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Global Cannabis Cultivation as a Gendered Activity: Findings from the 2020 International Cannabis Cultivation Questionnaire

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Abstract:	Background: As the global cannabis policy landscape shifts in some places from prohibition to decriminalization to different forms of regulated markets, there is a unique opportunity to explore how the experiences of women cultivators may vary along with such policy change. This study aims to advance our knowledge of women's participation in cannabis cultivation in a time when the legal status of cannabis is becoming more diversified globally. Methods: This research draws on the cultivation experiences of cannabis growers reported in response to the International Cannabis Cultivation Questionnaire administered between August 2020 and September 2021 to a purposive sample of 11,479 cannabis growers in 18 countries. Specific cultivation experiences examined include growing as a social activity, motivations for growing, income from growing, and contacts with the criminal justice system. Results: While our results indicate the persistence of gender differences in cannabis cultivation, key findings are that policy shifts towards legalization seem to be related to further reducing gender differences and disparities in cannabis cultivation. We found that in jurisdictions where cultivation was legal, women were more likely to grow than in nonlegal contexts and to earn a higher proportion of their income from growing compared to men, and to supply cannabis to others for medical use. Conclusion: The findings presented here come from the first multi-national study to provide a descriptive analysis of gendered differences in cannabis cultivation and how these vary in different legal contexts. The experiences of men and women cannabis growers varied across policy contexts. One of the impacts of legalization may be the increased involvement of women in cannabis production. Our study suggests a lessening of the gendered nature of cannabis cultivation over time – but also points to the need for more gender-sensitive future research to develop a more in-depth understanding of how policy shifts affect the gender constitution of cannabis markets.

September 25, 2025

Dear Reviewers,

Thank you for the detailed comments and useful suggestions. We have revised our manuscript accordingly to focus more on gendered differences in cultivation in general and across different policy contexts rather than detailed discussion of differences across each participating country.

We have addressed each of the comments in the included "Second Response to Reviewers" and provide a clean copy of the manuscript (Revised Manuscript - Clean Copy) as well as a version with changes tracked (Revised Manuscript - Changes Tracked).

We look forward to your review of our revised manuscript and please let me know should you require any additional information or clarification.

Regards,

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Global Cannabis Cultivation as a Gendered Activity: Findings from the 2020 International Cannabis Cultivation Questionnaire

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Declaration of Interest Statement

The authors report no conflicts of Interest.

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#Revision Note

Reviewer Comment	Page Number in Revision	Author Note
Guest editor		
I would encourage you to think carefully about what the main message of your article is and to try and work this in clearly from start to finish. Perhaps given the heavy revisions already completed, the overall message has been somewhat obscured. How would you sum up your main findings? Can you make sure this thread runs coherently throughout the work? At the moment, findings sometimes seem to argue towards the idea that women cultivators have different experiences to men, and these differences are largely mirroring the sexism women face in general society; at other times the argument tends more towards the idea that gender differences are narrowing and women cannabis cultivators do not have such a different experience as might be expected. Which would you say was the overall thread?	3-44	We thank the editor and reviewer for their helpful feedback, which has contributed to strengthening the core message of the manuscript. In the revised manuscript, we have emphasized the relationship between policy context and the experiences of men and women growers, and we have modified the text to ensure that this theme runs through the manuscript. We have also tried to resolve some of the inconsistencies in our presentation of the findings. We highlight that the relationship between gender and experiences in cannabis cultivation varies depending on the legal context but that, across policy contexts, the experiences of women growers often mirror broader patterns of structural sexism. Thus, while we show that the proportion of female growers may be increasing, gender differences in experiences persist, and we contend that both phenomena can be true.
It would also be useful to revisit the hypotheses. I agree with reviewer 1 that there are a lot of them and discussing them before the findings takes up a lot of space. A good deal of these hypotheses turn out to be confirmed and barely discussed in later sections. Might it be possible to (as reviewer 1 suggests) to write these more briefly as aims, or to perhaps pick the most pertinent ones for more fulsome discussion, cutting the others out or stating them very	11-13	We have followed Reviewer 1's advice and reframed the hypotheses as aims. We have also removed all mentions of hypotheses from later sections of the manuscript. We moved the text showing how our research questions emerged from prior research (previously located in the hypotheses section of the Introduction) to the Results section. We hope that these changes have tightened the

briefly. It feels like almost everything you hypothesized from existing data was borne out in your findings - so perhaps one way to think about the revisions would be to focus on the things which were not as you would have expected.		Introduction and improved the readability of the paper.
Could you provide a bit more detail on what the 'gendered barriers' to entering cannabis cultivation are? I think you provide risk as an example currently, but later your data actually seems to show that men are more risk averse.	35 and 37	We have developed the text around the issue of risk explored in our study. We propose that the results may be interpreted as indicating that women and men may differ in the strategies they use to mitigate risk. For instance, the finding that the percentage of women who grew in legal markets was higher than that of men may indicate that women are motivated to avoid the risks that derive from illicit cultivation contexts. While risk-sensitive men may choose to engage in cultivation as a means of mitigating potential risks, women may choose alternative strategies other than engaging in self-growing, such as acquiring cannabis through their social network.
Do you have any references for the 'healer discourse' idea that women are more likely to cultivate cannabis because they are generally more 'caring'?	8-9	We have now added additional references (i.e., Ehrenreich and English, 1972; Graham, 2022; McClain, 1989).
I would encourage you to a bit more clearly and extensively reflect on why there were so few women in your sample compared to other research on cannabis cultivation. Is there anything you could do to make the next iteration of the survey more appealing to women?	19	In the Limitations section, we have now expanded on our discussion of the proportion of women in our study in light of figures from prior research. We propose that one explanation for the lower percentage of women in our study may be that we specifically targeted cannabis <i>growing</i> . To be included in our sample, the respondents needed to have grown cannabis in the last 12 months. Some of the broader or peripheral activities of cannabis cultivation, such as trimming, packaging etc., may not have been interpreted by potential participants as “growing.” However, in prior research, such

		tasks may have been included, resulting in a higher representation of women than we saw in our sample. In the next iteration of the ICCQ, our team will ensure that the advertising materials are designed to reflect a broader range of cultivation roles, in order to attract a more diverse group of respondents, including women.
As noted by reviewer 1, the discussion is quite repetitive of the findings and lacks references. The limitations would work better elsewhere. I would be particularly interested in hearing some of your many suggestions for future research in this area.	20-30	We have now incorporated some text from the Discussion in the Results section in order to reduce redundancy and to give more context to the findings, as suggested by Reviewer 1. We have moved the Limitations section to the Methods and closed with suggestions for future survey research.
Reviewer 1		
The hypotheses are a rather clunky way of expressing the purposes of the research and they feel slightly repetitive and just too long. I would favour a shorter and more to the point description of the aims but defer to the editor. The literature review and the hypotheses are mismatched.	11-13	We have now removed the hypotheses in favor of a concise and broader statement outlining the study aims.
The intro highlights national/international difference but some hypotheses tend to iron out that difference to refer to 'women' in a homogenous way.	11-13	We appreciate the reviewer's observation and agree that our original hypotheses may have inadvertently smoothed over important distinctions. We believe this issue is resolved by removing the hypotheses and replacing them with more appropriately framed aims focused on policy context, which better reflect the nuances in our data.
I think this [methods section] might be a good place to put your limitations (rather than the conclusion) and I think you	, 19-20	We have expanded/clarified some of our discussion of limitations and moved this to the Methods section

need to provide a defence of your approach. It would be good to see a much stronger account of the reliability of this data. Yes, we understand that a survey of this kind can't be representative, but is it significant enough in size and distribution that analysis of gender can be undertaken?		as recommended.
These are still hard to read with a large number of tables and percentages without much interpretation of the analysis. Having so many hypotheses, and so much data, makes it hard to follow your line of enquiry/argument. I don't get a clear sense of how and where gender matters from reading your paper. There is no reference to the literature so it feels like wading through a lot of data without a clear understanding of an argument being developed. This feels much more like a report than a journal article. I am also still not completely persuaded that the findings can be extrapolated from data aggregated across a wide range of countries and policy contexts.	20-33	We have removed all mentions of hypotheses from the Results section. We have also now incorporated references to the literature throughout the Results section (some of which were previously in the Discussion section) to both establish the context for each analysis and contribute to an interpretation of the results.
The discussion section returns to some of the questions raised in the introduction and here there are references to the literature (there are very few in the results section). What is missing here is a clear line of argument about what has been found in your results. Even for this interested reader, it feels like there is a lot of information but not a clear line of analysis.	33-39	We have modified the text to maintain a consistent thread highlighting the persistent yet nuanced role of gender in shaping experiences of cannabis growers across different policy contexts. We have also restructured our results and discussion sections by integrating more discussion (and references) into the results section (and deleted parts of the original discussion to minimise repetition) to help clarify the overall development of our arguments. Finally, we have also tightened up our conclusions section to help emphasise, and give some possible explanation for, our main findings (i.e., that, in our sample, there are gendered differences in participation in cannabis growing, but these differ both in relation to different policy contexts and in comparison to other areas of drug market participation).

The conclusion seems to undermine some of your conclusions on the basis of what can or can't be extrapolated from your data. I found the final line - deferring to the importance of qualitative work, a little odd given your earlier statement that there is a lack of quantitative work.	43	The point was not to imply any deference to the importance of qualitative work over quantitative approaches, but rather to remind the reader that further quantitative and qualitative work is needed to improve our understanding of women's experiences with cannabis cultivation, with both approaches being better suited to answering different research questions. While not removing reference to future qualitative work completely (as this clearly has a role to play), we no longer end with that point. Instead, we have expanded on our suggestions for further survey work and returned to the overarching theme that gender still matters in drug research. We hope that these and other changes in the conclusion and elsewhere (discussed in other responses) have also removed the apparent and inadvertent contradictions between some of our results, discussion, and conclusions in the previous version.
Unfortunately I think this paper still needs a big overhaul. Rather than trying to demonstrate changes (i.e. more women are involved or are becoming involved), I think your data shows that policy impacts on women's apparent participation in cannabis cultivation. This is a novel finding but one that is currently lost in the article.		In the revised manuscript, we have increased our attention to the role of policy context and to highlighting the relationship between legal context and women's and men's differing experiences in cannabis cultivation.

Global Cannabis Cultivation as a Gendered Activity: Findings from the 2020 International Cannabis Cultivation Questionnaire

Abstract

Background:

As the global cannabis policy landscape shifts in some places from prohibition to decriminalization to different forms of regulated markets, there is a unique opportunity to explore how the experiences of women cultivators may vary along with such policy change. This study aims to advance our knowledge of women's participation in cannabis cultivation in a time when the legal status of cannabis is becoming more diversified globally.

Methods:

This research draws on the cultivation experiences of cannabis growers reported in response to the International Cannabis Cultivation Questionnaire administered between August 2020 and September 2021 to a purposive sample of 11,479 cannabis growers in 18 countries. Specific cultivation experiences examined include growing as a social activity, motivations for growing, income from growing, and contacts with the criminal justice system.

Results:

While our results indicate the persistence of gender differences in cannabis cultivation, key findings are that policy shifts towards legalization seem to be related to further reducing gender differences and disparities in cannabis cultivation. We found that in jurisdictions where cultivation was legal, women were more likely to grow than in nonlegal contexts and to earn a higher proportion of their income from growing compared to men, and to supply cannabis to others for medical use.

Conclusion:

The findings presented here come from the first multi-national study to provide a descriptive analysis of gendered differences in cannabis cultivation and how these vary in different legal contexts. The experiences of men and women cannabis growers varied across policy contexts. One of the impacts of legalization may be the increased involvement of women in cannabis production. Our study suggests a lessening of the gendered nature of cannabis cultivation over time – but also points to the need for more gender-sensitive future research to develop a more in-depth understanding of how policy shifts affect the gender constitution of cannabis markets. .

Keywords

Cannabis cultivation, Gender, Women, Legalisation, Web survey, International

Introduction

In a recent review of women's involvement in the drug trade, Fleetwood and Leban (2023) conclude that in comparison to the rather extensive literature that today exists on women in street-level drug sales, women's participation in drug production is under-researched. The present study aims to address this gap in research by exploring women's participation in cannabis cultivation in a time when the legal status of cannabis is becoming more diversified globally, from prohibition to legalization.

Early drug market research tended to focus on men, and typically described the drug trade as a male activity (Maher & Hudson, 2007). During the 1980s and 1990s, a larger body of research, however, began to examine women's roles and experiences particularly within retail-level drug markets for heroin and crack cocaine in the United States (e.g. Rosenbaum, 1981; Inciardi et al., 1993; Dunlap & Johnson, 1996). While documenting that women were indeed involved in the drug trade, albeit as a minority, much of this U.S. literature adopted what Anderson (2005) has called a "pathology and powerlessness narrative" (p. 374), portraying women as peripheral actors and as passive and helpless victims of male violence and sexual abuse. Drug markets were described as gender-stratified and hierarchical with women being largely relegated to high-risk and low-paying/low-status jobs (Adler, 1993; Maher & Daly, 1996), and women's participation was typically attributed to lack of choice, to them being companions of male dealers, or to male exploitation (Anderson, 2005; Maher & Hudson, 2007; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023).

In recent decades, the scholarly understanding of women in the drug trade has become more nuanced. Later studies have, for instance, focused on how women who sell drugs display (structured) agency (Maher, 1997; Denton & O'Malley, 1999; Fleetwood, 2014a; Grundetjern & Sandberg, 2012; Grundetjern, 2015), while acknowledging that women who sell drugs still face risks of violence and gendered risks of victimisation such as sexual abuse (Havard et al., 2023). Some studies even describe women's drug market participation as a form of agentic liberation (Campbell, 2008; Hobbs, 2013; Grundetjern & Miller, 2019). Studies also show that women take on a variety of roles in drug markets, including as individual entrepreneurs and sometimes in leadership positions (Campbell, 2008; Fleetwood, 2014b; Arsovska & Allum, 2014; Anderson & Kavanaugh, 2017; Deitzer et al., 2019). Mirroring Coomber's (2015) point that drug (sub-)markets are differentiated with regard to substances, practices, levels of violence, power-relations and cultural norms, research also shows that women's participation, roles and experiences can vary between different submarkets (e.g., heroin- or cocaine- vs. cannabis-markets), and between different market activities (e.g., selling and production). Some studies, for instance, suggest that since cannabis culture, at least in its European and North American version, has historical roots in leftwing politics and the hippie movement, the gendering of cannabis is considered being less hyper-masculine and more androgynous, compared to 'hard' drug cultures (Dahl & Sandberg, 2015). As a result, more equal and egalitarian relations sometimes exist between men and women in the lower-level cannabis market (Buxton, 2020), as also evidenced by Hafley and Tewksbury (1996) in their U.S. study of rural cannabis cultivation in the early 1990s, although in numerical terms, men still tend to dominate such markets. Later studies also argue that since cannabis cultivation is very labor intensive and includes a wider diversity of tasks, compared to urban drug selling in sometimes dangerous settings, this may have made it easier for women to

participate in the illegal cannabis industry, albeit often in subordinate positions, yet sometimes even running their own sites (Afsahi, 2015; Bouchard et al., 2009; see also Weisheit, 1992).

