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## “You got to love rosin: Solventless dabs, pure, clean, natural medicine.” Exploring Twitter data on emerging trends in Rosin Tech marijuana concentrates

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### Abstract

**Background**—“Rosin tech” is an emerging solventless method consisting in applying moderate heat and constant pressure on marijuana flowers to prepare marijuana concentrates referred to as “rosin.” This paper explores rosin concentrate-related Twitter data to describe tweet content and analyze differences in rosin-related tweeting across states with varying cannabis legal statuses.

**Method**—English language tweets were collected between March 15, 2015 and April 17, 2017, using Twitter API. U.S. geolocated unique (no retweets) tweets were manually coded to evaluate the content of rosin-related tweets. Adjusted proportions of Twitter users and personal communication tweets per state related to rosin concentrates were calculated. A permutation test was used to analyze differences in normalized proportions between U.S. states with different cannabis legal statuses.

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**Results**—eDrugTrends collected 8,389 tweets mentioning rosin concentrates/technique. 4,164 tweets (49.6% of total sample) posted by 1,264 unique users had identifiable state-level geolocation. Content analysis of 2,010 non-retweeted tweets revealed a high proportion of media-related tweets (44.2%) promoting rosin as a safer and solventless production method. Tweet-volume-adjusted percentages of geolocated Twitter users and personal communication tweets about rosin were respectively up to seven and sixteen times higher between states allowing recreational use of cannabis and states where cannabis is illegal.

**Conclusion**—Our results indicate that there are higher proportions of personal communication tweets and Twitter users tweeting about rosin in U.S. states where cannabis is legalized. Rosin concentrates are advertised as a safer, more natural form of concentrates, but more research on this emerging form of marijuana concentrate is needed.

## Keywords

Marijuana concentrates; Twitter; Cannabis legislation; Rosin technique; Social media

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## 1. Introduction

Recent years have seen rapid changes in the U.S. legislation regarding cannabis use, with 24 states now allowing medical and/or recreational marijuana use. These changes have been associated with the emergence of new forms of products (e.g., e-cannabis syrup, marijuana/THC concentrates). Marijuana concentrates, also known as “concentrates,” “shatter,” and “wax,” are usually vaporized and inhaled via a bong, oil pipe, vaporizer or electronic cigarette (Raber et al., 2015) and less frequently consumed within a marijuana joint or a marijuana blunt, or via a “gravity bong,” nectar collector, or hookah (Daniulaityte et al., 2017). According to Raber and colleagues (2015), marijuana concentrates are mainly produced via four methods: dry (e.g., finger hash, kief), water-based (e.g., hash, ice-wax), CO<sub>2</sub>-based (e.g., CO<sub>2</sub> concentrates), and solvent-based (e.g., isopropanol oil (ISO), Butane Hash Oil (BHO)). Marijuana concentrates produced via solvent-based methods generally display an average of 52.2% THC potency and can sometimes exceed 80% (U.S. Drug Enforcement Administration (DEA), 2016) compared to cannabis flowers, which on average are about 12% THC potency (ElSohly et al., 2016). Marijuana concentrates have drawn considerable attention due to injuries caused by the use of highly flammable chemical solvents such as butane (Carrillo, 2016; Dobnik, 2016; RMHIDTA, 2013; U.S. Drug Enforcement Administration (DEA), 2014). Prior research has suggested that high potency cannabis products are more likely to induce cannabis dependence, anxiety, panic attacks, psychotic episodes, and cognitive impairment (Di Forti et al., 2009; Di Forti et al., 2014; Hall and Degenhardt, 2015). Monitoring the emergence of new trends in marijuana concentrate use is of crucial importance considering the potential harms inherent in some forms of their manufacture and consumption.

“Rosin tech” is an emerging method to produce THC concentrates called “Rosin shatter” or “Rosin concentrates.” Initially used to extract terpene and essential oil from plants, this “solventless” technique of extraction consists of applying constant pressure at a moderate temperature to flower cannabis (Bennett, 2017) with something as inexpensive and widely available as a hair straightener. Industrial, more expensive, and sophisticated, “rosin presses”

are widely available on [Amazon.com](https://www.amazon.com). Media reports suggest that this extraction method has gained in popularity in the U.S. over the last two years (Bennett, 2016; High Times, 2017). A simple Google Trends query using the expression “rosin press” shows a large increase in searches for those terms over the past two years with an initial increase in late fall 2015 (<https://trends.google.com/trends/explore?geo=US&q=rosin%20press>). Despite the growing popularity of this extraction technique, epidemiological data on rosin concentrates are lacking.

