Community Drug Early Warning System (CDEWS-3): Washington, DC - Site 3 of 4

Office of National Drug Control Policy
Executive Office of the President
May 2017

ACKNOWLEDGMENTS

This report was funded by Cooperative Agreement #G14UMARYLAND awarded by the Executive Office of the President, Office of National Drug Control Policy (ONDCP), to the University of Maryland's Center for Substance Abuse Research (CESAR). Eric D. Wish, Ph.D. (Principal Investigator), Amy Billing, MSSA, Eleanor Erin Artigiani, MA, Felix Adatsi, Ph.D., and Jerome Robinson, M.F.S produced this report. Fe Caces, Ph.D., served as reviewer and Project Manager at ONDCP and Terry Zobeck, Ph.D., also served as a reviewer.

We are grateful to the criminal justice and laboratory staff that worked with us on this project. Without the support and assistance of the Pretrial Services Agency for the District of Columbia and Court Services and Offender Supervision Agency for the District of Columbia, this project could not have been completed. The independent laboratory analyses for this report were conducted by the Armed Forces Medical Examiner System (AFMES) Laboratory. We would like to thank the specific staff listed below:

Pretrial Services Agency for the District of Columbia and Court Services and Offender Supervision Agency for the District of Columbia

Clifford Keenan
Claire Fay
Spurgeon Kennedy

Armed Forces Medical Examiner System Laboratory

Dr. Jeff Walterscheid
Lt. Commander Pedro Ortiz
Major Lynn Wagner
CTR Anastasia Berrier
CTR Kimberley Heine
CTR Theresa Hippolyte
CTR Paul Kaiser

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Notice

> Billing, A.S., Artigiani, E.E., Robinson, J., Adatsi, F. and Wish, E.D. (2017). *Community Drug Early Warning System (CDEWS-3): Washington, DC – Site 3 of 4*. Office of National Drug Control Policy. Washington, DC: Executive Office of the President.

Electronic Access to Publication

This document can be accessed electronically through the following World Wide Web address:

http://www.whitehouse.gov/ondcp

Originating Office

Executive Office of the President
Office of National Drug Control Policy
Washington, DC 20503

May 2017

Abstract

The Community Drug Early Warning System (CDEWS) provides timely information about emerging drug use in criminal justice populations in local communities by collecting and re-testing urine specimens already obtained and tested for a limited panel of drugs by local criminal justice testing programs. CDEWS or local staff sample specimens that are ready to be discarded and send them to an independent laboratory for testing for an expanded panel of drugs. By using already collected de-identified urine specimens, CDEWS can provide a relatively quick and inexpensive snapshot of the types of drugs recently used by participating populations.

The CDEWS methodology has been implemented in five jurisdictions and the results are contained in two reports already released by the Office of National Drug Control Policy (Wish et al., 2013, 2015). This report presents findings from a single jurisdiction – the Pretrial Services Agency for the District of Columbia/Court Services and Offender Supervision Agency adult parole and probation program for the District of Columbia -- as part 3 of 4 sites for the third CDEWS Study, called CDEWS-3.

Adult parolees and probationers in the District of Columbia were studied in both of the prior CDEWS-1 and CDEWS-2 studies. These studies demonstrated the potential use of the CDEWS methodology for identifying the emergence of a new type of synthetic drug in Washington, DC--synthetic cannabinoids (SC). The current study, CDEWS-3, added 6 recently developed tests for newly identified SC metabolites and can provide additional information on the changing use and availability of the SC used by this population at high risk for drug use.

CDEWS-3 collected 120 specimens that had tested positive for any drug by the routine local criminal justice testing program (CJS+) and 150 specimens that had tested negative for any drug by the routine local criminal justice testing program (CJS-). As expected, the most dramatic results focused on the 31 specimens that the CDEWS laboratory found tested positive for SC. Among male probationers and parolees ages 18-30 (found in our prior studies to be at higher risk for SC use), only 16% of the CJS+ specimens and 15% of the CJS- specimens tested positive for SC, far below the percentages found in the CDEWS-1 and CDEWS-2 studies. This reduction in overall use was found even though CDEWS-3 tested for six additional SC metabolites (for a total of 27) and most of these newly added SC metabolites were detected in the SC+ specimens. In contrast to CDEWS-2, the percentage of synthetic cannabinoid positives was similar regardless of whether the probationer or parolee had passed or failed the criminal justice screen.

We found that 5 of the 6 newly added SC metabolites (AB-CHMINACA (parent), AB-CHMINACA (metab 4), AB-CHMINACA (metab 6), AB-FUBINACA (parent), and ADB-FUBINACA (parent)), were detected in the specimens. Only the metabolite 5F-AMB was not detected. However, these 5 newer metabolites did not appear to supplant the older metabolites. In fact, two of the older SC metabolites, UR-144 and XLR-11, were still prominent in CDEWS-3 specimens (found in 42% and 26% of SC+ specimens, respectively), although less so than in the prior CDEWS studies.

We estimated that had we not added the 6 new metabolites to our former test panel of 21 metabolites, we still would have identified 87% of the SC+ specimens we found using the larger test panel of 27 SC metabolites. In fact, the SC+ specimens in CDEWS-3 contained an average of 3.6 different SC metabolites. **Our results suggest that newly available metabolites are being found along with the older metabolites, rather than replacing them. This notion runs contrary to the widely held belief that once a SC metabolite is scheduled and prohibited, manufacturers simply abandon it and replace it with newly created chemicals.**

Taken together, the three CDEWS studies support the unique ability of CDEWS to track the rise and fall of an emerging drug in a high risk population. The earlier studies highlighted the rise in persons testing positive for SC. In the current study, we found lower numbers of persons testing positive for SC and that younger persons may be less likely to use the drug. There may also be fewer probationers and parolees turning to SC to avoid detection by the standard CJS drug screens. While this decline is a welcome sign, our findings are still very concerning because those who are using SC are likely exposing themselves to a diverse combination of new and old chemicals that may cause unpredictable and/or severe consequences to their health and well-being.

Table of Contents

List of Tables

List of Figures

Introduction

The Community Drug Early Warning System (CDEWS) provides timely information about emerging drug use in criminal justice populations in local communities by sampling and re-testing urine specimens already obtained and tested for a limited panel of drugs by local criminal justice testing programs. CDEWS or local staff sample the specimens that are ready to be discarded and send them de-identified to an independent laboratory for testing for an expanded panel of drugs. By using already collected urine specimens, CDEWS can provide a relatively quick and inexpensive snapshot of the types of drugs recently used by criminal justice populations (see Appendices A and B for details). Thus, the CDEWS methodology is designed to achieve two primary objectives: 1) to identify and describe the use of emerging drugs in populations at high risk for recent drug use; and 2) to specify any important drugs that the current local testing program may be missing. A major innovation in the CDEWS methodology used in the current study is the expansion of the CDEWS testing panel to include testing for more than 150 licit and illicit substances, including opioids, benzodiazepines, antidepressants, and new psychoactive substances (NPS), using more sensitive testing technology.

The CDEWS results are especially important for detecting emerging drugs because prior epidemics in the use of illegal drugs have often shown up in the trends in urinalysis results from criminal justice populations before they have become evident in the larger community (DuPont & Wish, 1992; Wish, 1997). In addition, local testing programs typically can test for only a small number (often 6-12) of different drugs and the CDEWS results for more than 150 substances can be used by the local testing programs to gain some insight into whether their standard limited test panel is adequate to identify most of the drugs being used by their tested population.

The CDEWS methodology has now been piloted in five jurisdictions and the results are provided in two reports already released by the Office of National Drug Control Policy (ONDCP) (Wish et al., 2013, 2015). This report contains findings from a single jurisdiction -- the Pretrial Services Agency for the District of Columbia/Court Services and Offender Supervision Agency adult parole and probation program and constitutes the third of 4 sites participating in the third iteration of CDEWS (CDEWS-3).

Adult parolees and probationers in the District of Columbia were studied in both of the prior CDEWS-1 and CDEWS-2 studies. These studies demonstrated the potential use of the CDEWS methodology for identifying and monitoring the emergence of a new type of synthetic drug in Washington, DC -- synthetic cannabinoids (SC). The inclusion of probationers and parolees from Washington in the CDEWS-3 study provides a unique opportunity to observe how repetitive CDEWS studies of a population can be used to track the changing patterns of use of an emerging drug. For example, two of the SC metabolites most likely to be detected in specimens from CDEWS-1, UR-144 and XLR-11, were again found in CDEWS-2. But CDEWS-2 also identified a few of the newer SC metabolites, including PB-22 and 5F-PB-22, that were added to the CDEWS-2 test panel. The current study, CDEWS-3, added 6 recently developed tests for newly identified SC metabolites and can

provide additional information on the changing use and availability of SC use by a population at high risk for drug use.

Methodology

Site Selection Procedures

We sought specimens from adults who had been urine drug tested by the DC parole and probation testing program. These parolees/probationers had residences primarily in Washington, DC, with a few living in the neighboring states of Maryland and Virginia. Logistics for data collection were discussed with site staff over the phone to establish the study protocols. Prior to data collection, CESAR submitted an application for the necessary approvals from the Pretrial Services Agency for the District of Columbia and obtained approval for the CDEWS-3 study from University of Maryland's Institutional Review Board (IRB). The specific steps taken to recruit and work with this site are described in Appendix A, along with more details about the specimen collection in Appendix B. Table 1 below provides an overview of the key characteristics of this site.

Washington, DC Adult Parolees and Probationers

In 2015, the Court Services and Offender Supervision Agency for the District of Columbia collected about 206,465 urine specimens from an estimated number of approximately 13,009 parolees and probationers. These specimens are then tested by the Pretrial Services Agency for the District of Columbia (PSA) using an onsite laboratory. Specimens are tested using enzyme immunoassay (EIA) methods for 6-Monoacetylmorphine (6-MAM) to detect heroin, amphetamine, cocaine, marijuana, opiates, PCP and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. Upon the probation officer's request, some specimens may also be tested for methadone. All amphetamine positives are confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. In October 2015, PSA started testing for synthetic cannabinoids using Homogenous Enzyme Immunoassay (HEIA), a technology to target the suspected SC varieties in current use (particularly UR-144, XLR-11, and their major metabolites).

Targeted Number of Specimens

We targeted for collection a total of 250 specimens from unduplicated adult male and female parolees and probationers. As was the case with prior CDEWS studies, we wanted to collect enough specimens that had tested positive or negative for anything by the standard local CJS drug screen so that we might compare their results. We therefore worked with the local staff to collect 100 CJS+ and 150 CJS- specimens. We oversampled CJS- specimens because previous CDEWS studies had revealed a large number of synthetic cannabinoid positives occurred in this subgroup. We wanted to determine whether this finding still held for the CDEWS-3 study. In addition, a sample of 20 specimens positive for amphetamine were sampled separately because amphetamine positive

specimens are held and processed separately by PSA.

Table 1: Description of the Participating Study Site

Site	Populations Covered	CJS Testing Protocol	Drugs in Standard CJS Screen	Targeted Number of Specimens to be Collected for CDEWS
DC: Court Services and Offender Supervision Agency for the District of Columbia (CSOSA)	Adult parolees and probationers (In 2015, the Court Services and Offender Supervision Agency for the District of Columbia collected about 206,465 urine specimens from an estimated number of approximately 13,009 parolees and probationers.)	Onsite laboratory	7-drug panel screen: 6-Monoacetylmorphine (6-MAM) to detect heroin, amphetamine, cocaine, marijuana, opiates, PCP and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. Methadone is tested upon request. All amphetamine positives were confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. Synthetic cannabinoids are tested by PSA using Homogenous Enzyme Immunoassay (HEIA).	250 specimens (100 CJS positives; 150 CJS negatives) and 20 amphetamine CJS positive specimens

Collection of Urine Specimens

Prior to collecting the urine specimens, CESAR staff talked with staff from the program by phone to determine their policies regarding required specimen holding periods, testing protocols, detection limits and other relevant site details. Specimens were then accumulated by the program using the specific CDEWS guidelines provided by CESAR as to how specimens were to be handled and stored. Additional details of the specimen selection appear in Appendix B and details about the CDEWS-3 laboratory test panel in Appendix C.

Interviews with Toxicologists to Develop the CDEWS-3 Testing Panel

In the prior CDEWS studies, we had learned that both the chemical composition of synthetic drugs available and patterns of use can vary widely even within a brief period of time. It is a recognized challenge for both laboratories and law enforcement to keep up with the rapid changes in the composition of synthetic drugs. The chemists producing these drugs modify the chemical structures of the drugs as existing formulations are scheduled by the DEA and made illegal. To ensure that the drug test panel for this third phase of the study, CDEWS-3, was as current as possible and included the most relevant drugs/metabolites, CESAR staff reviewed data on emerging drug trends and conducted interviews with toxicologists and other relevant professional contacts to identify substances for inclusion on the CDEWS-3 panel. Additional information on the data reviewed and persons interviewed appears in Appendix C (see also Table C-1). Based on the information reviewed,

we added six new SC metabolites to the SC test panel we had used in CDEWS-2, along with 14 additional new psychoactive substances (see Table C-2 in Appendix C for the full panel). Other SC metabolites were recently discovered, but urine tests for many of them were not available at the time of CDEWS-3, and could not be included in our test panel.