Arrest and survey data from various countries around the world show that though women are still outnumbered by men, they often make up a substantial proportion of local illegal cannabis growers (Bouchard et al., 2009; Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). Research also indicates that the increased normalization of cannabis use and cultivation as well as recent policy changes towards legalization might have reduced traditional gender disparities and created more room for women to grow individually or independently of men (Amado et al., 2020; Aguiar & Mustor, 2022; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). However, studies on women's involvement in cannabis cultivation remain scarce, and issues of gender have mainly been addressed in depth through small-scale qualitative studies focusing on single countries. There is thus a need for larger-scale survey-based studies to map out the broader patterns of women's involvement.

Women in cannabis cultivation

Women today participate extensively in cannabis cultivation, but their involvement and roles vary depending on national and local contexts. As outlined by Fleetwood and Leban (2023), women in the Global South have traditionally played a key role in subsistence farming, and since cannabis is often planted alongside food crops, in countries such as Senegal and Morocco, women are heavily involved in the farming and harvesting of cannabis. While women in Senegal are in charge and can thus earn good money from cannabis sales

(Fleetwood and Leban, 2023), in Morocco, the selling and management of finance is primarily a male preserve, thus reflecting a gendered division of labor and hierarchy (Afsahi, 2011; 2015).

Arrest and survey data from the Global North also confirm that women often make up a substantial proportion of local illegal cannabis growers, although they are still outnumbered by men (Bouchard et al., 2009; Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). According to Potter (2010), the numerical dominance of men seems most pronounced for large-scale and more commercially oriented operations. However, even in large-scale illegal growing operations, a relatively high number of women do sometimes participate. Schoenmakers et al. (2013), for instance, found that women constituted 40% of arrested Vietnamese cannabis growers in the Netherlands. Based on a self-reported survey of Canadian teenagers living in a region known for having a larger than average outdoor cannabis industry, Bouchard et al. (2009) found that women were hired as seasonal workers, and these made up 33% of the growers in their sample. Existing studies also show evidence of women's participation in small-scale illegal growing, albeit to varying degrees depending on national contexts. Based on self-reported survey data, and taking a broad national approach, Wilkins et al. (2018), for instance, found that while 21% of the participating cannabis growers in New Zealand were women, this was only the case for 5% of the participants in Israel. Nationally representative self-reported data from the U.S. for the period 2010-2014 also show that the male rate of participation in illegal cannabis cultivation is close to twice the rate for women (Azofeifa et al., 2021). While men continue to outnumber women, the above nevertheless suggests that women make up a substantial share of cannabis growers, in some contexts more than others.

In spite of the relatively high prevalence of women in cultivation, and more so than for drug selling (Bouchard et al., 2009), research indicates that the cannabis cultivation market often remains characterized by a gendered division of labor. Often women perform secondary and lower-status tasks such as harvesting, trimming, packaging, running errands, cleaning indoor equipment and grow rooms, and bringing refreshments and food to workers (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009). In the literature, women are identified as “personal-use growers” (Potter, 2010), “hired laborers” (Bouchard et al., 2009; Schoenmakers et al., 2013), “partners in crime”, and “trusted representatives” (Schoenmakers et al., 2013), and, similar to research showing how male companions are crucial to how some women source illegal drugs (Hathaway et al. 2018; Bennett & Holloway, 2019), studies also show that when some women engage in cannabis growing, they do so primarily as companions or romantic partners of male growers (Potter, 2010; Amado et al., 2020). As the above indicates, women seemingly often grow for or in collaboration with others.

Research, however, also shows that women at times take leading roles in illegal growing and distribution for medical users (in jurisdictions with no or little legal access to medical cannabis) (Potter & Klein, 2020; Klein & Potter, 2018; Bone et al., 2018), but also as independent entrepreneurs who grow and sell small-scale to supplement legal incomes (Amado et al., 2020; Potter, 2010; 2011). Amado et al. (2020) argue that what they see as a growing involvement of women in cannabis growing might be a result of a general normalization of cannabis use and cultivation. Indeed, traditionally, the normative emphasis on women’s reproductive roles has meant that the stigma associated with drug use/trading has been more pronounced for women, as these were associated with deviant motherhood and flawed femininity (Measham, 2002; Fleetwood, 2015; Fleetwood & Leban, 2023). Studies,

however, suggest that the general process of cannabis normalization, including a gradual destigmatization of cannabis growing, might have created more leeway for women to participate and for larger degrees of women's autonomy (Amado et al., 2020; Aguiar & Musto, 2022). Relatedly, the recent general societal shift from perceiving cannabis as an illicit drug to a medicine (Duff, 2017; Sjøgaard & Lerkanen, 2021), may have opened new avenues for women to 'do' respectable femininity while engaged in cannabis growing. According to Fleetwood (2015), women have difficulty employing discourses about crime to accomplish femininity, and crime-involved women thus often try to accomplish respectable femininity by emphasizing that their motives for crimes are rooted in their roles as caregivers and as having responsibility for specific others (e.g. having to generate money to help family members and children), or to a more abstract collective benefit. This trend is also evident in the context of cannabis cultivation where women's emphasis on altruistic and medical motives for growing can enable them to construct their offending in more gender-appropriate ways. As testament to this, Klein and Potter found that many of the women growers in their study reported being particularly involved in (illegal) growing and distribution for medical use/rs (Bone et al., 2018; Klein & Potter, 2018; Potter & Klein, 2020). Kittel (2018) also describes how the women (legal) growers in her study often drew on a "healer discourse" (Kittel, 2018, p. 40) to construct themselves as caring service providers and the cannabis they supply as "medicine". This is particularly interesting when considered in the context of the broader literature documenting women identifying as healers (Ehrenreich and English, 1972; Graham, 2022; McClain, 1989). Indeed, previous sociological studies have shown that women have been historically more involved in care than men and still play a major role in health and medicine management in informal settings (doi/10.1177/0192513X08316115 ; Hirschfeld, Social Politics 1995).

Lastly, recent studies also indicate that policy changes, including legalization, can indirectly influence women's participation and roles in cannabis production. Aguiar and Musto (2022), for instance, found that a higher number of women got involved in cannabis growing after Uruguay introduced a legally regulated model in 2013. In the U.S., media accounts have claimed that the emerging legal cannabis industry presents new opportunities for women independently of men (Anderson & Kavanaugh, 2017), with the most optimistic arguing that the legal cannabis industry will be a "blue skies market for women" (Kittel, 2018, p. 32).

While legalization has created more leeway for women to act as independent entrepreneurs (August, 2013) and for women's upward mobility to executive positions than previously, a notable departure from their subordination in illegal markets (Anderson & Kavanaugh, 2017), other reports suggests that the legal cannabis market remains entrenched in traditional disparities between men and women (Fleetwood & Leban, 2023). Kittel (2018), for instance, argues that many 'invisible' obstacles such as differences in risk, financial capacity, domestic responsibility, and morality – i.e., the historical and present stigmatization of women's drug use (see also Aguiar & Musto, 2022) – continue to influence women's access and ability to become successful in legalized cannabis markets. Relatedly, (legal) cannabis industry statistics show that the proportion of cannabis businesses owned by women is lower than the proportion of non-cannabis businesses owned by women in Ohio and Massachusetts. The proportion of cannabis industry executives who were women declined from a high of 36.8% in 2019 to 22.1% in 2021 and is now lower than the proportion of executives who were women in all other business sectors (29.8%) (Marijuana Business Daily, 2021: 5). Furthermore, the "blue skies market" discourse has also been criticized for ignoring

the intersection of race, class, and gender (Fleetwood & Leban, 2023). Research, for instance, indicates that higher level positions in the legal cannabis industry are primarily open to middle-class white women, some of whom have little or no history of cannabis or other drug use (Anderson & Kavanaugh, 2017), while students, lower-class women and undocumented migrant workers are relegated to low-status farmwork and support functions, sometimes under poor or exploitative conditions (Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). August (2013) also found that, even in legal markets, many women growers marketed their product through relationships with men, dealing only with close friends or having men actually sell their products, which testifies to the continued operation of gendered hierarchies in legal markets. Other research, however, shows how women, whose racial and class identities more closely align with professionalism ideals (i.e., white and educated), can more easily enter the cannabis industry without facing shame, stigma, and guilt (Rogers, 2017). Nevertheless, women's position in the legal cannabis market might have become more diversified. Since very little research today exists on the gendered nature of legalized cannabis markets, the question remains: how will the roles of women in legal markets compare with those in illegal markets? Against this background, this article draws on data from a large online survey (the GCCRC's ICCQ 2) of 11,479 cannabis growers in 18 countries to explore gender differences in participation in cannabis cultivation - whether legal or illegal.

The aim of this paper is to examine the gender distribution among cannabis growers based on a large international survey and, stratified by gender and legal context, to explore how differences in legal context influence women's motivations for growing, income from growing, contact with the criminal justice system, and the extent to which growing is a social versus independent activity.

Methods

Data

Data for this study were drawn from the International Cannabis Cultivation Questionnaire (ICCQ 2) (Global Cannabis Cultivation Research Consortium, 2020), a web-based Qualtrics survey conducted in 18 countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Georgia, Great Britain, Israel, Italy, the Netherlands, New Zealand, Portugal, Switzerland, the United States, and Uruguay) from August 2020 to September 2021. The survey was originally developed in English and translated into 11 additional languages. This survey is the second iteration (Sevigny et al., 2023), with the first (ICCQ 1) conducted in 2012–2013 (Decorte et al, 2012). Both survey waves were developed and carried out by the Global Cannabis Cultivation Research Consortium (GCCRC), an international group of researchers interested in studying small-scale cannabis growers and growing practices (see <https://worldwideweeds.nl>). The methodology in both waves was similar (for a detailed description of the methodology, see Barratt et al., 2012; Barratt et al., 2015b).

ICCQ 2 consisted of a core module of 40 questions covering various topics, including respondent demographics; cannabis growing experiences, practices, and methods; motivations for cannabis growing; personal use of cannabis and other drugs; participation in cannabis and other drug markets; police contact; and other illegal activity. In addition, there were 12 optional modules that participating countries could elect to include, covering topics such as conflicts and victimization, cannabis distribution, cannabis growing for medical purposes, views on cannabis policy, and the impact of COVID-19 on cannabis cultivation. The present analysis only includes questions from the core module. This study protocol received

ethical approval from the Human Research Ethics Committee of Curtin University (Perth, Australia; HRE2019-0542), with additional ethical approval obtained through national or institutional review processes where required.

Sample

Participants were a purposive self-selected sample of small-scale cannabis growers. They were recruited through various mediums, including an international website (<https://worldwideweeder.nl>), social media, traditional media (television, radio, and print), events, and grow shops. A total of 19,444 respondents initiated the online survey. Of these, 11,479 respondents met the inclusion criteria for participation in ICCQ-based analyses. These criteria included being aged 18 or older, having grown cannabis within the past five years, residing in one of the 18 participating countries, and providing valid answers to at least 50% of the core module questions. The present paper relies on a narrower inclusion criterion of having grown cannabis within the past 12 months to focus on those we would consider “current growers.” Our sample therefore consists of the 9,443 respondents who reported that they were currently growing or had grown cannabis in the last 12 months and identified as either men or women. Given the relatively few respondents who identified as nonbinary (n=65), we included only a dichotomous measure of gender, representing men and women identified respondents. A supplementary table including nonbinary respondents is included in the appendix.

Though it is impossible to determine a response rate for our sample in the absence of a sampling frame, we can provide a general description of our respondents. Most of the respondents were men (86.5%, n=8,172) while 13.5% (n=1,271) were women. We also note that 61.3% (n=5,785) of respondents were from the following five countries: Belgium (18.2%,

n=1,723), USA (17.5%, n=1,641), Italy (11.6%, n=1,094), Denmark (7.6%, n=718), and Germany (6.4%, n=609). One in four respondents (25.4%, n=2,398) were from countries with legal cannabis markets (Canada, USA, and Uruguay). As can be seen in Table 1, the proportion of respondents who were women varied by country, from 3.9% (n=7) in Georgia to 34.7% (n=50) in New Zealand. Countries with legal cannabis markets had a greater proportion of women respondents than in the overall sample: 15.7% in Canada, 17.4% in the USA, and 20.2% in Uruguay. The mean age of respondents was 39.6 years and varied between 27.9 years for respondents from Italy and 51.8 years for respondents from the USA. In all countries but Georgia, women respondents were significantly older on average ($M=43.6$ years, $SE= 0.43$) than men respondents ($M=39.0$ years, $SE=0.16/ t(1642)=-9.98, p<.001$).

Table 1: ICCQ Respondents by Gender and Country

Country	Men		Women	
	N	%	N	%
New Zealand	94	65.3	50	34.7
Uruguay	209	79.8	53	20.2
Denmark	591	82.3	127	17.7
United States of America	1,363	82.6	288	17.4
Australia	487	83.2	98	16.8
Canada	409	84.3	76	15.7
United Kingdom	253	84.3	47	15.7
Netherlands	250	85.6	42	14.4
Italy	963	88.0	131	12.0
Austria	30	88.2	4	11.8
Switzerland	202	89.0	25	11.0

Finland	383	89.3	46	10.7
Belgium	1,541	89.4	182	10.6
Portugal	77	89.5	9	10.5
Israel	70	90.9	7	9.1
Germany	566	92.9	43	7.1
France	510	93.4	36	6.6
Georgia	174	96.1	7	3.9
Total	8,172	86.5	1,271	13.5

Measures

Given our interest in the way that legal context may affect gender differences, we used two measures of legal context. First, we created a dichotomous measure of whether cultivation was legal or illegal where the respondent lives. This was based on respondents' answers to the following questions: "To the best of your knowledge, how is the law applied to growing a small number of cannabis plants where you live?" Respondents who answered that medical or recreational growing was legal in their home jurisdiction (either with restrictions, such as a license needed, or without restrictions) were categorized as growing in a legal context. Respondents who reported that both medical and recreational growing were illegal in their home jurisdiction were categorized as growing in an illegal context.

We then created a trichotomous measure of legal context that also reflected compliance with varying legal contexts. This measure was based on separating growing in a legal context into those whose growing practices were compliant or non-compliant with the law. This was based on responses to the question "To the best of your knowledge, does/did your most recent crop adhere to the law where you live?" Those respondents who reported that medical or recreational growing was legal in their home jurisdiction and that their most

recent crop adhered to the law were categorized as “Legal and compliant,” while those who reported that their most recent crop did not adhere to the law were categorized as “Legal and noncompliant.” Consistent with our dichotomous measure of legal context, those who reported that both medical and recreational growing were illegal in their home jurisdiction were categorized as growing in an illegal context. Where we make comparisons between Illegal and Legal Contexts, the latter includes those who are either compliant or noncompliant with local regulations in legal contexts.

We also created two amalgamated groupings of motivations for growing cannabis that captured “risk reduction” and “altruistic” reasons. Those respondents who reported that they grew “To avoid contact with criminals or supporting criminal networks” or believed that “Growing is not as risky as buying” were coded as having risk reduction motivations. Those who grew “To provide others with cannabis for recreational use,” “To provide others with medical cannabis,” “For ecological/environmental reasons,” or “For fair trade reasons” were coded as having altruistic motivations for growing. These two motivational amalgamations were not mutually exclusive: respondents could be motivated by both risk reduction and altruistic reasons.

Statistical Analyses

As we were interested in gender differences, all analyses were stratified by gender. We used descriptive statistics to compare men’s and women’s cannabis growing experiences and motivations. We present frequency distributions for categorical variables and means for ordinal and continuous variables. We also stratified men’s and women’s responses by legal context. Cross-tabulations and t-tests or chi-square tests were used. Odds ratios were computed from the cross-tabulations to provide a standardized effect size statistic. The odds

ratio was computed by calculating the odds of a particular outcome (e.g., number of women growing in illegal context/number of women growing in legal context) and then dividing the outcome by the odds of another, related outcome (e.g., number of men growing in illegal context/number of men growing in legal context).

