

2020 Regulated Marijuana Market Update

Prepared for:
Colorado Department of Revenue,
Marijuana Enforcement Division

PREPARED BY:



TABLE OF CONTENTS

Project Background	3-4
Summary	5-11
Market Trends	12-24
Market Structure	25-29
Supply & Demand	30-39
Covid Impacts	40-44
Appendices	45-47

PROJECT BACKGROUND

Overview

The Colorado Department of Revenue's Marijuana Enforcement Division (MED) commissioned this study to highlight key aspects of the state's regulated market. The MED provides this information to improve market transparency and to inform policymakers about the status of Colorado's marketplace.

The report provides several key metrics to the MED and highlights the use of the state marijuana Inventory Tracking System (provided by vendor METRC) to evaluate regulatory performance. This report is part of the state's continuous effort to monitor and improve a comprehensive marijuana regulatory framework.

This report is the fourth edition of Market Size and Demand for Marijuana in Colorado that was originally published in 2014. This edition examines the State's available Inventory Tracking System data through year-end 2020, focusing on the continued evolution of regulated marijuana trends in price, potency, product shares, production patterns, licensing structures and corporate market share, and product transfer flows.

This report also examines the effects of COVID-19 on daily transaction characteristics, sales volume, and consumer preferences.

 For more information please email info@mpg.consulting or brdinfo@colorado.edu.

Key Market Changes: 2018-2020

- **2018:** New courier/transport license
- **2018:** Own-source (vertical) products requirement eliminated
- **2019:** New medical conditions: autism and any condition treated with opiates
- **2019:** Public companies and nonresidents allowed to own Colorado marijuana companies
- **2020:** Medical marijuana delivery business commences
- **2020:** New hospitality establishment licenses become available

SUMMARY

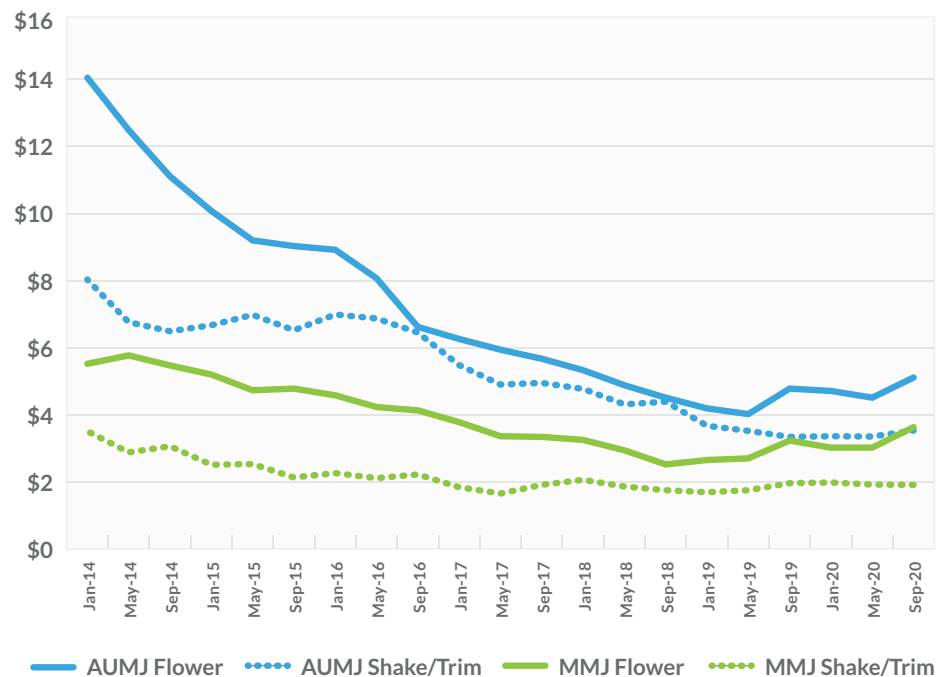
SUMMARY

This report provides an updated analysis of the regulated marijuana market in Colorado using new data through 2020 from the State’s Inventory Tracking System. The purpose of this report, completed under an interagency agreement between the Department of Revenue Marijuana Enforcement Division, University of Colorado, and MPG Consulting, is to provide continued analysis and insights into the State’s regulated marijuana market. The information presented in this report is targeted to help policymakers evaluate the effects of regulatory changes; identify shifts in market trends such as pricing, potency, and product mix; and to demonstrate the overall health and operational characteristics of the market. This report helps regulators continue to improve and build upon the market success, safety, and efficiency that the State has enjoyed as the longest-running legal marijuana market in the U.S.

