

Exploring Marijuana Advertising on Weedmaps, a Popular Online Directory

Tatiana Bierut¹ · Melissa J. Krauss² · Shaina J. Sowles² · Patricia A. Cavazos-Rehg²

© Society for Prevention Research 2016

Abstract With an increase in the legalization of recreational marijuana across the USA, advertising for marijuana products is more widespread, especially on the Internet where such practices pose a regulatory challenge. In this study, we examined the content of marijuana advertising on Weedmaps, a popular website that markets marijuana retailers online. A total of 146 recreational marijuana retailers in Colorado and Washington were examined on Weedmaps. We studied the age verification practices made in retailers' own websites, the presence of health claims they made about marijuana on Weedmaps, and the characteristics of followers of Weedmaps on social media sites. Many retailers had no security measure to determine age (41 % in Colorado, 35 % in Washington). Approximately 61 % of retailers in Colorado and 44 % in Washington made health claims about the benefits of marijuana, including anxiety reduction, treatment of depression, insomnia, and pain/inflammation. Inferred demographic characteristics of followers of Weedmaps on Twitter and Instagram revealed that over 60 % were male and nearly 70 % or more were age 20–29 years old, yet some (15–18 %) were under the age of 20. Our findings indicate that marijuana retailers have a visible presence on the Internet. Potential customers might be enticed by retailers who tout health claims about marijuana use. It may also be appealing for a younger demographic to overlook age restrictions and engage with marijuana retailers via social media.

As a whole, our findings can help to guide future policy making on the issue of marijuana-related advertising.

Keywords Marijuana · Cannabis · Advertising · Social media

Since 2012, the District of Columbia and four states have legalized medical marijuana as well as recreational marijuana for adults who are ≥ 21 years of age: Colorado, Washington, Oregon, and Alaska. In addition, twenty-three states have medical use and/or decriminalization laws, and nineteen states have allowances for marijuana dispensaries (National Conference of State Legislatures 2016). Shifts towards loosening marijuana policies are expected to continue. For instance, in 2016, five more states are anticipated to have recreational marijuana amendments on their ballot: Nevada, California, Maine, Arizona, and Massachusetts (Steinmetz 2015). With this change in the legal landscape for marijuana use, the number of recreational marijuana retailers in states where use is legal has quickly risen to accommodate a booming customer base (Martinez 2014). For instance, in January 2014, only 136 recreational marijuana stores were licensed in Colorado; in June 2015, less than 2 years later, that number more than doubled to 350 licenses (Colorado Department of Revenue 2015). As of November 2015, annual marijuana sales in Colorado reached nearly \$900 million, over \$500 million of which were recreational sales. This easily surpassed the \$700 million in marijuana sales (over \$300 million in recreational sales) in Colorado in 2014 (Baca 2016; Semenoff 2016). The growth of the marijuana industry is likely to continue, and the internet may be an especially important medium for retailers to advertise their marijuana-related products in a cost-effective manner to a mass audience. Yet, an assessment of online marijuana-related advertisement strategies has not yet been done but is timely and may be useful for informing future policies.

✉ Patricia A. Cavazos-Rehg
rehgp@psychiatry.wustl.edu

¹ Hamilton College, Clinton, New York, USA

² Department of Psychiatry, Washington University School of Medicine, 660 South Euclid Avenue, Box 8134, St. Louis, MO 63110, USA

At the time of our study in June 2015, Colorado and Washington were the only two states with operating licensed recreational marijuana retailers. Advertising guidelines were accordingly established by these states' regulatory authorities such as limiting dispensary online marketing to adult viewing (age 21 and older) (Colorado Department of Revenue 2013; Washington State Liquor and Cannabis Board 2015). Age-prohibitive online advertisements were considered to be a necessary policy component by marijuana regulatory authorities in order to protect underage youth from viewing these campaigns. This policy mirrors the age-restrictive policies that were established for alcohol and tobacco vendors to stop youth from viewing this content and/or purchasing these products online (Federal Trade Commission 2014; Food and Drug Administration 2016). Additionally, limiting exposure to marketing advertisements can potentially reduce the favorable attitudes towards substance use that come from advertisement exposure (Duke et al. 2014; Ho et al. 2014; McClure et al. 2013; D'Amico et al. 2015). Thus, it is timely to investigate marijuana industry compliance to age-restrictive online advertising during this era of recent growth.

The use of marijuana for potential medicinal purposes distinguishes it from alcohol and tobacco use, and advertising restrictions have accordingly been put in place to protect potential consumers from being misled by unsubstantiated claims. Specifically, regulations from the Colorado Department of Revenue Marijuana Enforcement Division indicate that, "a retail marijuana establishment shall not engage in advertising that is deceptive, false, or misleading" (Colorado Department of Revenue 2013). Also, regulations from the Washington State Liquor and Cannabis Board explicitly state, "You can talk about the effects of the [marijuana] product without linking them to medicinal claims" (Washington State Liquor and Cannabis Board 2015). Data supporting the medical use of marijuana is relatively scant with only moderate evidence supporting its use for treatment for chronic neuropathic or cancer pain and low quality evidence supporting its use for reduction of nausea and vomiting from chemotherapy, weight gain in HIV patients, and treatment of sleep disorders (Whiting et al. 2015). Nevertheless, the use of marijuana for medical/health benefits is a touted reason often expressed for legalization and decriminalization (Adler & Colbert 2013; Nelson 2015; Thomas 2015), and it is potentially an appealing way for vendors to draw in potential consumers. Thus, it is opportune to examine the health marketing claims made by marijuana retailers given the existing policy regulations that restrict this practice.