Limitations

This research is subject to limitations within our sample and measures, and these should be acknowledged here. Our sample included participants from 18 countries, which is an advantage in terms of the generalizability of the findings. However, such aggregated analyses may mask gender differences (or similarities) within individual countries. The survey was administered online to an anonymously participating self-selecting purposive sample (Barratt et al., 2012; Barratt et al., 2015b). As such, we cannot be sure of the representativeness of our sample. There is also no way to confirm that our anonymous respondents had ever grown cannabis.

Importantly, survey modality may account in part for differences in women's reported participation in cultivation. A survey study of Uruguayan growers found that one third were women (Aguiar and Musto, 2022), compared to a ratio of one woman per nine men in a comparable international study (Potter et al., 2015). The difference in survey modality between the face-to-face approach used by Aguiar and Musto (2022) and the online purposive sampling used by Potter et al. (2015) may explain some of the gender differences found in the two studies. Barratt et al. (2015a) note that women might be slightly less likely to participate in online purposive sample surveys compared to more traditional surveys.

Likewise we cannot be sure that any observed difference between 2012 and 2020 in the proportion of respondents who are women growers is not merely an artifact of women being more likely to respond to the survey, rather than a real change in the proportion of women growers. Given that most cannabis growers operate in jurisdictions where cannabis cultivation is illegal, and even in legal contexts, many growers do not operate in full compliance with the law, our survey was predominantly targeting those engaged in illegal behaviours. Such “hidden” populations of active offenders are notoriously hard to research, and it is – by definition – impossible to be sure of the representativeness of samples that do participate in survey (or other) research (Barratt et al., 2015a). However, we have some evidence that the (Australian) sample of growers recruited in our previous survey (ICCQ 1) was broadly representative of growers identified in a national crime survey in Australia (Barratt and Lenton, 2015), which may alleviate some of these concerns.

Results

The proportion of respondents who grew cannabis within the past five years and identified as men was 92% in 2012 (Potter et al., 2015: 229) and 86% in 2020. Recent policy changes towards legalization might have reduced traditional gender disparities and created more room for women to become involved in cannabis cultivation (Amado et al., 2020; Aguiar & Mustor, 2022; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). The general process of cannabis normalization, including a gradual de-stigmatization of cannabis growing, might have created more leeway for women to participate (Amado et al., 2020; Aguiar &

Musto, 2022). Although the ratio of men-to-women growers appears to have declined¹ between the first wave of the ICCQ in 2012 and the second wave in 2020, our data suggests that cultivation continues to be an activity overwhelmingly dominated by men.

Gender Representation of Growers by Legal Context

Research suggests that legal cannabis contexts provide openings for women to enter cultivation (Anderson & Kavanaugh, 2017; Musto, 2022). We found that the gender representation of growers responding to our survey differed significantly by legal context (see Table 1). While men were more prevalent in both legal and illegal contexts, women were more likely to grow in jurisdictions where cultivation was legal than in those where it was illegal, suggesting a potential gendered difference in aversion to the risks inherent in illicit cannabis markets (Withanarachchie et al, 2025). We observed that the proportion of respondents growing in legal contexts and in compliance with local regulations differed significantly by gender. A greater proportion of women (26.2%) than men (17.2%) grew in legal contexts and in compliance with local regulations ($\chi^2(1)=54.8, p<.001$). We also observed that a greater proportion of men (72.0%) compared to women (63.2%) grew in illegal contexts. Stated as an odds ratio, the odds of growing in illegal contexts was 1.49 times greater for men than women. How these gender differences were reflected in the material rewards of growing are examined next.

Table 1: Gender Differences in Prevalence of Cultivation by Legal Context

Variables	N	Percent	Chi-Square
Legal Context			54.833***

¹ A statistically meaningful comparison across the two waves is not possible given the addition of seven countries in the second wave and variations in respondent recruitment strategies, among other factors.

Men			
Illegal	5,483	72.0	
Legal but noncompliant	823	10.8	
Legal and compliant	1,313	17.2	
Total	7,619	100.0	
Women			
Illegal	728	63.2	
Legal but noncompliant	121	10.5	
Legal and compliant	302	26.2	
Total	1,151	99.9 ^a	

* p<.05 ** p<.005 *** p<.001

^a Does not total to 100% due to rounding.

Gender Differences in Income from Growing

As global attitudes towards cannabis use have shifted in the direction of greater tolerance (Ellis and Resko, 2022), it seems reasonable to expect that concurrent liberalization of cannabis prohibition might create openings for women to enter cultivation as an income earning activity. Prior research demonstrates that growing cannabis as a source of secondary income can be more important for women than men. In their study of socio-economically mainstream cannabis growers in Spain (n=219), Amado et al. (2020), for instance, found that, among cannabis growers who sold surplus products, women growers were more likely than men to sell to “earn money” (58% vs. 32%), while an equal percentage sold to fund their own cannabis use. On this basis, Amado et al. (2020) conclude that engaging in cannabis growing as a means of generating a secondary income (a supplement to legal incomes), appeared more important for the women than for the men in their study. Other research shows that

cannabis growing provides greater economic opportunity for some women (Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023; Rogers, 2017) although studies indicate a declining proportion of cannabis industry executives are women compared to the proportion who are women in other business sectors (Koonce, 2025; Marijuana Business Daily, 2021).

As a measure of these attitudinal and policy shifts, we examined gender differences in the proportion of income derived from growing. We found that a significantly greater proportion of women's income was from growing, with women reporting that an average of 43.6% of their income came from growing, compared to 31.1% for men ($t(87.7)=-2.609$, $p<.05$). Gender differences in income appear to be more marked in legal markets (see Table 2). In legal contexts, the mean proportion of income from growing was 59.2% for women and 44.0% for men ($t(208)=-2.2382$, $p<.05$), while in illegal contexts, the mean proportion of income from growing for women and men was 27.6% and 25.3%, respectively ($t(406)=-0.3975$, $p=0.6912$).² Beyond its material benefits, we examined cultivation as a collaborative activity.

Table 2: Gender Differences in Income from Growing and Percent Growing with Others by Legal Context

Variables	N	Mean or Percent	Chi-Square or t Value
Mean % of Income from Growing			
Illegal Context			-.398
Men	380	25.3	
Women	28	27.6	
Legal Context			-2.238*
Men	169	44.0	
Women	41	59.2	
Growing with Others			
Illegal Context			36.913***

² Information on legal context was missing for 28 respondents.

Men	532	9.7	
Women	124	17.2	
Legal Context			73.151***
Men	295	13.9	
Women	130	30.9	

*p<.05 ** p<.005 *** p<.001

Cannabis Growing as a Collaborative Activity

Prior research shows that women often grow cannabis for or in collaboration with others, sometimes as companions or romantic partners of male growers (Potter 2010; Amado et al. 2020). This is supported by the results of the present study indicating that cannabis cultivation appears to be a more collaborative activity for women growers. Women in our survey were significantly more likely to report that they grew with others (21.3%) compared to men (10.9%), $\chi^2(2)=109.65$, $p<.001$. We also found that this pattern persisted regardless of legal context (see Table 2). Women respondents were significantly more likely than men in both illegal contexts (17.2% vs 9.7%) and legal contexts (30.9% vs 13.9%) to report growing cannabis with others. If growing cannabis is a more social activity for women, we next explored the factors motivating people to participate.

Gender Differences in Motivations for Growing

We found that motivations for growing cannabis varied by gender. Some growers stated they grew their own cannabis to avoid different risks inherent in illegal markets. As noted previously, women growers were more likely to grow in contexts where cannabis was legal rather than where it was illegal. This may suggest a motivation to avoid the risks inherent in illicit cultivation contexts. As can be seen in Table 3, in illegal contexts, men were

significantly more likely (65.5%) than women (55.2%) to state they grew to “avoid contact with criminals or supporting criminal networks” and/or because they believed “growing was not as risky as buying.” The odds of men growing for risk reduction reasons in illegal contexts was 1.38 times greater than for women. Men were also significantly more likely (41.3%) than women (32.2%) to cite risk reduction motivations for growing in legal contexts. This finding suggests that women are less likely, compared to men, to choose self-growing as a preferred risk mitigation strategy. It is possible that very risk-sensitive women instead opt for alternative strategies, such as sourcing cannabis through their social network or trusted (male) others (see e.g. Withanarachchie et al. 2025).

Prior studies show that the increased normalization of cannabis use as well as the growing dominance of discourses emphasizing the medicinal benefits of cannabis have opened new avenues for women to do respectable femininity while engaging in cannabis growing, for instance by stating that this serves a broader collective benefit or that they are caring service providers who supply “medicine” to others rather than profit-seeking drug dealers, a role that is more in line with social norms expected from women (Kittel 2018). Similarly, we found gender differences in expressed altruistic motivations for growing among our respondents, and these differences varied by legal context. Women were significantly more likely (58.3%) than men (51.3%) in legal contexts to state they grew cannabis for altruistic reasons.

Table 3: Gender Differences in Motivations for Growing by Legal Context

Motivations	N	Percent	Chi-Square
Risk Reduction			
Illegal Context			30.107***

Men	3,588	65.5	
Women	401	55.2	
Legal Context			12.111***
Men	881	41.3	
Women	136	32.2	
Total	5,006		
Altruistic			
Illegal Context			.178
Men	2,485	45.4	
Women	336	46.2	
Legal Context			6.839*
Men	1,095	51.3	
Women	246	58.3	
Total	4,162		

* p<.05 ** p<.005 *** p<.001

Upon closer inspection, we observed gender differences in whether one was growing to supply cannabis for recreational or medical use. While men (19.4%) were significantly ($\chi^2(1)=5.842$, $p<.05$) more likely than women (16.4%) to grow to provide others with cannabis for recreational use, women (23.5%) were significantly ($\chi^2(1)=4.741$, $p<.05$) more likely than men (20.7%) to say they grow to supply others with medical cannabis. As can be seen in Table 4, when we examine gender differences in motivations for growing cannabis by legal context, a significantly greater proportion of men (16.3%) compared to women (11.8%) reported growing cannabis for others' recreational use in illegal contexts, $\chi^2(1)=9.837$, $p<.005$. Next, we consider the potential legal dangers for men and women growers by examining gender differences in criminal justice system contacts.

Table 4: Gender Differences in Motivations for Growing Cannabis to Supply Others for Medical vs Recreational Use by Legal Context

Motivations	N	Percent	Chi-Square
Grow to supply others for Medical Use			
Illegal Context			.748
Men	1,041	19.0	
Women	148	20.4	
Legal Context			2.842
Men	533	25.0	
Women	122	28.9	
Total	1,844		
Grow to supply others for Recreational Use			
Illegal Context			9.837**
Men	895	16.3	
Women	86	11.8	
Legal Context			1.546
Men	578	27.1	
Women	102	24.2	
Total	1,661		

* p<.05 ** p<.005 *** p<.001

Gender Differences in Experiences with the Criminal Justice System

Though women account for approximately 10 percent of global arrests for drug-related crimes, their proportional involvement in arrests is increasing and is greater in Central America as well as Australia and New Zealand (United Nations 2018). However, women continue to be underrepresented in more senior roles in cannabis cultivation and tend to

perform secondary and lower-status tasks (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009). If women are less involved in higher level roles in cannabis production and related distribution, or less involved in larger scale operations, they are less likely to be found guilty of higher level offences as a reflection of less prominent occupational roles. Also, as suggested by the “chivalry thesis” - which argues that women receive less harsh criminal justice outcomes than men for comparable offences (Johnson et Scheuble, 1991) - the likelihood of women being found guilty of cannabis-related offences across the board may be further reduced. While we found no significant difference in the proportion of men versus women who have ever come in contact with the police because of cannabis growing, regardless of legal context (see Table 5), we did find evidence that women would be less likely to be found guilty of growing-related offences. For our analysis, the different offense categories served as proxy measures for role/scale of involvement insofar as “trafficking,” “supply,” and “cultivation” were treated as more serious than “possession/use.”

Overall, 12.1% of growers reported ever having contact with the police because of their cannabis growing, with no significant difference between men and women. However, men were consistently more likely than women to be found guilty of cannabis possession/use, cultivation, supply, and trafficking offenses. Men were twice as likely as women (24.7% vs 12.0%) to be found guilty of cannabis possession/use in illegal contexts and over three times as likely in legal contexts (16.4% vs 5.7%). In illegal contexts, men were slightly more likely than women (8.3% vs 5.0%) to report having ever been found guilty of cannabis cultivation, but three times as likely to report having ever been found guilty of supplying cannabis (3.4% vs 1.1%). Though cell sizes were quite small, men were also significantly more likely to report having received a cannabis trafficking conviction, regardless of legal context (2.2% vs 0.8%).

Table 5: Gender Differences in Cannabis Related Criminal Justice Contacts by Legal Context

Prior Police Contact for Growing	N	Percent	Chi-Square
Illegal Context			.784
Men	696	13.7	
Women	85	12.5	
Legal Context			.048
Men	194	9.9	
Women	37	9.5	
Guilty of Cannabis Possession/Use			
Illegal Context			52.910***
Men	1,233	24.7	
Women	80	12.0	
Legal Context			29.749***
Men	315	16.4	
Women	22	5.7	
Guilty of Cannabis Cultivation			
Illegal Context			8.964**
Men	414	8.3	
Women	33	5.0	
Legal Context			3.312
Men	56	2.9	
Women	5	1.3	
Guilty of Cannabis Supply			
Illegal Context			10.728**
Men	170	3.4	

Women	7	1.1	
Legal Context			.127
Men	24	1.3	
Women	4	1.0	
Guilty of Cannabis Trafficking			
Illegal Context			6.215*
Men	110	2.2	
Women	5	0.8	
Legal Context			4.938*
Men	34	1.8	
Women	1	0.3	

* p<.05 ** p<.005 *** p<.001

Discussion

This paper set out to explore gender differences in cannabis cultivation. The literature has consistently pointed to participation in drug markets as a highly gendered activity dominated by men. However, we also speculated that the dual influences of the (western) historic egalitarian traditions of “cannabis culture”, the entanglements between cannabis cultivation and medicine, and the growing global trend away from cannabis prohibition would make these gendered differences less pronounced than found in other areas of drug market participation. The overall picture emerging from the data reveals some complexity. Nevertheless, we can make some important general interpretations of our findings. Women’s participation in cannabis cultivation is increasing , as, overall, men’s dominance of cannabis cultivation has declined to some extent since our previous survey (ICCQ 1; Potter et al., 2015).

This is true in both legal and illegal contexts , suggesting that some of the barriers to women’s participation, in the form of the stigmatization from illegality (Amado et al., 2020; Kittel, 2018) and hegemonic masculinity associated with illicit drug markets (Havard et al., 2023), have been reduced even where cannabis cultivation remains illegal. However, the ratio is notably smaller for growers operating in legal contexts and in compliance with the law, suggesting prohibition itself remains a more effective deterrent for women than men. This, of course, fits with the established literature showing the greater participation of men in drug markets (Fleetwood & Leban, 2023), as well as in criminality in general (Britton et al., 2018). This also fits with our observation from the literature review that more equal and egalitarian gender relations have sometimes existed in lower-level involvement in cannabis markets (the majority of our respondents grow cannabis on a relatively small scale) even going back a few decades (e.g., Hafley and Tewksbury, 1996). The egalitarian aspect of women’s involvement in cannabis growing may not be all that new, although it seems to have increased.