Testing of Urine Specimens by the New CDEWS-3 Independent Laboratory

All specimens were sent to the CDEWS independent laboratory, the Armed Forces Medical Examiner System (AFMES) Laboratory located in Delaware, for an expanded drug testing panel (see Table C-2 in Appendix C). All specimens were tested for a panel of 27 SC metabolites and 37 other new psychoactive substances, along with 89 other illicit and prescription drugs.

Results

In this report, *CJS test results* refers to the limited 7-drug screen routinely used by the local criminal justice agency to screen adult parolees and probationers. The *CDEWS test results* refers to the expanded drug tests used by the CDEWS independent laboratory, which also included all of the drugs tested for by the smaller CJS test panel.

We first describe the specimens collected and some basic demographic information about the persons who provided them. Next, we describe the CDEWS test results for specimens tested with our expanded drug screen. The results for CJS positive (CJS+) and CJS negative (CJS-) specimens are presented separately because we stratified our sample selection by whether the CJS sample was positive or negative for any drug in the local CJS drug screen. Given this sample stratification, it would be inappropriate for our analyses to simply combine and average all of the specimen results. Throughout this report, we have combined the PSA positive specimens with the separately sampled 20 amphetamine positive specimens and then weighted the amphetamine positive specimens to their expected proportion (4.3%) among all positive specimens, obtained from PSA. Finally, we present a comparison of the findings from this study, to the CDEWS-1 and CDEWS-2 findings for adult parolees and probationers from Washington, DC.

A. Specimens Received

Specimens obtained by CDEWS-3 had been collected from persons tested between August 2015 and October 2015. Table 2 shows the specimens received, according to the local CJS tests results. We received 120 CJS+ and 150 CJS- specimens from adult parolees and probationers.

Table 2: Number of CJS Positive and Negative Specimens Sampled

Site and Population	CJS Test Result		
	Positive	*Negative*	*Total*
Washington, DC: Pretrial Services Agency for the District of Columbia (PSA)			
CSOSA Parole & Probation	120*	150	270

*Includes a sample of 20 specimens that were found by PSA to test positive for amphetamine.

B. Demographic Characteristics of Persons Providing Specimens

Table 3 shows that the demographic characteristics of the persons who provided CJS+ and CJS- specimens were quite similar. The large majority came from men (79-83%) and African-Americans (93-97%), and 53% of the CJS+ and 41% of the CJS- specimens came from persons 41 or older. Their residence was also similar with most specimens originating from Wards 5 or 8 in both CJS+ and CJS- groups. A minority of specimens (11-13%) came from the neighboring state of Maryland, and 2% or fewer specimens came from Virginia.

C. Drugs Detected by the CDEWS Laboratory

Illicit or Prescription Drugs, excluding New Psychoactive Substances (NPS) and Synthetic Cannabinoids (SC). Table 4 presents the CDEWS independent laboratory's test results grouped according to whether the specimen had tested CJS+ or CJS- by the PSA laboratory.

CJS+ Specimens: Marijuana (37%), cocaine (38%) and PCP (20%), are included in the standard PSA screen and were, by definition, the drugs most likely to be detected in CJS+ specimens. In addition, 27% of the CJS+ specimens contained any opioid, typically morphine (18%), codeine (11%) and/or methadone (12%). Codeine is metabolized to morphine and may therefore be double counted here. Only a few specimens (5%) contained 6-MAM, a metabolite of heroin, but much of the original heroin may already have been metabolized to morphine. Research on the metabolism of 6-MAM indicates that this compound has a very short detection time of less than 8 hours which may have made it difficult to detect it in the study specimens (Cone et al., 1991). Fentanyl and its analogues were relatively rare, found in 3% or fewer of specimens. Most other drugs were rarely detected, with a small percentage containing any antidepressants (10%) or any benzodiazepines (7%).

CJS- Specimens: The CJS- specimens contained few drugs. The primary exception was marijuana (17%). A small number of specimens contained any opioids (11%), mostly morphine (5%) or buprenorphine (3%). Antidepressants were found in 10% of the CJS- specimens.

New Psychoactive Substances. The most common new psychoactive substance detected in CJS+ or CJS- specimens was mCPP (5-7%, see Table 4). The presence of mCPP could be caused by the use of Trazodone (an antidepressant) or by mCPP use alone. Ethylone was rarely detected (1-3%).

Synthetic Cannabinoids. SC metabolites were found in both CJS+ (9%) and CJS- (14%) specimens (see Table 4). In fact, 5 of the 6 SC metabolites newly added to the CDEWS-3 test panel were detected and are indicated in all tables within the report by bold type. The only newly added SC metabolite not detected was 5F-AMB (excluded from table). Of the 12 total SC metabolites detected, 8 were found in the CJS+ specimens and all 12 were detected in the CJS- specimens.

Combinations of SC metabolites. A total of 31 specimens from the CJS+ and CJS- groups tested positive for any SC. Table 5 shows the detection of each metabolite in these 31 SC+ specimens and the total number of metabolites found in each specimen. AB-CHMINACA (metab 4), a metabolite newly added to the CDEWS test panel, was found in 77% of the SC positive specimens. Two of the newly added metabolites, AB-CHMINACA (Parent) and ADB-FUBINACA (Parent) were found in 32% and 29% of the SC+ specimens, respectively. AB-CHMINACA (metab 6) and AB-FUBINACA (Parent) were found in only 10% and 3%, respectively. It is noteworthy that many of the older SC metabolites that had been detected in our earlier CDEWS-1 study were found in the CDEWS-3 specimens. For example, UR-144 and XLR-11 were still detected in a significant proportion (42% and 26%, respectively) of the CDEWS-3 specimens.

The bottom of Table 5 shows the number of metabolites found in each of these 31 SC+ specimens. Only 7% contained one SC metabolite but 45% contained 4 or more. The average number of SC metabolites detected in these specimens was 3.6.

Table 6 shows the specific combinations of metabolites detected in the 31 SC+ specimens. Of the 24 specimens that contained the newly added metabolite AB-CHMINACA (metab 4), 67%, also contained the older metabolite, AB-PINACA, and 50% contained 5F-PB-22.

Given that the newly added SC metabolites were often found along with the older metabolites, we estimated how many more SC+ specimens we identified by adding the newer SC metabolites to our test panel. We found that had we not added these 6 new metabolites to the CDEWS test panel and only tested for 21 metabolites, we still would have detected 87% of the 31 specimens that tested positive for any of the 27 metabolites tested for in CDEWS-3.

SC+, by PSA test result and age. Figure 1 shows the percentage of adult male parolees and probationers that tested positive for SC, according to their PSA test result and age. Females were removed from this analysis due to an insufficient sample size. The number of specimens obtained resulted in small cell sizes, yielding little statistical power to detect differences between the two groups. These comparisons can only suggest possible patterns for future research. While differences were not statistically significant, it appears that among males 26 and older, SC use may have been somewhat more common among CJS- persons than CJS+ persons. This did not appear to be the case for males aged 21-25. Regardless of their CJS test status, males between the ages of 26-40 appear most likely to test positive for SC.

SC+, by zip code of residence. Table 7 shows the metabolites found in 29 specimens for which residence was available. These metabolites were found widely throughout the District of Columbia.

D. Comparison of Test Results for Specimens from Males and Females

Table 8 compares the CDEWS laboratory test results for specimens provided by males and females. The number of specimens available for females was small and can provide only an indication of possible differences between males and females.

CJS+ Specimens: PCP was more likely to be found in CJS+ specimens from females than males (38% vs. 16%, p<.05). Both Trazodone and mCPP were detected more often in CJS+ specimens from females than males (20% vs. 2%, p<.01). Five SC metabolites were detected in CJS+ specimens from females and 8 SC metabolites were detected in CJS+ specimens from males. While this difference was not significant, marijuana was detected in 40% of the CJS+ specimens from males and in 24% of those from females, which may be indicative of use patterns. The percentage testing positive for any opiates was similar in males and females.

CJS- Specimens: No differences were found in the drugs detected in males and females. However, three different SC metabolites were detected in the specimens from females and 12 were found in the specimens from males.

E. Comparison of Findings for DC Parolees and Probationers from the Three CDEWS Studies

Specimens were collected from parolees and probationers in Washington D.C. for all three CDEWS studies completed to date. Because amphetamine positive specimens were segregated by PSA and not collected in CDEWS-1, we excluded the amphetamine positive specimens we collected in CDEWS-2 and CDEWS-3 from the comparisons below. The CDEWS-1 collection was conducted in late 2012/early 2013. The CDEWS-2 collection was conducted in late 2013/early 2014 and the CDEWS-3 study was conducted in 2015. All analyses presented in this section use results from only parolees and probationers.

Changes in Illicit/Prescription Drugs in DC Adult Parolees and Probationers.

CJS+ Specimens: The percentage of specimens found to be positive for marijuana or opiates, two of the drugs included on the PSA drug screen, were stable over the three studies (see Table 9). Significant increases in positives were found for cocaine (18% to 38%, p<.001) and PCP (10% to 21%, p<.01). While the percentage positive for any opiates remained relatively stable over time, ranging from 23-25%, some changes were detected in individual opiates, with buprenorphine positives declining from 13% to 3%, p<.001 and hydromorphone positives increasing from 3% to 9% (p<.01). Some increases in the number of drug positives found in CDEWS-3 may result from the higher sensitivity of the tests used in testing for some drugs in CDEWS-3. Cocaine, PCP and marijuana were

screened at higher sensitivity levels in CDEWS-3, than in CDEWS-1 and CDEWS-2. The testing panels and levels of detection employed in all three CDEWS studies are presented in Appendices C-E.

CJS- Specimens: With the exception of marijuana, other drugs were rarely detected in the CJS- specimens. There was a significant increase in the detection of marijuana in the CJS- specimens in CDEWS-3 (0% to 17%, p<.001). This increase may be due to the greater sensitivity of the marijuana test used by the new laboratory in CDEWS-3 or may also have resulted from increasing levels of marijuana use following its decriminalization in Washington, DC in July 2014.

Changes in SC Metabolites in DC Adult Parole and Probationers. Table 10 includes the 15 SC metabolites that were detected in at least one specimen from any of the three CDEWS studies. Several of the older generation cannabinoids that were tested for in the earlier CDEWS studies, such as UR-144 and XLR-11 were detected in all three studies. Four metabolites were detected in the CDEWS-1 study, 5 in CDEWS-2 and 12 in CDEWS-3. This was expected, given the addition of new metabolites to the SC test panel adopted for each subsequent CDEWS study. The two metabolites tested in all 3 studies, UR-144 and XLR-11 showed significant changes over time. Only 42% of the SC+ specimens collected in CDEWS-3 contained UR-144, down from more than 90% in the two prior studies (p<.001). XLR-11 also declined since the CDEWS-1 study from 40% to 26%, p<.001). Among the newer metabolites first introduced in CDEWS-2, AB-PINACA (0% to 65%, p<.001), 5F-PB-22 (10% to 52%, p<.001) and 5F-AB-PINACA (0% to 10%, p<.05) showed significant increases, while PB-22 declined from 40% to 10% (p<.01).

Correlates of Testing Positive for SC in DC Adult Parole and Probationers.

PSA test result and age. Figure 2 shows the likelihood that specimens from young adult males ages 18-30 tested positive for SC, by PSA test result. Females were excluded from these analyses because of their small number. The CDEWS-2 study found that males 18-30 who were CJS- were more likely to test positive for synthetic cannabinoids than those who were CJS+ (60% vs 27%, p<.01). However, this was no longer found to be the case in CDEWS-3, as the percentage of young adult males testing positive for synthetic cannabinoids was found to be almost the same, regardless of whether they had tested positive or negative on the more limited PSA drug test screen.

Residence in Washington, DC. Table 11 compares the distribution of the SC+ test results from each ward to the distribution of all specimens obtained from each ward. As in previous CDEWS studies, the likelihood of testing positive for SC in each ward largely followed the general geographic distribution of all specimens collected. However, as found in CDEWS-2, SC positive results were somewhat overrepresented in Ward 8 and underrepresented in Ward 4. In the CDEWS-1 and CDEWS-2 studies, Ward 7 was overrepresented for SC positives, but not in CDEWS-3.

Mean Age of Persons Positive for Specific Drugs. Table 12 shows that the mean age of persons positive for most drugs was relatively stable across the three CDEWS studies. The only significant change in ages over the three studies was found for synthetic cannabinoids. The mean age

of persons who tested positive for synthetic cannabinoids increased from 28.1 years in CDEWS-1 to 30.8 years in CDEWS-2 to 35.8 years in CDEWS-3 ($p<.01$). As found in all three CDEWS studies, marijuana, synthetic cannabinoids, and PCP tended to be found in persons under age 40 and opioids were found more commonly among persons over age 40. In all three studies, persons who tested positive for methadone or buprenorphine had the highest mean ages.

PCP and Marijuana Use, By Gender. Figure 3 shows that in CDEWS-2 and CDEWS-3, CJS+ specimens from females were significantly more likely to contain PCP than specimens from males. In contrast, as shown in Figure 4, CJS+ specimens from males were significantly more likely to contain marijuana in CDEWS-2 (27% vs. 8%, $p<.05$). CDEWS-1 and CDEWS-3 showed similar, but not statistically significant, patterns for marijuana.