In the present study, we investigate the online advertising practices among recreational marijuana retailers in Colorado and Washington who are using the popular online resource Weedmaps to advertise to potential consumers (<https://weedmaps.com/>). Given the value of social media as a marketing strategy for businesses, we

additionally examine the popularity of social media sites maintained by Weedmaps, indicated by the number of followers on each site, and the demographic characteristics of these followers on two popular social media platforms (i.e., Instagram and Twitter). Weedmaps is described as the "first and largest global technology and media company in the marijuana space" (Business Wire 2016), and numerous scientific studies have utilized Weedmaps as a resource for dispensary information (Freisthler & Gruenewald 2014; Freisthler et al. 2016; Mukhija & Loukaitou-Sideris 2015). Weedmaps enables potential customers to identify marijuana retailers near their location and share customer reviews about the quality of products and services of the retailers. Retailers who advertise on Weedmaps can include product prices, descriptions, and photographs, along with listings of discounts and other marijuana-related promotions. Consumers can also download a Weedmaps app to use on their mobile phones to find marijuana retailers. Fueling Weedmaps' online popularity is a partnership with the National Organization for the Reform of Marijuana Laws (NORML) that began in 2011 (General Cannabis Inc. 2011). In total, Weedmaps was estimated to generate about \$30 million in revenues in 2014 (Wagner 2014).

To better understand online marketing practices of recreational marijuana retailers, we undertook a three-phase evaluation of the online advertising practices of recreational marijuana retailers in Colorado and Washington who advertised on Weedmaps. First, we examined whether retailers required that the internet user be 21 years of age to enter the site, and whether it was necessary to enter a birthdate as verification. Then, we investigated retailers' advertised claims made about health effects of marijuana use on Weedmaps. Finally, we assessed the popularity of social media sites maintained by Weedmaps and the demographic characteristics of followers of Weedmaps on social media to gain insight into the potential consumers who are engaging with the advertising content on Weedmaps. The purpose of this study was to provide a snapshot of the landscape of the recreational marijuana-related marketing occurring online. Regulations surrounding marijuana-related advertisements are still in the early stages of development, and our findings may help to guide future policy making on this issue.

Methods

Selection of Recreational Marijuana Stores for Analysis

In June 2015, we contacted the Colorado Department of Revenue and the Washington State Liquor and Cannabis Board to obtain the state lists of licensed recreational

marijuana retailers, which included each retailer's name, license number, and address. Licensed recreational marijuana retailers that were eligible for our analysis included those that were operational and advertised on Weedmaps with a comprehensive advertising listing. Listings on Weedmaps are updated by the marijuana retailers, and the prices for listings are dependent upon type of retailer (e.g., store, delivery only) and the size of the marijuana market in that region of the country. We defined comprehensive advertising listings to include store location, contact information, customer reviews, additional store details, photos/videos, and a menu of available products. Figure 1 summarizes our selection of retailers for analysis. Details on metropolitan status of the county for each retailer were collected from the National Center for Health Statistics (Ingram & Franco 2014).

Advertising Practices

For the recreational retailers included in analysis, we examined each retailer-specific page on Weedmaps in order to document details about advertising practices. Specifically, we recorded whether the store was marketed as providing marijuana for recreational purposes only or for both recreational and medical use based on information listed on individual retailer websites and/or Weedmaps.

We examined the description for each product on retailer Weedmaps' pages to document health claims made by the recreational retailer which may appeal to users (Lee et al. 2007; Osborn et al. 2015). Thus, we specifically coded claims related to anxiety reduction and treatment of depression, insomnia, and pain/inflammation, and also noted when other claims were made (e.g., treatment of/appetite stimulation, cancer, diabetes, nausea/vomiting, post-traumatic stress disorder, skin irritations, and spasticity).

In addition, we determined whether each marijuana retailer had a website outside of Weedmaps and examined whether there was an age restriction for viewing the website. We coded for whether the retailer required that the internet user be 21 years of age to enter the site, and whether it was necessary to enter a birthdate as verification.

Four research team members coded the above classifications in a database created in REDCap, a secure web-based application hosted in the Biostatistics Division of Washington University School of Medicine (Harris et al. 2009). The principal investigator (PCR) coded the first 20 retailers to define the codes and establish processes for the coding staff. Each retailer was then coded by at least two staff members independently. Retailers were coded over a 3-week period (6/22/2015–7/13/2015) individually by coders. Inter-rater reliability was good, with a median Krippendorff's alpha of 0.80 (range 0.65 to 0.90). Any discrepancies were discussed among team members and a consensus reached.

Data were exported to SAS version 9.4 for Windows (SAS Institute, Inc., Cary, NC, USA) for descriptive analysis (e.g., percentages, medians). Data from Colorado and Washington are presented separately because each state set up state-specific policies for sale of recreational marijuana. Comparisons of categorical variables (e.g., type of retailer, use of health claims) were compared across states using Pearson chi-square tests with $p < 0.05$ considered statistically significant.

Social Media Followers of Weedmaps

Given the value of social media as a marketing strategy for businesses, we examined the popularity of social media sites maintained by Weedmaps. We quantified the number of social media users who follow Weedmaps on social media sites for which direct links were provided on Weedmaps' website (i.e., Facebook, Twitter, Instagram, LinkedIn, Google+, YouTube, and Vine). In addition, we used the services of DemographicsPro, a social media analytics company, to infer the demographic characteristics of social media users who were followers of Weedmaps on Twitter and Instagram (Demographics Pro 2016). Analyses of followers on the other social media sites were not available from DemographicsPro.

DemographicsPro uses proprietary algorithms to infer demographic characteristics of social media users based on their behavior on social media. To make predictions on the demographic characteristics of each Twitter or Instagram user, multiple data signals are used, including the nature and strength of ties between individuals within their social media networks, the consumption of information by the social media user on Twitter/Instagram revealed by accounts followed and real-world consumption revealed by Twitter/Instagram usage, and language (words and phrases) used in posts and biographies.

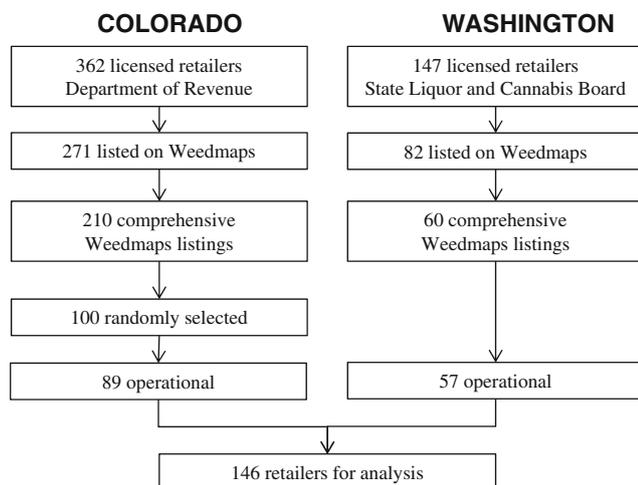


Fig. 1 Methodology for selecting sample of recreational marijuana retailers for analysis

Using large proprietary knowledge bases of established correlations between data points and demographic characteristics, the data signals were filtered and amplified, and the multiple amplified signals were combined via algorithms in order to infer the likely demographic characteristics. Big data methods, natural language processing, entity identification, image analyses, and network theory are all used in the prediction of the demographic characteristics. In order to estimate a single demographic characteristic, DemographicsPro requires confidence of 95 % or above. For example, 9500 out of 10,000 predictions would need to be correct in order to accept the methodology used to make the prediction. DemographicsPro has iteratively tested their models on large, established samples of social media users with verified demographics. In addition to the inferred characteristics of Weedmaps followers on Twitter and Instagram, DemographicsPro also provides benchmark values for comparison purposes for each social media site. These benchmarks are the median average values for each demographic characteristic on each social media site, which are determined from analyzing the demographic characteristics of followers from a large number of Twitter and Instagram accounts. Thus, the inferred demographic distributions of Weedmaps followers on Twitter and Instagram were descriptively compared to these benchmark values. We have previously used the services of DemographicsPro to infer demographic characteristics of Twitter (Cavazos-Rehg et al. 2015, 2016).

Results

A summary of the selection process of licensed recreational retailers for analysis is shown in Fig. 1. In Colorado, 362 recreational retailers were licensed by the Colorado Department of Revenue; 271 of these (75 %) were listed on Weedmaps. A total of 210 (58 %) listings were comprehensive and were eligible for analysis. Due to this large number of retailers eligible for analysis in Colorado ($n = 210$) and limited manpower of the research team, we randomly selected 100 of these for further analysis using the SAS proc surveyselect (SAS Institute Inc., Cary, NC, USA). In Washington, a list of 147 licensed recreational retailers was provided by the Washington State Liquor and Cannabis Board; 82 of these (56 %) were listed on Weedmaps. Sixty (41 %) had comprehensive listings and were thus eligible for analysis.

Among those chosen for analysis in Colorado and Washington, medical retailers whose recreational arm had not yet opened ($n = 10$), Weedmaps listings that became non-operational during the study ($n = 3$), and duplicate sites ($n = 1$) were excluded from further analysis. This resulted in a total of a sample of 89 recreational retailers in Colorado and 57 recreational retailers in Washington for analysis (total $n = 146$).

Retailer Type

Table 1 provides type of retailer and metropolitan status of the sample of retailers analyzed in Colorado and Washington, and Fig. 2 shows the location of the sampled retailers within the states. Among the sample of 89 Colorado retailers, 30 (34 %) were purely recreational and 59 (66 %) were both recreational and medical. Conversely, among the 57 Washington retailers, 55 (96 %) were purely recreational and 2 (4 %) were both recreational and medical ($\chi^2(1) = 56.3, p < 0.001$). In both states, most of the retailers (72/89, 81 % in Colorado; 52/57, 91 % in Washington) were in metropolitan areas. In Colorado, 42 % (37/89) of the sampled retailers were in the capital city of Denver (also the largest city in Colorado). In Washington, 46 % (26/57) of the retailers stretched from Olympia (the capital) northward to Everett along the Puget Sound (the second largest estuary in the USA).

Table 1 Characteristics of the sample of recreational marijuana retailers in Colorado and Washington

	Colorado ($N = 89$)	Washington ($N = 57$)
Characteristic	No. of retailers (%)	No. of retailers (%)
Type of retailer*		
Recreational marijuana only	30 (34)	55 (96)
Recreational and medical marijuana	59 (66)	2 (4)
Urbanization level ^a		
Metropolitan		
Large central metro ^b	37 (42)	11 (19)
Large fringe metro ^c	19 (21)	13 (23)
Medium metro ^d	11 (12)	13 (23)
Small metro ^e	5 (6)	15 (26)
Non-metropolitan		
Micropolitan ^f	11 (12)	3 (5)
Noncore ^g	6 (7)	2 (4)

* $P < 0.001$

^a 2013 National Center for Health Statistics urban-rural classification scheme was assigned for each retailer based on county

^b Counties in metropolitan statistical areas (MSAs) of 1 million or more population that contain the entire population of the largest principal city of the MSA, or have their entire population contained in the largest principal city of the MSA, or contain at least 250,000 inhabitants of any principal city of the MSA

^c Counties in MSAs of 1 million or more population that did not qualify as large central metro counties

^d Counties in MSAs of populations of 250,000 to 999,999

^e Counties in MSAs of populations less than 250,000

^f Counties in micropolitan statistical areas

^g Non-metropolitan counties that did not qualify as micropolitan



Fig. 2 Locations of sampled dispensaries in Washington ($N=57$) and Colorado ($N=89$)

Website Age Restriction Analysis

At the time of our analysis, approximately 85 % (76/89) of the sampled marijuana retailers in Colorado and 65 % (37/57) of the marijuana retailers in Washington had an independent operational website on the Internet in addition to their listing on Weedmaps. Among the marijuana retailers with an operational website, 41 % (31/76) in Colorado and 35 % (13/37) in Washington lacked any form of restriction to verify the user's age before entering the website, while 54 % (41/76) in Colorado and 59 % (22/37) in Washington required users to click “yes” to a prompt to confirm that they were over 21; only 5 % in both Colorado (4/76) and Washington (2/37) required that users enter their birthdate before entering the website. No significant differences were found in age restriction security measures by state (Fisher's exact $p=0.891$).

Health Claims

Of the sample retailers, 61 % (54/89) in Colorado and 44 % (25/57) in Washington made health claims about marijuana products ($\chi^2(1)=3.96, p=0.047$). Among retailers that made health claims, the most common health claim was use of the product to reduce anxiety (43/54, 80 % in Colorado; 25/25, 100 % in Washington). Other common health claims included treatment of depression (19/54, 35 % in Colorado; 11/25, 44 % in Washington), insomnia (31/54, 57 % in Colorado; 17/25, 68 % in Washington), and pain (52/54, 96 % in Colorado; 13/25, 52 % in Washington). Examples of product descriptions containing claims can be found in Fig. 3. Many additional health claims were observed including using marijuana to treat, help, or control cancer, diabetes, skin irritations such as rash/sores/acne/eczema, and post-traumatic stress disorder. We found no examples of retail stores that listed harmful or adverse effects of marijuana use.

Social Media Followers of Weedmaps

Weedmaps' website provided links to the following social media sites: Facebook, Twitter, Instagram, LinkedIn, Google+, YouTube, and Vine. Weedmaps had the greatest number of followers on Facebook (over 130,000) and YouTube (nearly 150,000), followed by Twitter (58,000). In addition, Weedmaps had over 3300 followers on Google+, approximately 2500 on Instagram, nearly 2000 on LinkedIn, and over 73,000 “loops” (or video views) on Vine.

Inferred demographic characteristics of Weedmaps followers on Twitter and Instagram are presented in Fig. 4. Compared to the Twitter median average, Twitter followers of Weedmaps (Fig. 4a) appeared more likely to be male and in the age range of 20–29 years old, and 15 % were <20 years old. Slightly more were Black or Hispanic than the Twitter median average. The largest proportion of Weedmaps followers were in California, and this was much larger than the Twitter median average. In addition, larger proportions of Weedmaps followers on Twitter were in Colorado and Washington (the two states central to this study) as compared to the Twitter median average. Similar trends in demographic characteristics were observed among Weedmaps followers on Instagram (Fig. 4b).

Discussion

Marijuana retailers have an established presence on the Internet. In this study, we investigated the age verification practices made in retailers' own websites, the presence of health claims that retailers made about marijuana on Weedmaps, and the characteristics of followers of Weedmaps on social media sites. We observed an overall lack of age verification in the online space of recreational marijuana retailers. Weedmaps does not verify age before

Fig. 3 Health claims ($N=54/89$, 61 % in Colorado; $N=25/57$, 47 % in Washington)

Most common health claims		
	Colorado (n=54)	Washington (n=25)
Reduce anxiety	43/54, 80%	25/25, 100%
Treat depression	19/54, 35%	11/25, 44%
Treat insomnia	31/54, 57%	17/25, 68%
Treat pain/inflammation	52/54, 96%	13/25, 52%

Example product descriptions with health claims	
<p>INDICA</p> <p>Chem Dawg #4</p> <p>Our Chem Dawg #4 is a very potent strain with one of the heaviest indica feelings out there. Soft, white, spongy buds with an extreme diesel smell helps with insomnia, lack of appetite, pain, and stress relief. Looking for a great nights sleep or trying to build that appetite back up? Look no further than Chem Dawg #4.</p> 	<p>SATIVA</p> <p>818 Headband</p> <p>818 Headband aka Sour OG by Cali Connection is a cross of their original Sour Diesel cut and their San Fernando Valley OG Kush IBL 818 Headband is a hybrid cross that produces healthy and hardy plants with solid buds up and down. If you're wondering what the 818 stands for, it is to represent their Southern California area code. 818 Headband is great for people suffering from depression and stress.</p> 
<p>CONCENTRATE</p> <p>Venom</p> <p>Wax (Budder) – Indica: Blueberry Headband Kush Hybrid; Lucinda, and Chem Durban – All \$35 a gram before tax!! Shatter – Hybrid: Wifi, and Ultra Sonja – All \$40 a gram before tax!</p> 	<p>CONCENTRATE</p> <p>RSO Oil Rick Simpson Oil</p> <p>The term "Rick Simpson Oil" refers to extremely potent and sedative purified decarboxylated cannabis resin with 95-98% THC. This substance can be used with great success to cure, treat or control cancer, pain, diabetes, arthritis, asthma, infections, inflammations, blood pressure, depressions, sleeping problems etc.</p> 

an individual is allowed to enter the site, which is unlike websites that advertise alcohol or tobacco (Campaign for Tobacco Free Kids 2015; Federal Trade Commission 2014; Ribisl et al. 2007). Perhaps more concerning is the lack of age verification when creating an online Weedmaps account; this suggests that underage individuals can easily create an online profile with Weedmaps, post content on this forum, and engage/connect with other Weedmaps' online community members. Similarly, of the Colorado and Washington retailers examined in this study, only 5 % of websites outside of Weedmaps required that an individual enter their birthday prior to viewing the content on the site. Our finding that most marijuana retailers are not using age restrictions to prevent youth from viewing their online advertisements demonstrates divergence with the Colorado and Washington policies instructing the restriction of online views of marijuana advertisements to adults age 21 and older (Colorado

Department of Revenue 2013; Washington State Liquor and Cannabis Board 2015).

While online age verification does not guarantee that minors will not access age-inappropriate content online (Jones et al. 2014), this verification has been a recommended regulation for tobacco and alcohol vendors (Federal Trade Commission 2014; Food and Drug Administration 2016). As is done by some tobacco companies (Malboro n.d.; Newport n.d.), website visitors register for age verification purposes, providing identifiable personal information such as name, date of birth, address, and the last four digits of the person's social security number, prior to allowing entrance into the website. However, evidence does not support that "age-gates" (i.e., restrict viewing to adults) have prevented underage youth from viewing tobacco and alcohol online advertisements (Jensen et al. 2004; Ribisl et al. 2003; Williams & Ribisl 2012). Also, retailers of tobacco and alcohol have been

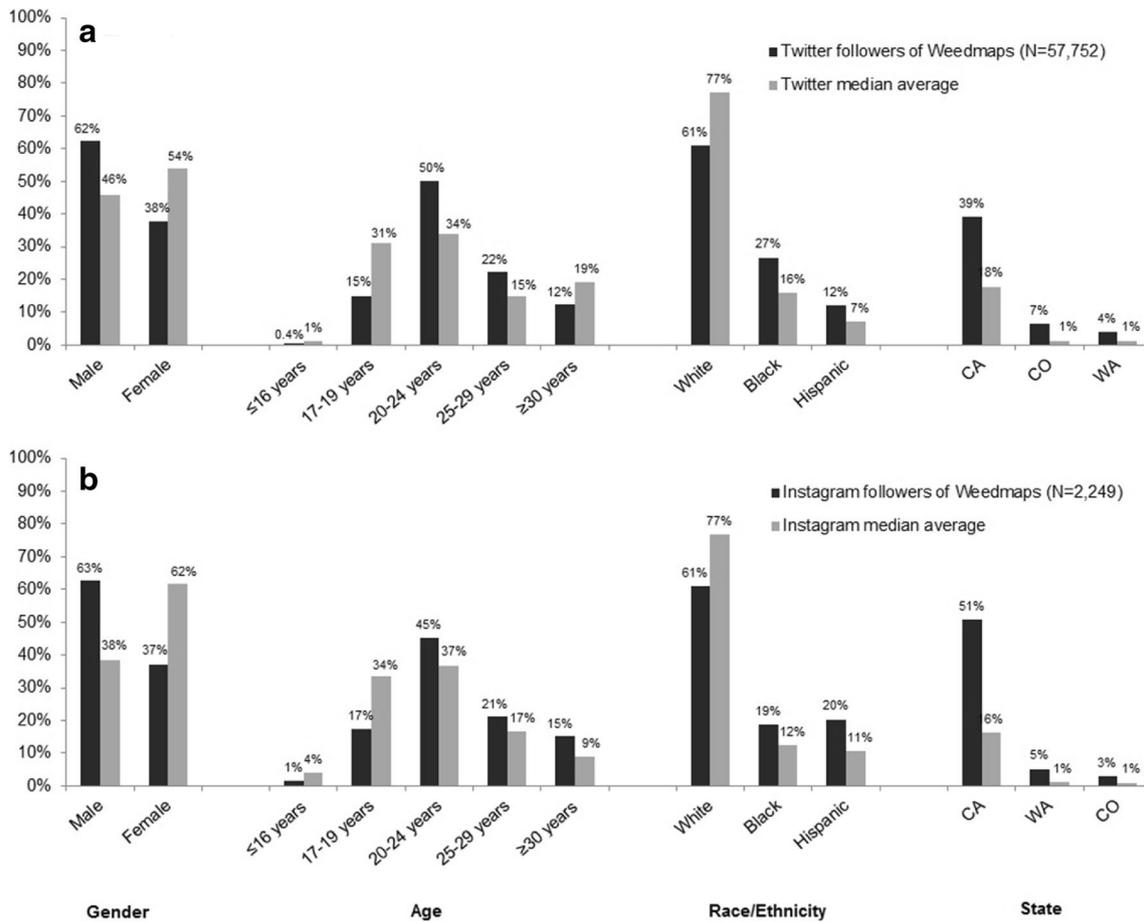


Fig. 4 Demographic characteristics of Weedmaps followers on Twitter (a) and Instagram (b) compared to the Twitter and Instagram median average. Note: States in the graph are not exhaustive. We included only

the two states central to this study (Colorado and Washington) as well as the state that constituted the largest proportion of followers by far (California)

inconsistent with their adherence to this policy (Jones et al. 2014; Ribisl 2003; Ribisl et al. 2002). Most importantly, this work highlights the ongoing need to establish strategies to effectively deter youth from viewing marijuana, tobacco, and alcohol online advertisements.

Our findings also highlight the popularity of Weedmaps among retailers by demonstrating its widespread use as a fee-for-service online advertising medium among recreational marijuana retailers in Colorado and Washington, the two key states at the front of a growing marijuana industry. Specifically, we observed that the majority of recreational marijuana retailers in Colorado and over half of those in Washington were found on Weedmaps. We also found that most of these retailers had gone beyond their contact listing (i.e., address, phone number) and more fully advertised the products that are available for purchase in their respective stores with descriptions, prices, and/or images. The popularity of Weedmaps among so many recreational marijuana retailers provides strong rationale for our in-depth analysis of this online forum in order to accomplish our primary goal of understanding how marijuana products are being marketed on the Internet.

Another important finding of our study was the observation that more than half of Colorado and Washington marijuana retailers studied on Weedmaps made claims of beneficial health effects associated with marijuana use including treatment of anxiety, depression, insomnia, and pain. Health claims to treat cancer and diabetes were identified. These advertising practices are concerning for their divergence from what is established in the scientific literature and from the policies that have been established by the respective state regulatory agencies. First, contrary to what retailers are advertising, current scientific evidence for efficacious health benefits of marijuana is modest at best as outlined in a recent review by Whiting et al. 2015. Furthermore, studies have shown that an increase of anxiety, depression, and psychotic illness are associated with regular marijuana use, and that the courses of illness may be worsened by the use of marijuana (Hill 2015). There is the recent report of a death from an edible marijuana product (Hancock-Allen et al. 2015); yet, we identified no health warnings regarding marijuana use on any of the retailer websites. Of additional importance is that the retailers' health claims associated with marijuana use are seemingly in conflict with the marijuana advertising guidelines that

have been established in Colorado and Washington, which specifically state that marijuana is to be labeled with a warning of potential health risks associated with the use of this product (Colorado Department of Revenue 2013; Washington State Liquor and Cannabis Board 2015). Moreover, health claims following marijuana use were a popular marketing tactic for retailers in both Colorado and Washington despite the low number of retailers who advertised themselves as recreational and medical marijuana vendors in Washington (4 %) versus those who promoted themselves recreational and medical marijuana vendors in Colorado (66 %).

Marketing regulations are designed to protect consumers, and this is especially the case for certain population groups who may be considered “vulnerable.” To illustrate, youth and/or minorities more readily experience harmful and/or negative consequences/disadvantages following marijuana use due to social and environmental risk factors, and targeting these subgroups with campaigns that encourage substance use behavior has been discouraged (Grier & Kumanyika 2010; Mason et al. 2014; Stock et al. 2013; Stone et al. 2012). It is therefore concerning that youth, young adults, and minorities are more likely to follow Weedmaps on Instagram and Twitter. Media literacy education about the influence of online advertising on marijuana use norms may be helpful in mitigating the harms of pro-marijuana use media messages among youth; these prevention efforts have had encouraging results on reducing intentions to use alcohol and tobacco and are recommended by the Centers for Disease Control and the American Academy of Pediatrics (Strasburger 2010; Centers for Disease Control and Prevention 2003).

For both Colorado and Washington, penalties for nonadherence to online advertisement restrictions exist and range from warnings to license revocation depending on the mitigating and aggravating circumstances (City of Seattle Office of the Mayor n.d.; Colorado Department of Revenue 2013). At present, the advertising of marijuana is a contentious issue at a federal and state level. Though marijuana sales remain illegal at a federal level, the Colorado Press Association, Westword, High Times, and Pulp Magazine sued the state of Colorado in federal court over rules that prohibited recreational marijuana retailers from advertising, claiming that this law was an unconstitutional violation of commercial free speech (Colorado Freedom of Information Coalition 2016). This suit is indicative of a desire to loosen advertising restrictions on businesses involved in the marijuana industry, but the suit was dismissed following the determination that there was not a legal standing to challenge this rule.

Our study represents a snapshot in time of recreational retailers, and the Internet is a constantly changing platform. We focused on Weedmaps, an online marijuana retailer directory that was selected because of its prominent presence on the Internet. We recognize that other directories exist, and this industry is evolving at a fast pace.

We coded only recreational retailers that comprehensively listed products on Weedmaps, and only those located in Colorado and Washington. This represents a first step in the examination of this new advertising space, and expanding this work to other states and additional online marijuana directories, such as Leafly.com, will be needed. Moreover, Weedmaps websites were being updated weekly or even daily, changing the descriptions and types of products sold by the retailers. We anticipate that the marijuana industry will continue to evolve and new products will be offered. Finally, while Weedmaps had the greatest number of followers on YouTube and Facebook, we could not infer demographic characteristics of these followers due to limitations of Demographics Pro capabilities. Therefore, we cannot generalize the demographic findings of Weedmaps’ Twitter and Instagram followers to those of other social media sites. It is noteworthy however that despite trailing Facebook in overall membership, Instagram and Twitter have the most active young social media users with 37 and 30 %, respectively, being under 24 years old (Mander 2014); a high youth prevalence on Instagram and Twitter may signal a need for more vigilant oversight of the marijuana advertisements occurring on these social media venues. Despite these limitations, we believe that this view into the online advertising of marijuana is important.

To our knowledge, our study is the first of its kind to examine the Internet advertising practices made by legal recreational marijuana retailers. We focus our study on the advertising content found on Weedmaps, a popular fee-for-service online directory for marijuana retailers; in doing so, our novel study has relevance for establishing a systematic and feasible approach for investigating the online advertising practices of the new growing industry. Our findings signal that retailers’ online advertising often emphasizes unproven health benefits without describing known harms of use. We additionally underscore practices that are worth regulators’ consideration including targeting customers via social media and lax age restrictions prior to viewing content that may not be suitable for children. By assessing the online advertising practices of recreational marijuana retailers in key states that are at the forefront of a rapidly growing industry, we provide new insight into the evolving marijuana industry that may be useful for stakeholders to consider when developing or refining regulations surrounding marijuana-related advertising.

Compliance with Ethical Standards

Funding This publication was supported by the Washington University in St. Louis Office of the Provost Diversity and Inclusion Grant and the Institute for Public Health, and the National Institutes of Health (grant numbers R01DA032843 (PCR) and R01DA039455 (PCR)).

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

Informed Consent The Washington University Human Research Protection Office granted this study a non-human determination. Therefore, consent was not needed for this study.

References

- Adler, J. N., & Colbert, J. A. (2013). Medicinal use of marijuana—polling results. *New England Journal of Medicine*, *368*, e30. doi:10.1056/NEJMc1305159.
- Baca, R. (2016). *Annual Colorado marijuana sales near \$900 million mark in November 2015*. The Cannabist, Retrieved from <http://www.thecannabist.co/2016/01/13/colorado-marijuana-sales-taxes-november-2015/46522/>.
- Business Wire. (2016). *Weedmaps announces new CEO*. Retrieved from <http://www.businesswire.com/news/home/20160223006806/en/Weedmaps-Announces-CEO>.
- Campaign for Tobacco-Free Kids. (2015). *Tobacco product marketing on the Internet*. Retrieved from <https://www.tobaccofreekids.org/research/factsheets/pdf/0081.pdf>.
- Cavazos-Rehg, P. A., Krauss, M., Fisher, S. L., Salyer, P., Grucza, R. A., & Bierut, L. J. (2015). Twitter chatter about marijuana. *Journal of Adolescent Health*, *56*, 139–145. doi:10.1016/j.jadohealth.2014.10.270.
- Cavazos-Rehg, P. A., Krauss, M. J., Sowles, S., Connolly, S., Rosas, C., Bharadwaj, M., & Bierut, L. J. (2016). A content analysis of depression-related tweets. *Computers in Human Behavior*, *54*, 351–357. doi:10.1016/j.chb.2015.08.023.
- Centers for Disease Control and Prevention. (2003). Media Literacy. In *Designing and implementing an effective tobacco counter-marketing campaign* (pp. 281–295). Retrieved from http://www.cdc.gov/tobacco/stateandcommunity/counter_marketing/manual/pdfs/tobacco_cm_manual.pdf.
- City of Seattle Office of the Mayor. (n.d.2016). *Non-state licensed cannabis establishment enforcement guidelines*. Retrieved from <http://www.seattle.gov/Documents/Departments/FAS/RegulatoryServices/MJ-Enforcement-Guidelines.pdf>.
- Colorado Department of Revenue. (2013). *Permanent rules related to the Colorado Retail Marijuana Code*. Retrieved from https://www.colorado.gov/pacific/sites/default/files/Retail%20Marijuana%20Rules,%20Adopted%20090913,%20Effective%20101513%5B1%5D_0.pdf.
- Colorado Department of Revenue. (2015). *MED licensed facilities*. Retrieved from <https://www.colorado.gov/pacific/enforcement/med-licensed-facilities>.
- Colorado Freedom of Information Coalition. (2016). *Judge tosses out federal lawsuit over retail marijuana advertising in Colorado*. Retrieved from <http://coloradofaic.org/judge-tosses-lawsuit-colorado-marijuana-retail-advertising/>.
- D'Amico, E. J., Miles, J. N., & Tucker, J. S. (2015). Gateway to curiosity: medical marijuana ads and intention and use during middle school. *Psychology of Addictive Behaviors*, *29*, 613–619. doi:10.1037/adb0000094.
- Demographics Pro (2016). <http://www.demographicspro.com/>
- Duke, J. C., Lee, Y. O., Kim, A. E., Watson, K. A., Arnold, K. Y., Nonnemaker, J. M., & Porter, L. (2014). Exposure to electronic cigarette television advertisements among youth and young adults. *Pediatrics*, *134*, e29–e36. doi:10.1542/peds.2014-0269.
- Federal Trade Commission. (2014). *Self-regulation in the alcohol industry*. Retrieved from <https://www.ftc.gov/system/files/documents/reports/self-regulation-alcohol-industry-report-federal-trade-commission/140320alcoholreport.pdf>.
- Food and Drug Administration. (2016). *Advertising & promotion*. Retrieved from <http://www.fda.gov/TobaccoProducts/Labeling/MarketingandAdvertising/default.htm>.
- Freisthler, B., & Gruenewald, P. J. (2014). Examining the relationship between the physical availability of medical marijuana and marijuana use across fifty California cities. *Drug and Alcohol Dependence*, *143*, 244–250. doi:10.1016/j.drugalcdep.2014.07.036.
- Freisthler, B., Ponicki, W. R., Gaidus, A., & Gruenewald, P. J. (2016). A micro-temporal geospatial analysis of medical marijuana dispensaries and crime in Long Beach, California. *Addiction*, *111*, 1027–1035. doi:10.1111/add.13301.
- General Cannabis Inc. (2011). *WeedMaps announces marketing agreement with the National Organization for the Reform of Marijuana Laws for website transformation*. Retrieved from <http://www.prnewswire.com/news-releases/weedmaps-announces-marketing-agreement-with-the-national-organization-for-the-reform-of-marijuana-laws-for-website-transformation-132431908.html>.
- Grier, S. A., & Kumanyika, S. (2010). Targeted marketing and public health. *Annual Review of Public Health*, *31*, 349–369. doi:10.1146/annurev.publhealth.012809.103607.
- Hancock-Allen, J. B., Barker, L., VanDyke, M., & Holmes, D. B. (2015). Notes from the field: death following ingestion of an edible marijuana product—Colorado, March 2014. *Morbidity and Mortality Weekly Report*, *64*, 771–772. Retrieved from <http://www.cdc.gov/MMWR/preview/mmwrhtml/mm6428a6.htm>.
- Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*, 377–381. doi:10.1016/j.jbi.2008.08.010.
- Hill, K. P. (2015). Medical marijuana for treatment of chronic pain and other medical and psychiatric problems: a clinical review. *JAMA*, *313*, 2474–2483. doi:10.1001/jama.2015.6199.
- Ho, S. S., Poorisat, T., Neo, R. L., & Detenber, B. H. (2014). Examining how presumed media influence affects social norms and adolescents' attitudes and drinking behavior intentions in rural Thailand. *Journal of Health Communication*, *19*, 282–302. doi:10.1080/10810730.2013.811329.
- Ingram, D. D., & Franco, S. J. (2014). 2013 NCHS urban–rural classification scheme for counties. National Center for Health Statistics. *Vital Health & Statistics*, *2*, 1–73. Retrieved from http://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.
- Jensen, J. A., Hickman, I. N., Landrine, H., & Klonoff, E. A. (2004). Availability of tobacco to youth via the internet. *JAMA*, *291*, 1837–1837. doi:10.1001/jama.291.15.1837.
- Jones, S. C., Thom, J. A., Davoren, S., & Barrie, L. (2014). Internet filters and entry pages do not protect children from online alcohol marketing. *Journal of Public Health Policy*, *35*, 75–90. doi:10.1057/jphp.2013.46.
- Lee, C. M., Neighbors, C., & Woods, B. A. (2007). Marijuana motives: young adults' reasons for using marijuana. *Addict Behaviors*, *32*, 1384–1394. doi:10.1016/j.addbeh.2006.09.010.
- Malboro. (n.d.). Retrieved from <https://www.marlboro.com/misc/devicecompat-marlboro.html>
- Mander, J. (2014). GWI Social Summary Q3 2014. *Global Web Index*. Retrieved from <http://www.globalwebindex.net/blog/social-q3-2014>.
- Martinez, M. (2014, January 1). *Colorado's recreational marijuana stores make history*. Cable News Network (CNN). Retrieved from <http://www.cnn.com/2013/12/31/us/colorado-recreational-marijuana/>
- Mason, M. J., Mennis, J., Linker, J., Bares, C., & Zaharakis, N. (2014). Peer attitudes effects on adolescent substance use: the moderating role of race and gender. *Prevention Science*, *15*, 56–64. doi:10.1007/s1121-012-0353-7.
- McClure, A. C., Stoolmiller, M., Tanski, S. E., Engels, R. C., & Sargent, J. D. (2013). Alcohol marketing receptivity, marketing-specific cognitions,

- and underage binge drinking. *Alcohol, Clinical and Experimental Research*, 37, E404–E413. doi:10.1111/j.1530-0277.2012.01932.x.
- Mukhija, V., & Loukaitou-Sideris, A. (2015). Reading the informal city: why and how to deepen planners' understanding of informality. *Journal of Planning Education and Research*, 35, 444–454. doi:10.1177/0739456x15591586.
- National Conference of State Legislatures. (2016). *State medical marijuana laws*. Retrieved from <http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx>.
- Nelson, B. (2015). Medical marijuana: hints of headway? Despite a conflicted regulatory landscape, support for medical marijuana is growing amid increasing evidence of potential benefits. *Cancer Cytopathology*, 123, 67–68. doi:10.1002/cncy.21524.
- Newport. (n.d.). Retrieved from <https://www.newport-pleasure.com/Account/Login?ReturnUrl=%2f>
- Osborn, L. A., Lauritsen, K. J., Cross, N., Davis, A. K., Rosenberg, H., Bonadio, F., & Lang, B. (2015). Self-medication of somatic and psychiatric conditions using botanical marijuana. *Journal of Psychoactive Drugs*, 47, 345–350. doi:10.1080/02791072.2015.1096433.
- Ribisl, K. M. (2003). The potential of the internet as a medium to encourage and discourage youth tobacco use. *Tobacco Control*, 12, i48–i59. doi:10.1136/tc.12.suppl_1.i48.
- Ribisl, K. M., Kim, A. E., & Williams, R. S. (2002). Are the sales practices of Internet cigarette vendors good enough to prevent sales to minors? *American Journal of Public Health*, 92, 940–941. doi:10.2105/AJPH.92.6.940.
- Ribisl, K. M., Williams, R. S., & Kim, A. E. (2003). Internet sales of cigarettes to minors. *JAMA*, 290, 1356–1359. doi:10.1001/jama.290.10.1356.
- Ribisl, K. M., Kim, A. E., & Williams, R. S. (2007). Sales and marketing of cigarettes on the internet: emerging threats to tobacco control and promising policy solutions. In R. Bonnie, K. Stratton, & R. B. Wallace (Eds.), *Ending the tobacco problem: a blueprint for the nation* (pp. 653–678). Washington: National Academies Press.
- Semenoff, A. (2016). Annual Colorado marijuana sales near \$900 million mark in November 2015. *The Denver Post*. Retrieved from http://www.denverpost.com/news/cj_29381019/annual-colorado-marijuana-sales-near-900-million-mark-in-november-2015.
- Steinmetz, K. (2015). These five states could legalize marijuana in 2016. *TIME*. Retrieved from <http://time.com/3748075/marijuana-legalization-2016/>.
- Stock, M. L., Gibbons, F. X., Gerrard, M., Houlihan, A. E., Weng, C.-Y., Lorenz, F. O., & Simons, R. L. (2013). Racial identification, racial composition, and substance use vulnerability among African American adolescents and young adults. *Health Psychology*, 32, 237–247. doi:10.1037/a0030149.
- Stone, A. L., Becker, L. G., Huber, A. M., & Catalano, R. F. (2012). Review of risk and protective factors of substance use and problem use in emerging adulthood. *Addictive Behaviors*, 37, 747–775. doi:10.1016/j.addbeh.2012.02.014.
- Strasburger, V. C. (2010). Media education. *Pediatrics*, 126, 1012–1017. doi:10.1542/peds.2010-1636.
- Thomas, L. S. (2015). A marijuana legalization model using benefits, opportunities, costs and risks (BOCR) analysis. *International Journal of Strategic Decision Sciences (IJSDS)*, 6, 1–11. doi:10.4018/ijsds.2015040101.
- Wagner, K. (2014). Weedmaps CEO Justin Hartfield may soon be America's weed guy. *Mashable*. Retrieved from http://mashable.com/2014/05/16/weedmaps-ceo-justin-hartfield/#0GPy.K_2DmqJ.
- Washington State Liquor and Cannabis Board. (2015). *Frequently asked questions about I-502 advertising*. Retrieved from http://lcb.wa.gov/mj2015/faq_i502_advertising.
- Whiting, P. F., Wolff, R. F., Deshpande, S., Di Nisio, M., Duffy, S., Hernandez, A. V., ... & Schmidtkofer, S. (2015). Cannabinoids for medical use: a systematic review and meta-analysis. *JAMA*, 313(24), 2456–2473. doi:10.1001/jama.2015.6358
- Williams, R. S., & Ribisl, K. M. (2012). Internet alcohol sales to minors. *Archives of Pediatrics & Adolescent Medicine*, 166, 808–813. doi:10.1001/archpediatrics.2012.265.

Author Note

Tatiana Bierut, Hamilton College; Melissa J. Krauss, Department of Psychiatry, Washington University School of Medicine; Shaina J. Sowles, Department of Psychiatry, Washington University School of Medicine; Patricia A. Cavazos-Rehg, Department of Psychiatry, Washington University School of Medicine.

This publication was supported by the Washington University in St. Louis Office of the Provost Diversity and Inclusion Grant and the Institute for Public Health, and the National Institutes of Health (grant numbers R01DA032843 (PCR) and R01DA039455 (PCR)) and the Washington University Clinical and Translational Science Award (CTSA) Grant (UL1 TR000448). The authors would like to acknowledge the Washington University School of Medicine research assistants, Elizabeth Pfitzinger and Haley Stelzer-Monahan for their assistance coding the Weedmaps retailers.