There is a growing recognition that social media and web-based data can be a valuable resource for studying emerging drug use trends (Cavazos-Rehg et al., 2016; Daniulaityte et al., 2015; Lamy et al., 2016; Daniulaityte et al., 2013; Hanson et al., 2013; Corazza et al., 2013; Schifano et al., 2011). Twitter represents a large and timely source of data, with 310 million monthly active users worldwide (Twitter, 2016) that generate over 500 million tweets per day (Internet-Live-Stats, 2016).

By collecting and analyzing Twitter data, this study aims to 1) compare the number of individuals tweeting about rosin between U.S. states with different cannabis legalization policies; and 2) conduct content analysis to provide preliminary insights about Twitter data on rosin concentrates.

## 2. Methods

### 2.1 Data Collection

Twitter data were collected through the eDrugTrends platform (eDrugTrends, 2015) using Twitter's streaming Application Programming Interface (API) that allows free access up to 1% of all publically available tweets (Twitter, 2015). English language tweets were continuously collected from March 15, 2015 through April 17, 2017 using sets of keywords related to cannabis products (for a detailed list of keywords, see Daniulaityte et al., 2015; Lamy et al., 2016). From all collected cannabis-related tweets, those that contained the term “rosin” were extracted for further analysis.

Because the study is limited to publicly available data, the University IRB approved the study under Human Subjects Research exemption 4. To protect tweeter anonymity, cited tweet content was modified slightly, and geolocation data were analyzed in aggregate form.

### 2.2 Content Analysis

Rosin-related tweets geolocated at the U.S state-level (re-tweets removed) were extracted and analyzed using QdA Miner (Provalis Research, 2011). First, a subset of tweets (n=150) was reviewed by four researchers (FL, RD, RC, MZ) to inductively develop the coding scheme (Neuendorf, 2002): (1) Sources of the tweets: a) personal communication, b) media, c) retail; (2) Characteristics associated with the rosin technique: a) “solventless”, b) “natural”, c) “safe”; (3) Media-related tweets were further coded to identify those that contained information about how to produce rosin concentrates (“tutorial”); 4) Personal communication tweets were further coded to identify: a) indication/intent of usage; b) positive effects; c) negative effects; and d) homemade production of rosin concentrates. To assess intercoder reliability, 300 tweets were coded independently by two researchers (FL,

MZ). The Krippendorff's Alpha (Krippendorff, 2012) was calculated using QDA Miner. The overall score was 0.79 denoting substantial agreement between coders.

### 2.3 Identifying Regional Differences

The eDrugTrends platform is equipped with a geolocation identification module (Daniulaityte et al., 2015; Lamy et al., 2016). To analyze regional differences, numbers of unique Twitter users tweeting about rosin per state, rather than the number of tweets, were used to limit the impact of “loud” Twitter users, who tweet far more than others. Adjusted percentages of Twitter users tweeting about “rosin” were calculated for each state as the proportion out of the “general” sample of unique Twitter users in that state, normalized so the adjusted percentages sum to 100% over all the states. To obtain “general” sample numbers, eDrugTrends counts unique users within the default random sample of 1% of all tweets provided by the Twitter API without using any keywords (Daniulaityte et al., 2016; Daniulaityte et al., 2015; Lamy et al., 2016).

To assess the relationship between cannabis legalization policies and adjusted percentages of Twitter users tweeting about rosin tech or rosin products, U.S. states were grouped into four categories based on cannabis legal status. Based on prior research that examined the level of restrictiveness of medical marijuana policies (Chapman et al., 2016; Williams et al., 2016), states with medical marijuana programs were grouped into two categories depending on the degree of restrictiveness the state's law imposes on becoming a registered medical marijuana user, whether cultivation and/or dispensaries are allowed, and the total amount of cannabis that the state's law allows a user to possess. The four categories are as follow: (1) “recreational” status (AK, CO, DC, OR, WA); (2) “medical, less restrictive” (AZ, CA, CT, HI, IL, MA, MD, ME, MI, MN, MT, NH, NJ, NM, NV, NY, RI, VT); (3) “medical, more restrictive” (DE, FL, GA, IA, KY, MO, MS, NC, OK, SC, TN, TX, UT, WI), and; (4) “illegal” (AL, AR, ID, IN, KS, LA, ND, NE, OH, PA, SD, VA, WV, WY). A permutation test with 10,000 replications was performed using R 3.3.1 (R Core Team, 2016) to examine differences in the adjusted percentage of unique Twitter users tweeting about rosin concentrates/technique between these four groups. We tested the null hypothesis of no difference in mean adjusted percentage between groups of states defined by legal status. Two-sided pairwise comparisons between the four groups were adjusted for six multiple comparisons using the Hommel procedure (Hommel, 1989) via SAS PROC MULTTEST in SAS 9.4 (SAS, 2010) to maintain a familywise  $\alpha = 0.05$  level of significance. Next, the same analyses were repeated with the tweets classified as personal communication by our content analysis to limit the impact of retail shops (e.g., cannabis dispensaries) and media sources tweeting activity on the results of the regional difference analysis.

## 3. Results

### 3.1 Data Collected

Out of the total sample of 88,901,647 cannabis-related tweets collected by eDrugTrends from March 15, 2015 to April 17, 2017, 8,389 mentioned rosin. Out of all rosin-related tweets, 4,164 (49.6%) were geolocated in the U.S. and were posted by 1,264 unique Twitter users. The sample of 1,264 Twitter users from the cannabis-related sample was used to

analyze regional differences. For content analysis, the sample of 4,164 rosin-related tweets was further processed to remove retweets, resulting in a sample of 2,010 unique rosin-related tweets.

### 3.2 Results from the Content Analysis

Content analysis results are presented in Table 1. Media-related tweets (44.2%) represented the largest proportion, about 32.1% were personal communication tweets, and 22.5% were retail-related. Only 1.2% of tweets were irrelevant or too vague to be coded.

Among the 646 “personal communication” tweets, 31.1% denoted recent/actual usage or intent to use rosin concentrates, 16.6% mentioned homemade production, 5.3% expressed a positive effect, and only 0.6% expressed a negative effect. It is worth noting that only one tweet mentioned use of rosin for self-medication. Among the 888 media-related tweets, 37.4% were coded as “tutorial” providing instructions on how to extract marijuana concentrates using the rosin technique.

The most common characteristics emphasized among all rosin-related tweets were the “solventless” (6.7%) aspect of their production, greater “safety” (1.8%) compared to other solvent-based concentrates, and their “natural” (1.7%) qualities. These characteristics were frequently mentioned in media and retail tweets describing and advertising rosin concentrates.

### 3.3 Regional Differences in Rosin-Related Tweeting

Among all Twitter users tweeting about rosin that eDrugTrends was able to geolocate inside the United States, the normalized proportion of rosin-posting Twitter users was highest in Colorado (10.1%) and Oregon (7.4%) (Figure 1). The average adjusted proportion of Twitter users tweeting about rosin for Status 1 (recreational) was 6.2%, for Status 2 (medical, less restrictive) was 2.3%, for Status 3 (medical, more restrictive) was 1.1%, and for Status 4 (illegal) was 0.9%. After adjusting for multiple comparisons, Status 1 had a significantly greater relative proportion of users tweeting about rosin tech and/or concentrates than each of the other three legal status groups (vs. Status 2:  $p < 0.005$ , vs. Status 3:  $p < 0.0001$ , vs. Status 4:  $p < 0.0001$ ). Differences between other groups were not statistically significant after adjusting for multiple testing.

Analysis of numbers of tweets classified as personal communication revealed the same geographic patterns. The average adjusted proportions of personal communication tweets were 9.1% for Status 1, 1.8% for Status 2, 1.0% for Status 3, and 0.6% for Status 4 states. The differences between Status 1 (recreational) and all other groups were statistically significant (vs. Status 2:  $p < 0.005$ , vs. Status 3:  $p < 0.005$ , and vs. Status 4:  $p < 0.001$ ).

## 4. Discussion

To the best of our knowledge, this is the first study that analyzes Twitter data about the rosin technique and rosin concentrates. Due to the recent emergence of this form of concentrate, there has been very limited research about it of any kind. Our findings indicate that, within a cannabis-related tweet sample, a greater proportion of Twitter users from U.S. states where

recreational cannabis use is legal are tweeting about rosin concentrates, suggesting a greater popularity of rosin concentrates in the states that legalized recreational use of cannabis.