We also examined the nature, rather than the extent, of women’s participation in cannabis cultivation. We found that women earn more of their overall income from their cannabis cultivation activities compared to men in both legal and illegal contexts, but especially in the former. This finding suggests that cannabis growing can be an attractive financial choice for women, and that cannabis cultivation (whether legal or illegal) has less pronounced gender pay disparities than other legal or illegal economic activities – but may also speak to gendered income inequalities in the established formal economy, where women generally earn less than men (Toczek et al., 2021).

Reflecting results from prior studies showing that women often have supporting rather than leadership roles in drug markets or have been introduced to drug market

participation via partners or friends who are men (Potter, 2009; Amado et al., 2020), our findings show that women are far more likely than men to collaborate with others, in both illegal and legal contexts. However, a better understanding of the gendered differences in working with others would need more information about the nature of the relationships with collaborators – such as divisions of labour, hierarchies, reasons for collaboration and, of course, the genders of collaborators – which were not addressed in ICCQ 2.

The ICCQ 2 included numerous questions related to motivations for growing cannabis. Our analyses illustrated gendered differences in these motives. Women were less likely to report risk-avoidance motives than men, although this may at least partly reflect the fact that risk itself is likely one of the key barriers to women's involvement in cannabis growing in the first place. As previously reported, however, women were also more likely than men to report growing in legal contexts in compliance with local regulations. One inference from these findings is that women avoid growing in illegal contexts because of risk while men are more likely to grow to avoid risk. However, the gendered differences in altruistic motives seem to tell a clearer story. Women were more likely to report altruistic motivations for growing in legal contexts, but there was no significant difference between genders in reported altruistic motivations in illegal contexts. Specifically, and interestingly, a higher proportion of women than men reported being motivated by the desire to provide other people with cannabis for medical use in both legal and illegal contexts – although the differences in the stratified analyses were not statistically significant. This result is consistent with sociological literature showing the involvement of women in care activities. Taken together, these observations lend some support to other research showing that many women involved in cannabis cultivation, whether legally or illegally, fit (or adopt) a “healer discourse” related to a “nurturing” or

“caring” female identity (e.g., Kittel, 2018; Fleetwood, 2015; Bone et al., 2018). Such an identity for women who grow cannabis contrasts with the profit-seeking identity more traditionally associated with women’s drug market involvement. This seems to be the case in both legal and illegal contexts, although less so in the latter.

Finally, we found that while women had similar levels of contact with law enforcement to men, the outcomes of such contacts differed, with women less likely to be found guilty of cannabis-related offences. Women are seemingly benefitting from more lenient outcomes, being significantly less likely to be found guilty of criminal offenses than men across the full range of potential cannabis offenses (from possession to trafficking) and regardless of legal context and compliance with the law. This may partly reflect the fact that women remain less likely to fill top-level cannabis-market roles (Koonce, 2025; Marijuana Business Daily, 2021), or be less likely to be involved in larger scale cultivation enterprises. It may also suggest that the “chivalry theory” identified elsewhere in criminology (Johnson et Scheuble, 1991) comes into play for cannabis cultivation offenses, which in turn suggests that criminal justice systems tend to treat cannabis cultivation (even when illegal) by women less harshly than such activity by men. In other areas of criminal activity that are seen to breach traditional gender norms (as well as breaking the law), women are often found to receive harsher sentences than men for committing otherwise similar offenses, as they are perceived to be “doubly deviant” (Lightowlers, 2019). Our findings point to the need for further research that will investigate the extent to which conviction rate differences for cannabis cultivation are a product of the chivalry of (still generally male-dominated) criminal justice professionals, or a reflection of the less prominent roles women occupy in cannabis cultivation, or a combination of these factors.

A particularly interesting aspect of our research to take into consideration when interpreting our results and their contribution to our understanding of gendered differences in cannabis cultivation is that our sample suggests a much lower proportion of women involved in cannabis growing compared with other research in this area (e.g., Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). There are several possible explanations for this. As suggested by prior research (Havard et al., 2023; Kittel, 2018), women growers face greater risks than men (especially when they have children) and this may have impacted women's willingness to participate in the ICCQ 2. Another potential explanation may be due to the fact that we specifically targeted cannabis *growers*. To be included in our study, the respondents needed to have grown cannabis in the last 12 months. Women involved in some of the broader or peripheral activities described earlier (e.g., trimming, packaging, running errands, cleaning indoor equipment and grow rooms, and bringing refreshments and food to workers) and included in some of the other research (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009) may therefore not be included in our sample. Though these activities are integral elements of cultivation, some potential respondents may not have perceived their activities as constituting "growing." These factors may, in turn, have led to an underrepresentation of women involved in cannabis growing within our survey or further atypicality of those who did so. Because of this, the gap between men's and women's participation in cannabis cultivation may be smaller than we report, and differences (or similarities) between men and women growers may have been further obscured. We also note that our analyses are further limited by the breadth and depth of questions contained in the survey. For example, we did not query our respondents about their specific roles and responsibilities growing cannabis (e.g., central involvement or more peripheral participation).

Overall, however, while our findings do indicate the persistence of gender differences in cannabis cultivation, a key finding in our study is that many of these differences seem far less pronounced than in other drug market contexts. Furthermore, legalization seems to clearly be related to a reduction in traditional gender differences and disparities in cannabis cultivation.

Conclusions

Our paper is the first multi-national study to provide a descriptive quantitative analysis of the broader gender differences in cannabis cultivation. Our sample is drawn from 18 countries, mainly but not exclusively from the “Global North,” predominantly but not exclusively involved in smaller-scale cultivation, and including respondents growing in both legal and (predominantly) illegal contexts. As such, our findings provide an important addition to the literature, complementing existing studies that have tended to focus on single countries (e.g., Afsahi 2011; Aguiar and Musto 2022; Bouchard et al. 2009; Wilkins et al. 2018), cultivation in developing world countries (Afsahi 2015; Fleetwood and Leban, 2023), women’s involvement in larger, profit-oriented (illegal) cannabis cultivation and distribution operations (Kittel 2018), or women’s participation in legal cultivation (Anderson & Kavanaugh 2017; Rogers 2017) - and/or take more qualitative approaches (e.g., August. 2013 ; Rogers 2017).

Our data suggests that cannabis cultivation (whether legal or illegal) remains a gendered occupation. Despite a closing gap, women still participate in cultivation in smaller numbers than men. When they do participate, gender differences, seemingly reflecting broader entrenched structural sexism and gender stereotypes, continue to exist, such as in differences in earnings, in motivations for participation, and in experiences with the criminal justice system.

The difference compared to other areas of drug-market participation may reflect some of the (historical and contemporary) ideological and normalization aspects of cannabis culture (compared to other drug cultures). Importantly, we found evidence of greater levels of women's involvement in cannabis cultivation in legal rather than illegal contexts, suggesting that prohibition itself is a greater deterrence to women than to men - and, therefore, that one of the impacts of legalization may be to increase the involvement of women in cannabis production.

Following from the findings presented here, we have suggestions for further survey research. In particular, it would be interesting to explore the nature of growing relationships (i.e., collaboration and co-participation with other people) to see how these manifest and how they relate to other variables, such as motivations behind growing and the legal context of growing. Some of this may be addressable via further analysis (including network analysis) of our own data-set, or by including more detailed questions in this area in future survey research. Other aspects of this question will probably be better addressed through qualitative research – detailed interviews with women growers operating both legally and illegally.

In particular, for any future iteration of the ICCQ or other surveys of cannabis growers,, it would be fruitful to include questions about specific roles occupied and tasks completed by

those involved in cannabis cultivation. Though the primary target of the International Cannabis Cultivation Questionnaire has been those who *grow* cannabis, it could be useful to widen the target population to those who are involved in other activities associated with cannabis cultivation. The cultivation process undoubtedly involves multiple activities including, for example, planting, irrigation, fertilizing, harvesting, drying, processing, and packaging in addition to the multiple ancillary support roles necessary for growing cannabis - and even more for any related distribution (Søgaard et al., 2025 - (e.g., preparing food, transporting product and supplies, security, bookkeeping, among others). By including such questions, we will likely be better able to capture and understand the role of women in the wider cultivation process. Finally, we suggest including questions that address the nature of the relationship between growers and those with whom they collaborate in the cultivation enterprise, including the gender of collaborators and the existence of potential hierarchical relations.

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Appendix

Table 1: Gender Differences in Prevalence of Cultivation by Legal Context

Variables	N	Percent	Chi-Square
Grew in past year			
Men	8,172	85.9	
Women	1,271	13.4	
Nonbinary	65	0.7	
Total	9,508	100.0	
Legal Context			54.998***
Men			
Illegal	5,483	72.0	
Legal and noncompliant	823	10.8	
Legal and compliant	1,313	17.2	
Women			
Illegal	728	63.2	
Legal and noncompliant	121	10.5	
Legal and compliant	302	26.2	
Nonbinary			
Illegal	40	69.0	
Legal and noncompliant	6	10.3	
Legal and compliant	12	20.7	

* p<.05 ** p<.005 *** p<.001

Table 2: Gender Differences in Income from Growing and Percent Growing with Others by Legal Context

Variables	N	Mean or Percent	F-test or Chi-Square
Mean % of Income from Growing			
Illegal Context			1.211
Men	380	25.3	
Women	28	27.6	
Nonbinary	1	70.0	
Legal Context			3.363*
Men	169	44.0	
Women	41	59.2	
Nonbinary	1	11.0	
Growing with Others			
Illegal Context			38.741***
Men	532	9.7	
Women	124	17.2	
Nonbinary	5	12.8	
Legal Context			74.652***
Men	295	13.9	
Women	130	30.9	
Nonbinary	2	11.1	

*p<.05 ** p<.005 *** p<.001

Table 3: Gender Differences in Motivations for Growing by Legal Context

Motivations	N	Percent	Chi-Square
Risk Reduction			9.403*
Illegal Context			
Men	3,588	80.3	
Women	401	74.7	
Nonbinary	28	77.8	
Legal Context			
Men	881	19.7	
Women	136	25.3	
Nonbinary	8	22.2	
Altruistic			32.078***
Illegal Context			
Men	2,485	69.4	
Women	336	57.7	
Nonbinary	29	74.4	
Legal Context			
Men	1,095	30.6	
Women	246	42.3	
Nonbinary	10	25.6	

* p<.05 ** p<.005 *** p<.001

Table 4: Gender Differences in Motivations for Growing Cannabis to Supply Others for Medical vs Recreational Use by Legal Context

Motivations	N	Percent	Chi-Square
Grow to supply others for Medical Use			
Illegal Context			.765
Men	1,041	19.0	
Women	148	20.4	
Nonbinary	8	20.0	
Legal Context			3.393
Men	533	25.0	
Women	122	28.9	
Nonbinary	6	33.3	
Total	1,858		
Grow to supply others for Recreational Use			
Illegal Context			9.859*
Men	895	16.3	
Women	86	11.8	
Nonbinary	6	15.0	
Legal Context			1.724
Men	578	27.1	
Women	102	24.2	
Nonbinary	4	22.2	
Total	1,671		

* p<.05 ** p<.005 *** p<.001

Table 5: Gender Differences in Cannabis Related Criminal Justice Contacts by Legal Context

Prior Police Contact for Growing	N	Percent	Chi-Square
Illegal Context			3.017
Men	696	13.7	
Women	85	12.5	
Nonbinary	2	5.3	
Legal Context			.217
Men	194	9.9	
Women	37	9.5	
Nonbinary	1	6.7	
Guilty of Cannabis Possession/Use			
Illegal Context			54.945***
Men	1,233	24.7	
Women	80	12.0	
Nonbinary	5	13.5	
Legal Context			30.593***
Men	315	16.4	
Women	22	5.7	
Nonbinary	1	6.7	
Guilty of Cannabis Cultivation			
Illegal Context			10.366*
Men	414	8.3	
Women	33	5.0	
Nonbinary	1	2.7	
Legal Context			4.206
Men	56	2.9	
Women	5	1.3	

Nonbinary	1	6.7	
Guilty of Cannabis Supply			
Illegal Context			11.989**
Men	170	3.4	
Women	7	1.1	
Nonbinary	0	0.0	
Legal Context			.312
Men	24	1.3	
Women	4	1.0	
Nonbinary	0	0.0	
Guilty of Cannabis Trafficking			
Illegal Context			7.022*
Men	110	2.2	
Women	5	0.8	
Nonbinary	0	0.0	
Legal Context			5.201
Men	34	1.8	
Women	1	0.3	
Nonbinary	0	0.0	

* p<.05 ** p<.005 *** p<.001

Global Cannabis Cultivation as a Gendered Activity: Findings from the 2020 International Cannabis Cultivation Questionnaire

Abstract

Background:

As the global cannabis policy landscape shifts in some places from prohibition to decriminalization to different forms of regulated markets, there is a unique opportunity to explore how the experiences of women cultivators may vary along with such policy change.

This study aims to advance our ~~knowledge~~understanding of women's participation in cannabis cultivation in a time when the legal status of cannabis is becoming more diversified globally.

Methods:

This research draws on the cultivation experiences of cannabis growers reported in response to the International Cannabis Cultivation Questionnaire administered between August 2020 and September 2021 to a purposive sample of 11,479 cannabis growers [in 18 countries](#). Specific cultivation experiences examined include growing as a social activity, motivations for growing, income from growing, and contacts with the criminal justice system.

Results:

While our results indicate the persistence of gender differences in cannabis cultivation, key findings are that policy shifts towards legalization seem to be related to further reducing gender differences and disparities in cannabis cultivation. We found that in jurisdictions where cultivation was legal, women were more likely to grow than in nonlegal contexts and to earn a higher proportion of their income from growing compared to men, and to supply cannabis to others for medical use. While there has been a slight decrease in the proportion of growers who are male over the past decade, and the percentage of women growing in legal contexts is higher than that of men (26% vs. 17%), the findings suggest that cannabis cultivation is still a male-dominated industry in both legal and illegal contexts. When women do, from 92% to 87%, the findings suggest that women still face substantial barriers to participation. When they do participate, their experiences vary by legal context but tend to reflect broader patterns of structural sexism and gender stereotypes in earnings, motivations to participate, and experiences with the criminal justice system.

Conclusion:

The findings presented here come from the first multi-national study to provide a descriptive analysis of the broader gendered differences in cannabis cultivation and how these vary in different legal contexts. The experiences of men and women cannabis growers varied across policy contexts. One of the impacts of legalization may be the increased involvement of women in cannabis production. Our study suggests a lessening of the gendered nature of cannabis cultivation may be lessening over time – but also points to the need for more gender-sensitive future survey research to develop a more in-depth understanding of how policy shifts affect the gender constitution of cannabis

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~~markets. nd be less pronounced than for other areas of drug market involvement. The change over time may reflect general trends towards gender equality.~~

Keywords

Cannabis cultivation, Gender, Women, Legalisation, Web survey, International

Introduction

In a recent review of women's involvement in the drug trade, Fleetwood and Leban (2023) conclude that in comparison to the rather extensive literature that today exists on women in street-level drug sales, women's participation in drug production is under-researched. The present study aims to address this gap in research by ~~exploring~~[advancing our understanding of](#) women's participation in cannabis cultivation in a time when the legal status of cannabis is becoming more diversified globally, from prohibition to legalization.

