

Age-Gating and Marketing Differences Between Storefront and Non-Storefront Cannabis Retailers

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ABSTRACT

Objective: The study investigated whether California storefront and non-storefront cannabis retailers are adhering to online age-gating requirements and whether differences in website marketing practices exist. **Methods:** Websites of 134 storefront and 115 non-storefront licensed retailers were randomly selected. Bivariate associations were tested between retailer type and website marketing, age-gating methods, and presence of age-gating at various purchase stages. **Results:** Among the 200 (80.3%) websites with age-gating when entering, 182 (91%) employed an ineffective method where users click either “Yes” or “No” to confirm their age. Moreover, 49 (19.68%) websites lacked age-gating when entering. Amongst those requiring photo identification during checkout ($n = 100$, 40.16%), 97% allowed users to proceed after uploading an irrelevant image. Significantly more storefront retailers employed combined age-gating at entry, mandatory account registration, and age-gating during checkout than non-storefront retailers, $X^2(1, N = 249) = 7.69, p < .01$. Retailer websites frequently displayed “clean” labels ($n = 200$, 80.32%), followed by positive state claims ($n = 198$, 79.52%), physical health claims ($n = 166$, 66.67%), and mental health claims ($n = 146$, 58.63%). Significantly more storefront retailers displayed physical health claims, $X^2(1, N = 249) = 7.52, p < .01$, and health warnings than non-storefront retailers, $X^2(1, N = 249) = 4.13, p = .04$. **Conclusions:** Most cannabis retailers comply with age-gating requirements; however, methods employed are easily circumvented. Youths’ easy and unrestricted access to cannabis retailer websites may increase positive attitudes about cannabis and encourage use.

Key words = cannabis; age-gating; storefront; marketing; policy

As more states legalize cannabis, an increase in harmful cannabis and adolescent use is of great concern. Nationally, cannabis vaping in the past 30 days among 12th graders increased steadily from 4.9% to 14.8% between 2017 and 2022 (Johnston et al., 2023), and past-month overall cannabis use increased from 6% in 2003 to 10.9% in 2019 among adults (National Survey on Drug Use and Health, 2005; National Survey on Drug Use and Health, 2020). In California, a near

doubling of cannabis use occurred during pregnancy over a decade, as well as major increases in cannabis-related emergency room visits and the tripling of daily use in adults (Center for Community Research, 2022; Padwa et al., 2022; Young-Wolff et al., 2022). Public health advocates have argued that lax regulations have failed to properly restrict the promotion of cannabis use, which may exacerbate the increasing trend of cannabis use. As such, public

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health approaches are needed (Barry & Glantz, 2016; Kilmer, 2014; Padon et al., 2022; Silver et al., 2020).

There is a legitimate concern that adolescents may be able to purchase cannabis via online retailers. In 2016/2017, most high school students in Los Angeles, CA obtained cannabis either for free (72.1%) or by purchasing it from others (50.9%), while only a few used a fake identification (ID) (3.1%) or online delivery service (1.7%) (Kelleghan et al., 2022). However, the mode of obtaining cannabis may have shifted due to the passage of California's Proposition 64, the Adult Use of Marijuana Act, which legalized retail sales of cannabis on January 1, 2018. The prior study utilized data from 2016-2017, which is before the 2019 allowance of both medicinal and recreational cannabis deliveries in all jurisdictions in California. Since Proposition 64's implementation, the downward trend of cannabis use among adolescents has shifted, where cannabis use among high-schoolers has increased (Paschall et al., 2021). Given that research has shown that there is increased cannabis use by youth within areas with denser legal retail storefronts (Borodovsky et al., 2017) and when youth have closer proximity to storefronts (Albers et al., 2024), creation of an expanded retail storefront and delivery infrastructure, especially when age verification or ID checks are flawed, could lead to the expanded adolescent use of fake ID and use of online delivery services.