Table 3: Demographic Characteristics of Adult DC Parolees & Probationers Providing Specimens, by PSA Drug Screen Result*

(N=270 specimens)

	Parole & Probation	
	PSA Screen Positive† *(N=120)*	*PSA Screen Negative (N=150)*
Gender		
Male	79%	83%
Race		
Black/African-American	93%	97%
Caucasian	7	3
Age		
18 to 20	5%	4%
21 to 25	13 (30%)	18 (37%)
26 to 30	12	15
31 to 40	17	22
41 to 50	22 (53%)	20 (41%)
51 and older	31	21
Total	100%	100%
Ward‡		
DC – Ward 1	3%	1%
DC – Ward 2	4	8
DC – Ward 4	6	10
DC – Ward 5	18	13
DC – Ward 6	6	3
DC – Ward 7	14	17
DC – Ward 8	26	27
Maryland	13	11
Virginia	0	2
Unknown	10	8
Total	100%	100%

*Pretrial Services Agency for the District of Columbia (PSA) tested the Parole & Probation population for 6-MAM, amphetamine, cocaine, marijuana, opiates, PCP and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. All amphetamine positives were confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. Synthetic cannabinoids are tested by PSA using Homogenous Enzyme Immunoassay (HEIA), and methadone is tested upon request. Separate estimates for the "PSA Screen Positive" and the "PSA Screen Negative" categories should not be averaged to create an overall estimate.

^N's differ for some characteristics because of missing information.

†Positive specimens from the DC Parole & Probation sample were weighted due to oversampling of amphetamine positive specimens.

‡Residence was determined by zip code. Zip codes overlapping multiple wards were placed in the ward that appeared to include 50% or more of the zip code. Ward 1: 20009, 20010; Ward 2: 20001, 20005, 20013; Ward 4: 20011, 20012; Ward 5: 20002, 20017, 20018; Ward 6: 20003, 20024; Ward 7: 20019; Ward 8: 20020, 20032. Unknown: No data on residence. Ward 3 was eliminated from the table because there were no specimens from zip codes in this ward.

Note: Certain percentages have been rounded in order for the total to equal 100%.

Table 4: CDEWS Laboratory Test Results for Adult DC Parole & Probation, by PSA Drug Screen Result^

(N=270 specimens collected between August 2015–October 2015)

Percentage Positive by CDEWS Lab for:	PSA Screen Positive‡ (for any drug) (N=120)	PSA Screen Negative (for any drug) (N=150)
Marijuana	37%	17%≈
Cocaine	38	3
PCP	20	0
Amphetamine	3	0
Any Opioid§	27	11
Morphine	18	5
Codeine	11	1
Methadone Metabolite (EDDP)	12	<1
Hydromorphone	9	0
Buprenorphine+	3	3
6-Monoacetylmorphine (6-MAM)	5	0
Oxycodone	0	1
Hydrocodone	<1	0
Oxymorphone	0	<1
Any Fentanyl	3	1
Acetylfentanyl	2	<1
Norfentanyl	2	0
Fentanyl	<1	<1
Any Synthetic Cannabinoid	9	14
AB-CHMINACA (metab 4)	8	11
AB-PINACA	6	9
5F-PB-22	8	5
UR-144	7	4
AB-CHMINACA (Parent)	4	4
ADB-FUBINACA (Parent)	0	6
XLR-11	5	2
5F-AB-PINACA	0	2
AB-CHMINACA (metab 6)	<1	1
PB-22	2	<1
ADB-PINACA	0	1
AB-FUBINACA (Parent)	0	<1
Any Antidepressant	10	10
Trazodone†	5	7
Sertraline	3	3
Citalopram	3	<1
Fluoxetine	3	0

Table 4 (Cont'd): CDEWS Laboratory Test Results for Adult DC Parole & Probation, by PSA Drug Screen Result^

Paroxetine	0	1
Amitriptyline	0	<1
Bupropion	<1	0
Desvenlafaxine/Desmethylvenlafaxine	0	<1
Nortriptyline	0	<1
Venlafaxine	0	<1
Any New Psychoactive Substance (NPS)	8	9
mCPP†	5	7
Ethylone	3	1
Benzylpiperazine	<1	0
Any Benzodiazepine	7*	1*
α-Hydroxyalprazolam	3	0
7-Aminoclonazepam	2	<1
Alprazolam	3	0
Clonazepam	<1	0
Lorazepam	<1	0
Oxazepam	0	<1
Temazepam	0	<1
Any Barbiturate	<1	0
Phenobarbital	<1	0
Other Drugs		
Dextromethorphan	5	3
Cetirizine	4	3
Naloxone	2	3
Promethazine	3	2
Quinidine/Quinine	4	0
Cyclobenzaprine	2	1
Haloperidol	2	<1
Methamphetamine	<1	<1
Hydroxyzine	<1	0

^Pretrial Services Agency for the District of Columbia (PSA) tested the Parole & Probation population for 6-MAM, amphetamine, cocaine, marijuana, opiates, PCP and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. All amphetamine positives were confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. Synthetic cannabinoids are tested by PSA using Homogenous Enzyme Immunoassay (HEIA), and methadone is tested upon request. Separate estimates for the "PSA Screen Positive" and the "PSA Screen Negative" categories should not be averaged to create an overall estimate.

‡Positive specimens from the DC Parole & Probation sample were weighted due to oversampling of amphetamine positive specimens.

≈Marijuana may have been detected by the CDEWS independent laboratory in some CJS- specimens because they use a more sensitive level of detection (15 ng/mL) for screening marijuana as compared to the DC PSA testing laboratory (50 ng/mL).

§Some specific opiates (e.g., morphine, codeine, etc.) could have been detected by PSA as part of the opiate screen in the routine PSA testing panel.

+All buprenorphine positives also tested positive for norbuprenorphine.

†Trazodone is an antidepressant whose major active metabolite is mCPP. It is not possible to definitively determine whether the presence of mCPP was due to Trazodone use or whether mCPP was taken on its own.

Notes: Bolded synthetic cannabinoid metabolites were newly added to the testing panel for CDEWS-3. Statistical tests between PSA screen positive and negative specimens were not run for drugs included in the PSA test screen.

*p<.05 by Fisher's exact test.

Table 5: Metabolites Detected in All Synthetic Cannabinoid (SC) Positive Specimens from Adult Parolees and Probationers in Washington, DC (Unweighted)

(N=31 specimens collected between August 2015–October 2015)

Percentage Positive for Each SC Metabolite (N=31)	
AB-CHMINACA (metab 4)	77%
AB-PINACA	65
5F-PB-22	52
UR-144	42
AB-CHMINACA (Parent)	32
ADB-FUBINACA (Parent)	29
XLR-11	26
AB-CHMINACA (metab 6)	10
5F-AB-PINACA	10
PB-22	10
ADB-PINACA	6
AB-FUBINACA (Parent)	3
Total Number of Metabolites Detected (of 12) in All SC Positive Specimens	
1	7%
2	29
3	19
4	19
5	16
6-11	10
Total	100%

45%

Notes:

Bolded metabolites were newly added to the testing panel for CDEWS-3.

Certain percentages have been rounded in order for the total to equal 100%

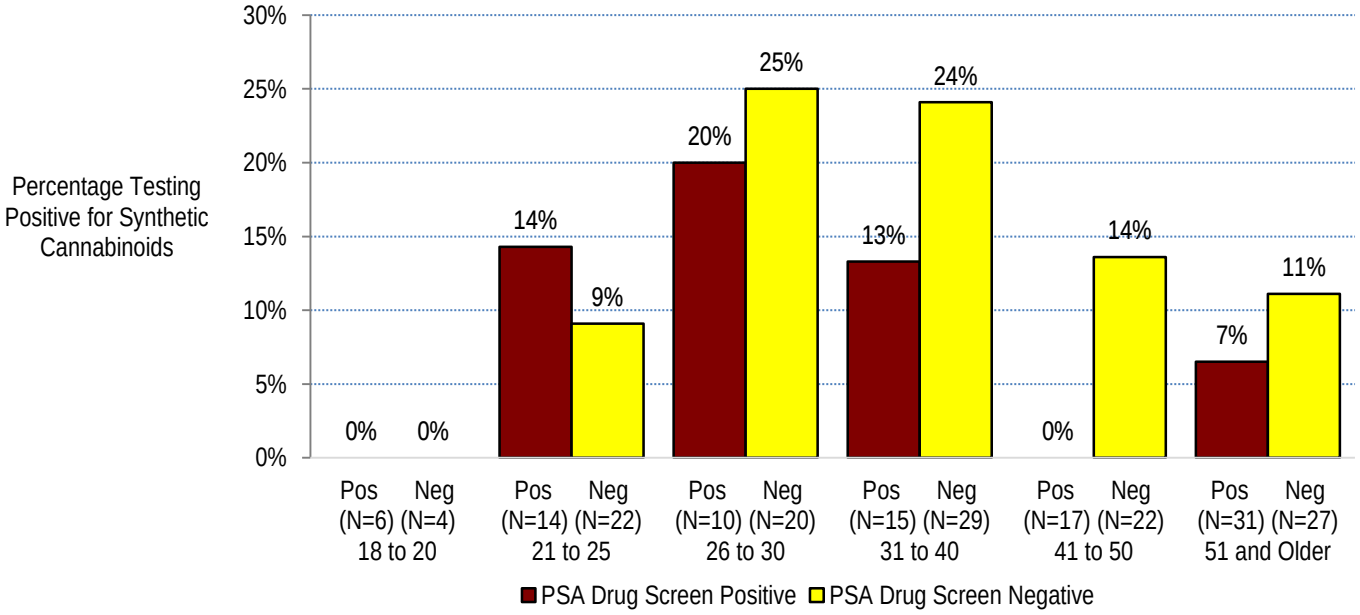
Table 6: Metabolites Detected in Each Synthetic Cannabinoid (SC) Positive Specimen from Adult Parolees and Probationers in Washington, DC (Unweighted)

(N=31 specimens collected between August 2015-October 2015)

SC Positive Specimen #	AB-CHMINACA (metab 4)	AB-PINACA	5F-PB-22	UR-144	AB-CHMINACA (Parent)	ADB-FUBINACA (Parent)	XLR-11	AB-CHMINACA (metab 6)	5F-AB-PINACA	PB-22	ADB-PINACA	AB-FUBINACA (Parent)	Total # of Metabolites
1	**+**				**+**								2
2	**+**	+	+										3
3	**+**	+											2
4	**+**												1
5				+			+						2
6			+	+			+						3
7	**+**	+	+	+	**+**	**+**	+	**+**	+	+		**+**	11
8	**+**	+											2
9		+	+	+									3
10	**+**		+										2
11	**+**	+	+	+	**+**	**+**			+				7
12		+				**+**							2
13	**+**	+		+	**+**	**+**							5
14	**+**	+				**+**					+		4
15								**+**	+				2
16	**+**					**+**							2
17	**+**	+											2
18	**+**	+	+										3
19	**+**	+				**+**					+		4
20	**+**	+	+		**+**	**+**							5
21	**+**	+			**+**	**+**							4
22	**+**	+	+	+	**+**		+	**+**					7
23	**+**												1
24	**+**	+	+										3
25	**+**	+	+		**+**								4
26		+	+	+									3
27	**+**			+	**+**		+						4
28		+	+	+			+			+			5
29	**+**	+	+	+	**+**								5
30	**+**		+	+			+						4
31	**+**		+	+			+			+			5
Total	24	20	16	13	10	9	8	3	3	3	2	1	–

Note: **Bolded** metabolites were newly added to the testing panel for CDEWS-3.

Figure 1: Percentage of Specimens for Adult Male DC Parolees & Probationers Testing Positive* for Synthetic Cannabinoids, by PSA Drug Screen Result and Age, 2015
(N=217 males^)



Note: PSA negative specimens were oversampled. Therefore, separate estimates for the "PSA Drug Screen Positive" and "PSA Screen Negative" groups should not be averaged to create an overall estimate.

*Positive specimens from the DC parole and probation sample were weighted due to oversampling of amphetamine positive specimens. See the results section of the full report.

^Females were removed from this analysis due to an insufficient sample size.

Table 7: Number of Synthetic Cannabinoid (SC) Positives*, by Zip Code (Unweighted)

(N=29 SC positive specimens of 233 total specimens)

Zip Code	N (Positive for any SC)	AB-CHMINACA (metab 4)	AB-PINACA	5F-PB-22	UR-144	AB-CHMINACA (Parent)	ADB-FUBINACA (Parent)	XLR-11	PB-22	AB-CHMINACA (metab 6)	5F-AB-PINACA	ADB-PINACA	AB-FUBINACA (Parent)
20001	2	2	1	2	2	1	-	1	-	-	-	-	-
20002	6	4	5	3	3	3	3	1	1	1	1	1	1
20003	1	1	1	-	-	-	-	-	-	-	-	-	-
20009	1	1	-	1	1	-	-	1	1	-	-	-	-
20012	1	1	1	1	-	1	1	-	-	-	-	-	-
20013	1	-	-	-	-	-	-	-	-	1	1	-	-
20019	5	3	3	3	3	1	1	2	1	-	1	-	-
20020	8	7	5	3	-	1	3	-	-	-	-	1	-
20032	3	2	2	3	2	1	-	2	-	1	-	-	-
20710	1	1	1	-	1	1	1	-	-	-	-	-	-
Total	29	22	19	16	12	9	9	7	3	3	3	2	1

Note: Only zip codes with at least one synthetic cannabinoid positive are represented in this table. Of the 31 synthetic cannabinoid positive specimens in the sample, 2 cases were missing zip code data and were omitted from this table.

Bolded metabolites were newly added to the testing panel for CDEWS-3.

*See Appendix C for the complete panel of synthetic cannabinoids tested for by the CDEWS laboratory.

Table 8: CDEWS Laboratory Test Results for Adult DC Parole & Probation, by Gender and PSA Drug Screen Result^

(N=270 specimens collected between August 2015–October 2015)

	PSA Screen Positive‡ (for any drug) (N=120)		PSA Screen Negative (for any drug) (N=150)	
Percent Positive by CDEWS Lab for:	Males (N=95)	Females (N=25)	Males (N=124)	Females (N=26)
Marijuana	40%	24%	16%~	23%~
Cocaine	36	42	4	0
PCP	16*	38*	0	0
Amphetamine	3	0	0	0
Any Opioid§	28	20	11	8
Morphine	21	8	6	4
Codeine	12	8	<1	4
Methadone Metabolite (EDDP)	12	8	<1	0
Hydromorphone	9	8	0	0
Buprenorphine+	4	0	4	0
6-Monoacetylmorphine (6-MAM)	6	0	0	0
Oxycodone	0	0	2	0
Hydrocodone	0	4	0	0
Oxymorphone	0	0	<1	0
Any Fentanyl	3	0	<1	4
Acetylfentanyl	2	0	<1	0
Norfentanyl	2	0	0	0
Fentanyl	1	0	0	4
Any Synthetic Cannabinoid	10	8	16	4
AB-CHMINACA (metab 4)	7	8	12	4
AB-PINACA	7	0	11	4
5F-PB-22	8	4	6	4
UR-144	6	8	5	0
AB-CHMINACA (Parent)	3	4	5	0
ADB-FUBINACA (Parent)	0	0	7	0
XLR-11	3	8	2	0
5F-AB-PINACA	0	0	2	0
AB-CHMINACA (metab 6)	1	0	2	0
PB-22	2	0	<1	0
ADB-PINACA	0	0	2	0
AB-FUBINACA (Parent)	0	0	<1	0
Any Antidepressant	6*	24*	9	15
Trazodone†	2**	20**	6	15
Sertraline	4	0	4	0
Citalopram	0	8	<1	0

Table 8 (Cont'd): CDEWS Laboratory Test Results for Adult DC Parole & Probation, by Gender and PSA Drug Screen Result^

Fluoxetine	1	8	0	0
Paroxetine	0	0	2	0
Amitriptyline	0	0	<1	0
Bupropion	1	0	0	0
Desvenlafaxine/Desmethylvenlafaxine	0	0	0	4
Nortriptyline	0	0	<1	0
Venlafaxine	0	0	0	4
Any New Psychoactive Substance (NPS)	5*	20*	7	15
mCPP†	2**	20**	6	15
Ethylone	3	0	2	0
Benzylpiperazine	1	0	0	0
Any Benzodiazepine	5	8	<1	4
α-Hydroxyalprazolam	4	0	0	0
7-Aminoclonazepam	1	4	<1	0
Alprazolam	3	0	0	0
Clonazepam	0	4	0	0
Lorazepam	0	4	0	0
Oxazepam	0	0	0	4
Temazepam	0	0	0	4
Any Barbiturate	0	4	0	0
Phenobarbital	0	4	0	0
Other Drugs				
Dextromethorphan	5	4	3	4
Cetirizine	3	4	3	4
Naloxone	2	0	4	0
Promethazine	1	4	2	0
Quinidine/Quinine	5	0	0	0
Cyclobenzaprine	2	0	<1	4
Haloperidol	0	8	<1	0
Methamphetamine	1	0	<1	0
Hydroxyzine	0	4	0	0

^Pretrial Services Agency for the District of Columbia (PSA) tested the Parole & Probation population for 6-MAM, amphetamine, cocaine, marijuana, opiates, PCP and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. All amphetamine positives were confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. Synthetic cannabinoids are tested by PSA using Homogenous Enzyme Immunoassay (HEIA), and methadone is tested upon request. Separate estimates for the "PSA Screen Positive" and the "PSA Screen Negative" categories should not be averaged to create an overall estimate.

‡Positive specimens from the DC Parole & Probation sample were weighted due to oversampling of amphetamine positive specimens.

≈Marijuana may have been detected by the CDEWS independent laboratory in some CJS- specimens because they use a more sensitive level of detection (15 ng/mL) for screening marijuana as compared to the DC PSA testing laboratory (50 ng/mL).

§Some specific opiates (e.g., morphine, codeine, etc.) could have been detected by PSA as part of the opiate screen in the routine PSA testing panel.

+All buprenorphine positives also tested positive for norbuprenorphine.

†Trazodone is an antidepressant whose major active metabolite is mCPP. It is not possible to definitively determine whether the presence of mCPP was due to Trazodone use or whether mCPP was taken on its own.

Note: **Bolded** synthetic cannabinoid metabolites were newly added to the testing panel for CDEWS-3.

*p<.05 by Fisher's exact test; **p<.01 by Fisher's exact test.

Table 9: CDEWS Laboratory Test Results for Adult Parolees and Probationers from Washington, DC, by PSA Drug Screen Result for CDEWS-1, CDEWS-2 and CDEWS-3 Studies

	PSA Screen Positive (for any drug)			PSA Screen Negative (for any drug)		
Percent Positive by CDEWS Lab for:	CDEWS-1 (N=197)	CDEWS-2 (N=188)^	CDEWS-3∞ (N=100)^	CDEWS-1 (N=103)	CDEWS-2 (N=101)	CDEWS-3∞ (N=150)
DATES OF COLLECTION	NOVEMBER 2012-JANUARY 2013	DECEMBER 2013-MARCH 2014	AUGUST 2015-OCTOBER 2015	NOVEMBER 2012-JANUARY 2013	DECEMBER 2013-MARCH 2014	AUGUST 2015-OCTOBER 2015
Marijuana≈	28%	25%	37%	0%***	0%***	17%***
Cocaine	18†***	25†***	38†***	0	0	3
PCP\\	10**	9**	21**	0	0	0
Opiates§	25	23	23‡	1	2	7‡
Morphine	22	20	19	1	2	5
Codeine	21	17	11	1	0	1
Buprenorphine+	13***	4***	3***	0	5	3
Methadone Metabolite (EDDP)	11	7	12	2	1	<1
Oxymorphone	5	5	0	0	2	<1
Oxycodone	5	5	0	0	3	1
Hydromorphone	3**	1**	9**	0	0	0
Hydrocodone	2	1	1	0	0	0

∞The levels of detection for the drugs in this table were more sensitive in the CDEWS-3 study than in the CDEWS-1 and CDEWS-2 studies. This is due to the fact that in CDEWS-3, LC/MS/MS testing was used to detect most of the drugs in the testing panel. In the earlier studies, TLC and EIA testing were conducted in conjunction with GC/MS and LC/MS confirmations for select drugs. The full testing panels, including levels of detection used for all three studies are referenced in Appendices C-E.

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this table.

≈The CDEWS-3 study used a more sensitive level of detection for marijuana (15 ng/mL) as compared to the previous two CDEWS studies (50 ng/mL).

†Cocaine positives from the "PSA Screen Positive" sample in CDEWS-1 is based on a subset of the sample (N=176). 21 PSA Screen Positive specimens from CDEWS-1 were excluded from this analysis as they were screened in error for cocaine with a detection limit of 300 ng/mL rather than 150 ng/mL which was the detection limit used for CDEWS-2. Given that we used LC/MS/MS to screen for most drugs in CDEWS-3, the level of detection for cocaine was more sensitive (25 ng/mL) in the CDEWS-3 study, which may explain the higher number of cocaine positives found in the CDEWS-3 study.

\\The CDEWS-3 study used a more sensitive level of detection for PCP (10 ng/mL) as compared to the previous two CDEWS studies (25 ng/mL).

§Some specific opiates (e.g., morphine, codeine, etc.) could have been detected by PSA as part of the opiate screen in the routine PSA testing panel.

‡For the CDEWS-3 opiates result, we approximated the EIA opiates panel used in the earlier CDEWS studies (CDEWS-1 and CDEWS-2) given that we were screening for all opioids using LC/MS/MS in the CDEWS-3 study. The CDEWS-3 opiates result includes morphine, codeine and hydrocodone positives only (Cone et al., 1992).

+All buprenorphine positives also tested positive for norbuprenorphine.

Note: Separate estimates for the "PSA Screen Positive" and the "PSA Screen Negative" categories should not be averaged to create an overall estimate.

**p<.01 by chi-square.

***p<.001 by chi-square.

Table 10: Metabolites Identified in Synthetic Cannabinoid (SC) Positive Specimens from Washington, DC, CDEWS-1, CDEWS-2, and CDEWS-3 Studies

	CDEWS-1 Adult Parole & Probation Population (N=45)	CDEWS-2 Adult Parole & Probation Population (N=67)^	CDEWS-3 Adult Parole & Probation Population (N=31)^
Percentage Positive by CDEWS Lab For:			
UR-144	91%***	99%***	42%***[a]
XLR-11	40%***	5%***	26%***[a]
JWH-018	7%	0%	0%
JWH-073	2%	0%	0%
AB-PINACA	Not Tested	0%***	65%***
5F-PB-22	Not Tested	10%***	52%***
PB-22	Not Tested	40%**	10%**
5F-AB-PINACA	Not Tested	0%*	10%*
ADB-PINACA	Not Tested	0%	7%
AKB-48	Not Tested	2%	0%
AB-CHMINACA (metab 4)	Not Tested	Not Tested	77%
AB-CHMINACA (Parent)	Not Tested	Not Tested	32%
ADB-FUBINACA (Parent)	Not Tested	Not Tested	29%
AB-CHMINACA (metab 6)	Not Tested	Not Tested	10%
AB-FUBINACA (Parent)	Not Tested	Not Tested	3%

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this table.

*p<.05 by chi-square or Fisher's exact test.

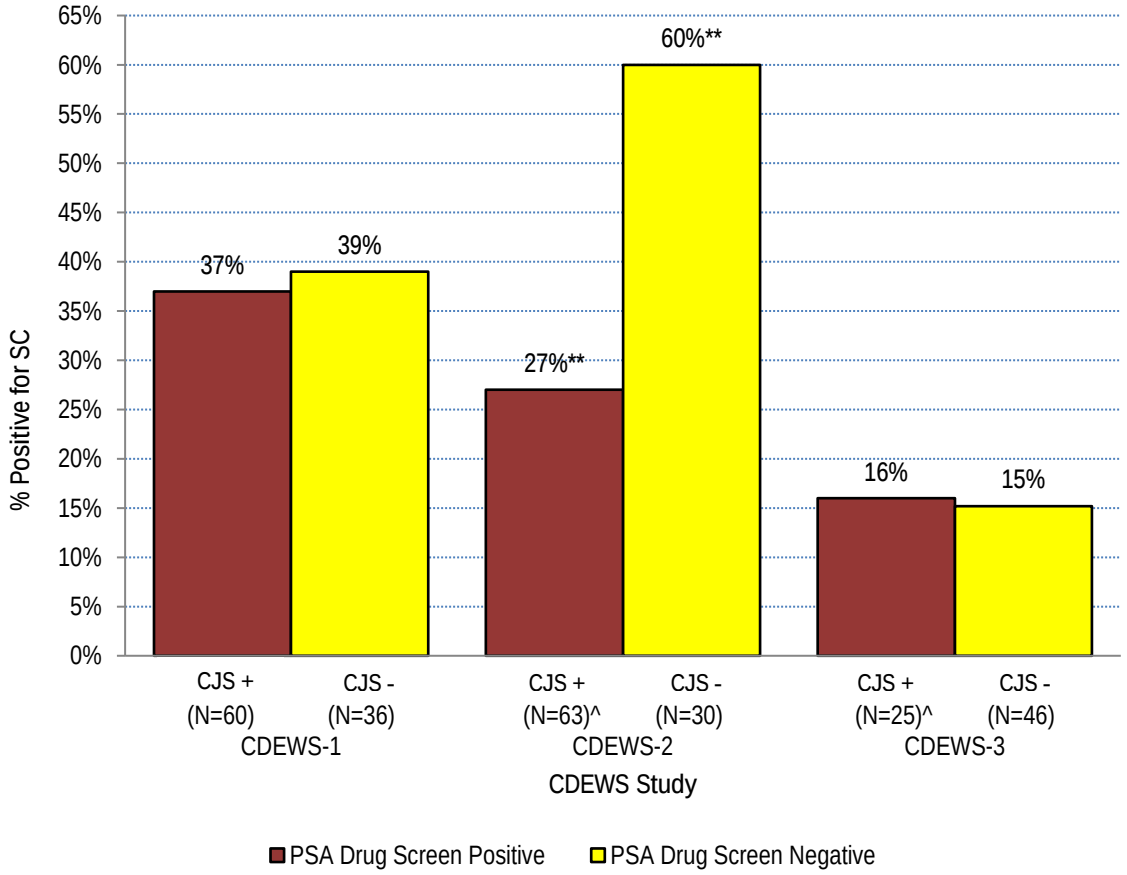
**p<.01 by chi-square or Fisher's exact test.

***p<.001 by chi-square or Fisher's exact test.

[a]2x3 chi-square or Fisher's exact test.

Figure 2: Percentage of Young Adult Males Testing Positive for Synthetic Cannabinoids (SC), by PSA Drug Screen Result and CDEWS Study

(N=260 Parolee/Probationer Specimens from Males Age 18-30)



Note: Separate estimates for the "PSA Drug Screen Positive" and "PSA Drug Screen Negative" groups should not be averaged to create an overall estimate.

**p<.01 by Fisher's exact test.

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this figure.

Table 11: Residence† from which DC Adult Parolee and Probationer Synthetic Cannabinoid Positive Specimens Came, by CDEWS Study

	CDEWS-1		CDEWS-2		CDEWS-3	
	All PSA Screened Specimens (for any drug) (N=156)	Positive by CDEWS Lab for Any Synthetic Cannabinoid (N=45)	All PSA Screened Specimens (for any drug) (N=286)^	Positive by CDEWS Lab for Any Synthetic Cannabinoid (N=64)	All PSA Screened Specimens (for any drug) (N=233)^	Positive by CDEWS Lab for Any Synthetic Cannabinoid (N=29)
Residents of Washington, DC:						
Ward 8	28%	27%	31%	36%	29%	38%
Ward 7	17	33	16	19	17	17
Ward 5	15	11	19	19	17	21
Ward 4	10	7	11	5	9	4
Ward 2	9	9	10	9	7	10
Ward 1	7	4	4	3	2	4
Ward 6	2	7	4	3	5	3
Ward 3	<1	0	<1	0	0	0
Residents Outside of Washington, DC:						
Maryland	11%	2%	4%	6%	13%	3%
Other States	<1	0	0	0	0	0
Virginia	0	0	<1	0	1	0
TOTAL	100%	100%	100%	100%	100%	100%

Note: Excluded from this table are 3 cases with missing zip codes from CDEWS-2 of which all were positive for synthetic cannabinoids, and 17 cases with missing zip codes from CDEWS-3 of which 2 specimens were positive for synthetic cannabinoids.

†Residence was determined by zip code. Zip codes overlapping multiple wards were placed in the ward that appeared to include 50% or more of the zip code. Ward 1: 20009, 20010; Ward 2: 20001, 20005, 20013, 20036, 20037, 20052; Ward 3: 20008; Ward 4: 20011, 20012, 20015; Ward 5: 20002, 20017, 20018, 20022, 20074; Ward 6: 20003, 20024; Ward 7: 20019; Ward 8: 20020, 20032.

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this table.

Table 12: Mean Age of Persons Positive for Specific Drugs in Washington, DC Adult Parolees and Probationers for CDEWS-1, CDEWS-2, and CDEWS-3 Studies

	CDEWS-1 Mean Age			CDEWS-2^ Mean Age			CDEWS-3^ Mean Age		
	(n)	$\bar{x}$	(SD)	(n)	$\bar{x}$	(SD)	(n)	$\bar{x}$	(SD)
Positive by CDEWS Lab for:									
Marijuana	(55)	29.5	(8.7)	(47)	27.5	(9.1)	(63)	30.5	(12.6)
Synthetic Cannabinoids	(45)	28.1**	(7.6)	(67)	30.8**	(9.2)	(31)	35.8**	(11.9)
PCP	(19)	32.8	(5.4)	(16)	31.6	(6.3)	(21)	36.2	(8.8)
Codeine	(43)	48.0	(10.2)	(32)	47.5	(13.3)	(13)	41.7	(14.2)
New Psychoactive Substance (NPS)	(0)	-	-	(0)	-	-	(21)	45.0	(13.1)
Antidepressant	(0)	-	-	(2†)	-	-	(24)	45.3	(12.2)
Opiates§	(50)	47.8	(10.7)	(45)	48.0	(12.1)	(33)	46.2	12.3
Morphine	(45)	48.5	(10.3)	(40)	50.4	(9.6)	(27)	46.6	(11.5)
Cocaine	(31)	49.5	(8.8)	(46)	46.5	(10.7)	(43)	47.5	(10.6)
Oxycodone	(9)	45.1	(12.6)	(13)	47.5	(12.6)	(2†)	-	-
Oxymorphone	(9)	45.8	(12.6)	(11)	48.6	(10.9)	(1†)	-	-
Buprenorphine	(25)	46.2	(11.8)	(12)	52.0	(12.5)	(8)	52.4	(14.3)
Methadone Metabolite (EDDP)	(24)	50.6	(8.6)	(15)	53.1	(6.8)	(13)	55.1	(5.1)

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this table.

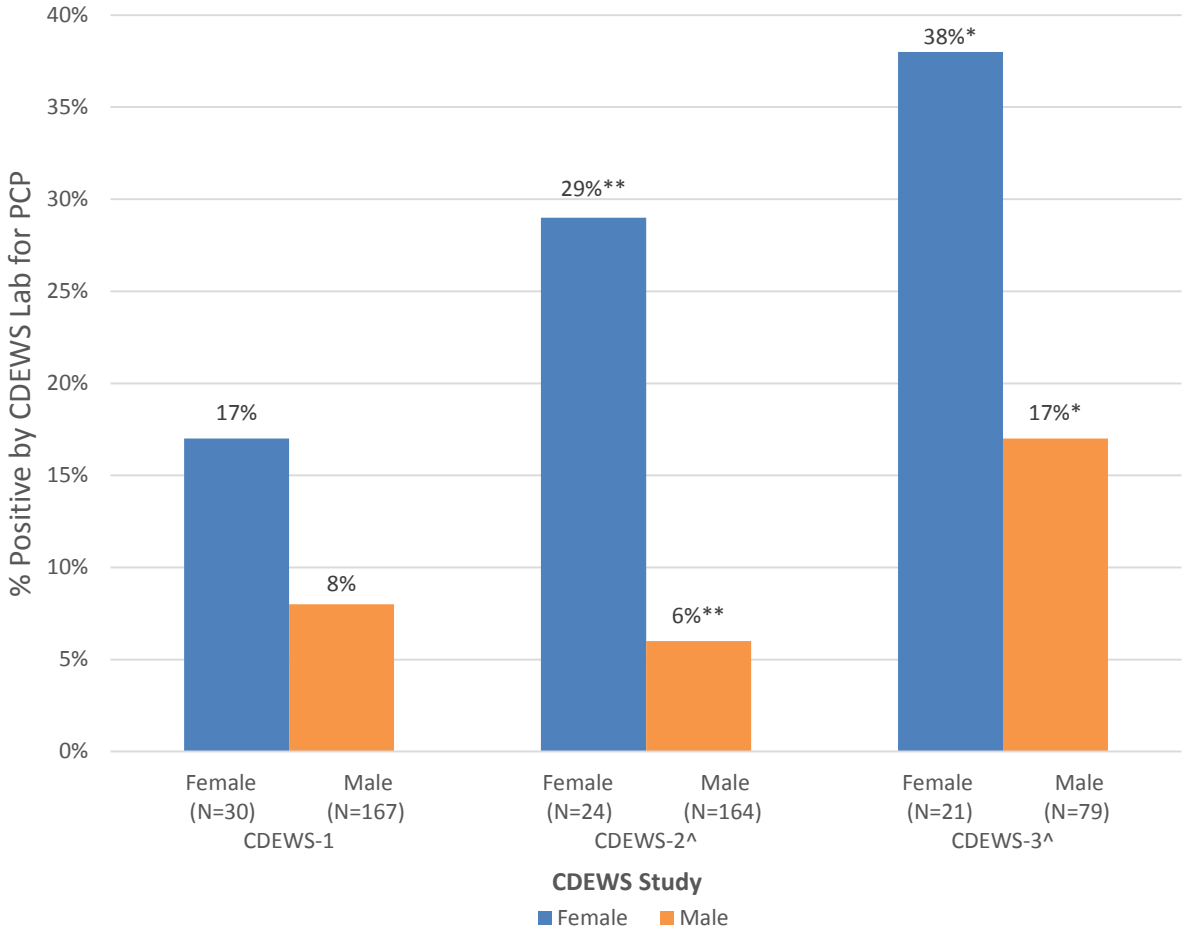
**p<.01 by ANOVA.

†This table only includes drugs for which there were a minimum of 8 positive specimens.

§For the CDEWS-3 opiates result, we approximated the EIA opiates panel used in the earlier CDEWS studies (CDEWS-1 and CDEWS-2) given that we were screening for all opioids using LC/MS/MS in the CDEWS-3 study. The CDEWS-3 opiates result includes morphine, codeine and hydrocodone positives only (Cone et al., 1992).

Figure 3: Percentage of PSA Drug Screen Positive Specimens Testing Positive for PCP\\, by CDEWS Study and Gender

(N=485 specimens from parolees/probationers)



*p<.05 by Fisher's exact test.

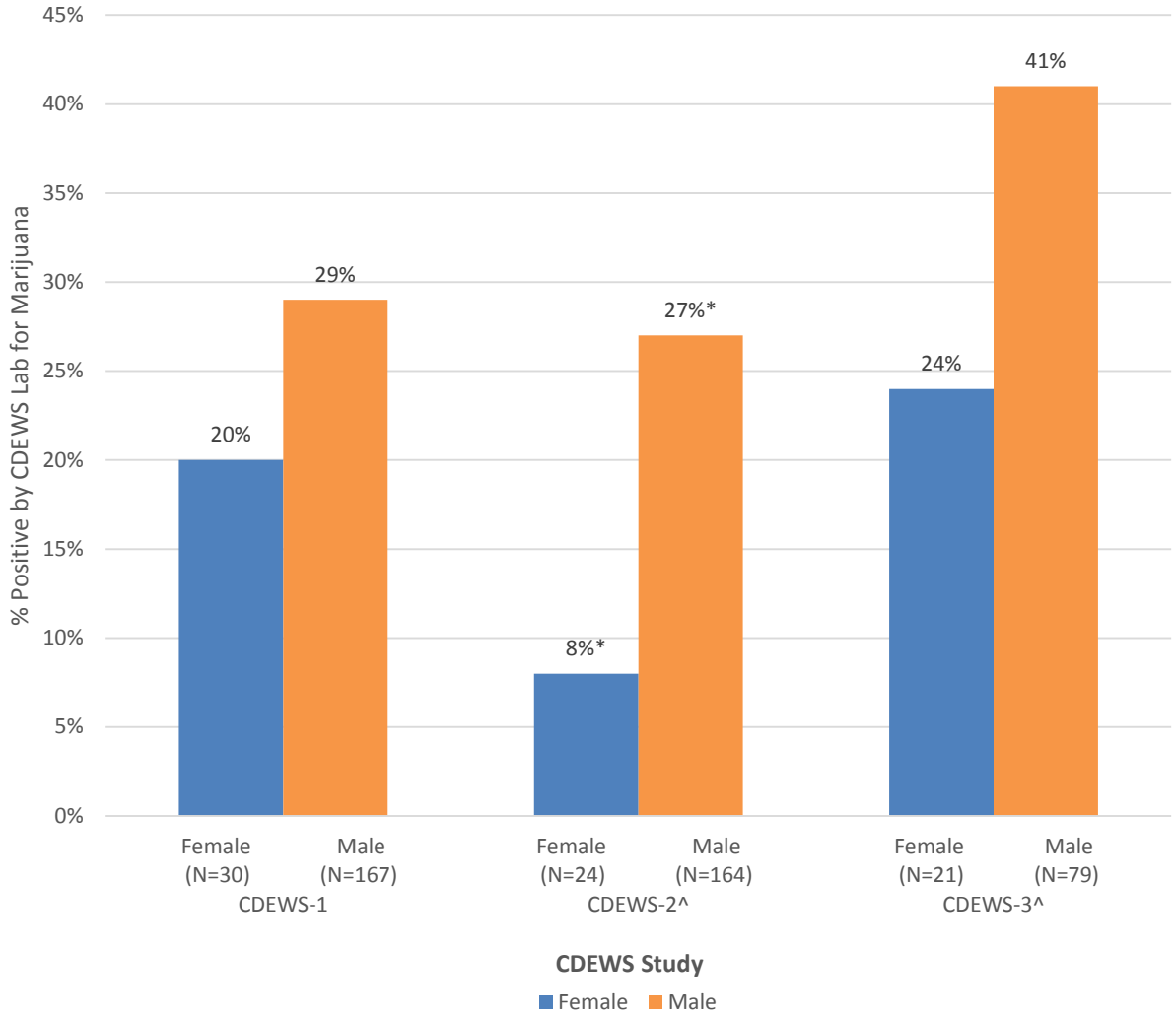
**p<.01 by Fisher's exact test.

\\The CDEWS-3 study used a more sensitive level of detection for PCP (10 ng/mL) as compared to the previous two CDEWS studies (25 ng/mL).

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this figure.

Figure 4: Percentage of PSA Drug Screen Positive Specimens Testing Positive for Marijuana≈, by CDEWS Study and Gender

(N=485 specimens from parolees/probationers)



*p<.05 by Fisher's exact test.

≈The CDEWS-3 study used a more sensitive level of detection for marijuana (15 ng/mL) as compared to the previous two CDEWS studies (50 ng/mL).

^To make the PSA positive specimens from CDEWS-2 and CDEWS-3 comparable to those from CDEWS-1, the amphetamine positive specimens oversampled in CDEWS-2 and CDEWS-3 were omitted from this figure.

Study Limitations

This study has a number of important limitations that must be kept in mind in interpreting the results.

The CDEWS model depends on collecting a small number of specimens that have already tested positive or negative by the CJS agency's routine drug screen. Every attempt was made to randomly select from the specimens available that met our selection criteria. We do not know whether these small samples are representative of all persons tested in the participating CJS populations. However, CDEWS results have been found to be internally consistent and often agree with other indicators of drug use in the studied jurisdictions. CDEWS is designed to produce an indication of emerging drugs in a community rather than provide precise prevalence estimates.

CDEWS obtains samples of urine specimens that have already been collected and tested by the criminal justice system (CJS) as part of a drug testing program. The persons selected for testing are typically at high risk for drug use because of prior use or treatment history, suspected drug misuse, and/or drug offense history. While a population at high risk for drug use is exactly what we seek in order to achieve the CDEWS mission of uncovering emerging drugs, it also means that the CDEWS findings do not necessarily represent all persons in the CJS populations studied. Nevertheless, drug trends in high risk criminal justice populations often foreshadow trends that appear later in the general population (DuPont & Wish, 1992).

One important limitation regarding this study is that most of the drug tests conducted by the CDEWS laboratory in CDEWS-3 were completed using LC/MS/MS at more sensitive levels of detection than those typically used by the DC Pretrial Services Agency. The more sensitive levels of detection used by the CDEWS laboratory may account for some of the drug positives found in the CJS- group, such as the marijuana positives (17%) noted in Table 4 (the CDEWS laboratory used a 15ng/mL level of detection for screening marijuana as compared to 50 ng/mL used by the DC PSA testing laboratory). Furthermore, the CDEWS testing laboratory was changed in CDEWS-3 and some levels of detection for the drugs on the testing panel were lowered which may affect the comparisons of the percentage of drug positives detected over time. For example, in Table 9, increases in drug positives for marijuana, cocaine, and PCP may have been affected by the more sensitive levels of detection used in the CDEWS-3 study as compared to the earlier studies. When relevant, differences and/or changes in the levels of detection used have been included in the footnotes of the study tables.

The CDEWS results can only provide an indication of the prescription and illicit drugs used recently by the people who submitted the specimens. A more complete understanding of the results will require additional studies. For example, we cannot tell whether a person testing positive for a prescribed drug like methadone or buprenorphine is taking it under medical supervision. Nor can our test results tell us why or how often they used the drug or where they obtained it.

Decisions regarding modifying CJS drug testing protocols should not be based on CDEWS results alone. Rather, local policymakers should review the CDEWS results as they weigh the complex law enforcement, public health, and budgetary considerations in their jurisdiction to determine what drugs to test for. CDEWS provides critical information with which to paint a picture of the age and gender characteristics of likely CJS users and, most importantly, the local communities where one might wish to collect more detailed information about a particular emerging drug's availability and use.

Discussion

One of the two primary objectives of the CDEWS project is to identify and describe the use of emerging drugs in populations at high risk for recent drug use. The CDEWS-1 and CDEWS-2 studies uncovered the rise of SC in Washington, DC, and documented the variety of specific SC metabolites that users tested positive for. The metabolites were found to be rapidly changing as new chemicals were developed and introduced into the drugs being sold. The prior CDEWS studies also showed that SC was often more likely to be found in specimens from young men and persons who had passed (tested CJS-) the standard drug screen used by the DC PSA. The prior CDEWS results supported reports that persons being monitored by a criminal justice testing program often turned to using SC only, in order to avoid a positive drug test (Perrone, 2013). This was the context within which this third CDEWS study of probationers and parolees in Washington DC was launched. The new CDEWS-3 findings provide clear evidence that the composition of SC being used by this population and the characteristics of users may have again dramatically changed.

New and old synthetic cannabinoid metabolites co-occur

CDEWS-3 introduced a new laboratory that used more sensitive testing technology capable of detecting a larger number of licit and illicit drugs. The new test panel of over 150 drugs included tests for 27 synthetic cannabinoid metabolites, adding six newly developed synthetic cannabinoid tests that were unavailable for inclusion in the prior CDEWS studies. The CDEWS-3 results therefore provide the most up-to-date epidemiologic study of the changing nature of the SC metabolites used by this high risk population of probationers and parolees in Washington, DC.

We found that 5 of the 6 newly added SC metabolites (AB-CHMINACA (parent), AB-CHMINACA (metab 4), AB-CHMINACA (metab 6), AB-FUBINACA (parent), and ADB-FUBINACA (parent)), were detected in the specimens. Only the metabolite 5F-AMB was not detected. AB-CHMINACA (metab 4), a metabolite newly added to the CDEWS test panel, was found in 77% of the SC positive specimens. Two of the newly added metabolites, AB-CHMINACA (Parent) and ADB-FUBINACA (Parent) were found in 32% and 29% of the SC+ specimens, respectively. It is interesting to note that most of the

specimens in this sample contained at least one of the new SC metabolites. However, these newer metabolites did not appear to supplant the older metabolites. In fact, two older SC metabolites, UR-144 and XLR-11, were still prominent in the CDEWS-3 specimens, although less so than in the prior CDEWS studies.

We estimated that had we not added the 6 new metabolites to our former test panel of 21 metabolites, we still would have identified 87% of the SC+ specimens we found using the larger test panel of 27 SC metabolites. **Our results suggest that newly available metabolites are being found along with the older metabolites, rather than replacing them, or that people are consuming old and new batches together. This notion runs contrary to the widely held belief that once an SC metabolite is scheduled and prohibited, manufacturers simply abandon it and replace it with newly created chemicals.** Instead, it may be possible that the newer SC blends contain a combination of both old and new SC metabolites. It is also possible, but less likely, that the multiple metabolites identified in some specimens could have occurred if a person had recently used both old and new batches of the drug.

The CDEWS-1 and CDEWS-2 studies found that the majority of SC+ specimens (57/64%) contained only one SC metabolite, with only 2 and 13% containing more than 3 metabolites. The CDEWS-3 results indicated that only 7% of specimens contained one SC metabolite but 45% of the SC+ specimens contained 4 or more SC metabolites. The average number of SC metabolites detected in the CDEWS-3 specimens was 3.6. The fact that SC+ specimens from both CJS+ and CJS- specimens from females contained a smaller number of different SC metabolites, just 3-5, compared with 8-12 in SC+ specimens obtained from males suggests that these groups may have used different products.

SC was found both in persons who passed and failed the CJS drug screen

In the previous CDEWS-2 study, we found that young adult males who had passed the CJS drug screen test (CJS-) were more likely to test positive for SC, as compared to those that had failed it. In contrast, the CDEWS-3 study has found that SC was as likely to be detected in males who had tested CJS+ as those who had tested CJS- by in the routine PSA tests. This is similar to what was found in the CDEWS-1 study, but a lower level of SC was detected in CDEWS-3. The decrease in SC use found in CDEWS-3 could have been caused by a decline in SC use in this population, and perhaps the community. Also noteworthy is the finding that of the 12 total SC metabolites detected, 8 were found in the CJS+ specimens and all 12 were detected in the CJS- specimens.

Fewer young men may be using SC

The likelihood of young men testing positive for SC was the lowest we have seen in any of the CDEWS studies (found only in 15-16%). In comparison, in CDEWS-1 and CDEWS-2, approximately one-quarter to more than one-half of the young adult males tested positive for SC. The higher risk of SC use now appears to be among men ages 26-40. This was reflected in the age of persons found to

test positive for SC over the three CDEWS studies increasing significantly from 28.1 years to 30.8 to 35.8 years. It is possible that younger persons have decided to abandon the drug, given the recent adverse media reports of persons appearing at emergency departments suffering from negative consequences of self-reported use of SC (Blake, 2015; Thompson, 2015; Wagner & DeMarco, 2016).

Epidemic of SC use in DC may have peaked

The findings for SC from the three CDEWS studies of parolees and probationers in Washington, DC, paint a picture of likely declining use of SC in this high risk population. A number of other information sources also support the likelihood that the SC epidemic in Washington, DC, has peaked. First, according to statistics from the District of Columbia Fire and EMS Department, the number of synthetic cannabinoid EMS cases reached 600 per month in August and September 2015, but declined to 110-240 cases monthly from November 2015 through June 2016 (Sa'adah, 2016). In July (597) and August (459) there was a resurgence of cases but through the beginning of September (9/10/16) there were only 106 cases. Second, emergency department physicians in two hospitals in the DC metro area who are collecting information from SC overdose patients for the next phase of the study have reported a drop in SC patient admissions. Third, the DC pretrial testing program began testing arrestees for a limited number of SC metabolites in October 2015. Their reports indicate that the percentage of all drug positive arrestees testing positive for SC has declined from 10% in October 2015 to 1% or less from March through September 2016 (Pretrial Services Agency for the District of Columbia, 2015-2016).

Taken together, the three CDEWS studies support the ability of CDEWS to track the rise and fall of an emerging drug in a community. In this high risk population, we found lower numbers of persons testing positive for SC and that younger persons may be lessening their use the drug. There may also be fewer probationers and parolees turning to SC to avoid detection by the standard CJS drug screens. While this decline is a welcome sign, our findings are still concerning because those who are using SC are likely exposing themselves to a diverse combination of new and old chemicals that may cause unpredictable and/or severe consequences to their health and well-being.

Other notable findings

Buprenorphine use has declined among CJS+ probationers/parolees. We found a significant reduction in persons CJS+ who tested positive for buprenorphine over our three studies (13%, 4%, 3%. $p<.001$). Buprenorphine was detected in all 3 CDEWS studies in persons with an average age around 50. Buprenorphine is a medication used to treat opioid substance use disorders which can be misused. While our urine tests cannot determine whether the buprenorphine we detected was being used under the supervision of a physician, the fact that it was rarely detected and mainly among older persons suggests that it is not widely misused in the DC criminal population and that it may be primarily being used by older opioid users seeking treatment or self-medicating their symptoms. In

addition, among all arrestees tested in the DC pretrial testing program opiates are rare; found in 8% or fewer specimens in any month in 2016 (Pretrial Services Agency for the District of Columbia, 2016).

Detection of drugs differs by gender. While the numbers of specimens available from females were quite small, some statistically significant differences were found in comparisons of results for males and females. In both CDEWS-2 and CDEWS-3, CJS+ specimens from females were more likely to test positive for PCP. We are aware of no rationale for why these females were more likely to have recently used PCP.

In CDEWS-3, both Trazodone and mCPP were detected more often in CJS+ females than males (20% vs. 2%, $p<.01$), suggesting that drug using females were possibly experiencing depression. It is not possible to determine whether these positive test results were caused by the presence of Trazodone or mCPP alone.

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Appendices

Appendix A: Site Selection Procedures

Data collection was repeated in this site given that a high proportion of synthetic cannabinoid positives were uncovered in DC in our earlier CDEWS-1 and CDEWS-2 studies. In the current CDEWS study, we repeated collection in adult parolees/probationers given that most jurisdictions around the country conduct routine urine testing with this population. PSA uses an agency-run laboratory to test their specimens and maintains an advanced electronic record-keeping system to track results. This system was utilized during the sampling process to ensure that only one specimen per person was sampled for the study and also to collect demographic data. In order to obtain approval for this research study, we submitted a brief proposal for review by the agency research committee. Given that this was the third collection at this site and followed a very similar protocol to that used in the previous studies, the approval process for the parolee/probationer study was brief, approximately two weeks. The University of Maryland Institutional Review Board (UM IRB) application was then processed and approved. The data collection for parolee/probationer specimens occurred approximately 4 months after approval was received from the PSA research committee (after specimens were accumulated and prepared for CESAR to collect). Researchers spent one day on-site to sample the already collected specimens.

Table A-1: Time to Obtain Approval and Collect Specimens On-Site

Site	Time to Obtain Approval	Researcher Time On-Site Collecting Specimens
District of Columbia: Adult Parole and Probation - Court Services and Offender Supervision Agency for the District of Columbia (CSOSA)	2 weeks	1 day

Appendix B: Collection of Urine Specimens

Over the period of approximately 3 months (August 2015 to October 2015), staff at the PSA laboratory accumulated specimens for parolees and probationers for inclusion in the study. PSA laboratory staff randomly selected negatives and positives from boxes of specimens for which the 48 hour holding period for negatives and the 40 day holding period for positives had passed until an adequate number of specimens had been obtained. These specimens at PSA are routinely tested for 6-MAM (a metabolite of heroin used to definitively assess heroin use), amphetamine, cocaine, marijuana, opiates, PCP, and synthetic cannabinoids. EtG (Ethyl glucuronide, a specific metabolite for ethanol or alcohol) is tested for in cases where alcohol consumption is suspected or upon request. Some individuals are also tested for methadone. All amphetamine positives are confirmed by PSA using GC/MS. Other drugs are confirmed upon request using GC/MS and GC-MS/MS. Synthetic cannabinoids are tested by PSA using Homogenous Enzyme Immunoassay (HEIA). All specimens are also tested to assess creatinine levels.

Each available specimen was scanned by PSA laboratory staff using a barcode on its label and entered electronically into a database. Once all specimens were obtained, the database for was sent to the IT department at PSA to ensure that only one specimen per person was selected and so that demographic data for each individual specimen could be added to the file. In instances when more than one specimen from a single individual was present in the database, PSA used the Police Department Identification Number (PDID) to select the most recent specimen collected from that individual which also contained an adequate quantity of urine for expanded testing (15mL). The specimen collection date, age, gender, race, zip code of residence, and whether the specimen tested positive or negative for any drug on the PSA screen were added to the database. PSA staff also assigned a temporary ID to each record. Any specimens with creatinine levels of less than 20 ng/mL[1] were eliminated from the sample by PSA staff. The selected specimens were then aliquoted into new specimen cups and labeled with a temporary PSA ID using labels provided by CESAR. The temporary PSA IDs were also added to the corresponding records in the database. All negative and positive specimens were held separately in distinct groups to make sampling easier.

Once all specimens were labeled with the temporary IDs, the database was emailed to CESAR staff. All personal identifiers, including PDID's, were removed from the database before it was shared with CESAR staff. CESAR staff then scheduled a day to conduct sampling at the PSA laboratory. The process for sampling was as follows. For each specimen selected, a CESAR staff member blacked out the temporary PSA ID on the specimen label and re-labeled the specimen cup with a non-identifiable CESAR-assigned study ID. The CESAR-assigned study ID was not shared with PSA staff. CESAR staff then replaced the temporary PSA assigned ID in the database with the CESAR-assigned study ID. The urine specimen cup was then placed in a sealed plastic bag and prepared for shipment to the CDEWS laboratory. The final database retained by CESAR did not contain any identifying information from PSA. Therefore, it is not possible to link the specimen or the records in the database back to the person by CESAR or by PSA.

270 specimens (120 positives and 150 negatives) that were ready to be discarded were

[1] These specimens were eliminated because the urine was considered to be diluted and not valid.

selected for the adult parolee and probationer population. 20 of the 120 positive specimens were selected from a known group of amphetamine positives. These were sampled separately as they are held separately by PSA from the other specimens. All specimens were refrigerated prior to sampling by CESAR. One round of sampling was conducted to collect the required number of specimens. Three CESAR research staff participated in this sampling, which took approximately one day.

Appendix C: Testing of Urine Specimens by the CDEWS Independent Laboratory

Armed Forces Medical Examiner System Laboratory

CESAR contracted with the Armed Forces Medical Examiner System Laboratory for testing, as this laboratory has a shared mission to identify emerging drugs for testing in the United States. The drugs and metabolites included in the CDEWS-3 panel were selected after interviewing 13 chemists at 9 labs, as well as 3 other experts from programs including the High Intensity Drug Trafficking Area Program (HIDTA) and other law enforcement drug testing divisions to identify new psychoactive substances (NPS) to consider adding to our panel and to assess the availability of tests for these drugs. We also reviewed data and information from multiple international, national and local sources before finalizing the testing panel. All specimens were held in cold storage for the duration of the study. Over 150 drugs were tested for using Gas Chromatography/Mass Spectrometry (GC/MS) and Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS). The test results, labeled by study ID, were sent electronically to CESAR.

Selecting Substances for Inclusion in the Testing Panel

Selecting substances to include in the study test panel was critical to the ability of the study to detect emerging drugs, particularly as related to synthetic cannabinoids since those in use are constantly altered, presumably to avoid detection and legal sanction. NPS are also an area of fast-paced change in terms of availability and use.

To plan our test panel, we reviewed data and information from multiple international, national and local sources. This included a review of the 2014 National data from the Drug Enforcement Administration's (DEA) National Forensic Laboratory Information System (NFLIS), special data runs for 2014-2015 provided by the DEA's Special Testing and Research Laboratory, as well as reports from the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), United Nations Office on Drugs and Crime (UNODC) Early Warning Advisories, and other sources (Baumann, 2015; Dye, 2014; EMCDDA, 2015; Head, 2014; NMS Labs, 2015; UNODC, Early Warning Advisory, 2013a, 2013b, 2013c, 2014a, 2014b, 2014c, 2014d, 2014e, 2015a, 2015b, 2015c; U.S. DEA, Office of Diversion Control, 2014, 2015; U.S. DEA, Office of Diversion Control, NFLIS, 2015c; U.S. DEA, Special Testing and Research Laboratory, Emerging Trends Program/Reference Material Program, 2015, 2016). We also reviewed local NFLIS data, as well as any other local data available, to assess local drug trends in our participating CDEWS sites (Maryland Poison Center, University of Maryland School of Pharmacy, 2015; U.S. DEA, Office of Diversion Control, NFLIS, 2015a, 2015b, 2015d, 2015e; Washington Baltimore HIDTA, Investigative Support Center, 2015; Winter et al., 2014).

In addition, we also interviewed 13 chemists at 9 labs, as well as 3 other experts from programs including the High Intensity Drug Trafficking Area Program (HIDTA) and other law enforcement drug testing divisions prior to finalizing the test panel for CDEWS-3. The persons interviewed were selected from existing networks of toxicologists with expertise in the area of NPS and/or urine testing that we have identified from past CDEWS studies, as well as through other professional networks. We also identified contacts through referrals from our existing network of

toxicologists, researchers, and law enforcement representatives. All persons interviewed are listed in Table C-1 below. A standard set of questions was asked including:

- What specific substances do you think are most important for us to include in our testing panel?
- Are there any new or emerging synthetic drugs that we should include?
- What synthetic drugs do you test for at your agency?
- What synthetic cannabinoid metabolites have you been finding in your most recent specimens? cathinones? other synthetic drugs?
- To your knowledge, are there tests available for each of these drugs? What would be the recommended test (EIA, LC/MS, etc.)?

Table C-1: Toxicologists Interviewed for CDEWS-3

NAME	TITLE/AFFILIATION
Dr. (CDR) Thomas Bosy; Major William McCalmont	Armed Forces Medical Examiner System (AFMES)
Dr. Gregory Endres; Donna Iula	Cayman Chemical
Dr. Barry Logan	NMS Labs
Dr. Jeffery Moran	Arkansas Public Health Laboratory, Arkansas Department of Health
Dr. Marilyn Huestis	National Institute on Drug Abuse, National Institutes of Health Biomedical Research Center
Staff (2 unnamed per request)	State of HI Narcotics Enforcement Division
Wayne Kimoto; Michele Shishato	Honolulu Police Department Crime Laboratory
Kathy Pung	Hawaii Police Department Crime Laboratory
Jerome Robinson	Pretrial Services Agency for the District of Columbia
Gary Yabuta	Hawaii HIDTA
Jill Head; Emily Dye	Special Testing and Research Laboratory, Drug Enforcement Administration

Based on the information reviewed, we added six new SC metabolites to our previous CDEWS-2 metabolite screen: 5F-AMB, AB-CHMINACA (parent), AB-CHMINACA (metab 4), AB-CHMINACA (metab 6), AB-FUBINACA (parent), and ADB-FUBINACA (parent) (see Table C-2 in Appendix C for the full panel). We also tested specimens for the following SC metabolites that were part of our earlier CDEWS studies: JWH-018, JWH-019, JWH-073, JWH-081, JWH-122, JWH-210, JWH-250, AM-2201, MAM-2201, RCS-4, UR-144, XLR-11, AKB-48, 5F-AKB-48, BB-22, PB-22, 5F-PB-22, AB-PINACA, 5F-AB-PINACA, ADB-PINACA, and ADBICA. Many additional SC metabolites were identified as relevant to the study, however, urine tests were not available for these metabolites at the time the study began. The synthetic cannabinoid tests were performed using liquid chromatography-tandem mass spectrometry (LC/MS/MS).

Further, for CDEWS-3, we expanded the new psychoactive substances (designer stimulant) panel to add 14 new compounds. The new additions are: 25C-NBoMe, 2C-T-7, AH-7921, alpha-PVP, B-Methylphenethylamine, Flephedrone, Methiopropamine, Methoxetamine, Mitragynine, Naphyrone,

Phenmetrazine, Phentermine, PMMA, and Trazodone. Several additional NPS were identified as relevant to the study but were not included due to test availability and cost.

Table C-2: The CDEWS-3 Laboratory Expanded Drug Screening Panel and Levels of Detection

SYNTHETIC CANNABINOID PANEL

	COMPOUND	LOD (ng/mL)
1	JWH-018-5-COOH	0.25
2	JWH-019-6-OH	0.25
3	JWH-073-4-COOH	0.25
4	JWH-081-5-OH	0.25
5	JWH-122-5-OH	0.25
6	JWH-210-5-OH	0.25
7	JWH-250-5-OH	0.25
8	AM2201-4-OH	0.50
9	MAM-2201-5-COOH/JWH 122 COOH	0.50
10	RCS-4-5-COOH	0.50
11	UR-144-5-COOH	0.50
12	XLR-11-4-OH	Presence
13	AKB-48 COOH	0.50
14	5F AKB-48 metabolite	0.50
15	BB-22 metabolite	0.50
16	PB-22 Carb Indole	0.50
17	5F PB-22 Carb Indole	0.50
18	AB-PINACA	0.50
19	5F AB PINACA	0.50
20	ADB-PINACA-5-COOH	0.50
21	ADBICA-5-COOH	0.50
22	AB-FUBINACA (Parent)	0.50
23	AB-CHMINACA (Parent)	0.50
24	AB-CHMINACA (metab 4)	0.50
25	AB-CHMINACA (metab 6)	0.50
26	ADB-FUBINACA (Parent)	0.50
27	5F-AMB	0.50

Table C-2 (Cont'd): The CDEWS-3 Laboratory Expanded Drug Screening Panel and Levels of Detection

NEW PSYCHOACTIVE SUBSTANCES PANEL

	COMPOUND	LOD (ng/mL)
1	25B-NBoMe	2.5
2	25I-NBoMe	2.5
3	25C-NBoMe	2.5
4	2C-B	10
5	2-Fluoroamphetamine	10
6	2-Fluoromethamphetamine	10
7	3-Fluoromethcathinone	10
8	4-Methylethcathinone (4-MEC)	10
9	Buphedrone	10
10	Butylone	10
11	Benzylpiperazine	10
12	Cathinone	10
13	Methcathinone/Ephedrone	10
14	Ethylone	10
15	Eutylone	10
16	mCPP	10
17	MBDB	10
18	MDPV	10
19	α-PVP	10
20	Mephedrone	10
21	Methedrone	10
22	Methylone	10
23	Pentedrone	10
24	Pentylone	10
25	TFMPP	10
26	Phentermine	10
27	B-Methylphenethylamine	10
28	Trazodone	10
29	Phenmetrazine	10
30	Naphyrone	10
31	Mitragynine	10
32	Methoxetamine	10
33	PMMA	10
34	2C-T-7	10
35	Flephedrone	10
36	AH-7921	10
37	Methiopropamine	10

Table C-2 (Cont'd): The CDEWS-3 Laboratory Expanded Drug Screening Panel and Levels of Detection

THC/BARBS/BUPRENORPHINE/LSD PANEL

	COMPOUND	SCREEN	LOD (ng/mL)	CONFIRM	LOD (ng/mL)
1	THC-COOH	PMOD	15	LC/MS/MS	5
2	Amobarbital	PMOD	200	LC/MS/MS	25
3	Butalbital	PMOD	200	LC/MS/MS	25
4	Pentobarbital	PMOD	200	LC/MS/MS	25
5	Phenobarbital	PMOD	200	LC/MS/MS	25
6	Secobarbital	PMOD	200	LC/MS/MS	25
7	Buprenorphine	PMOD	10	LC/MS/MS	1
8	Norbuprenorphine	na	na	LC/MS/MS	1
9	Naloxone	na	na	LC/MS/MS	1
10	LSD	PMOD	0.5	LC/MS/MS	0.05

Table C-2 (Cont'd): The CDEWS-3 Laboratory Expanded Drug Screening Panel and Levels of Detection

GENERAL PANEL

	COMPOUND	LOD (ng/mL)		COMPOUND	LOD (ng/mL)
1	6-Monoacetylmorphine (6-MAM)	5	41	Hydroxyzine	25
2	7-Aminoclonazepam	25	42	Ketamine	25
3	Acetylfentanyl	1	43	Lorazepam	25
4	Alprazolam	25	44	MDA	25
5	Amitriptyline	25	45	MDEA	25
6	Amphetamine	25	46	MDMA	25
7	Atomoxetine	25	47	Meperidine	25
8	Benzoylecgonine	25	48	Methadone	25
9	Bupropion	25	49	Methamphetamine	25
10	Carisoprodol	50	50	Methylphenidate	25
11	Cetirizine	25	51	Morphine	25
12	Chlorpromazine	25	52	Naloxone	25
13	Citalopram	25	53	Nordiazepam	25
14	Clonazepam	25	54	Norfentanyl	4
15	Codeine	25	55	Normeperidine	25
16	Cyclobenzaprine	25	56	Nortriptyline	25
17	Demoxepam	25	57	Oxazepam	25
18	Desalkflurazepam	25	58	Oxycodone	25
19	Desmorphine	25	59	Oxymorphone	25
20	Desmethylvenlafaxine/Desvenlafaxine	25	60	Paroxetine	25
21	Dextromethorphan	25	61	PCP	10
22	Diazepam	25	62	Phenmetrazine	25
23	Diclazepam	25	63	Phenazepam	25
24	Doxepin	25	64	Prazepam	25
25	Duloxetine	25	65	Promethazine	25
26	EDDP	25	66	Pseudoephedrine	25
27	Ephedrine	25	67	Pyrazolam	25
28	Estazolam	25	68	Propoxyphene	25
29	Etizolam	25	69	Quinidine	25
30	Fentanyl	1	70	Quinine	25
31	Flubromazepam	25	71	Sertraline	25
32	Flunitrazepam	25	72	Tapentadol	25
33	Fluoxetine	25	73	Temazepam	25
34	Flurazepam	25	74	Thioridazine	25
35	Haloperidol	25	75	Tramadol	25
36	Hydrocodone	25	76	Venlafaxine	25
37	Hydromorphone	25	77	Zaleplon	5
38	α-Hydroxyalprazolam	25	78	Zolpidem	5
39	α-Hydroxymidazolam	5	79	Zopiclone	5
40	α-Hydroxytriazolam	25			

Appendix D: The CDEWS-1 Laboratory Expanded Drug Screening Panel and Levels of Detection

Table D-1: CDEWS-1 Independent Laboratory Expanded Drug Screening Panel

Drugs Tested, by Method	Detection Limit
Enzyme Immunoassay (EIA)	
Amphetamines	500 ng/mL
Barbiturates	200 ng/mL
Benzodiazepines	300 ng/mL
Buprenorphine	5 ng/mL
Cocaine	150 ng/mL
MDMA	500 ng/mL
Methadone	300 ng/mL
Methadone Metabolite	300 ng/mL
Opiates	300 ng/mL
Oxycodone	100 ng/mL
PCP	25 ng/mL
THC	50 ng/mL
Thin-layer Chromatography (TLC)	
Ami/Nortriptyline	Hydroxyzine
Amphetamines	Methadone
Ativan/Dalmane	Morphine
Benzodiazepines	Oxycodone
Clonazepam	Opiates
Cocaine	Phenmetrazine
Codeine	Phenothiazines
Demerol	Quinine
Dilaudid	Tramadol
Doxepin	Valium
Hydrocodone	
Confirmations	
Liquid Chromatography/Mass Spectrometry	
LC/MS was conducted on all EIA positives for opiates, amphetamines and buprenorphine. LC/MS confirmation for opiates was also conducted on all EIA oxycodone positives with a negative EIA opiate screen.	
Gas Chromatography/Mass Spectrometry	
GC/MS was conducted on all EIA positives for PCP.	