Key themes examined in the report are summarized here:

- Saturation and maturity.** Several key market indicators such as prices, potency, and active licenses appear to be consolidating at stabilized levels, with minimal changes through 2020. As the market settles into maturity these market indicators could be stabilizing barring any external shocks, as corporate entities continue to shift toward a more concentrated market with fewer, but larger, participants.
- Pricing.** 2020 marks the first year in which prices reached and sustained higher levels than in previous years. The average prices for Flower, Shake/Trim, and Concentrates reached all-time lows in mid-2019, increasing slightly into 2020 and settling at higher levels. The wholesale market also had elevated prices in 2020 (p. 21), showing that prices

AVERAGE PRICE PER GRAM OF FLOWER & SHAKE/TRIM



increased throughout the supply chain. Edibles is the only category in which 2020 prices were lower than 2019; however, the decrease was minimal, and the downward trend appears to be slowing. The stabilization of prices across the market suggests that supply, demand, and profitability may have reached an equilibrium.

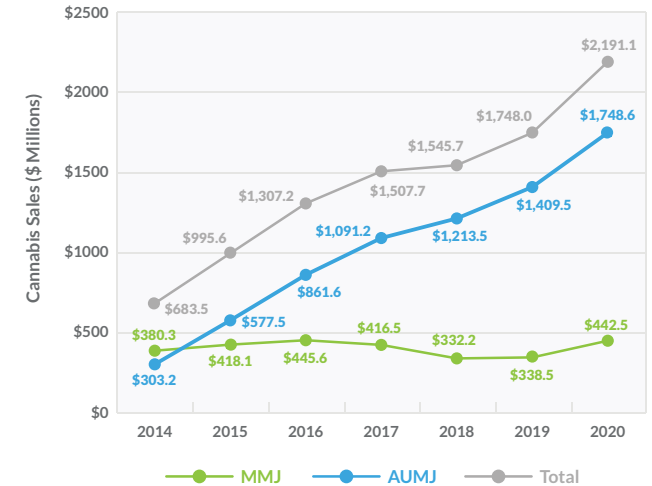
- Adult use marijuana sales continued annual growth was expected; an increase in medical marijuana sales was unexpected.** Total Adult Use Marijuana (AUMJ) sales continued a rapid growth trend in 2020, reaching a new record of \$1.75 billion (24.1 percent higher than the

SUMMARY

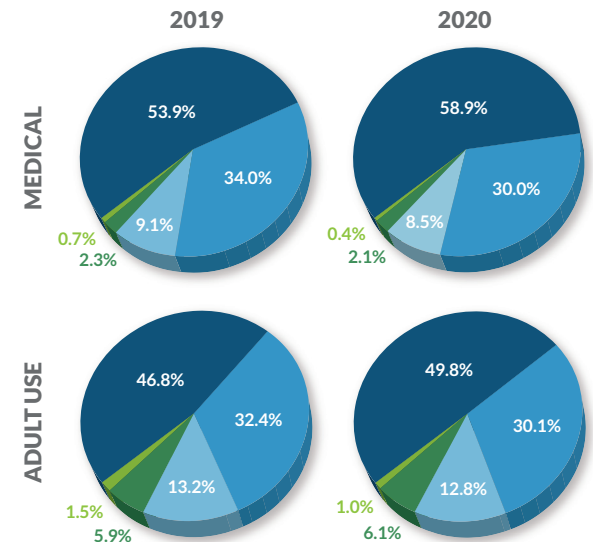
previous record of \$1.41 billion in 2019). COVID-19 increased demand for adult-use and medical marijuana as household spending shifted to food, drink, and entertainment consumed at home. The first significant increase in MMJ sales since 2016 was observed in 2020, rising from \$338.5 million in 2019 to \$442.5 million in 2020 (a 30.7 percent gain). This uptick, combined with an increase in registered MMJ patients, might suggest that some AUMJ demand may have shifted back into the MMJ market where prices tend to be lower, perhaps as a response to COVID-19. Price increases in 2020 likely played a small role, but increased sales continues to primarily reflect increased demand for Colorado marijuana.