The reduced surveillance of compliance at the point of cannabis delivery compared to at a brick-and-mortar storefront may be attractive to adolescents interested in obtaining cannabis from a legal retailer. These concerns warrant an examination of online age verification methods used by licensed cannabis retailers. California requires age confirmation (i.e., age-gating), such as a simple pop-up message to confirm legal age, before engaging in any communication with patrons on retail websites (Cal. Bus. & Prof. Code § 26151, 2017). California regulation also states that to effectuate a sale of adult-use cannabis, including an online sale, a licensed retailer must verify a government-issued identification (Cal. Code Regs. Tit. 4, § 15404, 2024).

Exposure to online and traditional cannabis marketing has been associated with positive attitudes toward cannabis, lower perceptions of harm, and substantial increases in past year

cannabis use among exposed adolescents (Cohn et al., 2023; Trangenstein et al., 2019; Whitehill et al., 2020). Some states have placed restrictions on the online marketing of cannabis (Colo. Code Regs. § 212-3-720, 2024; Wash. Rev. Code § 69.50.369, 2022). Additionally, cannabis licensees may not publish or disseminate health-related advertising that is untrue or leads to misleading impressions regarding the health effects of cannabis consumption (Cal. Bus. & Prof. Code § 26154, 2017).

Although age-gating regulations are in place to curb minors' exposure to online cannabis marketing and sales, compliance with these rules and the effectiveness of current age-gating methods are unclear. Further, retailers' adherence to health claims regulations has been shown to be inconsistent. Two-thirds of cannabis retailer websites from 10 U.S. states with legal markets displayed health claims and over half had claims of benefits of using cannabis with little or no evidence (Cavazos-Rehg et al., 2019). In a more recent study of five cities, more than 90% of retailers endorsed use for anxiety, insomnia, and/or pain, and 54.3% for pregnancy associated nausea (Romm et al., 2024).

Only a handful of researchers have estimated the prevalence of age-gating practices among cannabis retail websites. Bierut and colleagues (2017) found that 41% of retailers in Colorado and 35% in Washington lacked any form of age verification, which is likely due to the lack of age-gating requirements in both states (Colo. Code Regs. § 212-3-720, 2024; Wash. Rev. Code § 69.50.369, 2022). Cavazos-Rehg et al. (2019) found that among randomly selected retailer websites across the U.S., 75% had no form of age-gating in 2016. In contrast, Madson (2022) found that 90% of retailer websites in Arizona, where age verification is required (Ariz. Rev. Stat. § 36-2859, 2024), employed some form of age-gating in 2022.

It is possible that storefront retailers, who are allowed to sell products online or at a physical store in California, may be more likely to comply with regulations to reduce the risk of license suspension, a costly risk given the high overhead and operational costs for running a physical location. Non-storefront retailers, who are only allowed to sell via delivery, may focus less on age-gating patrons at the initial entry to their website, and more on age verification during the checkout process. The present study aims to test for

differences between storefront and non-storefront cannabis retailer website marketing practices and adherence to California's age-gating requirements. Given the increasing accessibility of legal cannabis for both adults and adolescents, continued monitoring of industry adherence to marketing restrictions and age-verification methods is needed. Since specific retailer characteristics may correlate with adherence to the regulations, identifying such characteristics may help improve policies or enforcement efforts. To our knowledge, there has been no previous research investigating differences in age-gating or marketing practices between websites of storefront and non-storefront cannabis retailers.

METHODS

Selection of Retailer Websites

The full set of cannabis retailers legally operating as of October 2022 in California was obtained from the state's Department of Cannabis Control (DCC). Types of retailers included businesses with a Type 9 (non-storefront) retail license and microbusinesses with a non-storefront license were categorized as non-storefront cannabis retailers. Those with a Type 10 (storefront) retail license and microbusinesses with a storefront license were categorized as storefront cannabis retailers. Non-storefront retailers are restricted to sales via delivery only, while storefront retailers may sell at a physical location and by delivery (Department of Cannabis Control, n.d.).

Utilizing a chi-square test, a minimum sample of 113 storefront and 113 non-storefront cannabis retailers was estimated to be sufficient to detect a statistically significant bivariate association (McHugh, 2013; Serdar et al., 2021; Sullivan & Feinn, 2012) based on the following parameters: $1-\beta$ of .85, w of 0.2, df of 1, and α of .05. However, we chose a slightly larger stratified random sample of 134 storefront and 115 non-storefront retailers ($N = 249$) for the analyses.

Standalone websites, which are operated by the retailer, were found by utilizing both their legal business name and Doing-Business-As (DBA) name from the DCC database. Standalone websites were searched by inputting the respective business name in the Google

search engine and were checked by cross-referencing their physical store location or delivery boundaries, business email, business phone number, and business license number in the DCC database. Retailers without a standalone website or those who only used third-party retailer websites (e.g., www.Weedmaps.com) were replaced by another storefront or non-storefront retailer randomly selected from the DCC database. Coding of the selected websites was carried out in October, 2022

Algorithm & Coding Procedures

A prototype algorithm based on work by Barry et al. (2021) and Jones et al. (2014) on alcohol retailers was modified for the present project. A total of three coders were trained in coding cannabis retailer websites utilizing the prototype algorithm. During this training process, the prototype algorithm was iteratively adjusted until no further variables were added or removed due to strong inter-rater reliability. The coders had an average pairwise Cohen's K of 0.844 for all 35 coded variables.

The algorithm was designed to first code for the presence and type of initial age-gating, which is age-gating occurring when entering the website (see Appendix A). Coders would deliberately fail the age-gating process and record whether they were properly blocked from progressing onto the website. If initial age-gating was present, the visibility of health claims or health warnings during or before initial age-gating was recorded, to assess whether dialogue from the retailers began before age confirmation. Regardless of whether age-gating was present, coders visited every page on the retailer's website to also code for the presence of physical health claims, mental health claims, positive state messages, "clean" labels, and health warnings. Next, we additionally coded the type of age-gating employed during checkout (e.g., required upload of photo ID), the consequences of failing those age-gating methods (e.g., inputting an underage date of birth), use of a third-party web payment system, and retailer's exclusive use of a customer pick-up service. Furthermore, the presence of mandatory account registration, where retailers require patrons to create an

account to proceed within their website, which may also act as an additional form of age-gating prior to sale in California, was also coded (see Appendix B). Completion of cannabis purchases was not assessed in this study.

Health Claims, Positive States, and Clean Labels

Health claims were coded into two categories: (1) Physical health claims were defined as any statement or imagery that describes or insinuates a reduced risk of a physical disease or alleviation of a physical health-related condition (e.g., physical pain, cancer), including sleep-related disturbances (e.g., insomnia) (Hoeper et al., 2022). (2) Mental health claims describe or imply a relationship between cannabis and alleviation of a psychological health-related condition or mental illness (e.g., anxiety) (Hoeper et al., 2022).

“Positive state” was coded for any statement or imagery suggesting that cannabis use induces positive emotions (e.g., zen, wellness, well-being). Sites were categorized as displaying “clean labels” if any terms or visuals conveyed one or more of the following properties: (1) minimal industrial processing or plant modifications (e.g., non-GMO); (2) reduced health risk (i.e., gluten-free); (3) animal cruelty-free testing; (4) environmental consciousness (e.g., organic); (5) absence of contaminants or additives (e.g., pesticide-free); or of (6) high quality (Asioli et al., 2017; Negowetti et al., 2022).

Data Analysis

Univariate (frequency) and bivariate (chi-square test of independence) methods were used to examine each coded variable by type of retailer (storefront/non-storefront). The following composite variables were also tested for their association with retailer type: (1) presence of physical and/or mental health claims; (2) implementation of initial age-gating and/or mandatory account registration; (3) implementation of initial age-gating, age-gating during checkout, and mandatory account registration; (5) requiring either a photo ID or ID number during the mandatory account registration or checkout process; and (6)

requiring a photo ID during mandatory account registration or checkout. A Fisher’s exact test was used for variables that had expected cell frequencies of less than five by retailer type (McCrum-Gardner, 2008).

RESULTS

Descriptive Statistics

Initial age gating. Two hundred websites (80.32%) had initial age-gating; among them, 174 utilized age-gating immediately upon entering the homepage and 26 when entering their product page. The remaining 49 (19.68%) had no form of initial age-gating. Among retailers with initial age-gating, most ($n = 182$) employed a simple method of having users click either a “Yes” or “No” button to confirm they are of legal age to use cannabis products (21+, in some cases providing an option for 18+ with a medical card), followed by those only offering a “Yes” option to confirm their legal age ($n = 15$). Among the websites that had either a simple (i.e., yes/no) or manual date-of-birth (DOB) entry age-gating system, three websites asked visitors to reconfirm their response when deliberately failing the age-gating, while one site allowed immediate website access even after deliberately failing the age-gating test.

Age gating during account registration. Of the 249 websites, 105 (42.17%) required account registration at some stage in the process. Only 56 (53.3%) of these required users to upload a driver’s license and 10 (9.50%) required a driver’s license number. Of the 249 retailers, 215 (86.35%) had either initial age-gating or required a later mandatory account registration to proceed, 90 (36.14%) implemented both initial age-gating and an account registration system only, and 121 (48.59%) comprehensively implemented initial age-gating, age-gating during checkout, and mandatory account registration. While 164 (65.86%) retailers required a driver’s license or ID number during the checkout process or mandatory account registration, one-third of retailers did not require any documentation, and this did not differ significantly by retailer type. See Appendix C for more descriptive statistics on age-gating and marketing behaviors stratified by retailer type.

Table 1. *Prevalence and Bivariate Associations of Website Age-Gating Practices by Storefront and Non-Storefront Cannabis Retailers Operating in California, 2022*

Characteristic	Storefront retailers	Non- storefront retailers	Total	Chi- square ^f	<i>p</i> -value	Cramér's <i>V</i>
	<i>n</i> = 134 (% of total storefront retailers)	<i>n</i> = 115 (% of total non- storefront)	<i>N</i> = 249 (% of all retailers)			
Age-gating and age-gating type						
Initial age-gating implemented	112 (83.58%)	88 (76.52%)	200 (80.32%)	1.53	.22	0.08
No initial age-gating implemented	22 (16.42%)	27 (23.48%)	49 (19.68%)	1.53	.22	0.216
Initial age-gating type: 'yes' or 'no' option	100/112 (89.29%) ^a	82/88 (93.18%) ^a	182/200 (91%) ^a	0.50	.48	0.05
Initial age-gating type: only 'yes' option	9/112 (8.04%) ^a	6/88 (6.82%) ^a	15/200 (7.50%) ^a	0.003	.96	.004
Initial age-gating effectiveness						
Immediate restricted access when deliberately failed at initial age-gating	102/103 (99.03%) ^b	82/82 (100%) ^b	184/185 (99.46%) ^b	0.08	.78	0.02
Allowed entry by deliberately passing initial age-gating followed by failed attempt	100/103 (97.09%) ^b	81/82 (98.78%) ^b	181/185 (97.84%) ^b	0.17	.68	0.03
Age-gating at checkout						
Presence of age-gating during checkout	94 (70.15%)	54 (46.96%)	148 (59.44%)	11.85***	< .001	0.22
Checkout age-gating: upload photo identification	50/94 (53.19%) ^c	50/54 (92.59%) ^c	100/148 (67.57%) ^c	0.95	.33	0.06
Checkout age-gating: input identification number	12/94 (12.77%) ^c	10/54 (18.52%) ^c	22/148 (14.86%) ^c	0.00	.99	0.00
Effectiveness of age-gating at checkout						
Unable to proceed after deliberately failing age-gating during checkout	67/94 (71.28%) ^c	35/54 (64.81%) ^c	102/148 (68.92%) ^c	0.19	.66	0.04
Unable to proceed after uploading an irrelevant photo identification	0/50 (0%) ^d	3/50 (6%) ^d	3/100 (3%) ^d	-	-	-

Age-gating during mandatory account registration & type

Mandatory account registration required	40 (29.85%)	65 (56.52%)	105 (42.17%)	16.98***	< .001	0.26
Account registration age-gating: upload photo identification	19/40 (47.50%) ^e	37/65 (56.92%) ^e	57/105 (53.33%) ^e	0.55	.46	0.07
Account registration age-gating: input identification number ^g	5/40 (12.50%) ^e	5/65 (7.69%) ^e	10/105 (9.52%) ^e	0.59	.50	-

Combined initial age-gating & signup

Implemented either initial age-gating or mandatory account registration	115 (85.82%)	100 (86.96%)	215 (86.35%)	0.01	.94	0.01
Implemented both initial age-gating and mandatory account registration	37 (27.61%)	53 (46.09%)	90 (36.14%)	8.37**	< .01	0.18
Implemented initial age-gating, age-gating at checkout, and mandatory account registration	77 (57.46%)	44 (38.94%)	121 (48.59%)	7.69**	< .01	0.18
Required identification number or photo identification at either the mandatory account registration or checkout process	77 (57.46%)	87 (75.65%)	164 (65.86%)	0.04	.84	0.02
Required photo identification at the mandatory account registration and checkout process	0 (0%)	0 (0%)	0 (0%)	-	-	-

Note. Percentages in each cell were calculated using the total number of retailers of the respective type (storefront retailers $n = 134$, non-storefront retailers $n = 115$) apart from those marked "a" where percentages were calculated by dividing the frequency counts of each coded variable by the total number of respective retailer type which implemented initial age-gating (storefront $n = 112$, non-storefront $n = 88$); those marked "b" where percentage of the respective frequency counts of the variable by retailer type which implemented initial age-gating, excluding those which only had the 'Yes' option type of age-gating (storefront $n = 103$, non-storefront $n = 82$); those marked "c" where percentage of respective frequency counts of the variable by retailer type which had any presence of age-gating during checkout (storefront $n = 94$, non-storefront $n = 54$); those marked "d" where percentage of the respective frequency counts of the variable divided by the number of each retailer type which required uploading a photo ID during the checkout process (storefront $n = 50$, non-storefront $n = 50$); and those marked "e" where percentage of respective frequency counts of the variable divided by the number of each retailer type which required mandatory signup to proceed with navigating the website (storefront $n = 40$, non-storefront $n = 65$); ^fPresented Chi-square tests of independence had one degree of freedom. Significance at the level: * $p < .05$; ** $p < 0.01$; *** $p < .001$. ^gFisher exact test utilized where odds ratios are reported within the Chi-square test effect size instead. Cramer's V are reported for Chi-square tests to observe substantive significance, but were omitted for variables which utilized the Fisher exact test.

Consequences of a failed age-gating test.

Among the websites with initial age-gating ($n = 200$), excluding those with the “Yes” only type of initial age-gating ($n = 15$), a failed age-gating test frequently redirected users to the Google search engine ($n = 55$). Nine websites either redirected users to entertainment websites catering to children (e.g., Nickelodeon) or websites selling children’s clothes (e.g., Cookie Monster shirts). Among the 148 websites which had one or more age-gating methods implemented during checkout, 31% of them still allowed the user to proceed after deliberately failing the age-gating. Among the 100 retailers which required photo ID as part of their implemented age-gating methods during checkout, 97% allowed users to still proceed with the checkout process even after uploading an irrelevant document.

Health claims, positive states, clean labels, and health warnings. Among the 249 retailer websites, 166 (66.67%) had physical health claims, 146 (58.63%) had mental health claims, and 179 (71.89%) had either physical or mental health claims located anywhere on their website. Physical health claims commonly referred to improving sleep or relieving sleep-related conditions and chronic pain, but others mentioned cannabis for the treatment or relief of asthma, allergies, diabetes, cancer, human immunodeficiency virus, headaches, multiple sclerosis, arthritis and so on. Mental health claims commonly referred to relieving stress, anxiety, and depression, but also for managing obsessive-compulsive disorder, post-traumatic stress disorder, and bipolar disorder. A total of 198 websites (79.52%) had a positive state claim on their website, often used when describing their displayed products. The following were common keywords used to imply an induced positive state from using cannabis: blissful, calming, creative, elevated, energizing, euphoric, focused, giggly, invigorating, and uplifting. Next, 200 websites (80.32%) had one or more clean labels. Clean labels were also often used to promote displayed products. The following were common clean label words utilized: all-natural, clean, ethically grown, hand-grown, natural, organic, and pesticide-free. Lastly, only 27 websites (10.84%) displayed health warnings, most often California’s mandatory Proposition 65 cancer warning and statement on reproductive harm.

Among the 200 retailer websites with initial age-gating, 42 (21%) had physical health claims or mental health claims visible prior to or during the age-gating process. Four websites (2%) had health warnings visible prior to or during the age-gating process.

Bivariate Associations

A significant association was observed between retailer type and age-gating practices. A higher percentage of storefront retailers employed a combination of all three age-gating types (i.e., initial, during checkout, and mandatory account registration) than non-storefront retailers (57.46% vs. 38.94%, $X^2(1, N = 249) = 7.69, p < .01$). However, a higher percentage of non-storefront retailers employed age-gating during checkout (70.15% vs. 46.96%, $X^2(1, N = 249) = 11.85, p < .001$) and employed the slightly weaker combination of two methods, initial age-gating and mandatory account registration than storefront retailers (46.09% vs 27.61%, $X^2(1, N = 249) = 8.37, p < .01$). No significant differences were found in the practice of requiring photo ID or ID numbers during the mandatory account registration or checkout process between storefront and non-storefront retailers. Among the stores that required mandatory account registration, none required a photo ID to be uploaded during checkout.

No significant association was detected between storefront and non-storefront retailers for the initial age-gating practices or displaying health claims, clean labels, or health warnings during or before the initial age-gating process. However, significantly more storefront retailers displayed physical health claims (74.63% vs. 57.39%, $X^2(1, N = 249) = 7.52, p < .01$), any type of health claim (79.10% vs. 63.48%, $X^2(1, N = 249) = 6.72, p = .01$), and health warnings (14.93% vs. 6.09%, $X^2(1, N = 249) = 4.13, df = 1, p = .04$) on their website compared to non-storefront retailers. Storefront retailers also had more positive states displayed compared to non-storefront retailers, but did not reach significance ($X^2(1, N = 249) = 3.51, df = 1, p = .06$). See Table 2 for more chi-square test results and their respective Cramér’s V effect sizes.

Table 2. *Prevalence and Bivariate Associations of Different Health Claim Practices by Storefront and Non-Storefront Cannabis Retailers Operating in California, 2022*

Characteristic	Storefront retailers	Non- storefront retailers	Total	Chi-square ^b	<i>p</i> -value	Cramér's <i>V</i>
	<i>n</i> = 134 (% of total store front retailers)	<i>n</i> = 115 (% of total non- storefront)	<i>N</i> = 249 (% of all retailers)			
Health claims by type						
Health claims or clean labels visible at initial age-gating	20/112 (17.86%) ^a	22/88 (25%) ^a	42/200 (21%) ^a	1.12	.29	0.07
Health warnings visible at initial age-gating ^c	2/112 (1.79%) ^a	2/88 (2.27%) ^a	4/200 (2%) ^a	1.18	.99	-
Presence of physical health claims	100 (74.63%)	66 (57.39%)	166 (66.67%)	7.52**	< .01	0.17
Presence of mental health claims	80 (59.70%)	66 (57.39%)	146 (58.63%)	0.06	.81	0.02
Presence of both health claims	74 (55.22%)	59 (51.30%)	133 (53.41%)	0.24	.62	0.03
Presence of either health claims	106 (79.10%)	73 (63.48%)	179 (71.89%)	6.72**	.01	0.03
Health warnings, clean labels, and positive states						
Presence of positive state claims	113 (84.33%)	85 (73.91%)	198 (79.52%)	3.51	.06	0.12
Presence of clean labels	108 (80.60%)	92 (80%)	200 (80.32%)	0.00	.99	0.00
Presence of health warnings	20 (14.93%)	7 (6.09%)	27 (10.84%)	4.13*	.04	0.13

Note. Percentages in each cell were calculated using the total number of retailers of the respective type (storefront retailers *n* = 134, non-storefront retailers *n* = 115) apart from those marked with “a” where percentages were calculated by dividing the frequency counts of each coded variable by the total number of respective retailer type which implemented initial age-gating (storefront *n* = 112, non-storefront *n* = 88). Significance at the level: **p* < .05; ***p* < 0.01; ****p* < .001. ^bPresented Chi-square tests of independence had one degree of freedom. Cramer’s *V* are reported for Chi-square tests to observe substantive significance. ^cFisher exact test utilized where odds ratios are reported within the Chi-square test effect size instead. Cramer’s *V* are reported for Chi-square tests to observe substantive significance, but were omitted for variables which utilized the Fisher exact test.

DISCUSSION

Findings indicate that storefront and non-storefront cannabis retailers predominantly employed some method of age-gating and

mandatory account registrations; yet, the former used more comprehensive age-gating methods than the latter. Nevertheless, age-gating methods employed by either retailer were likely ineffective as a prospective customer could easily bypass these measures. Health claim messages were

often visible to patrons prior to and during the age-gating process. One in five retailers used no form of age-gating, failing to prevent access to home page or product page cannabis marketing. Further, one-third did not require any documentation of age at registration or checkout, suggesting significant levels of noncompliance with legal requirements. Irrelevant photos submitted for photo IDs were almost universally accepted. Health claims of varying types were also widely displayed, especially physical health claims among storefront retailers. Lastly, the provision of any relevant health warnings on the use of cannabis and cannabis products overall was rare, especially among non-storefront retailers.

The utilization of initial age-gating by both storefront (83.58%) and non-storefront (76.52%) retailers, albeit using weak methods, differs from findings of prior studies. Bierut et al. (2017) reported that roughly 59% and 65% of adult-use cannabis retailers in Colorado and Washington, respectively, implemented some form of initial age-gating. Given their data was from 2015, cannabis retailers may have expanded implementation of age-gating systems since legalization. Moreover, Colorado and Washington do not explicitly require age confirmation of patrons visiting cannabis retailer websites but only require online retailers to limit marketing to patrons 21 or older (Colo. Code Regs. § 212-3-720, 2024; Wash. Rev. Code § 69.50.369, 2022). Thus, age-gating for online retailers located in Colorado and Washington is more of an indirect suggestion, differing from California's explicit requirements on website age-gating (Cal. Bus. & Prof. Code § 26151, 2017).

Although most storefront and non-storefront retailers properly blocked website access after failing the initial age-gating (99.03% and 100%, respectively), a prospective customer could simply change their response to enter, further illustrating the ineffectiveness of these allowed age-gating methods. Similarly, even when moving through the site to the mandatory account registration and checkout phase, uploading documentation was not required by one-third of retailers, and uploading irrelevant images was accepted, suggesting that systems can easily be circumvented by minors.

Although age-gating has been used by other industries (e.g., alcohol), its effectiveness has been questioned by researchers (Barry et al., 2021;

Madson, 2022; Williams et al., 2015; Williams & Ribisl, 2012). This should sound the alarm for regulators, policymakers, parents, and industry alike on the need to implement a more effective system to prevent minors from accessing online cannabis marketing. A more stringent age verification method for online purchases, such as required use of independent third-party sites for verification of a government-issued ID should be considered, similar to that recommended in the previous United States Food and Drug Administration's (FDA) guidance for e-cigarettes (FDA, 2020) and by the online gambling industry (Nash et al., 2015). Moreover, states could consider implementing practices used in tobacco and alcohol control to discourage retailers from selling to minors, such as minor decoy operations (Cal. Bus. & Prof. Code § 22590, 2024). A complete prohibition of delivery is also an option, such as that adopted in 2021 by Oregon for tobacco, after concluding that enforcement was more feasible in the storefront environment (Or. Admin. R. 845-025-1300, 2024).

Despite the limited evidence on the medicinal benefits of cannabis for health-related outcomes, past research has found cannabis retailers use a wide array of health claims to market cannabis on websites (Bierut et al., 2017; Boatwright & Sperry, 2020; Hoeper et al., 2022). In this study, nearly 67% of all retailers displayed physical health claims, and 59% displayed mental health claims. Moreover, storefront retailers were more likely to display physical health claims compared to non-storefront retailers.

In addition, clean labels were widely used to market cannabis products (80.32%). Clean labels have been used previously by the tobacco industry to market cigarettes (e.g., American Spirit) (Dewhirst, 2022) and e-cigarettes (Phua et al., 2018). The FDA recognized that promoting cigarettes using clean labels misled adolescents into initiating tobacco use (Iles et al., 2021; Moran et al., 2021), and prohibited clean labeling of tobacco products in 2017 (Neuhauser & Simoneau, 2017). Cannabis retailers appear to be taking full advantage of the lack of regulation of 'clean' labeling claims for cannabis products. In addition, the vast majority (80%) of retailers used positive states to promote their products, which may affect youth in particular. Adolescents have been shown to favor advertisements appealing to positive experiential outcomes (Chen & Yoon,

2021; Nash et al., 2009; Padon et al., 2018) and may be more receptive to messages that suggest a positive emotional experience (Pechmann et al., 2005).

Our study also reveals that non-storefront websites are significantly less likely to display health warnings on the use of cannabis. Public health advocates have strongly recommended the need for clear and comprehensive health warnings similar to those proposed by FDA for cigarette packages and used globally (FDA, 2021; Cal. Legis. Assemb. S. B. 1097. Reg. Sess. 2021-2022, 2022). The State of California only requires a 6-point-font warning on or inside of cannabis product packages, but some cities and counties have implemented additional warning requirements for local storefront and non-storefront retailers, such as posting warnings in stores or handing them out at delivery (Padon et al., 2022).

Strengths and Limitations

To our knowledge, this is one of the first studies to compare age-gating and marketing behaviors of storefront and non-storefront cannabis retailer websites. It also examines a representative sample of retailers in a more mature legalized market compared to earlier studies (Bierut et al., 2017; Cavazos-Rehg et al., 2019). However, a few limitations should be noted. First, the current study was limited to analyzing standalone retailer websites, not encompassing retailers utilizing solely 3rd party websites (e.g., Weedmaps). Secondly, we assessed neither age verification during final checkout, nor confirmation of physical documentation of age upon pickup or delivery, as federal research restrictions precluded purchasing cannabis. These would provide more comprehensive verification of rigor of age confirmation for purchase. Lastly, this study only examined legal cannabis retailers. It did not capture online marketing of the illicit cannabis sector or the growing sector of hemp-derived psychoactive cannabis products which have no age requirement for sale in California.

Conclusion

The present study contributes to the nascent body of research on the cannabis retail market,

which operates extensively online with limited enforcement of required age-gating and marketing restrictions. Findings suggest that roughly one-fifth of cannabis retailers are not complying at all with minimum legal requirements for age-gating, and most existing practices are easily circumvented. Rigorous FDA-recommended practices, such as third-party verification of identification, are not widely used. Lastly, significant differences in age-gating and health marketing practices between storefront and non-storefront retailers were identified. Use of weakly regulated and monitored health claims, positive states, and clean labels is widespread. Altogether, easy access to cannabis retailer websites and exposure to cannabis marketing messages and claims may increase positive adolescent attitudes about cannabis, and encourage underage use. Results call for government officials in California to improve regulation and enforcement of the content of online cannabis marketing, and of the guardrails that prevent underage access to the marketing and sales.

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