Early drug market research tended to focus on men, and typically described the drug trade as a male activity (Maher & Hudson, 2007). During the 1980s and 1990s, a larger body of research, however, began to examine women's roles and experiences particularly within retail-level drug markets for heroin and crack cocaine in the United States (e.g. Rosenbaum, 1981; Inciardi et al., 1993; Dunlap & Johnson, 1996). While documenting that women were indeed involved in the drug trade, albeit as a minority, much of this U.S. literature adopted what Anderson (2005) has called a "pathology and powerlessness narrative" (p. 374), portraying women as peripheral actors and as passive and helpless victims of male violence and sexual abuse. Drug markets were described as gender-stratified and hierarchical with women being largely relegated to high-risk and low-paying/low-status jobs (Adler, 1993;

Maier & Daly, 1996), and women's participation was typically attributed to lack of choice, to them being companions of male dealers, or to male exploitation (Anderson, 2005; Maier & Hudson, 2007; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023).

In recent decades, the scholarly understanding of women in the drug trade has become more nuanced. Later studies have, for instance, focused on [how](#) women who sell drugs [display](#) (structured) agency (Maier, 1997; Denton & O'Malley, 1999; Fleetwood, 2014a; Grundetjern & Sandberg, 2012; Grundetjern, 2015), while acknowledging that women who sell drugs still face risks of violence and gendered risks of victimisation such as sexual abuse (Havard et al., 2023). Some studies even describe women's drug market participation as a form of agentic liberation (Campbell, 2008; Hobbs, 2013; Grundetjern & Miller, 2019). Studies also show that women take on a variety of roles in drug markets, including as individual entrepreneurs and sometimes in leadership positions (Campbell, 2008; Fleetwood, 2014b; Arsovska & Allum, 2014; Anderson & Kavanaugh, 2017; Deitzer et al., 2019). Mirroring Coomber's (2015) point that drug (sub-)markets are differentiated with regard to substances, practices, levels of violence, power-relations and cultural norms, research also shows that women's participation, roles and experiences can vary between different submarkets (e.g., heroin- or cocaine- vs. cannabis-markets), and between different market activities (e.g., selling and production). Some studies, for instance, suggest that since cannabis culture, at least in its European and North American version, has historical roots in leftwing politics and the hippie movement, the gendering of cannabis is [considered being](#) less hyper-masculine and more androgynous, compared to 'hard' drug cultures (Dahl & Sandberg, 2015). As a result, more equal and egalitarian relations sometimes exist between men and women in the lower-level cannabis market ([Buxton, 2020](#)), as [also](#) evidenced by Hafley and Tewksbury (1996) in their U.S. study of rural cannabis cultivation in the early 1990s, although in numerical

terms, men still tend to dominate such markets. Later studies also argue that since cannabis cultivation is very labor intensive and includes a wider diversity of tasks, compared to urban drug selling in sometimes dangerous settings, this may have made it easier for women to participate in the illegal cannabis industry, albeit often in subordinate positions, yet sometimes even running their own sites ([Afsahi, 2015](#); Bouchard et al., 2009; see also Weisheit, 1992).

Arrest and survey data from various countries around the world show that though women are still outnumbered by men, they often make up a substantial proportion of local illegal cannabis growers (Bouchard et al., 2009; Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). Research also indicates that the increased normalization of cannabis use and cultivation as well as recent policy changes towards legalization might have reduced traditional gender disparities and created more room for women to grow individually or independently of men (Amado et al., 2020; Aguiar & Mustor, 2022; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). However, studies on women's involvement in cannabis cultivation remain scarce, and issues of gender have mainly been addressed in depth through small-scale qualitative studies focusing on single countries. There is thus a need for ~~more~~ larger-scale survey-based studies ~~that try to~~ map out the broader patterns of women's involvement.

Women in cannabis cultivation

Women today participate extensively in cannabis cultivation, but their involvement and roles vary depending on national and local contexts. As outlined by Fleetwood and Leban (2023), women in the Global South have traditionally played a key role in subsistence farming,

and since cannabis is often planted alongside food crops, in countries such as Senegal and Morocco, women are heavily involved in the farming and harvesting of cannabis. While women in Senegal are in charge and can thus earn good money from cannabis sales (Fleetwood and Leban, 2023), in Morocco, the selling and management of finance is primarily a male preserve, thus reflecting a gendered division of labor and hierarchy (Afsahi, 2011; 2015).

Arrest and survey data from the Global North also confirm that women often make up a substantial proportion of local illegal cannabis growers, although they are still outnumbered by men (Bouchard et al., 2009; Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). According to Potter (2010), the numerical dominance of men seems most pronounced for large-scale and more commercially oriented operations. However, even in large-scale illegal growing operations, a relatively high number of women do sometimes participate. Schoenmakers et al. (2013), for instance, found that women constituted 40% of arrested Vietnamese cannabis growers in the Netherlands. Based on a self-reported survey of Canadian teenagers living in a region known for having a larger than average outdoor cannabis industry, Bouchard et al. (2009) found that women were hired as seasonal workers, and these made up 33% of the growers in their sample. Existing studies also show evidence of women's participation in small-scale illegal growing, albeit to varying degrees depending on national contexts. Based on self-reported survey data, and taking a broad national approach, Wilkins et al. (2018), for instance, found that while 21% of the participating cannabis growers in New Zealand were women, this was only the case for 5% of the participants in Israel. Nationally representative self-reported data from the U.S. for the period 2010-2014 also show that the male rate of participation in illegal cannabis cultivation is close to twice the rate for women (Azofeifa et al., 2021). While men continue to outnumber

women, the above nevertheless suggests that women make up a substantial share of cannabis growers, in some contexts more than others.

In spite of the relatively high prevalence of women in cultivation, and more so than for drug selling (Bouchard et al., 2009), research indicates that the cannabis cultivation market often remains characterized by a gendered division of labor. Often women perform secondary and lower-status tasks such as harvesting, trimming, packaging, running errands, cleaning indoor equipment and grow rooms, and bringing refreshments and food to workers (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009). In the literature, women are identified as “personal-use growers” (Potter, 2010), “hired laborers” (Bouchard et al., 2009; Schoenmakers et al., 2013), “partners in crime”, and “trusted representatives” (Schoenmakers et al., 2013), and, similar to research showing how male companions are crucial to how some women source illegal drugs (Hathaway et al. 2018; Bennett & Holloway, 2019), studies also show that when some women engage in cannabis growing, they do so primarily as companions or romantic partners of male growers (Potter, 2010; Amado et al., 2020). As the above indicates, women seemingly often grow for or in collaboration with others.

Research, however, also shows that women at times take leading roles in illegal growing and distribution for medical users (in jurisdictions with no or little legal access to medical cannabis) (Potter & Klein, 2020; Klein & Potter, 2018; Bone et al., 2018), but also as independent entrepreneurs who grow and sell small-scale to supplement legal incomes (Amado et al., 2020; Potter, 2010; 2011). ~~In their study of socio-economically mainstream cannabis growers in Spain (n=219), Amado et al. (2020), for instance, found that, among cannabis growers who sold surplus products, women growers were more likely than men to~~

sell to “earn money” (58% vs. 32%), while an equal percentage sold to fund their own cannabis use. On this basis, Amado et al. (2020) conclude that engaging in cannabis growing as a means of generating a secondary income (a supplement to legal incomes), appeared more important for the women than for the men in their study. Amado et al. (2020) further argue that what they see as a growing involvement of women in cannabis growing might be a result of a general normalization of cannabis use and cultivation. Indeed, traditionally, the normative emphasis on women’s reproductive roles has meant that the stigma associated with drug use/trading has been more pronounced for women, as these were associated with deviant motherhood and flawed femininity (Measham, 2002; Fleetwood, 2015; Fleetwood & Leban, 2023). Studies, however, suggest that the general process of cannabis normalization, including a gradual de-stigmatization of cannabis growing, might have created more leeway for women to participate and for larger degrees of women’s autonomy (Amado et al., 2020; Aguiar & Musto, 2022). Relatedly, the recent general societal shift from perceiving cannabis as an illicit drug to a medicine (Duff, 2017; Søgaaard & Lerkanen, 2021), may have opened new avenues for women to ‘do’ respectable femininity while engaged in cannabis growing. According to Fleetwood (2015), women have difficulty employing discourses about crime to accomplish femininity, and crime-involved women thus often try to accomplish respectable femininity by emphasizing that their motives for crimes are rooted in their roles as caregivers and as having responsibility for specific others (e.g. having to generate money to help family members and children), or to a more abstract collective benefit. This trend is also evident in the context of cannabis cultivation where women’s emphasis on altruistic and medical motives for growing can enable them to construct their offending in more gender-appropriate ways. As testament to this, Klein and Potter found that many of the women growers in their study reported being particularly involved in (illegal) growing and distribution for medical

use/rs (Bone et al., 2018; Klein & Potter, 2018; Potter & Klein, 2020). Kittel (2018) also describes how the women (legal) growers in her study often drew on a “healer discourse” (Kittel, 2018, p. 40) to construct themselves as caring service providers and the cannabis they supply as “medicine”. This is particularly interesting when considered in the context of the broader literature documenting women identifying as healers (Ehrenreich and English, 1972; Graham, 2022; McClain, 1989). Indeed, previous sociological studies have shown that women have been historically more involved in care than men and still play a major role in health and medicine management in informal settings (doi/10.1177/0192513X08316115 ; Hirschfeld, Social Politics 1995).

Lastly, recent studies also indicate that policy changes, including legalization, can indirectly influence women’s participation and roles in cannabis production. Aguiar and Musto (2022), for instance, found that a higher number of women got involved in cannabis growing after Uruguay introduced a legally regulated model in 2013. ~~One third of the Uruguayan growers participating in Aguiar and Musto’s survey study were women compared to a ratio of one woman per nine men in a comparable international study (Potter et al., 2015).~~ In the U.S., media accounts have claimed that the emerging legal cannabis industry presents new opportunities for women independently of men (Anderson & Kavanaugh, 2017), with the most optimistic arguing that the legal cannabis industry will be a “blue skies market for women” (Kittel, 2018, p. 32).

~~Importantly, survey modality may account in part for differences in women’s reported participation in cultivation. The difference in survey modality between the face-to-face approach used in Aguiar and Musto’s study (2022) (Uruguay) and the online purposive sampling used in Potter et al.’s (2015) study may explain some of the gender differences~~

~~found in the two studies. Barratt et al. (2015a) note that women might be slightly less likely to participate in online purposive sample surveys compared to more traditional surveys.~~

While legalization has created more leeway for women to act as independent entrepreneurs (August, 2013) and for women's upward mobility to executive positions than previously, a notable departure from their subordination in illegal markets (Anderson & Kavanaugh, 2017), other reports suggests that the legal cannabis market remains entrenched in traditional disparities between men and women (Fleetwood & Leban, 2023). Kittel (2018), for instance, argues that many 'invisible' obstacles such as differences in risk, financial capacity, domestic responsibility, and morality – i.e., the historical and present stigmatization of women's drug use (see also Aguiar & Musto, 2022) – continue to influence women's access and ability to become successful in legalized cannabis markets. Relatedly, (legal) cannabis industry statistics show that the proportion of cannabis businesses owned by women is lower than the proportion of non-cannabis businesses owned by women in Ohio and Massachusetts. ~~Yet, t~~The proportion of cannabis industry executives who were women declined from a high of 36.8% in 2019 to 22.1% in 2021 and is now lower than the who were women was greater (36.8%) than the proportion of executives who were women in all other business sectors (29.821.0%) (Marijuana Business Daily, 2021~~19~~: 58). Furthermore, the "blue skies market" discourse has also been criticized for ignoring the intersection of race, class, and gender (Fleetwood & Leban, 2023). Research, for instance, indicates that higher level positions in the legal cannabis industry are primarily open to middle-class white women, some of whom have little or no history of cannabis orand other drug use (Anderson & Kavanaugh, 2017), while students, lower-class women and undocumented migrant workers are relegated to low-status farmwork and support functions, sometimes under poor or exploitative conditions (Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). August (2013) also

found that, even in legal markets, many women growers marketed their product through relationships with men, dealing only with close friends or having men actually sell their products, which testifies to the continued operation of gendered hierarchies in legal markets. Other research, however, shows how women, whose racial and class identities more closely align with professionalism ideals (i.e., white and educated), can more easily enter the cannabis industry without facing shame, stigma, and guilt (Rogers, 2017). Nevertheless, women's position in the legal cannabis market might have become more diversified. Since very little research today exists on the gendered nature of legalized cannabis markets, the question remains: how will the roles of women in legal markets compare with those in illegal markets? Against this background, this article draws on data from a large online survey (the GCCRC's ICCQ 2) of 11,479 cannabis growers in 18 countries to explore gender differences in participation in cannabis cultivation - whether legal or illegal.

The aim of this paper is to examine the gender distribution among cannabis growers based on a large international survey and, stratified by gender and legal context, to explore how differences in legal context influence women's motivations for growing, income from growing, contact with the criminal justice system, and the extent to which growing is a social versus independent activity.

Hypotheses

~~H1: The ratio of men to women growers is expected to be lower than it was during the first wave of the ICCQ in 2012. Recent policy changes towards legalization might have reduced traditional gender disparities and created more room for women to become involved in cannabis cultivation (Amado et al., 2020; Aguiar & Mustor, 2022; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). The general process of cannabis normalization, including a~~

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gradual de-stigmatization of cannabis growing, might have created more leeway for women to participate (Amado et al., 2020; Aguiar & Musto, 2022).

~~H2: The ratio of men to women growers will be more equal in legal cannabis contexts compared to places where cannabis is illegal.~~ Related to the first hypothesis, we would expect that in places where cannabis is perceived more as a medicine than an illicit drug (Duff, 2017; Sogaard & Lerkanen, 2021), the proportion of growers who are women will be greater. Other research suggests that legal cannabis contexts provide openings for women to enter cultivation (Anderson & Kavanaugh, 2017; Musto, 2022). Relatedly, medical cannabis may have opened new avenues for women to ‘do’ respectable femininity while engaged in cannabis growing (Duff, 2017; Sogaard & Lerkanen, 2021).

~~H3: Women will report a greater proportion of income derived from growing overall but a lower proportion in illegal compared to legal contexts.~~ Prior research demonstrates that growing cannabis as a source of secondary income is more important for women than men (Amado et al. 2020). Other research shows that cannabis growing provides greater economic opportunity for some women (Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023; Rogers, 2017) and roughly mirrors the finding that a greater proportion of cannabis industry executives are women compared to the proportion who are women in other business sectors (Marijuana Business Daily, 2019).

~~H4: Women will be more likely to report growing cannabis with others.~~ Prior research shows that women often grow cannabis for or in collaboration with others, sometimes as companions or romantic partners of male growers (Potter 2010; Amado et al. 2020).