- Flower reclaimed market share from Concentrates for the first time, perhaps signifying a shift in consumer preferences that could be related to COVID-19.** Flower has been the most popular product category in both the AUMJ and MMJ markets, however it has steadily lost market share as Concentrates and Edibles have increased in popularity. Data from 2020 represents the first year in which Flower has increased in market share compared to the previous year, increasing from 53.9 percent of all MMJ sales to 58.9 percent, and from 46.8 percent of all AUMJ sales to 49.8 percent. The unexpected shift back toward Flower could be related to reverting preferences, availability, a response to COVID-19 quarantines, or the lingering effects of reports of vape-related lung injuries that occurred in late 2019 as a result of illicit market products causing a change in consumer preferences. Flower pricing was up relative to concentrates and edibles, also contributing to the increase in market share value relative to quantity sold.
- The average potency of most products has leveled off.** The average THC content of Flower increased slightly to 19.2 percent in 2020 from 18.8 percent in 2019 (a 2.1 percent year-over-year increase), reflecting continued improvements in genetics and production processes. The overall average THC content of Concentrate products sold by the gram decreased slightly in 2020 to 67.8 percent from 69.4 percent in 2019, which is negligible in practicality. The two exceptions to potency stabilization in 2020 were vaporizer cartridges, which increased from 69.1 percent THC in 2019 to 79.7 percent in 2020, and MMJ Edibles, which increased from 540 to 737 milligrams of average THC content.

ANNUAL COLORADO MARIJUANA SALES



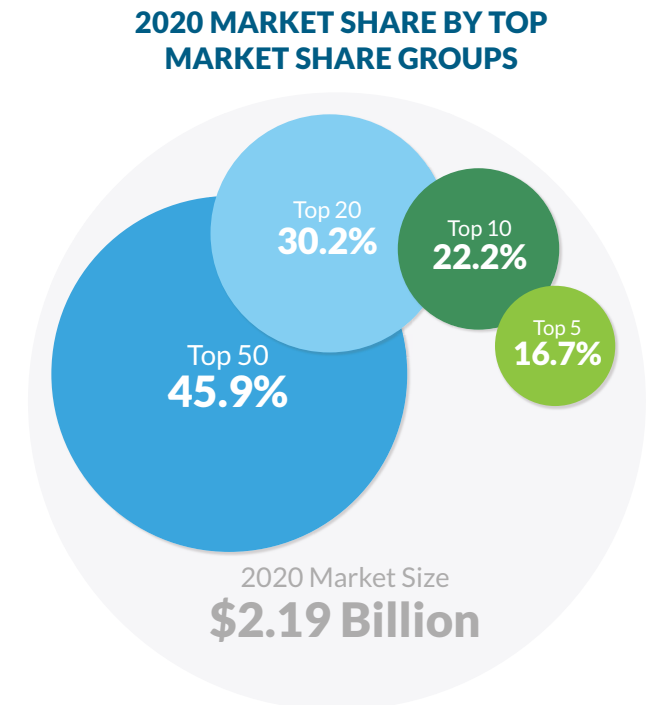
MARIJUANA PRODUCT CATEGORIES BY MARKET SHARE



Note: Figures may not add due to rounding and a small amount of seed and clone sales (< 0.1%).

SUMMARY

- **The COVID-19 pandemic had a notable impact on short-term sales and transactions and may have affected consumption patterns and supply chains.** In mid-March the State began enacting restrictions on businesses and social gatherings in response to COVID-19. During this initial lockdown period, several sales metrics increased, including daily sales and transactions, as well as average daily items and expenditures per receipt. Over the next several months, Flower also grew in terms of market share. Concentrates and Edibles declined in market share over the same period, suggesting that consumers and suppliers switched to Flower as the state restricted activities, and then gradually transitioned back toward Concentrate and Edible products later in the year. A potential theory is that consumer preferences shifted as a result of being at home, and the availability of Concentrates and Edibles may have decreased as producers rushed to keep products on the shelves, skipping the manufacturing process and sending more flower directly to retailers. Transfer data from manufacturers to retailers lends some support to this explanation of sales decline.
- **Inventory Tracking System data continues to provide valuable insights into market compliance and performance.** Each year, the report examines regulated marijuana production, transfers, and sales to further understand the quantity and channels through which products come to market. One of the most important outcomes of this analysis is the residual product that is not accounted for in sales or inventory. Over time, the Colorado market has demonstrated a marked improvement in accounting for regulated marijuana products, indicating a persistent trend in compliance in recordkeeping, inventory management, and transparency.
- **Retail market concentration:** The Top 5 entities accounted for 16.7 percent of sales and the top 10 entities accounted for 22.2 percent of sales in 2020. COVID-19 uncertainty may have dampened consolidation efforts, but this trend seems likely to continue as the market exhibits further maturity. Colorado's market is in its early stages and remains very competitive when compared to other industries. See page 29 for more information on industry concentration.



