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RESEARCH ARTICLE

# Availability and Characteristics of Hemp-Derived Psychoactive Cannabis Products: A Pilot Study in Cleveland, Ohio

Jessica Suratkal[1]; Erika Trapl[1]; Catherine Osborn[1]; Pranav Vasu[1]; Stephanie Pike Moore[1]

[1]Department of Population and Quantitative Health Sciences, Case Western Reserve University, Cleveland, OH

Corresponding Author: Stephanie Pike Moore,11000 Cedar Ave #453, Cleveland, OH 44106, (216) 368-1918, stephanie.pike@case.edu

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## ABSTRACT

**Background:** Hemp-derived psychoactive cannabis products (HDPCPs), such as delta-8 tetrahydrocannabinol (THC), emerged onto the market as an alternative to cannabis following the 2018 US Farm Bill which legalized hemp. Research on HDPCPs remains limited. The purpose of this research was to evaluate the availability, placement, and consumption modality of HDPCPs as well as to identify potential defining characteristics of consumers.

**Methods:** Between October 2022 and January 2023, researchers visited a random sample of 82 tobacco retailers in Cleveland, Ohio, to evaluate the availability of HDPCPs marketed as delta THC (eg, delta-8 or delta-10). Information was captured on where the HDPCPs were placed (eg, behind the counter, on the counter, by candy, or elsewhere) as well as the consumption modality (eg, edible or inhaled). Among retailers who stocked these products, clerks were asked who typically buys these products and how often they are purchased.

**Results:** Over two-fifths (41.5%) of retailers carried HDPCPs. Most retailers (97.1%) carried delta THC products behind the counter and carried products as inhaled (82.4%), edible (70.6%). More than half of retailers (55.9%) carried both inhaled and edible forms of HDPCP. Retail clerks reported on a range of ages of consumers from younger to older or "everyone."

**Conclusion:** Hemp-derived psychoactive cannabis products are prevalent in this pilot study sample. These findings necessitate additional research to better quantify the population health impact of these products to determine if regulatory action may be necessary to protect public health.

**Keywords:** Hemp-derived psychoactive cannabis products; Delta-8; Market research; Substance use

## INTRODUCTION

Hemp-derived psychoactive cannabis products (HDPCPs) emerged onto the market in the United States (US) following the 2018 Farm Bill, which removed hemp from the list of federally controlled substances.[1] This legislation allowed for the proliferation of industry seeking to use hemp-derived cannabidiol (CBD) to synthesize psychoactive cannabis products,[2] which contain the same psychoactive constituent of federally illicit cannabis, tetrahydrocannabinol (THC).[3-5] These products are more commonly referred to as delta-8, delta-10, THC-O, or TCH-P.

While several states restricted or banned the sale of HDPCPs, these products are still largely available to populations of all ages in the majority of US states,[2,6] thus making them an attractive option to individuals who use THC, particularly in places where adult or medicinal cannabis use remains restricted. Public interest in HDPCPs has grown tremendously,[7] with the number of online

search queries for delta-8 THC hitting 35% of the "marijuana" query in 2021.[8] To cater to a growing consumer base, HDPCPs have become particularly prevalent online as well as in brick-and-mortar retailers such as convenience stores, gas stations, and bodegas, where CBD and other hemp products are also commonly sold.[9]

The production and sale of HDPCPs may present several risks to broader public health. First, there is no regulatory oversight of the production of these cannabinoids. Manufacturers may use strong reactants which have not been thoroughly evaluated for their impact or safety, nor are they required to be disclosed to consumers.[2,10] Second, there is limited information about how to treat individuals who experience adverse effects. Currently, many medical facilities do not have toxicology screening assays readily available to assess for potential exposure to or intoxication with HDPCPs.[6] Further, many manufacturers have mislabeled products with incorrect THC concentrations, posing a hazard to consumers who may not know exactly how much of this psychoactive substance they are consuming.[11,12] As a result, poison control centers and emergency departments are seeing pediatric patients unconscious and unresponsive because of high-dose exposure to THC,[9] highlighting a consequence of a lack of product oversight. Additionally, new isomers are being synthesized rapidly, with the recently emerging THC-P being reported to be 33 times stronger than the naturally occurring delta-9 isomer.[13] In line with industry innovation and as HDPCPs continue to become more potent, there is growing imperative to thoroughly evaluate the potential risk to public health.

Research on availability and prevalence of use of these products is limited. Among adults who used cannabis in the past 30 days, 16.7% report use of delta-8 THC.[14] There is evidence that these products are disproportionately available in socioeconomically deprived communities,[15] which would exacerbate existing inequities if these products are found to contribute to poorer health outcomes particularly within the scope of substance use disorders and their subsequent health outcomes. While the state of Ohio implemented legislation in December 2023 which allows for retail sales of cannabis and possession of up to 2.5 ounces of cannabis by residents over the age of 21 years,[16] there is no current legislation regulating or restricting sales or marketing of hemp-derived psychoactive cannabinoids. However, in January 2024, Ohio legislators have begun discussions regarding restrictions or regulation of these products across the state.[17] One notable gap, however, is that little is known regarding the general availability of these products to potential consumers particularly in brick-and-mortar locations. To date, there are fewer than 5 publications describing the availability of HDPCPs in a physical retail space, none of which are set in Ohio. In order to begin laying a strong scientific foundation to assess public health impact, this research sought to determine if the availability of HDPCPs could be captured using measures adapted from the field of tobacco.

## METHODS

### Setting

In the city of Cleveland, prior to statewide implementation of adult use cannabis laws in 2023, cannabis retail sales were restricted to medical use with a limited number of available licensed dispensaries in the city.[18] Cleveland is a highly segregated city due primarily to historic redlining practices which have contributed to one of the most substantial poverty rates in the US with an estimated 31.2% of Cleveland residents living under the federal poverty line compared to Ohio (13.4%) and the US (11.5%).[19,20] In hand with the current legislative context, these factors may represent a vulnerable context for individuals who are susceptible to these products thus necessitating research to assess their availability in their first steps toward broader evaluation of the impact of HDPCPs.

### Retail Sample

The sample used in this pilot study was drawn from the Cleveland Food and Tobacco Retail Database (CIFTR). Collected since 2015, CIFTR includes an annual assessment of all food and tobacco retailers in Cleveland. Tobacco retailers were chosen for data collection for this study because HDPCPs have been found to be commonly available in these stores.[21] Additionally, cannabis and tobacco products often are used concurrently or in a substitutive manner, that is switching one product for another.[22] Therefore, a high prevalence of HDPCPs in tobacco retailers may have implications for tobacco smoking cessation.

A stratified random sample of 20% of the 422 tobacco retailers was identified from CIFTR in summer 2022 (n=85). Sampling was stratified by the east and west sides of Cleveland due to broad sociodemographic differences, which are linked to the historic redlining practices of the mid-20$^{th}$ century and contribute to higher rates of area deprivation on the east side of the Cuyahoga River compared to the west side[19] as well as a greater number of tobacco retailers (229 on the east side and 193 on the west side) based on the 2022 CIFTR data collection. Thus, random sampling was conducted with 20% of retailers within each geographic stratum.

### Data Collection

The data collection tool used items adapted from the Standardized Tobacco Assessment for Retail Settings (STARS) surveillance developed by the State and Community Tobacco Control Research as well as the tobacco-related Assurance of Voluntary Compliance Field Inspection Form which are both published by Counter Tools to capture availability and placement of tobacco products.[23,24] The adaptation of these items asked specifically about the availability of products marketed as "delta" or "Δ" THC (eg, delta-8, delta-10) and the placement of these products (eg, behind the counter, on the counter, within 1 foot of candy, or elsewhere) to evaluate the potential accessibility of these products to adolescents or children with products that were behind the counter being considered not accessible and those on the counter, by candy, or elsewhere being

considered accessible. Two items were developed to better understand the availability of these products across consumption modality to gain a broader sense of how products may appeal to individuals who use or co-use tobacco or cannabis (eg, inhaled vape or combustible) or to youth (eg, edible candies). To capture this, the data collection tool included options to indicate whether the products available were intended to be inhaled (eg, as a vape or vaping concentrate, prerolled joint, or "flower") or eaten (eg, as a candy, beverage, or other edible). Lastly, to capture any information about potential consumers, an open-ended question, "Who buys [HDPCPs]?" was developed to help guide the development of future surveillance items. The data collection tool used in this research is shown in the Appendix.

Two research assistants received training in the audit tool and protocol before conducting any audits. Prior to conducting the pilot study, the tool was tested in 3 retailers and modifications to the tool or protocol were made based on the feedback received by the research assistants. Once the tool and protocol were finalized, both research assistants visited each of the 85 retailers between October 2022 and January 2023. Three retailers were excluded from data collection and analysis because they were closed or declined to participate, yielding a final sample of 82 retailers.

### Analysis

Data on the availability, placement, and consumption modality of HDPCPs in tobacco retailers are provided descriptively. Bivariate analyses using chi-square and Fisher exact tests were used to evaluate differences, if any, between HDPCP availability, placement, and consumption modality on the east and west sides of Cleveland. In addition to the quantitative data, qualitative summaries regarding potential consumer characteristics were summarized to generate recommendations for future data collection.

## RESULTS

Across the random sample of tobacco retailers visited in this pilot study (n = 82), 41.5% (n = 34) carried HDPCPs (Table 1). The HDPCPs were predominantly located behind the counter (97.1%) in places that were not accessible to consumers without the assistance of a retail clerk. Only one store placed these products on a counter, and no stores placed them near candy or elsewhere in the store. Products were available in both consumption modalities, inhaled (82.4%) and edible (70.6%). No differences were observed between retailers on the east side or west side of Cleveland with respect to availability, placement, or modality with one exception. West side retailers were more likely to carry both inhaled and edible forms of HDPCPs than retailers on the east side (76.5% compared to 37.5%, respectively).

Qualitative responses were captured from HDPCP retailers (n = 33). Clerks responding to the question regarding who is purchasing these products consistently mentioned age in their responses while others discussed other demographic characteristics including race and gender. When discussing age, there was substantial variability among responses particularly with no clear age group emerging as the primary consumer. Several clerks reported that younger populations typically purchase HDPCPs, while others reported middle aged or older consumers. Finally, some clerks reported that "everyone" bought these products or that ages were "varied" with a "mix of old and young."

## DISCUSSION

Results from this pilot study demonstrate that HDPCPs are prevalent in tobacco retailers in Cleveland, with 41.5% of retailers in this pilot study offering some form of these products (eg, inhaled, edible), which may necessitate broader epidemiological surveillance and investigation in Cleveland as well as the state of Ohio.

The high prevalence of HDPCPs in this Cleveland sample, along with a lack of regulation or restriction on these products in Ohio, necessitates regulatory oversight. While Ohio legalized adult can-

**Table 1. Availability, Placement, and Consumption Modality of Hemp-Derived Psychoactive Cannabis Products[a] Cleveland, Ohio, 2022-2023**

| | Full sample n=82 | | East side n=43 | | West side n=39 | | |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | p value[b] |
| **Availability** | | | | | | | |
| | 34 | 41.5% | 16 | 37.2% | 18 | 46.2% | 0.4116 |
| **Placement**[c,d] | | | | | | | |
| Not accessible | 33 | 97.1% | 15 | 93.8% | 18 | 100% | 0.2817 |
| Accessible | 1 | 2.9% | 1 | 6.3% | 0 | 0% | - |
| **Consumption modality**[d,e] | | | | | | | |
| Inhaled[f] | 28 | 82.4% | 12 | 75.0% | 16 | 94.1% | 0.1304 |
| Edible[g] | 24 | 70.6% | 10 | 62.5% | 14 | 82.4% | 0.1412 |
| Both inhaled and edible | 19 | 55.9% | 6 | 37.5% | 13 | 76.5% | 0.0366 |

[a] Includes products marketed as "delta" or "Δ" tetrahydrocannabinol (THC) excluding delta-9 THC which is naturally occurring.
[b] Calculated based on chi-square or Fisher exact test.
[c] Placement was measured to evaluate the potential accessibility of these products to youth. Products located behind the counter were considered not accessible while products located on the counter or by candy were determined to be accessible. Notably, only 1 retailer had products on the counter and no retailers placed these products near candy or elsewhere in the store.
[d] The proportion calculated here represents the number of retailers carrying hemp-derived psychoactive cannabis products.
[e] Retailers could carry multiple modalities of products which means that totals will not add up to 100%.
[f] As a vape or vaping concentrate, prerolled joint, or "flower."
[g] As a candy, beverage, or other edible.

nabis use in 2023, HDPCPs are expected to remain a prevalent public health issue, as they produce similar psychoactive effects to THC[3] but are much more accessible than legal cannabis products. Adult use cannabis sales are restricted to licensed dispensaries, and, while the state of Ohio has a limited number of dispensaries currently, a preponderance of tobacco retailers selling HDPCPs have already been identified as highlight in this research, demonstrating the high accessibility of these products in Cleveland and likely throughout Ohio.

The availability of inhaled products may pose similar health risks to combusted cannabis as well as cannabis that is in a concentrate or vaping liquid. Combusted HDPCPs present with respiratory symptoms resembling those from smoking delta-9 THC cannabis, including cough, respiratory tract irritation, and throat tightness.[25] Combusted cannabis has been shown to carry similar health risks as tobacco smoke. For example, Graves et al identified 110 different compounds in combusted cannabis smoke that are known to have a carcinogenic effect—69 of which are shared with tobacco smoke.[26] Vaping concentrates may similarly pose health risks. An analysis of vaping liquids obtained from patients diagnosed with e-cigarette or vaping product use-associated lung injury (EVALI) indicates a high prevalence of unnatural THC isomers including delta-8 and delta-10.[27,28] Preliminary evidence shows that 41.5% of adults who use delta-8 primarily consume it as a vaping concentration, increasing the potential public health risks posed by these products.[14]

This research highlights substantial availability of HDPCPs in the form of edibles and candies in Cleveland. Livne et al found these modalities to be popular, with 30.9% and 25.0% of past 30-day delta-8 users using edibles and candies, respectively.[14] The availability of edible products present concerns specific to adolescents, particularly with respect to those products available as gummies that resemble popular name-brand candies both in package design and flavors.[29] Not only do these products appeal to youth, but there is also the added risk of accidental intoxication of adolescents. Forty-one percent of adverse events reported to the National Poison Data System in 2021 were for delta-8 THC involved unintentional exposure, and most of these reports (77%) were for children under the age of 18 years.[30] The ongoing development of even stronger HDPCPs (such as THC-P with physiological affinity 33 times that of naturally occurring delta-9) poses even higher risk for accidental intoxication and adverse events.[13] Risks to health are specifically high for adolescents, whose brains are still developing. A review by Fisher et al highlights that adolescent cannabis exposure contributes to both psychiatric symptoms and daily function and may alter neurobiological pathways of reward and stress.[31] There may be a need for additional considerations regarding age restrictions of these products to reduce the risks posed to adolescents. Currently, there is no federal mandate or policy in the US stipulating a minimum legal purchasing age. Even if product packaging itself indicates an age restriction, there is no legal obligation for HDPCP retailers currently to abide by these restrictions. Additionally, the widespread availability of these products may pose a risk to adults with substance use disorders. Given the psychoactive similarities between HDPCPs and cannabis, HDPCPs may be used as a substitute to cannabis, and a lack of information and education surrounding these products may cause accidental propagation of substance use disorders.[3,32]

The prevalence of HDPCPs in Cleveland, Ohio, was much greater among tobacco retailers compared to the prevalence documented in Fort Worth, Texas, where 11% of alcohol, tobacco, and cannabis retailers carried specifically delta-8 THC products.[15] However, this research may have captured a broader swath of HDPCPs available beyond delta-8 THC products. While the sample size of this study was limited to a subset of tobacco retailers in Cleveland, additional retail types may need to be examined such as cannabis dispensaries or alcohol retailers (although Livne et al suggests that the most common way of obtaining delta-8 THC is through stores that were not cannabis dispensaries[14]). Regardless, the prevalence of these products in these 2 municipalities in differing regions necessitates further investigation of this broader national phenomenon. Additionally, given the prevalence of HDPCPs in retailers that also sell commercial tobacco products, which are known to be marketed specifically toward marginalized populations,[33] further research should investigate whether these products are being marketed in the same way as commercial tobacco products.

While these results shed light on the emergence and prevalence of these products, there are several methodological improvements that may improve future surveillance. First, there was limited variability in the placement of these products highlighting several potential scenarios including that these products are less accessible in the retail setting to adolescents or products are higher value and require mechanisms of theft prevention. An improvement for capturing accessibility to adolescents could be capturing if retailers themselves have set a minimum purchasing age requirement. Second, results from Rossheim et al in Fort Worth, Texas, suggest that HDPCP item costs are variable across consumption modality with edibles (predominantly gummies) costing an average of $8.58 less than inhaled forms.[15] Specific formulations of HDPCPs were not captured in this research nor was a more in-depth measure of the consumption modality (ie, vaping concentrates, “flower,” and prerolled joints were combined into a single category). As an alternate means of capturing accessibility of products, individual products and their respective prices and marketing may provide further depth for consideration. Lastly, retailers describe the consumers consistently by age group with responses ranging across the lifespan yet the open-ended measure used to capture this among clerks and owners is subjective and limited in its interpretability. Consumer behavior and perceptions of these products may be better quantified through a more rigorous human subjects research design or through qualitative research

which would allow us to more effectively assess the broader population-level health impacts of these products.

## PUBLIC HEALTH IMPLICATIONS

Hemp-derived psychoactive cannabis products are an emerging product presenting pressing threats to public health and potential harms to consumers. Data suggests that these products are quite prevalent in the city of Cleveland, Ohio, with 41.5% of tobacco retailers in this pilot study offering them in some form. The high availability of HDPCPs highlights a need for additional research into these products to better assess the public health impact to determine if regulatory oversight is a necessary public health measure.

**Data Availability Statement**

Data can be made available upon reasonable request to the corresponding author.

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## APPENDIX—Data Collection Tool

| Tobacco, THC, Other: Product Placement & Advertising *check all that apply | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a. Product Available** | **NONE** | **BEHIND COUNTER** | **ON COUNTER/ KIOSK** | **BY CANDY (within 1 ft)** | **ELSEWHERE IN STORE** | **FLAVOR** CHARACTERIZING | **FLAVOR** CONCEPT |
| Cigarettes | | | | | | | |
| Menthol Cigarette | | | | | | n/a | n/a |
| LCCs | | | | | | | |
| ENDS | | | | | | | |
| NRT | | | | | | n/a | n/a |
| **a.1. New Products of Interest** | **NONE** | **BEHIND COUNTER** | **ON COUNTER/ KIOSK** | **BY CANDY (within 1 ft)** | **ELSEWHERE IN STORE** | **INHALED PRODUCT List types** | **EDIBLE PRODUCT List Types** |
| CBD | | | | | | | |
| Delta THC | | | | | | | |
| Kratom | | | | | | | |
| Other: | | | | | | | |

| **b. Interior Advertising** | **INSIDE** | | | | |
|---|---|---|---|---|---|
| | **NONE** | **BELOW 3 ft.** | **3+ ft.** | **FLAVOR CHARACTERIZING** | **FLAVOR CONCEPT** |
| Cigarettes | | | | | |
| LCCs | | | | | |
| ENDS | | | | | |
| NRT | | | | n/a | n/a |
| Hemp | | | | n/a | n/a |

| **c. Outdoor Advertising** | **# ON BUILDING** | | | | **# ON PROPERTY** | | | |
|---|---|---|---|---|---|---|---|---|
| | **NONE** | **#** | **FLAVOR CHARACTERIZ-ING** | **FLAVOR CONCEPT** | **NONE** | **#** | **FLAVOR CHARACTERIZING** | **FLAVOR CONCEPT** |
| Cigarettes | | | | | | | | |
| LCCs | | | | | | | | |
| ENDS | | | | | | | | |
| NRT | | | n/a | n/a | | | n/a | n/a |
| Hemp | | | n/a | n/a | | | n/a | n/a |
| **d. Is there local, state or federal t21 signage posted?** | **YES NO** | | | | | | | |
| **e. Did you purchase a product?** | **YES NO** | | | | **Did they check your ID? YES NO ___** | | | |