~~H5: Gender differences in motivations for growing cannabis will vary by legal context with a greater proportion of women in illegal contexts reporting that they grow for risk reduction~~

~~reasons. Though men in the general population are far more likely than women to be victims of violence, women are more likely the victims of sexualized violence (Selmini and McElrath 2014). In illicit contexts, gender identity compounds the risks for women. As women in the drug trade still face risks of violence and gendered threats of victimisation such as sexual abuse (Havard et al., 2023), women's participation in cannabis growing may function as a form of agentic liberation (Campbell, 2008; Hobbs, 2013; Grundetjern & Miller, 2019).~~

~~H6: Women will be more likely to report that they grow for altruistic and medical reasons. Some women are drawn to growing because it fulfills a gendered role expectation of women as caregivers for specific others as well as a broader collective benefit. Even in illegal contexts, there is evidence that women provide medicine for use/rs (Klein & Potter, 2018; Potter & Klein, 2020) and perceive themselves as caring service providers and the cannabis they supply as "medicine" (Kittel 2018).~~

~~H7: Women will be less likely to be found guilty of cannabis-related offences. Though women account for approximately 10 percent of global arrests for drug-related crimes, their proportional involvement in arrests is increasing and is greater in Central America as well as Australia and New Zealand (United Nations 2018). However, women continue to be underrepresented in more senior roles in cannabis cultivation and instead perform secondary and lower status tasks (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009). If women are less involved in higher level roles in cannabis production and related distribution, or less involved in larger scale operations, we would expect women to be less likely to be found guilty of higher level offences as a reflection of less prominent occupational roles. We also expect the 'chivalry thesis'—where women receive less harsh criminal justice outcomes~~

~~than men for comparable offences (Johnson et Scheuble, 1991) — to further reduce the likelihood of women being found guilty of cannabis-related offences across the board.~~

Methods

Data

Data for this study were drawn from the International Cannabis Cultivation Questionnaire (ICCC 2) ([Global Cannabis Cultivation Research Consortium, 2020](#)), a web-based Qualtrics survey conducted in 18 countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Georgia, Great Britain, Israel, Italy, the Netherlands, New Zealand, Portugal, Switzerland, the United States, and Uruguay) from August 2020 to September 2021. The survey was originally developed in English and translated into 11 additional languages. This survey is the second iteration (Sevigny et al., 2023), with the first (ICCC 1) conducted in 2012–2013 ([Decorte et al, 2012](#)). Both survey waves were developed and carried out by the Global Cannabis Cultivation Research Consortium (GCCRC), an international group of researchers interested in studying small-scale cannabis growers and growing practices (see <https://worldwideweeds.nl>). The methodology in both waves was similar (for a detailed description of the methodology, see Barratt et al., 2012; Barratt et al., 2015b).

ICCC 2 consisted of a core module of 40 questions covering various topics, including respondent demographics; cannabis growing experiences, practices, and methods; motivations for cannabis growing; personal use of cannabis and other drugs; participation in cannabis and other drug markets; police contact; and other illegal activity. In addition, there were 12 optional modules that participating countries could elect to include, covering topics

such as conflicts and victimization, cannabis distribution, cannabis growing for medical purposes, views on cannabis policy, and the impact of COVID-19 on cannabis cultivation. The present analysis only includes questions from the core module. This study protocol received ethical approval from the Human Research Ethics Committee of Curtin University (Perth, Australia; HRE2019-0542), with additional ethical approval obtained through national or institutional review processes where required.

Sample

Participants were a purposive self-selected sample of small-scale cannabis growers. They were recruited through various mediums, including an international website (<https://worldwideweed.nl>), social media, traditional media (television, radio, and print), events, and grow shops. A total of 19,444 respondents initiated the online survey. Of these, 11,479 respondents met the inclusion criteria for participation in ICCQ-based analyses. These criteria included being aged 18 or older, having grown cannabis within the past five years, residing in one of the 18 participating countries, and providing valid answers to at least 50% of the core module questions. The present paper relies on a narrower inclusion criterion of having grown cannabis within the past 12 months to focus on those we would consider “current growers.” Our sample therefore consists of the 9,443 respondents who reported that they were currently growing or had grown cannabis in the last 12 months and identified as either men or women. Given the relatively few respondents who identified as nonbinary (n=65), we included only a dichotomous measure of gender, representing men and women identified respondents. A supplementary table including nonbinary respondents is included in the appendix.

Though it is impossible to determine a response rate for our sample in the absence of a sampling frame, we can provide a general description of our respondents. Most of the respondents were men (86.5%, n=8,172) while 13.5% (n=1,271) were women. We also note that 61.3% (n=5,785) of respondents were from the following five countries: Belgium (18.2%, n=1,723), USA (17.5%, n=1,641), Italy (11.6%, n=1,094), Denmark (7.6%, n=718), and Germany (6.4%, n=609). One in four respondents (25.4%, n=2,398) were from countries with legal cannabis markets (Canada, USA, and Uruguay). As can be seen in Table 1, the proportion of respondents who were women varied by country, from 3.9% (n=7) in Georgia to 34.7% (n=50) in New Zealand. Countries with legal cannabis markets had a greater proportion of women respondents than in the overall sample: 15.7% in Canada, 17.4% in the USA, and 20.2% in Uruguay. The mean age of respondents was 39.6 years and varied between 27.9 years for respondents from Italy and 51.8 years for respondents from the USA. In all countries but Georgia, women respondents were significantly older on average ($M=43.6$ years, $SE= 0.43$) than men respondents ($M=39.0$ years, $SE=0.16$, $t(1642)=-9.98$, $p<.001$).

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Table 1: ICCQ Respondents by Gender and Country

Country	Men		Women	
	N	%	N	%
New Zealand	94	65.3	50	34.7
Uruguay	209	79.8	53	20.2
Denmark	591	82.3	127	17.7
United States of America	1,363	82.6	288	17.4
Australia	487	83.2	98	16.8
Canada	409	84.3	76	15.7
United Kingdom	253	84.3	47	15.7

Netherlands	250	85.6	42	14.4
Italy	963	88.0	131	12.0
Austria	30	88.2	4	11.8
Switzerland	202	89.0	25	11.0
Finland	383	89.3	46	10.7
Belgium	1,541	89.4	182	10.6
Portugal	77	89.5	9	10.5
Israel	70	90.9	7	9.1
Germany	566	92.9	43	7.1
France	510	93.4	36	6.6
Georgia	174	96.1	7	3.9
Total	8,172	86.5	1,271	13.5

Measures

Given our interest in the way that legal context may affect gender differences, we used two measures of legal context. First, we created a dichotomous measure of whether cultivation was legal or illegal where the respondent lives. This was based on respondents' answers to the following questions: "To the best of your knowledge, how is the law applied to growing a small number of cannabis plants where you live?" Respondents who answered that medical or recreational growing was legal in their home jurisdiction (either with restrictions, such as a license needed, or without restrictions) were categorized as growing in a legal context. Respondents who reported that both medical and recreational growing were illegal in their home jurisdiction were categorized as growing in an illegal context.

We then created a trichotomous measure of legal context that also reflected compliance with varying legal contexts. This measure was based on separating growing in a

legal context into those whose growing practices were compliant or non-compliant with the law. This was based on responses to the question “To the best of your knowledge, does/did your most recent crop adhere to the law where you live?” Those respondents who reported that medical or recreational growing was legal in their home jurisdiction and that their most recent crop adhered to the law were categorized as “Legal and compliant,” while those who reported that their most recent crop did not adhere to the law were categorized as “Legal and noncompliant.” Consistent with our dichotomous measure of legal context, those who reported that both medical and recreational growing were illegal in their home jurisdiction were categorized as growing in an illegal context. Where we make comparisons between Illegal and Legal Contexts, the latter includes those who are either compliant or noncompliant with local regulations in legal contexts.

We also created two amalgamated groupings of motivations for growing cannabis that captured “risk reduction” and “altruistic” reasons. Those respondents who reported that they grew “To avoid contact with criminals or supporting criminal networks” or believed that “Growing is not as risky as buying” were coded as having risk reduction motivations. Those who grew “To provide others with cannabis for recreational use,” “To provide others with medical cannabis,” “For ecological/environmental reasons,” or “For fair trade reasons” were coded as having altruistic motivations for growing. These two motivational amalgamations were not mutually exclusive: respondents could be motivated by both risk reduction and altruistic reasons.

Statistical Analyses

As we were interested in gender differences, all analyses were stratified by gender. We used descriptive statistics to compare men’s and women’s cannabis growing experiences

and motivations. We present frequency distributions for categorical variables and means for ordinal and continuous variables. We also stratified men's and women's responses by legal context. Cross-tabulations and t-tests or chi-square tests were used. Odds ratios were computed from the cross-tabulations to provide a standardized effect size statistic. The odds ratio was computed by calculating the odds of a particular outcome (e.g., number of women growing in illegal context/number of women growing in legal context) and then dividing the outcome by the odds of another, related outcome (e.g., number of men growing in illegal context/number of men growing in legal context).

Limitations

This research is subject to limitations within our sample and measures, and these should be acknowledged here. Our sample included participants from 18 countries, which is an advantage in terms of the generalizability of the findings. However, such aggregated analyses may mask have masked gender differences (or similarities) within individual countries. The survey was administered online to an anonymously participating self-selecting purposive sample (Barratt et al., 2012; Barratt et al., 2015b). As such, we cannot be sure of the representativeness of our sample. There is also no way to confirm that our anonymous respondents had ever grown cannabis.

Importantly, survey modality may account in part for differences in women's reported participation in cultivation. A survey study of Uruguayan growers found that one third were women (Aguiar and Musto, 2022), compared to a ratio of one woman per nine men in a comparable international study (Potter et al., 2015). The difference in survey modality between the face-to-face approach used by in Aguiar and Musto's study (2022) (Uruguay) and

the online purposive sampling used by in Potter et al.'s (2015) study may explain some of the gender differences found in the two studies. Barratt et al. (2015a) note that women might be slightly less likely to participate in online purposive sample surveys compared to more traditional surveys.

Likewise we cannot be sure that anythe observed difference between 2012 and 2020 in the proportion of respondents who are women growers is not merely an artifact of women being more likely to respond to the survey in 2020, rather than a real change in the proportion of women growers. Given that most cannabis growers operate in jurisdictions where cannabis cultivation is illegal, and even in legal contexts, many growers do not operate in full compliance with the law, our survey was predominantly targeting those engaged in illegal behaviours. Such "hidden" populations of active offenders are notoriously hard to research, and it is – by definition – impossible to be sure of the representativeness of samples that do participate in survey (or other) research (Barratt et al., 2015a). However, we have some evidence that the (Australian) sample of growers recruited in our previous survey (ICQ 1) was broadly representative of growers identified in a national crime survey in Australia (Barratt and Lenton, 2015), which may alleviate some of these concerns.

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Results

The proportion of respondents who grew cannabis within the past five years and identified as men was 92% in 2012 (Potter et al., 2015: 229) and 86% in 2020. Recent policy changes towards legalization might have reduced traditional gender disparities and created more room for women to become involved in cannabis cultivation (Amado et al., 2020; Aguiar & Mustor, 2022; Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023). The general

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process of cannabis normalization, including a gradual de-stigmatization of cannabis growing, might have created more leeway for women to participate (Amado et al., 2020; Aguiar & Musto, 2022). Although the ratio of men-to-women growers appears to have declined¹ between the first wave of the ICCQ in 2012 and the second wave in 2020, our data suggests that cultivation continues to be an activity overwhelmingly dominated by men. ~~but, apart from this, there were surprisingly few observed gender differences across our analyses. The proportion of respondents who grew had grown cannabis within the past five years and identified as men was 92% in 2012 (Potter et al., 2015: 229) and 86% in 2020. This finding is consistent with our first hypothesis insofar as the ratio of men to women growers appears to have declined between the first wave of the ICCQ in 2012 and the second wave in 2020. However, we cannot conduct a statistically meaningful comparison across the two waves given the addition of seven countries in the second wave and variations in respondent recruitment strategies, among other factors.~~

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Gender Representation of Growers by Legal Context

Research suggests that legal cannabis contexts provide openings for women to enter cultivation (Anderson & Kavanaugh, 2017; Musto, 2022). ~~Consistent with our second hypothesis, we found that~~ the gender representation of growers responding to our survey differed significantly by legal context (see Table 1). ~~We, to the extent that~~ while men were more prevalent in both legal and illegal contexts, women were more likely to grow in jurisdictions where cultivation was legal than in those where it was illegal, suggesting a potential gendered difference in aversion to the risks inherent in illicit cannabis markets

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¹ ~~A statistically meaningful comparison across the two waves is not possible given the addition of seven countries in the second wave and variations in respondent recruitment strategies, among other factors.~~

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(Withanarachchie et al, 2025)cultivation contexts. We observed that the proportion of respondents growing in legal contexts and in compliance with local regulations differed significantly by gender. A greater proportion of women (26.2%) than men (17.2%) grew in legal contexts and in compliance with local regulations ($\chi^2(1)=54.8$, $p<.001$). We also observed that a greater proportion of men (72.0%) compared to women (63.2%) grew in illegal contexts. Stated as an odds ratio, the odds of growing in illegal contexts was 1.49 times greater for men than women. How these gender differences were reflected in the material rewards of growing are examined next.

Table 1: Gender Differences in Prevalence of Cultivation by Legal Context

Variables	N	Percent	Chi-Square
Legal Context			54.833***
Men			
Illegal	5,483	72.0	
Legal but noncompliant	823	10.8	
Legal and compliant	1,313	17.2	
Total	7,619	100.0	
Women			
Illegal	728	63.2	
Legal but noncompliant	121	10.5	
Legal and compliant	302	26.2	
Total	1,151	99.9 ^a	

* $p<.05$ ** $p<.005$ *** $p<.001$

^a Does not total to 100% due to rounding.

Gender Differences in Income from Growing

As global attitudes towards cannabis use have shifted in the direction of greater tolerance (Ellis and Resko, 2022), ~~it seems reasonable to expect~~~~we expected~~ that concurrent liberalization of cannabis prohibition might create openings for women to enter cultivation as an income earning activity. ~~Prior research demonstrates that growing cannabis as a source of secondary income can be~~ is more important for women than men (Amado et al. 2020). In their study of socio-economically mainstream cannabis growers in Spain (n=219), Amado et al. (2020), for instance, found that, among cannabis growers who sold surplus products, women growers were more likely than men to sell to “earn money” (58% vs. 32%), while an equal percentage sold to fund their own cannabis use. On this basis, Amado et al. (2020) conclude that engaging in cannabis growing as a means of generating a secondary income (a supplement to legal incomes), appeared more important for the women than for the men in their study. Other research shows that cannabis growing provides greater economic opportunity for some women (Anderson & Kavanaugh, 2017; Fleetwood & Leban, 2023; Rogers, 2017) although studies indicate a declining roughly mirrors the finding that a greater proportion of cannabis industry executives are women compared to the proportion who are women in other business sectors (Koonce, 2025; Marijuana Business Daily, 2021).

~~In their study of socio-economically mainstream cannabis growers in Spain (n=219), Amado et al. (2020), for instance, found that, among cannabis growers who sold surplus products, women growers were more likely than men to sell to “earn money” (58% vs. 32%), while an equal percentage sold to fund their own cannabis use. On this basis, Amado et al. (2020) conclude that engaging in cannabis growing as a means of generating a secondary~~

income (a supplement to legal incomes), appeared more important for the women than for the men in their study.

As a measure of the these attitudinal and policy is shifts, we examined gender differences in the proportion of income derived from growing. We found that -support for our third hypothesis- a significantly greater proportion of women's income was from growing, with women reporting that an average of 43.6% of their income came from growing, compared to 31.1% for men ($t(87.7)=-2.609, p<.05$). _

Gender differences in income appear to be more marked in legal markets (see Table 2). In legal contexts, the mean proportion of income from growing was 59.2% for women and 44.0% for men ($t(208)=-2.2382, p<.05$), while in illegal contexts, the mean proportion of income from growing for women and men was 27.6% and 25.3%, respectively ($t(406)=-0.3975, p=0.6912$).² Beyond its material benefits, we examined cultivation as a collaborative activity,

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Table 2: Gender Differences in Income from Growing and Percent Growing with Others by

Legal Context

Variables	N	Mean or Percent	Chi-Square or t Value
Mean % of Income from Growing			
Illegal Context			-.398
Men	380	25.3	
Women	28	27.6	
Legal Context			-2.238*
Men	169	44.0	
Women	41	59.2	
Growing with Others			
Illegal Context			36.913***

² Information on legal context was missing for 28 respondents.