The report is organized in three main sections:

1. Market Trends; 2. Market Structure; and 3. Supply & Demand.

The report also includes an appendix that provides detail on the Flower Equivalent metric and calculation.

Definitions (1 of 2)

Adult Use Marijuana (AUMJ)

Marijuana that is grown and sold for adult use pursuant to the Retail Code and includes seeds and immature plants. Unless the context otherwise specifies, Concentrates and Infused Products are considered adult use marijuana and are included in the definition. The terms “retail” and “recreational” were often used in this context previously. The acronym AUMJ is used for adult use marijuana throughout the report.

Concentrate

Refers to any product which extracts cannabinoids and other compounds into a resinous material. This umbrella term includes any type of hash, solventless (kief, rosin), as well as any hash oils (BHO, CO2 oil, shatter, wax, etc.) and indicates that these products are a concentrated form of marijuana, carrying a higher potency.

Edible

Any adult use or medical marijuana product for which the intended use is oral consumption, including but not limited to, any type of food, drink, or pill.

Flower Equivalent

A measure developed specifically for this study that converts non- Flower consumption or production into weight-based units of Flower based on relative THC content. This method allows regulators to properly compare supply, demand, potency, and pricing across different product types.

Herfindahl-Hirschman Index (HHI)

An indicator of market concentration (or consolidation), using values between 0 and 10,000. A value below 100 indicates that there are numerous competitors with no dominant operators and a value of 10,000 indicates that the market is organized as a pure monopoly, where one company accounts for 100 percent of all sales. The HHI is calculated by taking the market share of each firm in an industry, squaring them, and summing the result.

Infused Product

A product infused with marijuana that is intended for use or consumption other than by smoking, including but not limited to, edible products, ointments, and tinctures.

Inventory Tracking System

State statute requires an inventory tracking system that monitors product flows from seed or immature plant stage until the final product is sold to a customer at an adult use or medical marijuana store.

Licensee or License Holder

Any individual licensed pursuant to the Colorado Marijuana Code (previously Retail Code or Medical Code).

Definitions (2 of 2)

Marijuana Demand

Marijuana demand is defined as the annual amount of marijuana sold in regulated adult use and medical stores expressed in weight.

Marijuana Flower

The Flowering buds of the female marijuana plant that are harvested and cured for sale to manufacturers, adult use or medical stores.

Marijuana Supply

The annual amount of marijuana Flower and Shake/Trim harvested expressed in weight (metric tons).

Medical Marijuana (MMJ)

Marijuana that is grown and sold pursuant to the Medical Code and includes seeds and immature plants. Unless the context otherwise requires, Medical Marijuana Concentrates and Infused Products are considered Medical Marijuana and are included in the definition. The acronym MMJ is used for medical marijuana throughout the report.

Regulated Marijuana

Adult use and medical marijuana that is under the regulatory oversight of the Colorado Department of Revenue's Marijuana Enforcement Division.

Shake/Trim

After harvest, the marijuana plant is generally trimmed of its leaf matter, leaving behind only the flowering buds. Shake/Trim refers to the leftover leaves, which can be used for making Concentrates and Infused products.

THC

Delta-9-tetrahydrocannabinol, the main psychoactive compound in marijuana.

2020 Inventory Tracking System Data Description

Facility Ownership

The ownership data includes 9,166 observations. Attributes include license number, license type, licensee name, owner name, ownership share, address, city, and zip. Data obtained from MED My License Office database.

Harvest

The harvest data includes 195,722 observations for 2018, 155,209 observations for 2019, and 140,838 for 2020. Attributes include harvest ID, name, drying location, current weight, waste weight, wet weight, packaged weight, plant count, and harvest date.

Plants

The plant data includes 1,330,874 observations for 2018, 1,512,079 for 2019, and 1,575,108 for 2020. Attributes include license number, licensee, immature plant count, vegetative plant count, flowering plant count, harvested plant count, and destroyed plant count.

Plant Allocations

The plant allocation data includes 1,390 observations. Attributes include license number, licensee, tier, and allocated plants.

Transfers

The shipment/transfer data includes 3,026,381 observations for 2017, 3,406,716 for 2018, 3,828,543 for 2019, and 4,516,284 for 2020.

Attributes include the shipper facility license number and name, recipient facility license number and name, shipment type, product and product category name, and the shipped and received quantity.

Testing

The 2020 testing data includes 819,618 observations. Attributes include the origin facility type and ID, retail indicator, package ID, package label, product category, testing facility type and Id, testing facility name and license number, test type, and test result.