The largest proportion of rosin-related tweets were media-related (44.2%), promoting the rosin technique. Research has already underlined the importance of social media exposure in the adoption of new behavior related to alcohol use (Fournier et al., 2013; Moreno et al., 2012). The large proportion of media-related tweets promoting the rosin technique has potentially played an important role in the diffusion of this emergent method. This emphasizes the importance of media monitoring to identify emerging trends (Mounteney et al., 2010) and calls for more research on the potential influence of social media on Twitter users who consume cannabis products.

The content analysis of rosin concentrate-related tweets suggests that this emerging form of cannabis concentrates has benefited from several factors favoring its popularity in the Twittosphere. First, the rosin technique is advertised by retail stores and media as a safer, more natural alternative to the solvent-based “generation” of marijuana concentrates, as this extraction method does not require chemical solvents, which eliminates the risks of explosion and reduces the risk of health-related harms through contamination due to solvent chemicals (Raber et al., 2015). Second, several media sources (e.g., HighTimes, 420 Magazine, Leafly) have consistently provided links to tutorial videos through Twitter describing how to extract rosin concentrates from flower cannabis using a heat press or hair straighteners. Third, the legal status of cannabis in numerous U.S. states has contributed to an increased availability of a large amount of marijuana needed for the production of concentrates.

These combined factors, availability of information about how to produce concentrates using the rosin technique; ease of production; perceived safety; and availability of raw materials, have potentially contributed to the emergence of the rosin technique as a safe “do it yourself” form of concentrate production. The substantial number of personal communication tweets mentioning homemade rosin concentrates exemplified this last point. Although the rosin technique is perceived to be a safer version of its solvent-based counterparts, rosin concentrates remain highly potent cannabis products, which can potentially lead to accrued health-related harms (Di Forti et al., 2009; Di Forti et al., 2014; Hall and Degenhardt, 2015).

The study has several limitations. First, tweets were not collected based on “rosin” as a keyword, but re-extracted from a more general cannabis-related dataset. Therefore, the data collected do not reflect the complete rosin-related tweeting activity, which could explain the limited number of tweets collected. However, doing so insured the precision and relevance of the dataset as it links the search term “rosin” to other terms related to marijuana concentrates limiting the proportion of “false positives” such as “rosin resin” for violin strings or “rosin bags” for gymnastics in the dataset. Second, the study was limited to English language tweets. Third, Twitter users living in states with liberal cannabis policies might be more inclined to publically post about their usage of cannabis, potentially affecting regional differences in rosin-related tweeting activity. Fourth, because the general sample of tweets is based on the 1% of tweets provided by Twitter, more active Twitter users might

have been more likely selected inducing a selection bias and potentially affecting the results of the regional analysis based on Twitter users. However, it is not known if there are differences among states in terms of who are more or less likely to be active Twitter users.

In conclusion, the relative ease of THC concentrate production through the rosin technique could influence experimentation and use of marijuana concentrates. Although only four collected personal communications were negative, the present findings call for more studies on this new form of marijuana concentrate as its prevalence and potential side-effects remain unknown and understudied. The study also illustrates how social media content analysis can provide timely information regarding new and understudied trends of drug use.

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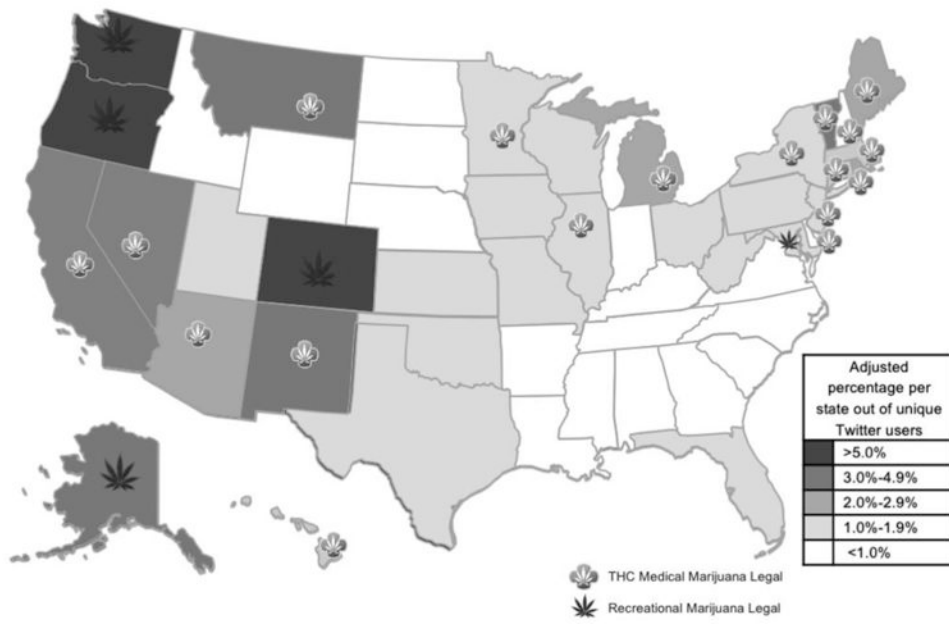
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### Highlights

- Rosin is a new and understudied technique of marijuana concentrates extraction
- Rosin tech is a solventless method involving only heat and mechanical pressure
- Higher proportion of rosin Twitterers in U.S states where cannabis is legal
- Rosin concentrates are advertised as easy to produce, natural and safer



**Figure 1.**  
U.S. state-level repartition of rosin-posting Twitter users.

**Table 1**  
**Content analysis and coding reliability of tweets related to rosin concentrates**

Code	Count (%)	Examples of Tweets
<b>All Tweets (n=2010)</b>		
<b>Personal Communication</b>	646 (32.1%)	Rosin concentrates & latte coffee #BestBreakfastEver Sorry, but you're smoking butane if your dab is not rosin and has bubbles in it. No need to argue there. Rosin concentrates FTW
<b>Media</b>	888 (44.2%)	Rosin is fundamentally altering the weed business
		Making #Rosin: The New, Clean, Solvent-Free, Potent #Marijuana Extract
		Why The Rosin Revolution Is Real
<b>Retail</b>	452 (22.5%)	Into dabs? Check out our Straight Medicinal rosin, \$30 for a half gram, in Sour Berry or Forum GSC, all the flavor of bud, with a kick!
		\$99 OGK Oz, 2For1: All Hash & Critical Kush, 3For2 All Rosin, 20% Pure Vape C02 Wax (78%+ THC!)
<b>Irrelevant/Unknown</b>	24 (1.2%)	Another rad prairie plant, rosin weed ( <i>Silphium integrifolium</i> ), it's stiff & makes rattle noise when you touch it <a href="https://t.co/R1VE708fNb">https://t.co/R1VE708fNb</a>
<b>Rosin Dabs Qualities Emphasized in Tweets (n=2010)</b>		
Solventless	135 (6.7%)	No solvent rosin is definitely the new wave in the extracts
Safe	36 (1.8%)	#rosin is key!!!! Buy a press & smoke wax! No chemicals. No explosions. <a href="https://t.co/eoYGz1wPqN">https://t.co/eoYGz1wPqN</a> don't blow up!!!!
Natural	34 (1.7%)	Mr Natural Inc BRAND NAME Medical Marijuana CULTIVATION Collective 'All Organic ROSIN <a href="https://t.co/3UOP9xcgzo">https://t.co/3UOP9xcgzo</a>
<b>Personal Communication Tweets only (n=646)</b>		
Indicating usage of rosin dabs	201 (31.1%)	No one there and I am bored: I will smoke hash bowls and rosin dabs until I can't see clear anymore
		To start this working day: Rosin dabs. #rosintech
Home-making rosin dabs	107 (16.6%)	I'm using Gorilla Glue weed to make my personal rosin dabs with my hair straightener Yesterday, I pressed 9 grams of keef and this rosin looks so good.
Positive effect	34 (5.3%)	I got ripped by those rosin dabs
Negative effect	4 (0.6%)	WTF, I got couch locked by these Rosin dabs
<b>Media Tweets only (n=888)</b>		
Tutorial, information of how to make rosin dabs	332 (37.4%)	What Is #Marijuana Rosin Tech And How Do You Make It? Learn How to Make #Cannabis Rosin at Home

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