Men	532	9.7	
Women	124	17.2	
Legal Context			73.151***
Men	295	13.9	
Women	130	30.9	

*p<.05 ** p<.005 *** p<.001

Cannabis Growing as a Collaborative Activity

Prior research shows that women often grow cannabis for or in collaboration with others, sometimes as companions or romantic partners of male growers (Potter 2010; Amado et al. 2020). This is supported by the results of the present study indicating that cCannabis cultivation appears to be a more collaborative activity for women growers -responding to our survey. WAs expected, women in our survey were significantly more likely to report that they grew with others (21.3%) compared to men (10.9%), $\chi^2(2)=109.65$, $p<.001$. We also found that this pattern persisted regardless of legal context (see Table 2). Women respondents were significantly more likely than men in both illegal contexts (17.2% vs 9.7%) and legal contexts (30.9% vs 13.9%) to report growing cannabis with others. If growing cannabis is a more social activity for women, we next explored the factors motivating people to participate.

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Gender Differences in Motivations for Growing

Though men in the general population are far more likely than women to be victims of violence, women are more likely the victims of sexualized violence (Selmini and McElrath 2014). In illicit contexts, gender identity compounds the risks for women (Kittel 2018). As women in the drug trade still face risks of violence and gendered threats of victimisation such

~~as sexual abuse (Havard et al., 2023), women's participation in cannabis growing may function as a form of agentic liberation (Campbell, 2008; Hobbs, 2013; Grundetjern & Miller, 2019).~~

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We found that ~~M~~motivations for growing cannabis varied by gender, ~~but not always in the direction hypothesized.~~ Some growers stated they grew their own cannabis to avoid different risks inherent in illegal markets. As noted previously, women growers were more likely to grow in contexts where cannabis was legal rather than where it was illegal. This may suggest a motivation to avoid the risks inherent in illicit cultivation contexts. As can be seen in Table 3, in illegal contexts, men were significantly more likely (65.5%) than women (55.2%) to state they grew to “avoid contact with criminals or supporting criminal networks” and/or because they believed “growing was not as risky as buying.” The odds of men growing for risk reduction reasons in ~~an~~ illegal contexts ~~s~~ was 1.38 times greater than for women. Men were also significantly more likely (41.3%) than women (32.2%) to ~~cite~~have risk reduction motivations for growing in legal contexts. This finding suggests that women are less likely, compared to men, to choose self-growing as a preferred risk mitigation strategy. It is possible that very risk-sensitive women instead opt for alternative strategies, such as sourcing cannabis through their social network or trusted (male) others (see e.g. Withanarachchie et al. 2025). while men may be more likely to grow cannabis to avoid risk where cannabis remains illegal, women avoid growing altogether in illicit contexts given the legal risks and potential threats to personal safety, among other harms they may face. If risk mitigation is less important for women than for men, what motivates women to grow cannabis?

Prior studies show that the increased normalization of cannabis use as well as the growing dominance of discourses emphasizing the medicinal benefits of cannabis ~~have~~ opened new avenues for women to do respectable femininity while ~~engaging~~ in cannabis growing, for instance by stating that this serves a broader collective benefit or ~~by~~ that they

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are caring service providers who supply “medicine” to others rather than profit-seeking drug dealers, a role that is more in line with social norms expected from women (Kittel 2018). ~~Some women may be drawn to growing because it fulfills a gendered role expectation of women as caregivers for specific others as well as a broader collective benefit. Even in illegal contexts, there is evidence that women provide medicine for use/rs (Klein & Potter, 2018; Potter & Klein, 2020) and perceive themselves as caring service providers and the cannabis they supply as “medicine” (Kittel 2018).~~ Similarly, ~~in fact, we found~~ ~~There also existed~~ gender differences in expressed altruistic motivations for growing ~~among our respondents~~, and these differences varied by legal context. ~~As expected, w~~ Women were significantly more likely (58.3%) than men (51.3%) in legal contexts to state they grew cannabis for altruistic reasons.

Table 3: Gender Differences in Motivations for Growing by Legal Context

Motivations	N	Percent	Chi-Square
Risk Reduction			
Illegal Context			30.107***
Men	3,588	65.5	
Women	401	55.2	
Legal Context			12.111***
Men	881	41.3	
Women	136	32.2	
Total	5,006		
Altruistic			
Illegal Context			.178
Men	2,485	45.4	
Women	336	46.2	

Legal Context			6.839*
Men	1,095	51.3	
Women	246	58.3	
Total	4,162		

* p<.05 ** p<.005 *** p<.001

~~There is evidence that in places where cannabis is perceived more as a medicine than an illicit drug (Duff, 2017; Sogaard & Lerkanen, 2021), there will be a greater proportion of growers who are women. Relatedly, medical cannabis may have opened new avenues for women to ‘do’ respectable femininity while engaged in cannabis growing – (Duff, 2017; Sogaard & Lerkanen, 2021).~~ Upon closer inspection, ~~we observed~~~~there were~~ gender differences in whether one was growing to supply cannabis for recreational or medical use. While men (19.4%) were significantly ($\chi^2(1)=5.842$, $p<.05$) more likely than women (16.4%) to grow to provide others with cannabis for recreational use, women (23.5%) were significantly ($\chi^2(1)=4.741$, $p<.05$) more likely than men (20.7%) to say they grow to supply others with medical cannabis. –As can be seen in Table 4, when we examine gender differences in motivations for growing cannabis by legal context, a significantly greater proportion of men (16.3%) compared to women (11.8%) reported growing cannabis for others’ recreational use in illegal contexts, $\chi^2(1)=9.837$, $p<.005$. Next, we consider the potential legal dangers for men and women growers by examining gender differences in criminal justice system contacts.

~~There is evidence that in places where cannabis is perceived more as a medicine than an illicit drug (Duff, 2017; Sogaard & Lerkanen, 2021), there will be a greater proportion of growers who are women. Relatedly, medical cannabis may have opened new avenues for women to ‘do’ respectable femininity while engaged in cannabis growing – (Duff, 2017; Sogaard & Lerkanen, 2021).~~

Table 4: Gender Differences in Motivations for Growing Cannabis to Supply Others for Medical vs Recreational Use by Legal Context

Motivations	N	Percent	Chi-Square
Grow to supply others for Medical Use			
Illegal Context			.748
Men	1,041	19.0	
Women	148	20.4	
Legal Context			2.842
Men	533	25.0	
Women	122	28.9	
Total	1,844		
Grow to supply others for Recreational Use			
Illegal Context			9.837**
Men	895	16.3	
Women	86	11.8	
Legal Context			1.546
Men	578	27.1	
Women	102	24.2	
Total	1,661		

* p<.05 ** p<.005 *** p<.001

Gender Differences in Experiences with the Criminal Justice System

Though women account for approximately 10 percent of global arrests for drug-related crimes, their proportional involvement in arrests is increasing and is greater in Central America as well as Australia and New Zealand (United Nations 2018). However, women continue to be underrepresented in more senior roles in cannabis cultivation and tend

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~~to instead~~, perform secondary and lower-status tasks (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009). If women are less involved in higher level roles in cannabis production and related distribution, or less involved in larger scale operations, they are less likely to be found guilty of higher level offences as a reflection of less prominent occupational roles. Also, ~~it is possible that~~, as suggested by the “chivalry thesis” - which argues that where women receive less harsh criminal justice outcomes than men for comparable offences (Johnson et Scheuble, 1991) - ~~may to further reduce the likelihood of women being found guilty of cannabis-related offences across the board~~, may be further reduced. While we found no significant difference in the proportion of men versus women who have ever come in contact with the police because of cannabis growing, regardless of legal context (see Table 56), we did find evidence ~~to support our hypothesis~~ that women would be less likely to be found guilty of growing-related offences ~~given their secondary roles in cultivation~~. For our analysis, the different offense categories served as proxy measures for role/scale of involvement insofar as “trafficking,” “supply,” and “cultivation” were treated as more serious than “possession/use.”

Overall, 12.1% of growers reported ever having contact with the police because of their cannabis growing, with no significant difference between men and women. However, men were consistently more likely than women to be found guilty of cannabis possession/use, cultivation, supply, and trafficking offenses. Men were twice as likely as women (24.7% vs 12.0%) to be found guilty of cannabis possession/use in illegal contexts and over three times as likely in legal contexts (16.4% vs 5.7%). In illegal contexts, men were slightly more likely than women (8.3% vs 5.0%) to report having ever been found guilty of cannabis cultivation, but three times as likely to report having ever been found guilty of supplying cannabis (3.4%

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vs 1.1%). Though cell sizes were quite small, men were also significantly more likely to report having received a cannabis trafficking conviction, regardless of legal context (2.2% vs 0.8%).

Table 5: Gender Differences in Cannabis Related Criminal Justice Contacts by Legal Context

Prior Police Contact for Growing	N	Percent	Chi-Square
Illegal Context			.784
Men	696	13.7	
Women	85	12.5	
Legal Context			.048
Men	194	9.9	
Women	37	9.5	
Guilty of Cannabis Possession/Use			
Illegal Context			52.910***
Men	1,233	24.7	
Women	80	12.0	
Legal Context			29.749***
Men	315	16.4	
Women	22	5.7	
Guilty of Cannabis Cultivation			
Illegal Context			8.964**
Men	414	8.3	
Women	33	5.0	
Legal Context			3.312
Men	56	2.9	
Women	5	1.3	

Guilty of Cannabis Supply			
Illegal Context			10.728**
Men	170	3.4	
Women	7	1.1	
Legal Context			.127
Men	24	1.3	
Women	4	1.0	
Guilty of Cannabis Trafficking			
Illegal Context			6.215*
Men	110	2.2	
Women	5	0.8	
Legal Context			4.938*
Men	34	1.8	
Women	1	0.3	

* p<.05 ** p<.005 *** p<.001

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Discussion

This paper set out to explore gender differences in cannabis cultivation. ~~I We expected to find differences between women and men, as~~ the literature has consistently pointed to participation in drug markets as a highly gendered activity dominated by men. However, we also speculated that the dual influences of the (western) historic egalitarian traditions of “cannabis culture”, the entanglements between cannabis cultivation and medicine, and the growing global trend away from cannabis prohibition would make these gendered differences

less pronounced than found in other areas of drug market participation. ~~Specifically, we proposed seven hypotheses that we tested against data from the ICCQ 2.~~

~~Not all of our hypotheses were supported, and t~~The overall picture emerging from the data ~~reveals some complexityis far from clear~~. Nevertheless, we can make some important general interpretations of our findings. ~~W~~~~Our first two hypotheses suggest that w~~omen's participation in cannabis cultivation is increasing ~~(H1)~~, as, overall, men's dominance of cannabis cultivation has declined to some extent since our previous survey (ICCQ 1; Potter et al., 2015). This is true in both legal and illegal contexts ~~(H2)~~, suggesting that some of the barriers to women's participation, in the form of the stigmatization from illegality (Amado et al., 2020; Kittel, 2018) and hegemonic masculinity associated with illicit drug markets (Havard et al., 2023), have been reduced even where cannabis cultivation remains illegal. However, the ratio is notably smaller for growers operating in legal contexts and in compliance with the law, suggesting prohibition itself remains a more effective deterrent for women than men. This, of course, fits with the established literature showing the greater participation of men in drug markets (Fleetwood & Leban, 2023), as well as in criminality in general (Britton et al., 2018). This also fits with our observation from the literature review that more equal and egalitarian gender relations have sometimes existed in lower-level involvement in cannabis markets (the majority of our respondents grow cannabis on a relatively small scale) even going back a few decades (e.g., Hafley and Tewksbury, 1996). The egalitarian aspect of women's involvement in cannabis growing may not be all that new, although it seems to have increased.

We also examined the ~~Our next two hypotheses spoke to the~~ nature, rather than the extent, of women's participation in cannabis cultivation. We found, ~~as predicted~~, that women

earn more of their overall income from their cannabis cultivation activities compared to men in both legal and illegal contexts, but especially in the former ~~(H3)~~. This finding suggests that cannabis growing can be ~~is~~ an attractive financial choice for women, and that cannabis cultivation (whether legal or illegal) has less pronounced gender pay disparities than other legal or illegal economic activities – but may also speak to gendered income inequalities in the established formal economy, where women generally earn less than men (Toczek et al., 2021).

Reflecting results from prior studies showing that ~~Our examination of the social dimensions of cultivation revealed. Our fourth hypothesis (H4) reflected, on the one hand, the fact that~~ women often historically have ~~had~~ supporting rather than leadership roles in drug markets or have been introduced to drug market participation via partners or friends who are men ~~and, on the other, that collaboration with others may help (or be necessary) to overcome some of the gendered barriers to entry into cannabis cultivation (whether legal or illegal)~~ (Potter, 2009; Amado et al., 2020). ~~Our~~ findings show that women are far more likely than men to collaborate with others, in both illegal and legal contexts. However, a better understanding of the gendered differences in working with others would need more information about the nature of the relationships with collaborators – such as divisions of labour, hierarchies, reasons for collaboration and, of course, the genders of collaborators – which were not addressed in ICCQ 2.

The ICCQ 2 did include numerous questions related to one's motivations for growing cannabis. Our analyses illustrated ~~Although our hypotheses in this area were not fully supported, a strong narrative around~~ gendered differences in these motives ~~behind participation in cannabis growing does begin to emerge. W~~Contrary to our expectations,

women were less likely to report risk-avoidance motives than men (~~H6~~), although this may at least partly reflect the fact that risk itself is likely one of the key barriers to women's involvement in cannabis growing in the first place. As previously reported, however, women were also more likely than men to report growing in legal contexts in compliance with local regulations. One inference from these findings is that women avoid growing in illegal contexts because of risk while men are more likely to grow to avoid risk. However, the gendered differences in altruistic motives (~~H5~~) seem to tell a clearer story. Women were more likely to report altruistic motivations for growing in legal contexts, but there was no significant difference between genders in reported altruistic motivations in illegal contexts. Specifically, and interestingly, a higher proportion of women than men reported being motivated by the desire to provide other people with cannabis for medical use in both legal and illegal contexts – although the differences in the stratified analyses were not statistically significant. This result is consistent with sociological literature showing the involvement of women in care activities. Taken together, these observations lend some support to other research showing the patterns those established in coming from the existing literature: that many women involved in cannabis cultivation, whether legally or illegally, fit (or adopt) a “healer discourse” related to a “nurturing” or “caring” female identity (e.g., see Kittel, 2018; Fleetwood, 2015; Bone et al., 2018). Such an identity for women who grow cannabis contrasts with the profit-seeking identity more traditionally associated with women's drug market involvement. This seems to be the case in both legal and illegal contexts, although less so in the latter.