Sales

The sales data includes approximately \$1.55 billion in marijuana sales representing 43,524,912 transactions in 2018, \$1.75 billion in marijuana sales representing 65,960,024 transactions in 2019, and \$2.1 billion in 2020 across 72,260,077 transactions. Sales transaction attributes include license number, adult use/medical, geographic location, receipt ID, transaction ID, package label, product category, total price, and quantity sold.

Average Market Rate

The data on Average Market Rates for wholesale transactions used in this report is publicly available through the Colorado Department of Revenue website and includes quarterly values from January 2014 through April 1, 2021. Attributes include date, wholesale price per pound of buds, trim, buds allocated for extraction, trim allocated for extraction, wet whole plants, contaminated product allocated for extraction, immature plants (each), and seeds (each).

MARKET TRENDS

Introduction

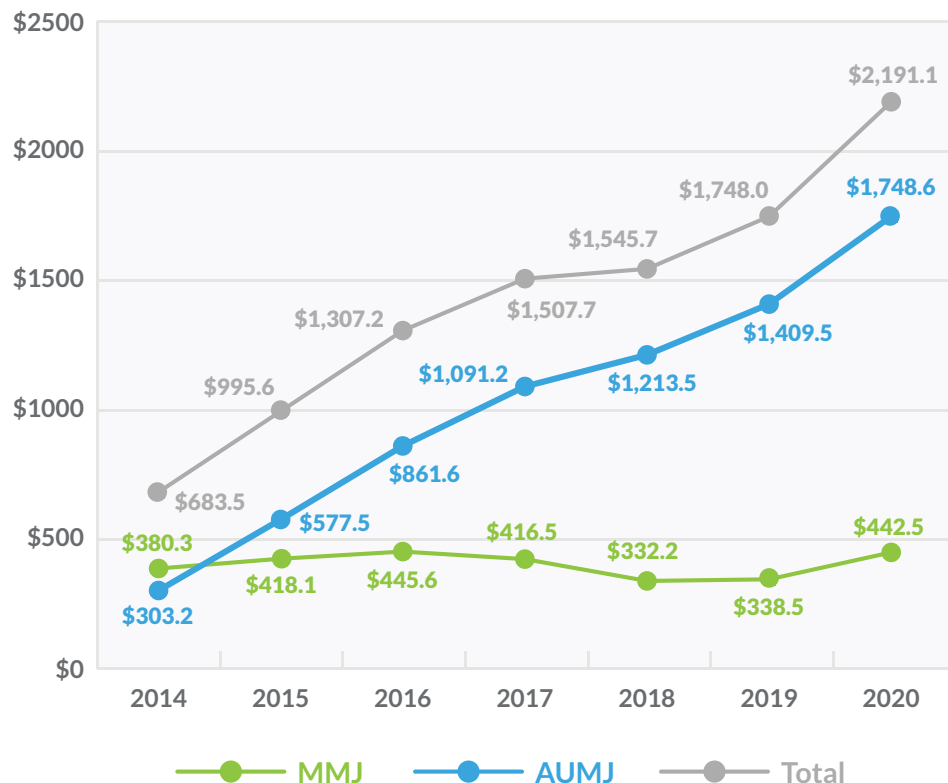
This section provides a review of market trends and patterns observed in the adult use marijuana (AUMJ) and medical marijuana (MMJ) markets, compares them to historical data, and provides commentary on implications and insights. The 2020 market saw several important market data indicators begin to consolidate and stabilize, providing increasing evidence that Colorado's regulated marijuana market is nearing maturity and a stable equilibrium. This analysis utilizes inventory tracking data collected by the MED on prices, potency, transaction receipts, and sales quantities. The key findings from the analysis are summarized below:

1. MMJ market size increased significantly for the first time since 2016.

Reversing a steady decline, the MMJ market increased from \$338.5 million in 2019 sales to \$442.5 million in 2020, a 30.7 percent gain. This uptick suggests that some AUMJ demand may have shifted to the MMJ market where prices tend to be lower, perhaps as a response to COVID-19 restrictions. The increase in MMJ sales does not appear to have slowed AUMJ sales growth, which increased to \$1.75 billion in 2020, up 24 percent from 2019. Increasing prices in 2020 were likely a factor, however sales growth in both markets continues to primarily reflect a general trend of increased demand for regulated Colorado marijuana coupled with an increase in consumable product demand associated with COVID-19.