Source: Center for Substance Abuse Research (CESAR), Community Drug Early Warning System (CDEWS-1), September 2013.

Table D-2: Synthetic Cannabinoid Metabolites Included in the CDEWS-1 Drug Testing Panel

Synthetic Cannabinoid Metabolites
JWH-018
JWH-019
JWH-073
JWH-081
JWH-122
JWH-210
JWH-250
AM-2201
MAM-2201
RCS-4
UR-144*
XLR-11*

Notes: The synthetic cannabinoids tests are performed using LC/MS/MS. The screening and confirmation tests are performed using different analytical phase columns to enhance accuracy in detection and reporting. The screening and confirmation methods were developed in accordance with the College of American Pathologist guidelines for Forensic Drug Testing (FDT) and are subject to CAP and state agency inspections. Detection limits vary between 0.2 and 0.5ng/ml using 0.1ml of urine.

*Three new synthetic cannabinoids were recently put on temporary scheduling by DEA. Two of the three (UR-144 and XLR-11) were included in the CDEWS testing panel. One (AKB-48) was not included in the CDEWS testing panel because it was not available for testing at the time of the study.

Source: Center for Substance Abuse Research (CESAR), Community Drug Early Warning System (CDEWS-1), September 2013.

Appendix E: The CDEWS-2 Laboratory Expanded Drug Screening Panel and Levels of Detection

Table E-1: The CDEWS-2 Laboratory Expanded Drug Screening Panel

Drugs Tested, by Method	Detection Limit
Enzyme Immunoassay (EIA)	
Amphetamines	500 ng/mL
Barbiturates	200 ng/mL
Benzodiazepines	300 ng/mL
Buprenorphine	5 ng/mL
Cocaine	150 ng/mL
MDMA	500 ng/mL
Methadone	150 ng/mL
Methadone Metabolite	300 ng/mL
Opiates	300 ng/mL
Oxycodone	100 ng/mL
PCP	25 ng/mL
THC	50 ng/mL
6 Monoacetyl Morphine	150 ng/mL
Thin-layer Chromatography (TLC)	
Ami/Nortriptyline	Hydroxyzine
Amphetamines	Methadone
Ativan/Dalmane	Morphine
Benzodiazepines	Oxycodone
Clonazepam	Opiates
Cocaine	Phenmetrazine
Codeine	Phenothiazines
Demerol	Quinine
Dilaudid	Tramadol
Doxepin	Valium
Hydrocodone	
Confirmations	
Liquid Chromatography/Mass Spectrometry	
LC/MS was conducted on all EIA positives for opiates, amphetamines and buprenorphine. LC/MS confirmation for opiates was also conducted on all EIA oxycodone positives with a negative EIA opiate screen.	
Gas Chromatography/Mass Spectrometry	
GC/MS was conducted on all EIA positives for PCP.	

Source: Center for Substance Abuse Research (CESAR), Community Drug Early Warning System (CDEWS-2), March 2015.

Table E-2: Synthetic Cannabinoid Metabolites Included in the CDEWS-2 Drug Testing Panel, Metabolites Detected and their Detection Limits

Tested for in CDEWS-1

Synthetic Cannabinoid Metabolites		Metabolites Detected	Detection Limit
1.	JWH-018	5-(3-(1-naphthoyl)-1H-indol-1-yl)-pentanoic acid	0.2 ng/mL
2.	JWH-019	(1-(6-hydroxyhexyl)-1H-indol-3-yl)(naphthalen-1-yl)methanone	0.2 ng/mL
3.	JWH-073	4-(3-(1-naphthoyl)-1H-indol-1-yl)-butanoic acid	0.2 ng/mL
4.	JWH-081	(1-(5-hydroxypentyl)-1H-indol-3-yl)(4-methoxynaphthalen-1-yl)methanone	0.5 ng/mL
5.	JWH-122	(1-(5-hydroxypentyl)-1H-indol-3-yl)(4-methylnaphthalen-1-yl)-methanone	0.2 ng/mL
6.	JWH-210*	(4-ethylnaphthalen-1-yl)(1-(5-hydroxypentyl)-1H-indol-3-yl)methanone	0.5 ng/mL
7.	JWH-250	1-(1-(5-hydroxypentyl)-1H-indol-3-yl)-2-(2-methoxyphenyl)ethanone	0.5 ng/mL
8.	AM-2201	(1-(5-fluoro-4-hydroxypentyl)-1H-indol-3-yl)(naphthalen-1-yl)methanone	0.2 ng/mL
9.	MAM-2201*	5-(3-(4-methyl-1-naphthoyl)-1H-indol-1-yl)pentanoic acid	0.2 ng/mL
10.	RCS-4	5-(3-(4-methoxybenzoyl)-1H-indol-1-yl)pentanoic acid	0.5 ng/mL
11.	UR-144	5-(3-(2,2,3,3-tetramethylcyclopropanecarbonyl)-1H-indol-1-yl)pentanoic acid	0.5 ng/mL
12.	XLR-11	(1-(5-fluoro-4-hydroxypentyl)-1H-indol-3-yl)(2,2,3,3-tetramethylcyclopropyl)methanone	0.2 ng/mL
13.	APINACA (AKB-48)	1-pentyl-N-tricyclo[3.3.1.13,7]dec-1-yl-1H-indazole-3-carboxamide	2.5 ng/mL
14.	5F-AKB-48[+]	N-((3s,5s,7s)-adamantan-1-yl)-1-(5-fluoropentyl)-1H-indazole-3-carboxamide	2.5 ng/mL
15.	BB-22*	1-(cyclohexylmethyl)-8-quinolinyl ester-1H-indole-3-carboxylic acid	5 ng/mL
16.	PB-22	1-pentyl-8-quinolinyl ester-1H-indole-3-carboxylic acid	5 ng/mL
17.	5F-PB-22	1-(5-fluoropentyl)-8-quinolinyl ester-1H-indole-3-carboxylic acid	5 ng/mL
18.	AB-PINACA	5-(3-((1-amino-3-methyl-1-oxobutan-2-yl)carbamoyl)-1H-indazol-1-yl)pentanoic acid	5 ng/mL
19.	5F-AB-PINACA*	N-(1-amino-3-methyl-1-oxobutan-2-yl)-1-(5-fluoro-4-hydroxypentyl)-1H-indazole-3-carboxamide	5 ng/mL
20.	ADB-PINACA	5-(3-((1-amino-3,3-dimethyl-1-oxobutan-2-yl)carbamoyl)-1H-indazol-1-yl)pentanoic acid	5 ng/mL
21.	ADBICA*	5-(3-((1-amino-3,3-dimethyl-1-oxobutan-2-yl)carbamoyl)-1H-indol-1-yl)pentanoic acid	5 ng/mL

Note: The synthetic cannabinoids tests are performed using LC/MS/MS. The screening and confirmation tests are performed using different analytical phase columns to enhance accuracy in detection and reporting. The screening and confirmation methods were developed in accordance with the College of American Pathologist Guidelines for Forensic Drug Testing (FDT) and are subject to CAP and state agency inspections.

*These metabolites have not yet been scheduled by the DEA as of January 2015.

[+]Per DEA, this SC may be treated as a "controlled substance analogue" under the CS pursuant to 21 U.S.C §§802(32)(A) and 813.

Source: Center for Substance Abuse Research (CESAR), Community Drug Early Warning System (CDEWS-2), March 2015.

Table E-3: New Psychoactive Substances Included in the CDEWS-2 Drug Testing Panel

1. 25B-NBOMe	2-(4-bromo-2,5-dimethoxyphenyl)-*N*-[(2-methoxyphenyl)methyl]ethanamine
2. 25I-NBOMe	2-(4-iodo-2,5-dimethoxyphenyl)-*N*-[(2-methoxyphenyl)methyl]ethanamine
3. 2C-B	2-(4-bromo-2,5-dimethoxyphenyl)ethanamine
4. 2-Fluoroamphetamine*	1-(2-Fluorophenyl)propan-2-amine
5. 2-Fluoromethamphetamine*	1-(2-fluorophenyl)-N-methylpropan-2-amine
6. 3-Fluoromethcathinone	1-(3-Fluorophenyl)-2-methylaminopropan-1-one
7. 4-Methylethcathinone	2-ethylamino-1-(4-methylphenyl)propan-1-one
8. Buphedrone*	2-(methylamino)-1-phenylbutan-1-one
9. Butylone	1-(1,3-benzodioxol-5-yl)-2-(methylamino)butan-1-one
10. Benzylpiperazine	1-benzylpiperazine
11. Cathinone	2-amino-1-phenyl-1-propanone
12. Ephedrone/Methcathinone	2-(methylamino)-1-phenyl-propan-1-one
13. Ethylone*	1-(1,3-benzodioxol-5-yl)-2-(ethylamino)propan-1-one
14. Eutylone*	1-(1,3-benzodioxol-5-yl)-2-(ethylamino)butan-1-one
15. mCPP*+	1-(3-chlorophenyl)piperazine
16. MBDB*	1-(1,3-Benzodioxol-5-yl)-*N*-methylbutan-2-amine
17. MDPV	1-(Benzo[*d*][1,3]dioxol-5-yl)-2-(pyrrolidin-1-yl)pentan-1-one
18. Mephedrone	2-methylamino-1-(4-methylphenyl)propan-1-one
19. Methedrone	1-(4-methoxyphenyl)-2-(methylamino)propan-1-one
20. Methylone	2-Methylamino-1-(3,4-methylenedioxyphenyl)propan-1-one
21. Pentedrone	1-phenyl-2-(methylamino)pentan-1-one
22. Pentylone	1-(1,3-benzodioxol-5-yl)-2-(methylamino)pentan-1-one
23. TFMPP	1-[3-(trifluoromethyl)phenyl]piperazine

*Indicates synthetic compounds that have not yet been scheduled by the DEA as of January 2015.

+Testing for mCPP was not conducted on the juvenile population as this test was discontinued by the testing laboratory due to cross-reactivity issues with the immunoassay.

Note: MDMA, MDA and MDEA are detected as part of the amphetamine confirmation done by LC/MS. Detection limit for all of the above substances is 20 ng/mL.

Source: Center for Substance Abuse Research (CESAR), Community Drug Early Warning System (CDEWS-2), March 2015.

Appendix F: Glossary of Abbreviated Terms

6-MAM: 6-Monoacetylmorphine, a unique metabolite of heroin used to definitively determine heroin use
CDEWS: Community Drug Early Warning System
CESAR: Center for Substance Abuse Research
CJS: Criminal Justice System
DEA: Drug Enforcement Administration
EIA: Enzyme Immunoassay, a method of urine drug testing
IRB: Institutional Review Board at the University of Maryland, a committee that must approve all human subjects research at the University of Maryland
LC/MS: Liquid Chromatography/Mass Spectrometry, a method for confirming drug positives in urine
LC/MS/MS: Liquid Chromatography-Tandem Mass Spectrometry, a method for confirming drug positives in urine
LSD: Lysergic Acid Diethylamide, a hallucinogen
MDMA: 3,4-methylenedioxy-N-methylamphetamine, also known as ecstasy or Molly
NFLIS: National Forensic Laboratory Information System
NIDA: National Institute on Drug Abuse
ONDCP: Office of National Drug Control Policy
PCP: Phencyclidine, a dissociative anesthetic and hallucinogen
SC: Synthetic Cannabinoid, also known as synthetic marijuana, K2, or spice
THC: Tetrahydrocannabinol, the primary active ingredient in marijuana
UM: University of Maryland