We tentatively agree: legalization *per se*, as well as the concomitant changes in how a drug is then acquired, can alter perceptions of the drug's safety, in turn potentially changing perceptions of the consequences of use [14]. Such factors may interact with other forms of messaging around cannabis—for example, the presence of signs promoting the benefits of cannabis in dispensaries is associated with increased use in California [15]. The emergence of cannabis use for evidence-based and purported therapeutic benefits may appeal to and bring in different types of people who use cannabis, while also changing the perceptions of health consequences among those who already use cannabis.

In contrast to the United States, Canadian cannabis users reported higher perceived CUD risk post-legalization [16], and preliminary data from emergency psychiatric units indicate higher use and CUD rates [17]. CUD treatment entry has also been increasing in Europe [18]. In short, the local social, regulatory and broader societal milieu in which cannabis is consumed is exceedingly complex. There

BOX 1 Cannabis research context statements.

Recommended content to include	Example
Location	'This study was conducted in
Year	Amsterdam, the
Cannabis policy (i.e. legal status recreational and/or medicinal use, commercial versus non-commercial)	Netherlands in 2023. Recreational cannabis has been decriminalized since 1976 and can be bought in commercial "coffee shops" in small quantities.
Description of retail market (if applicable)	The majority of users
Common method of administration	smoke "joints" with added tobacco, and many
Average regional cannabinoid content (if available)	also smoke cigarettes daily. The average THC content is X. The average CBD content is X. The
Regional prevalence of cannabis use and cannabis use disorder	rates of cannabis use and CUD are X and X, respectively. Treatment entries have been decreasing in the past decade'

are reasons to believe that these factors may affect who initiates use, how it affects them and whether they perceive such effects. Greater attention to these cannabis contexts may improve our understanding of the effects of cannabis.

IMPLICATIONS AND GUIDANCE FOR RESEARCH

If the experiences of people who use cannabis across different contexts are—as we suggest—potentially so variable, then how are we to proceed in investigating and understanding the effects of cannabis? One approach is to sample niche populations of homogeneous, cannabis-only users, but this will ignore the reality of cannabis use. It is this more complex picture that we need to understand to provide nuanced evidence-based guidelines regarding safer patterns of cannabis use that can generalize to the wider population of people who use cannabis. Instead, researchers should embrace the heterogeneity of cannabis use and study the potential impact of cannabis context. To achieve this, we recommend the following; first, we urge researchers to study and report cannabis use in a more standardized fashion. The iCannToolkit [19] can provide a framework for this, facilitating evidence integration and characterization of context-specific patterns of cannabis use. It proposes the time-line follow-back (TLFB) methodology (in combination with a 5-mg THC unit across products and ROA) as an extensive self-report use quantification method. Self-

reports of cannabis product are a quick and reliable proxy for cannabinoid exposure [20]. Secondly, when testing time allows for it, perceived risks and benefits of cannabis use and motives for use (e.g. recreational versus medicinal) are relevant to incorporate. When samples are large enough, exploratory analyses can assess whether these factors influence health outcomes. Beyond studying people who use cannabis, it may be valuable to assess public perceptions of cannabis among different countries and regions—including often under-represented minority groups—over time. Finally, we strongly recommend that studies incorporate explicit 'cannabis context' statements, including the elements described in Box 1. These statements can provide a brief overview of the typical cannabis context in which the study was conducted to help characterize heterogeneity in contexts across studies, potentially improving data synthesis. Over time, information contained in such statements may even be used meta-analytically to help explain variations in findings across time and regions.

KEYWORDS

Cannabis, cannabis use disorder, context, culture, environment, potency

AUTHOR CONTRIBUTIONS

Janna Cousijn: Conceptualization (equal); funding acquisition (equal); supervision (lead); writing—original draft (supporting); writing—review and editing (lead). **Lauren Kuhns:** Conceptualization (equal); writing—original draft (equal). **Francesca Filbey:** Conceptualization (supporting); funding acquisition (equal); writing—review and editing (supporting). **Tom P. Freeman:** Conceptualization (supporting); writing—review and editing (supporting). **Emese Kroon:** Conceptualization (equal); writing—original draft (supporting); writing—review and editing (supporting).

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DECLARATION OF INTERESTS

All authors report no conflicts of interest to declare.

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