Finally, we found that~~hypothesized (H7) that~~ while women ~~had~~would have similar levels of contact –with law enforcement to men, the outcomes of such contacts ~~would~~

differ~~ed~~, with women less likely to be found guilty of cannabis-related offences. ~~This hypothesis was supported: despite no difference in the likelihood of men and women reporting contact with law enforcement regardless of the legality of their growing, there were important gendered differences in the outcomes of criminal justice contacts when they did occur.~~ Women are seemingly benefitting from more lenient outcomes, being significantly less likely to be found guilty of criminal offenses than men across the full range of potential cannabis offenses (from possession to trafficking) and regardless of legal context and compliance with the law. This may partly reflect the fact that women remain less likely to fill top-level cannabis-market roles ([Koonce, 2025; Marijuana Business Daily, 2021](#)), or be less likely to be involved in larger scale cultivation enterprises. It may also suggest that the “chivalry theory” identified elsewhere in criminology (Johnson et Scheuble, 1991) comes into play for cannabis cultivation offenses, which in turn suggests that [criminal justice systems tend to treat](#)see cannabis cultivation (even when illegal) [by women less harshly](#) ~~is a more excusable activity~~acceptable ‘deviant’ occupation for women ~~than such activity by men~~other types of criminal activityfor men~~to be involved in~~. In other areas of criminal activity that are seen to breach [traditional](#) gender-~~role~~ ‘norms’ (as well as breaking the law), women are often found to receive harsher sentences than men for committing otherwise similar offenses, as they are perceived to be “doubly deviant” (Lightowlers, 2019). [Our findings point to the need for further research that will investigate the extent to which conviction rate differences for cannabis cultivation are a product of the chivalry of \(still generally male-dominated\) criminal justice professionals, or a reflection of the less prominent roles women occupy in cannabis cultivation, or a combination of these factors.](#)

A particularly interesting aspect of our research to take into consideration when interpreting our results and their contribution to our understanding of gendered differences in cannabis cultivation is that our sample suggests a much lower proportion of women involved in cannabis growing. Our findings may be limited by the proportion of respondents ~~who are women~~ compared with other research in this area ~~on cannabis growers~~ (e.g., Schoenmakers et al., 2013; Potter et al., 2015; Wilkins et al., 2018; Amado et al., 2020). There are several possible explanations for this. As suggested by prior research (Havard et al., 2023; Kittel, 2018), women growers face greater risks than men (especially when they have children) and this may have impacted women's willingness to participate in the ICCQ 2. Another potential explanation may be due to the fact that we specifically targeted cannabis growers. To be included in our study, the respondents needed to have grown cannabis in the last 12 months. Women involved in sSome of the broader or peripheral activities described earlier (e.g., trimming, packaging, running errands, cleaning indoor equipment and grow rooms, and bringing refreshments and food to workers) and included in some of the other research (August, 2013; Schoenmakers et al., 2013; Bouchard et al., 2009) may therefore not be included in our sample. Though these activities are integral elements of cultivation, some potential respondents may not have perceived their activities as constituting "growing." These factors may, in turn, have led to an underrepresentation of women involved in cannabis growing within our survey or further atypicality of those who did so. Because of this, the gap between men's and women's participation in cannabis cultivation may be smaller than we report, and differences (or similarities) between men and women growers may have been further obscured. We also note that our analyses are further limited by the breadth and depth of questions contained in the survey. For example, we did not query our respondents about

their specific roles and responsibilities growing cannabis (e.g., central involvement or more peripheral participation).

Overall, however, while our findings do indicate the persistence of gender differences in cannabis cultivation, a key finding in our study is that ~~many~~most of these differences seem far less pronounced than in other drug market contexts. Furthermore, legalization seems to clearly be related to a reduction in ~~have a clear effect in reducing~~ traditional gender differences and disparities in cannabis cultivation.

~~Whether legal or illegal, we might have expected gendered differences in participation in cannabis cultivation because drug markets tend to be dominated by men, and the experiences of men and women within them have tended to be different because of historic, structural gendered barriers to participation (Fleetwood and Leban, 2023). But we might also expect some of the ideological factors associated with cannabis — and some of the recent trends towards gender equality in wider society — to lessen these differences in comparison to other drug markets. We might also expect these differences to be less pronounced in jurisdictions with legal cannabis cultivation.~~

~~Overall, we identified a number of points of interest in relation to gender differences in cannabis cultivation. First, as with other areas of drug market participation, men in this sample still dominate in participation in illegal cultivation — but with some indications that this dominance is lessening. Men also dominate in legal cultivation, but less so than in illegal cultivation. Apart fromHowever, participation rates aside, we found surprisingly few gendered differences in many of our measures of experiences of cannabis cultivation: once involved in cannabis growing, men and women have remarkably similar experiences to report.~~

~~Some notable differences in the experiences of women and men cannabis growers do~~
remain. Women in this sample earned a greater proportion of their total income from cultivation than men — which may suggest that cultivation is a more attractive financial opportunity for women than men. This may reflect that cannabis cultivation (whether legal or illegal) has less pronounced gender pay disparities than other legal or illegal economic activities. Women in this sample we are more likely to collaborate with others in their growing than men we are. Without more information on the nature of these relationships, it is difficult to interpret this. Women in this sample we are also more likely to participate in cannabis cultivation for altruistic reasons — especially for the reason of supplying others with cannabis for medical use — than men, which may reflect gender stereotypes of the nurturing/caring/healing woman, as identified in other (qualitative) studies of women's participation in legal (Kittel, 2018) and illegal (Klein & Potter, 2018; Potter & Klein, 2020) cannabis cultivation.

Finally, while women in this sample were as likely as men to come into contact with the criminal justice system for their growing, they were less likely to be found guilty of (and therefore sentenced for) otherwise similar offenses. Further research should examine the extent to which conviction rate differences are a product of the chivalry of (still generally male dominated) criminal justice professionals, reflect the less prominent roles women occupy in cannabis cultivation, how women differently engage with the criminal justice system, or a combination of these factors.

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Conclusions

Our findings and conclusions are subject to limitations within our methods and data, and these should be acknowledged here. Our survey included participants from 18 countries, which is an advantage in terms of the generalizability of the findings. However, such aggregated analyses may have masked gender differences (or similarities) within individual countries. The survey was administered online to an anonymously participating self-selecting purposive sample (Barratt et al., 2012; Barratt et al., 2015b). As such, we cannot be sure of the representativeness of our sample nor that our respondents are answering truthfully. There was no way to confirm that respondents had ever grown cannabis. Likewise we cannot be sure that the observed difference between 2012 and 2020 in the proportion of respondents who are women growers is not merely an artifact of women being more likely to respond to the survey in 2020. Given that most cannabis growers operate in jurisdictions where cannabis cultivation is illegal, and even in legal contexts, many growers do not operate in full compliance with the law, our survey was predominantly targeting those engaged in illegal behaviours. Such 'hidden' populations of active offenders are notoriously hard to research, and it is —by definition— impossible to be sure of the representativeness of samples that do participate in survey (or other) research (Barratt et al., 2015a). However, we have some evidence that the (Australian) sample of growers recruited in our previous survey (ICCQ 1) was broadly representative of growers identified in a national crime survey in Australia (Barratt and Lenton, 2015), which may alleviate some of these concerns. On the other hand, if, as we have suggested, women growers are more risk averse than men, this may have impacted women's willingness to participate in the ICCQ 2. This may, in turn, have led to an underrepresentation of women growers within our survey or further atypicality of those who

~~did so. Because of this, the gap between men's and women's participation in cannabis cultivation may be smaller than we have detected, and differences (or similarities) between men and women growers may have been further obscured, although it seems unlikely that differences in willingness to participate in an online survey account for all of the gender differences identified in the survey and reported on here. We also note that our analyses are further limited by the breadth and depth of questions contained in the survey. For example, we did not query our respondents about their specific roles and responsibilities growing cannabis (e.g., central involvement or more peripheral participation).~~

~~Even with the caveats about our survey data, o~~Our paper is the first multi-national study to provide a descriptive quantitative analysis of the broader gender differences in cannabis cultivation. Our sample is drawn from 18 countries, ~~mainly~~predominantly but not exclusively from the “Global North,” ~~predominantly~~ but not exclusively involved in smaller-scale cultivation, and including respondents growing in both legal and (predominantly) illegal contexts. As such, our findings provide an important addition to the literature, complementing existing studies that have tended to focus on single countries (e.g., Afsahi 2011; Aguiar and Musto 2022; Bouchard et al. 2009; Wilkins et al. 2018), cultivation in developing world countries (Afsahi 2015; Fleetwood and Leban, 2023), women's involvement in larger, profit-oriented (illegal) cannabis cultivation and distribution operations (Kittel 2018), or women's participation in legal cultivation (Anderson & Kavanaugh 2017; Rogers 2017) - and/or take more qualitative approaches (e.g., August. 2013 ; Rogers 2017).

Our data suggests that cannabis cultivation (whether legal or illegal) remains a gendered occupation. Despite a closing gap, women still participate in cultivation in ~~much~~ smaller numbers than men, ~~suggesting that they face significant barriers to participation.~~

When they do participate, ~~their experiences are not as different to those of men as we might have expected—but,~~ gender differences, seemingly reflecting broader entrenched structural sexism and gender stereotypes, continue to exist, such as in differences in earnings, in motivations for participation, and in experiences with the criminal justice system.

~~However, the gendered nature of cannabis cultivation may be lessening over time—and be less pronounced than for other areas of drug-market involvement. The change over time may reflect general trends towards gender equality.~~ The difference compared to other areas of drug-market participation may reflect some of the (historical and contemporary) ideological and normalization aspects of cannabis culture (compared to other drug cultures). Importantly, we found evidence of greater levels of women's involvement in cannabis cultivation in legal rather than illegal contexts, suggesting that prohibition itself is a greater deterrence to women than to men - and, therefore, that one of the impacts of legalization may be to increase the involvement of women in cannabis production.

Following from the findings presented here, we have ~~many~~ suggestions for further [survey](#) research. In particular, it would be interesting to explore the nature of growing relationships (i.e., collaboration and co-participation with other people) to see how these manifest and how they relate to other variables, such as motivations behind growing and the legal context of growing. Some of this may be addressable via further analysis (including network analysis) of our own data-set, or by including more detailed questions in this area in future [survey](#) research. Other aspects of this question will probably be better addressed through qualitative research – detailed interviews with women growers operating both legally and illegally.

In particular, for any future iteration of the ICCQ or other surveys of cannabis growers, ~~For instance,~~ it would ~~also~~ be fruitful to include questions about specific roles occupied and tasks completed by those involved in cannabis cultivation. Though the primary target of the International Cannabis Cultivation Questionnaire ~~has been~~ ^{are} those who grow cannabis, it could be useful to widen the target population to those who are involved in other activities associated with cannabis cultivation. T~~he~~ cultivation process undoubtedly involves multiple activities including, for example, planting, irrigation, fertilizing, harvesting, drying, processing, and packaging in addition to the multiple ancillary support roles necessary for growing cannabis - and even more for any related distribution (Søgaard et al., 2025 - (e.g., preparing food, transporting product and supplies, security, bookkeeping, among others). By including such questions, we will likely be better able to capture and understand the role of women in the wider cultivation process. Finally, we suggest including questions that address the nature of the relationship between growers and those with whom they collaborate in the cultivation enterprise, including the gender of collaborators and the existence of potential hierarchical relations.

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Appendix

Table 1: Gender Differences in Prevalence of Cultivation by Legal Context

Variables	N	Percent	Chi-Square
Grew in past year			
Men	8,172	85.9	
Women	1,271	13.4	
Nonbinary	65	0.7	
Total	9,508	100.0	
Legal Context			54.998***
Men			
Illegal	5,483	72.0	
Legal and noncompliant	823	10.8	
Legal and compliant	1,313	17.2	
Women			
Illegal	728	63.2	
Legal and noncompliant	121	10.5	
Legal and compliant	302	26.2	
Nonbinary			
Illegal	40	69.0	
Legal and noncompliant	6	10.3	
Legal and compliant	12	20.7	

* p<.05 ** p<.005 *** p<.001

Table 2: Gender Differences in Income from Growing and Percent Growing with Others by Legal Context

Variables	N	Mean or Percent	F-test or Chi-Square
Mean % of Income from Growing			
Illegal Context			1.211
Men	380	25.3	
Women	28	27.6	
Nonbinary	1	70.0	
Legal Context			3.363*
Men	169	44.0	
Women	41	59.2	
Nonbinary	1	11.0	
Growing with Others			
Illegal Context			38.741***
Men	532	9.7	
Women	124	17.2	
Nonbinary	5	12.8	
Legal Context			74.652***
Men	295	13.9	
Women	130	30.9	
Nonbinary	2	11.1	

*p<.05 ** p<.005 *** p<.001

Table 3: Gender Differences in Motivations for Growing by Legal Context

Motivations	N	Percent	Chi-Square
Risk Reduction			9.403*
Illegal Context			
Men	3,588	80.3	
Women	401	74.7	
Nonbinary	28	77.8	
Legal Context			
Men	881	19.7	
Women	136	25.3	
Nonbinary	8	22.2	
Altruistic			32.078***
Illegal Context			
Men	2,485	69.4	
Women	336	57.7	
Nonbinary	29	74.4	
Legal Context			
Men	1,095	30.6	
Women	246	42.3	
Nonbinary	10	25.6	

* p<.05 ** p<.005 *** p<.001

Table 4: Gender Differences in Motivations for Growing Cannabis to Supply Others for Medical vs Recreational Use by Legal Context

Motivations	N	Percent	Chi-Square
Grow to supply others for Medical Use			
Illegal Context			.765
Men	1,041	19.0	
Women	148	20.4	
Nonbinary	8	20.0	
Legal Context			3.393
Men	533	25.0	
Women	122	28.9	
Nonbinary	6	33.3	
Total	1,858		
Grow to supply others for Recreational Use			
Illegal Context			9.859*
Men	895	16.3	
Women	86	11.8	
Nonbinary	6	15.0	
Legal Context			1.724
Men	578	27.1	
Women	102	24.2	
Nonbinary	4	22.2	
Total	1,671		

* p<.05 ** p<.005 *** p<.001

Table 5: Gender Differences in Cannabis Related Criminal Justice Contacts by Legal Context

Prior Police Contact for Growing	N	Percent	Chi-Square
Illegal Context			3.017
Men	696	13.7	
Women	85	12.5	
Nonbinary	2	5.3	
Legal Context			.217
Men	194	9.9	
Women	37	9.5	
Nonbinary	1	6.7	
Guilty of Cannabis Possession/Use			
Illegal Context			54.945***
Men	1,233	24.7	
Women	80	12.0	
Nonbinary	5	13.5	
Legal Context			30.593***
Men	315	16.4	
Women	22	5.7	
Nonbinary	1	6.7	
Guilty of Cannabis Cultivation			
Illegal Context			10.366*
Men	414	8.3	
Women	33	5.0	
Nonbinary	1	2.7	
Legal Context			4.206
Men	56	2.9	
Women	5	1.3	

Nonbinary	1	6.7	
Guilty of Cannabis Supply			
Illegal Context			11.989**
Men	170	3.4	
Women	7	1.1	
Nonbinary	0	0.0	
Legal Context			.312
Men	24	1.3	
Women	4	1.0	
Nonbinary	0	0.0	
Guilty of Cannabis Trafficking			
Illegal Context			7.022*
Men	110	2.2	
Women	5	0.8	
Nonbinary	0	0.0	
Legal Context			5.201
Men	34	1.8	
Women	1	0.3	
Nonbinary	0	0.0	

* p<.05 ** p<.005 *** p<.001

Declaration of interests

☒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.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: