The Intersection between Spliff Usage, Tobacco Smoking, and Having the First Joint after Waking

Navin Kumar1,2, Cheneal Puljević2,3, Jason Ferris4, Adam Winstock5,6 & Monica J. Barratt7,8

Cannabis users who are also tobacco smokers are more likely to exhibit cannabis dependence and psychosocial problems. However, there has been minimal research around various cannabis and tobacco mixing (spliff usage) behaviours and likeliness to smoke the first joint within an hour of waking, known colloquially as wake and bake. The time of first joint and spliff usage may be related as they are associated with the intersection of tobacco and cannabis use. Compared to non-morning cannabis users, morning users reported significantly more cannabis-related problems. Through a survey of US cannabis users, we test the association between various cannabis and spliff use behaviours and likeliness to smoke the first joint within an hour of waking. Compared to those who smoked tobacco and did not use spliffs, the following spliff use behaviour groups were less likely to have their first joint within 60 minutes after waking: those who smoked tobacco and used spliffs (95%CI: 0.605–0.988); those who never smoked tobacco and did not use spliffs (95%CI: 0.489–0.892); those who never smoked tobacco and used spliffs (95%CI: 0.022–0.915). We provided possible explanations for our results and suggested further research to better understand findings, important given expanding US cannabis markets.

The US legal cannabis market has been growing rapidly in recent years, from $2.7 billion in 20141 to $10.4 billion in 20182. Given expanding US cannabis markets, heavy frequent use and cannabis use disorder are a concern3. In 2017, in the US, there were approximately 40.9 million people (15.0%) aged 12 or older who used cannabis in the last year4. About one in 11 US cannabis users aged 15 or older develops dependent patterns of use, with about 4.2 million people meeting diagnostic criteria for frequent or problematic use5. Such patterns of cannabis use are often associated with psychotic symptoms, suicidal ideation and major depressive disorder6. These findings are not causal and it is unclear if cannabis is self-medication for mental health conditions. Several studies have detailed US cannabis use prevalence7–9, but there has been minimal research around various cannabis and tobacco mixing behaviours and likeliness to smoke the first joint within an hour of waking, known colloquially as wake and bake10. The time of first joint and mixing cannabis with tobacco may be related as they are associated with the intersection of tobacco and cannabis use11,12. Moreover, cannabis users who are also tobacco smokers are more likely to exhibit cannabis dependence and psychosocial problems12. Mixing cannabis with tobacco is defined as the smoking of spliffs—a colloquial term, which are joints (cannabis cigarette) filled with loose-leaf tobacco and cannabis13. Our definition does not include blunts, which are partially or completely hollowed out cigar wrappers filled with cannabis14. Time to first tobacco cigarette is correlated with many dimensions of nicotine dependence; for example, individuals who smoked their first cigarette within an hour of waking (versus later in the day) tend to smoke more per day and experienced increased difficulty in quitting15,16. Similarly, smoking the first cannabis joint within an hour of waking may be a marker of harmful cannabis usage. Compared to non-morning users, morning users reported significantly more cannabis-related problems10.

Individuals use spliffs for a variety of reasons, such as; decreased strength and cost of the preparation17, and increased uptake of THC18. Spliffs are associated with unfavourable consequences, such as forgoing one’s responsibilities or injuring oneself or someone else due to cannabis usage19. In addition, the practice exposes users to...
Methods

Methods statement. The study received institutional review board (IRB) approval from Kings College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittee (PNM RESC). All research was performed in accordance with relevant guidelines/regulations. All respondents confirmed they were 16 + years and provided informed consent. IRB approval was received to survey those aged <18, as per previous studies with the Global Drug Survey (GDS)26–28. Similarly, several studies globally did not require parental consent for surveys regarding age groups 16–1728.

GDS annually develops and conducts anonymous, online surveys to investigate international trends in drug use, both legal and illicit. US data from GDS 2017, collected from November 15, 2016 to January 18, 2017, is utilized in this paper. Methods utilized here are similar to our previous work with the GDS20–22. The survey was actively promoted on social media platforms, such as Twitter, Facebook, and through media partners, such as, Mixmag and The Guardian (USA). We were unable to control for sample variation based on recruitment mode. All respondents confirmed they were 16 + years and provided informed consent. The study received institutional review board (IRB) approval from Kings College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittee (PNM RESC). Survey questions were not forced choice. Responses were included only if individuals indicated they had used cannabis in the last 12 months, such as smoking, eating, and vaporizing. The measures in this paper covered demographic characteristics, whether spliffs were used in the last year, time of first joint, tobacco use, amount of cannabis used per session, number of hours of day spent stoned in a session, time of last joint and number of days cannabis was used in the last year.

Regarding spliff use, participants were asked When did you last mix cannabis with tobacco? with the following options: Never, In the last 30 days, Between 31 days and 12 months ago, More than 12 months ago. The question referred to loose leaf tobacco being added to cannabis joints (spliffs or cannabis cigarettes), not blunts (cigar wrappers filled with cannabis). The survey item did not explicitly refer to spliff use and this is noted in the Limitations section. Concerning time of first joint, we asked How soon after you wake up do you smoke your first joint on a day that you use cannabis? with the following options: Immediately within 5 minutes, Within less than an hour, Within 1–4 hours, Within 5–12 hours, After more than 12 hours. For normal daily cannabis use, we asked participants On a day that you use cannabis how much would you say you normally use? from a dropdown list of 29 weights, starting at 50 mg and gradually increasing to the final selection of >20 g. Regarding the number of hours spent stoned in a session, we asked On a day that you use cannabis how many hours of the day would you say that you are stoned? with a dropdown list of 24 options, with the first being 1 Hour with one-hour increments and the last option being 24 Hours. We did not define stoned in the survey, as we assumed the meaning would be apparent to cannabis-using participants. In this paper, we define stoned as any form of cannabis intoxication20,21. Regarding tobacco use, we asked When did you last use Tobacco/cigarettes? with the options: Never, In the last 30 days, Between 31 days and 12 months ago, More than 12 months ago. The survey item refers to tobacco use on its own e.g. someone could answer Never but still use spliffs. For the number of days cannabis was used in the year, we asked During the last 12 months, on how many days have you used cannabis? and participants keyed in their response. We also asked participants How long before bed do you have your last joint on a day that you use cannabis? with the following options: Last thing before bed, 1–2 hours before bed, 3–4 hours before bed, More than 4 hours before bed. For the Preferred form of cannabis item, we provided the following options: High potency herbal cannabis (cannabis plant with higher levels of THC), Resin/hash (substance scraped off the cannabis plant and pressed into a lump21), Normal weed/bush/pressed (lower quality cannabis plant), Edibles (food product that contains cannabinoids), Kief (cannabis resin sifted from dry cannabis). Regarding the Most Common Mode of Cannabis Consumption item, the following were provided: Oil (cannabis concentrate consumed by vaporizing), Butane Hash Oil (cannabis resin extracted using butane and later vaporized), Smoked in a joint with tobacco, Smoked in a joint without tobacco, Smoked in a blunt with tobacco, Smoked in a blunt without tobacco, Smoked in a pipe with tobacco, Smoked in a pipe without tobacco, Smoked in a bong/water pipe with tobacco (bong is a filtration device used for cannabis smoking), Smoked in a bong/water pipe without tobacco, Bucket bong (a bong variant), Hot knife (method of cannabis smoking that uses hot knife blades), Vaporizer (a device that generates cannabis in the form of vapor), Eaten in food, Tincture/drank as tea (cannabis product made by soaking cannabis flowers in ethanol), Medical spray (alcohol-based spray containing cannabinoids).

The spliff item was coded as a binary variable: Yes, No (Variable A). Time of first joint (cannabis cigarette) in a day was categorized into ≥60 mins and <60 mins of waking, modelling time to first cigarette22,33. Grams of cannabis used per session was recoded into a continuous variable, and the >20 g value was recoded as 21 grams. For ease of interpretation, the age variable was recoded into a categorical variable with breaks of ten years each and consecutive age groups representing less than 5% of the sample were subsumed into a larger group (41–79 years). We created a variable to model patterns of spliff use, coded: Smoked tobacco in the last 12 months and did not use spliffs, Smoked tobacco in the last 12 months and used spliffs, Never smoked tobacco and did not use spliffs, Never smoked tobacco and used spliffs, Smoked tobacco more than 12 months ago and did not use spliffs, Smoked tobacco more than 12 months ago and used spliffs (Variable B). Smoking tobacco refers to smoking tobacco on its own, thus someone could state they never smoked tobacco and still use spliffs. Logit models, with and without controls, were used to assess if spliff use was associated with time of first joint. We ran two sets of models. We first used spliff use as a binary independent variable (Variable A) and then...
used various spliff use behaviours as the independent variable (Variable B). We used listwise deletion for missing values. We controlled for demographic characteristics, tobacco use in the last year, time of last cannabis joint, amount of cannabis used per session, number of hours stoned per session and number of days cannabis was used in the last year. We included how long before bed participants had their last joint, as cannabis is sometimes used for sleep initiation and this form of use may contribute to cannabis dependence34. Frequency and quantity used per session are associated with problematic cannabis use 35. We included number of days cannabis was used in the last 12 months and amount of cannabis used per session. Time spent intoxicated on cannabis is a marker of problematic use36 and we included a measure of number of hours spent stoned in a session.

Odds ratios (ORs), adjusted odds ratios (aORs), 95% confidence intervals (95% CI) and p-values were reported. Participants were not required to answer every question, resulting in some missing data. Given the structured sequence of questions, missing values for mixing tobacco with cannabis meant that participants had not used a spliff e.g. if someone indicated they did not use cannabis, the mixing tobacco with cannabis (spliff use) value would be missing. Thus, we coded missing values for mixing tobacco with cannabis (spliff use) as Never.

| Age (N = 8345) | -16–20 | 28.4% |
|               | -21–30 | 41.7% |
|               | -31–40 | 14.9% |
|               | -41–79 | 15.0% |
| Sex (N = 8345) | Male   | 75.5% |
|               | Female | 23.6% |
|               | Transgender | 0.9% |
| Time of First Joint (N = 7033) | >60 mins | 78.0% |
|               | <60 mins | 22.0% |
| Time of Last Joint (N = 7034) | Last Thing before Bed | 31.3% |
|               | 1–2 hours before bed | 49.1% |
|               | 3–4 hours before bed | 15.4% |
|               | More than 4 hours before bed | 4.2% |
| Spliff Use (N = 8345) | No | 78.0% |
|               | Yes | 22.0% |
| Cannabis Used Per Session (Grams) (N = 7667) | Median | 0.5 |
|               | Interquartile Range | 0.125–1.000 |
| Number of Hours Stoned in a Session (N = 6970) | Median | 4 |
|               | Interquartile Range | 3.0–6.0 |
| Number of Hours Stoned in a Session for those who had their Last Joint Just Before Bed (N = 1926) | Median | 6 |
|               | Interquartile Range | 3.0–11.0 |
| Number of Days Cannabis was Used in the Last Year (N = 7389) | Median | 250 |
|               | Interquartile Range | 50–360 |
| Preferred Form of Cannabis (N = 7565) | High potency herbal cannabis | 62.1% |
|               | Resin/hash | 11.2% |
|               | Normal weed/bush/pressed | 1.7% |
|               | Edibles | 1.3% |
|               | Kief | 8.3% |
|               | Oil | 8.0% |
|               | Butane Hash Oil | 7.6% |
| Most Common Mode of Cannabis Consumption (N = 7913) | Smoked in a joint with tobacco | 3.8% |
|               | Smoked in a joint without tobacco | 11.3% |
|               | Smoked in a blunt with tobacco | 0.7% |
|               | Smoked in a blunt without tobacco | 7.5% |
|               | Smoked in a pipe with tobacco | 0.5% |
|               | Smoked in a pipe without tobacco | 33.3% |
|               | Smoked in a bong/water pipe with tobacco | 2.6% |
|               | Smoked in a bong/water pipe without tobacco | 23.0% |
|               | Bucket bong | 1.5% |
|               | Hot knife | 0.2% |
|               | Vaporizer | 12.7% |
|               | Eaten in food | 2.4% |
|               | Tincture/drank as tea | 0.4% |
|               | Medical spray | 0.1% |

Table 1. Variables of Interest (Number of Participants Reporting Cannabis Use in Last Year = 8345).
When accounting for questions participants were not required to answer, the percentage of missing values for all variables did not exceed 20% (see Supplementary Table 1). Multiple imputation was utilized to appropriately handle missing values, assumed to be missing at random. Given the number of categorical variables, we used the predictive mean matching technique with only the variables described in this study. Similar analyses were run on the imputed dataset (see Supplementary Table II). We generated 10 imputation data sets. Statistical tests were performed on original and imputed data sets to determine the extent of result convergence. All analysis was conducted using R with the following packages: dplyr, stargazer, plyr, lmtest, multiwayvcov, sandwich, mice.

### Results

#### Sample

From November 2016 to January 2017, a total of 10183 responses were recorded in the US. 8345 (82%) participants reported cannabis use in the past year. A further 1955 records were excluded due to missing data. The remaining 6390 respondents formed the sample for analysis. Males accounted for 75.48% of the sample, with a median age of 23 (interquartile range (IQR): 19–32, Range: 16–79, see Table 1).

#### Demographic characteristics

Of those who reported cannabis use in the past year, most (78%) reported consuming their first joint more than an hour after waking and most (78%) tended not to use spliffs (see Table 1). Participants used cannabis for a median of 250 days in the last year (almost daily), with 0.50 grams the median for use per session. Participants spent a median of four hours a day stoned when cannabis was used. Those who had their last joint just before bed spent a median of six hours a day stoned. About half the sample had their last joint more than 12 months ago and did not use spliffs. Those who smoked tobacco more than 12 months ago and used spliffs had the lowest probability of smoking within the first hour and those who smoked just before bed spent a median of six hours a day stoned. About half the sample had their last joint just before bed.

### Table 2. Differences in Cannabis Use Behaviors Across Tobacco and Spliff Usage Groups.

When accounting for questions participants were not required to answer, the percentage of missing values for all variables did not exceed 20% (see Supplementary Table 1). Multiple imputation was utilized to appropriately handle missing values, assumed to be missing at random. Given the number of categorical variables, we used the predictive mean matching technique with only the variables described in this study. Similar analyses were run on the imputed dataset (see Supplementary Table II). We generated 10 imputation data sets. Statistical tests were performed on original and imputed data sets to determine the extent of result convergence. All analysis was conducted using R with the following packages: dplyr, stargazer, plyr, lmtest, multiwayvcov, sandwich, mice.

#### Consumption first joint within an hour after waking and spliff use

No statistically significant associations were found for the logistic regression with or without controls, for the relationship between spliff use (Never, Yes) and smoking the first joint within an hour after waking, and various spliff use patterns. When accounting for controls, compared to those who smoked tobacco and did not use spliffs, the following groups were more likely to have their first joint within 60 minutes after waking: those who smoked tobacco and did use spliffs (aOR = 0.80, p = 0.02), those who never smoked tobacco and did not use spliffs (aOR = 0.69, p = 0.00), those who never smoked tobacco and did use spliffs (aOR = 0.47, p = 0.00). Those who never smoked tobacco and did use spliffs had the lowest probability of smoking within the first hour and those who smoked just before bed spent a median of six hours a day stoned. About half the sample had their last joint just before bed.
tobacco but did not use spliffs had the highest probability (see Fig. 1). Results of logistic regression analysis run on the original and imputed data converged for all explanatory variables and categories (see Supplementary Table II).

**Discussion**

We sought to test the association between various spliff usage behaviours and likeliness to smoke the first joint within an hour of waking, among US cannabis users. Accounting for controls, compared to those who smoked tobacco and did not use spliffs, the following were less likely to have their first joint within an hour after waking: those who smoked tobacco and used spliffs, those who never smoked tobacco and did not use spliffs, those who never smoked tobacco and used spliffs.

There are a range of explanations for our results. We explore two possible explanations, in line with the limitations of our data. Harm reduction, of a life-functioning variant instead of a pulmonary/respiratory variant47, may explain why respondents who smoked tobacco and used spliffs, did not want to have their first joint within an hour of waking. Some participants may be aware of the harms of tobacco smoking combined with spliff use and thus seek to reduce engagement in another harmful behaviour; waking and baking. Another explanation may be demographic differences across spliff usage groups. We indicate proportionately more younger participants in certain spliff usage groups, possibly related to our outcome variable. Similarly, cannabis and tobacco users have differing outcomes compared to those who use only cannabis12. Qualitative research around specific demographic groups and tobacco and cannabis use behaviours may provide further insight.

**Limitations.** We conducted the largest US study testing the association between various spliff usage behaviours and having the first joint within an hour after waking. This research design has costs and benefits, such as population level29,48,49 reliability and validity. When data are limited, online surveys may be valid. Comparable probability sampling and ethnographic data may be key to increase validity of our findings29. The age and sex distributions of cannabis users who completed the GDS were similar to demographic distributions in a household survey across Australia, the US, and Switzerland29. The GDS is therefore an efficient means of getting a graduated insight around stigmatised behaviours as long as the survey is not used to determine population-level drug prevalence29.

We did not have information on how nicotine dependence may have influenced the results; frequency of tobacco use and time to first tobacco cigarette. This information may help explain our findings and future research can incorporate these survey items. As we used an online survey of US drug users, our sample was skewed toward younger participants. We used age and sex as controls, but other covariates such as sexuality, urban/non-urban

| Variable                  | Level                                      | n   | OR (95% CI)       | P-value | aOR (95% CI)      | P-value |
|---------------------------|--------------------------------------------|-----|------------------|---------|-------------------|---------|
| Spliff Usage Groups       | Smoke tobacco and did not use spliffs      | 1802| 1.00             | —       | 1.00              | —       |
|                           | Smoke tobacco and used spliffs             | 1699| 0.93 (0.78, 1.09)| 0.38    | 0.80 (0.61, 0.99)**| 0.02    |
|                           | Never smoked tobacco and did not use spliffs| 1646| 0.60 (0.43, 0.77)**| 0.00    | 0.69 (0.49, 0.89)**| 0.00    |
|                           | Never smoked tobacco and used spliffs      | 228 | 0.57 (0.20, 0.94)**| 0.00    | 0.47 (0.02, 0.92)**| 0.00    |
|                           | Smoked tobacco more than 12 months ago and did not use spliffs | 877 | 0.88 (0.69, 1.07) | 0.17    | 0.83 (0.60, 1.06) | 0.12    |
|                           | Smoked tobacco more than 12 months ago and used spliffs | 138 | 0.96 (0.56, 1.36) | 0.85    | 0.75 (0.28, 1.23) | 0.24    |
| Age                       | 16–20                                      | 1756| —                | —       | 1.00              | —       |
|                           | 21–30                                      | 2692| —                | —       | 1.08 (0.89, 1.26) | 0.44    |
|                           | 31–40                                      | 979 | —                | —       | 1.08 (0.84, 1.32) | 0.53    |
|                           | 41–79                                      | 963 | —                | —       | 0.61 (0.35, 0.87)**| 0.00    |
| Sex                       | Male                                       | 4864| —                | —       | 1.00              | —       |
|                           | Female                                     | 1470| —                | —       | 1.07 (0.90, 1.24) | 0.45    |
|                           | Transgender                                 | 56  | —                | —       | 1.50 (0.76, 2.24) | 0.28    |
| Cannabis Used Per Session | —                                          | 6390| —                | —       | 1.17 (1.12, 1.21)**| 0.00    |
| Number of Hours Stoned in a Session | —                                     | 6390| —                | —       | 1.19 (1.17, 1.20)**| 0.00    |
| Number of Days Cannabis was Used in the Last Year | —                                     | 6390| —                | —       | 1.00 (1.00, 1.00)**| 0.00    |
| Time of Last Joint        | Last Thing before Bed                      | 2006| —                | —       | 1.00              | —       |
|                           | 1–2 hours before bed                        | 3137| —                | —       | 0.46 (0.31, 0.60)**| 0.00    |
|                           | 3–4 hours before bed                        | 984 | —                | —       | 0.15 (−0.21, 0.52)**| 0.00    |
|                           | More than 4 hours before bed               | 263 | —                | —       | 0.24 (−0.43, 0.90)**| 0.00    |
|                           | Constant                                   | —   | 0.34 (0.23, 0.45)| —       | 0.06 (−0.23, 0.35) | —       |
| N                         |                                            | 6390| —                | 6390    | —                 | 6390    |

Table 3. Consuming First Joint Within an Hour after Waking and Spliff Usage Patterns, With and Without Adjusting for Controls (N = 6390). *OR, adjusted odds ratio. OR, odds ratio. **p < 0.05; ***p < 0.01.
residence and recruitment mode were not included. Not everyone in the sample reported smoking joints and future studies can exclusively recruit joint smokers. Our definition of spliffs did not include blunts, which can be detailed in future research. The survey item did not explicitly refer to spliffs and it is possible that some respondents thought the item indicated other ways of mixing cannabis with tobacco. We will explicitly refer to spliffs in future survey iterations. It is possible that participants who reported not smoking tobacco but use spliffs mistakenly reported consuming tobacco on one question but not the other. We were not able to control for such effects but will include corrective mechanisms in future survey iterations. Those who had their last joint just before bed had a greater median time spent stoned compared to the larger sample. We did not conduct analysis with time of last joint, which may be marker of problematic use. We handled missing data with multiple imputation. While results from original and imputed datasets converged, a reduced rate of missing data would increase reliability of findings.

Concluding statement. Accounting for controls, in the US, compared to those who smoked tobacco and did not use spliffs, those with the following spliff usage behaviours were less likely to have their first joint within 60 minutes of waking: those who smoked tobacco and used spliffs; those who never smoked tobacco and did not use spliffs; those who never smoked tobacco and used spliffs. We provided some possible explanations for our results and suggested further research to better understand findings. Overall, we shed light on time of first joint and spliff usage behaviours, important given expanding US cannabis markets.

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**Competing interests**
The authors declare no competing interests.

**Additional information**
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Correspondence and requests for materials should be addressed to N.K.

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