- 2. Prices have stabilized above their historical lows from 2019.** Average prices for Flower and Concentrates in 2020 in both the AUMJ and MMJ markets were higher than those observed in 2019, after more than five years of steady decline. The average price for a gram of AUMJ Flower increased 20 percent from 2019 to 2020, while MMJ Flower increased 26 percent. The price changes of Concentrate products were mixed, with prices per gram declining by 2.9 percent in the AUMJ market but increasing 4.4 percent in the MMJ market. Vaporizer cartridges and Edibles were the only two product categories to exhibit lower average prices in 2020, likely reflecting continued improvements in extraction methods and lower non-cannabis input costs.
- 3. Average THC potency appears to be reaching a plateau.** The THC content of Flower and Concentrates have historically increased each year as genetics and production techniques improved. In 2020, this trend has slowed, with Flower increasing in average THC content only by 2.1 percent and the average Concentrates decreasing by 2 percent. The two exceptions were MMJ edibles and AUMJ vaporizer cartridges, which increased in average THC content per unit.
- 4. Flower market share increased for the first time.** Since 2014, Flower has held the largest market share in both the AUMJ and MMJ markets. However, each year Flower market share declined while Concentrates and Edibles increased. Data from 2020 represents the first year in which Flower has increased in market share compared to the previous year, increasing from 53.9 percent of all MMJ sales to 58.9 percent, and from 46.8 percent of all AUMJ sales to 49.8 percent. Data shows an increase in both flower price and quantity sold in 2020.

Annual Sales Colorado Regulated Marijuana 2014-2020



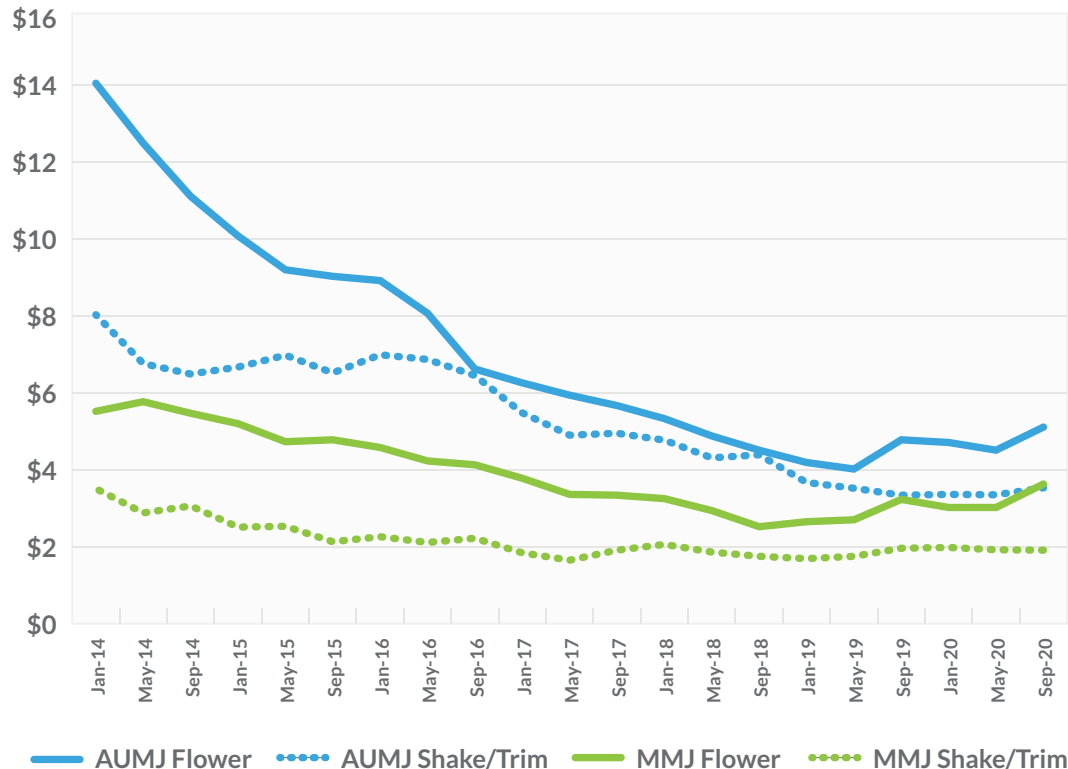
- Colorado continued its steady upward trend in total annual sales with another record year of \$2.19 billion in 2020, a 25.3 percent increase over the previous 2019 record sales of \$1.75 billion. The total market size has averaged 22.2 percent in year-over-year sales growth from 2015 to 2020. For comparison, Colorado liquor excise tax collections grew by an average of 3.5 percent each year over the same period¹ and the Dow Jones Industrial Average increased by 10 percent per year.²
- The first significant increase in MMJ sales since 2016 was observed in 2020, rising from \$338.5 million in 2019 to \$442.5 million in 2020, a 30.7 percent gain. This uptick suggests that some AUMJ demand may have shifted to the MMJ market where prices tend to be lower, perhaps as a response to COVID-19 restrictions.
- The increase in MMJ sales does not appear to have slowed AUMJ sales growth, which increased to \$1.75 billion in 2020, up 24 percent from 2019.
- The following slides demonstrate that 2020 was the first year since the 2014 inception of AUMJ in which prices did not continue a sustained decline, stabilizing above the lowest price levels observed in 2019. Sales growth continues to primarily reflect increased demand for regulated Colorado marijuana, with a slight increase in prices also a contributing factor for the first time.

1. Colorado Dept. of Revenue. <https://cdor.colorado.gov/data-and-reports/liquor-data/liquor-excise-tax-reports>.
 2. Federal Reserve Economic Data (FRED) <https://fred.stlouisfed.org/series/DJIA>

Average Price Per Gram of Flower & Shake/Trim

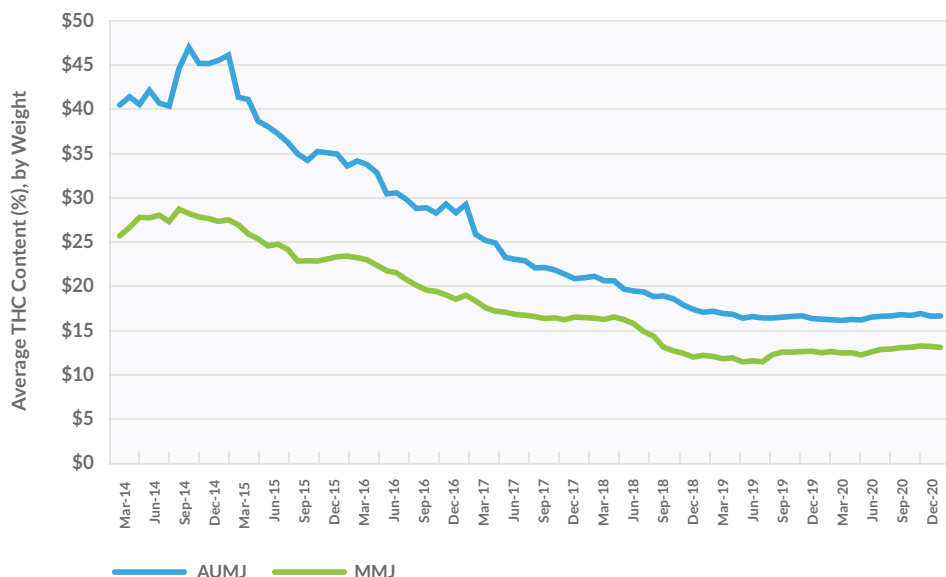
- Average Flower prices rose consistently for the first time from mid-2019 through 2020, fluctuating around levels that were first observed in 2017.
- Beginning in mid-2019, the average price for a gram of AUMJ Flower increased from a low of \$3.99 in April 2019 to an average of \$4.80 in 2020, a 20 percent increase. MMJ Flower price per gram increased from a 2019 low of \$2.60 to average \$3.28 in 2020, a 26 percent increase.
- Shake/Trim prices exhibited less significant changes over the past year, with average prices decreasing from \$3.46 in 2019 to \$3.39 in 2020 in the AUMJ market. Prices increased from \$1.82 to \$1.95 in the MMJ market.
- The 2020 increase in prices in both markets occurred even as total retail outlets and production levels increased to all-time highs, suggesting that the market found a price floor in 2019.

AVERAGE FROM 2014 THROUGH 2020



MARKET TRENDS

AVERAGE PRICE PER GRAM OF CONCENTRATES



AVERAGE 2020 PRICE PER GRAM OF CONCENTRATE, BY TYPE

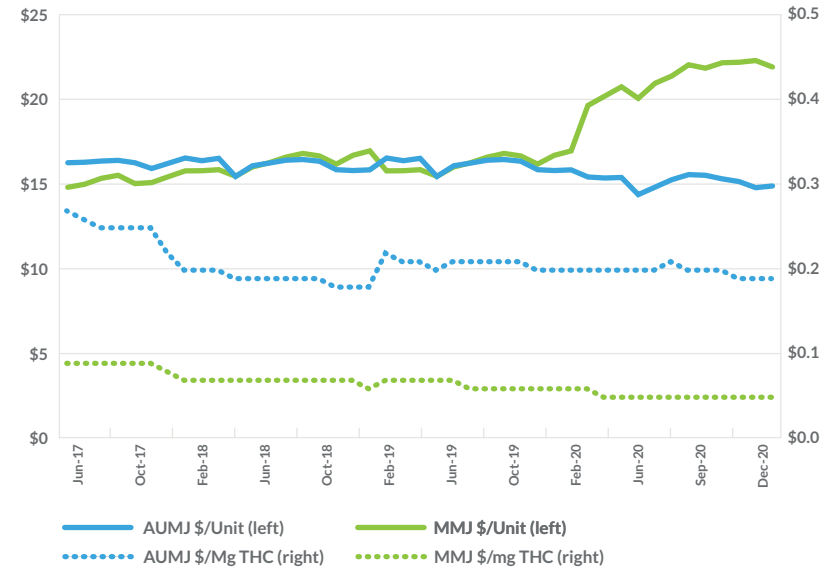
Product	AUMJ	MMJ
All Concentrates (g)	\$16.55	\$12.85
500mg Vaporizer Cartridge (each)	\$21.80	\$13.53
Oil (g)	\$22.23	\$16.55
Resin (g)	\$23.11	\$18.46
Hash (g)	\$22.52	\$14.29
Sugar (g)	\$16.88	\$12.82
Wax (g)	\$14.94	\$11.38
Butter (g)	\$14.75	\$11.97
Shatter (g)	\$14.29	\$11.06

- Concentrate prices have stabilized, with the AUMJ price per gram decreasing slightly from an average of \$17.06 per gram in 2019 to \$16.55 in 2020 (2.9 percent). Concentrate prices increased slightly in the MMJ market from an average of \$12.40 in 2019 to a 2020 average of \$12.85 (4.4 percent). These prices are based on Concentrate products sold by the gram and do not include vaporizer cartridges, which are sold on a per-unit basis.
- Vaporizer cartridges remain one of the most common forms of Concentrate products and represent one of the only regulated cannabis product categories to exhibit a significant price decline likely due to further improvements in production methods and technology. The average price of a 500mg cartridge decreased from \$26.02 in 2019 to \$21.80 in 2020 in the AUMJ market (16.2 percent), and from \$16.47 to \$13.53 in the MMJ market (17.8 percent). Where a portion of the cost of vaporizer cartridges is due to the non-cannabis materials used in the cartridge itself (glass, metal, and electronics), prices may have room to decrease even further, depending on material costs and technological/efficiency improvements in production.
- The other categories of Concentrate products observed fewer price movements in 2020 compared to 2019 and remain similarly ranked in terms of average price.

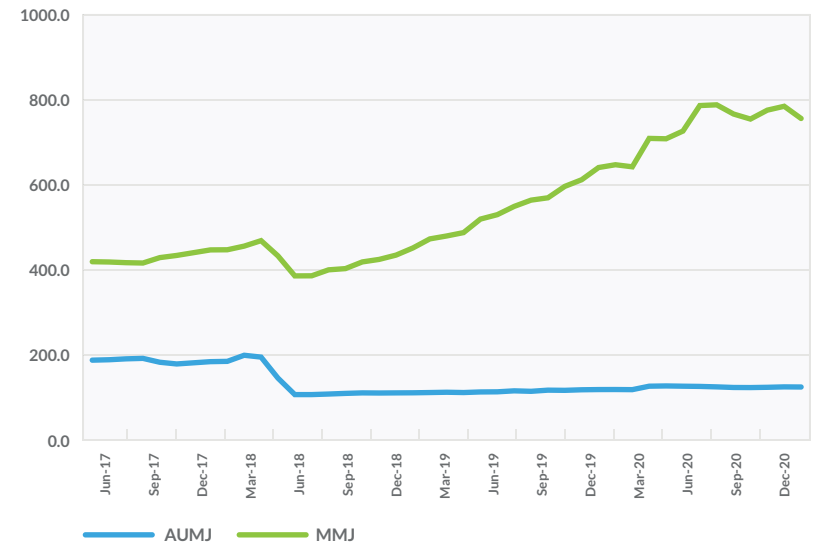
Average Price per Edible Unit

- Marijuana Edibles are sold and recorded as individually packaged units. One unit may contain a single brownie or cookie, or multiple gummies. The testing and sales data allows for an evaluation of average prices per unit, as well as average THC per unit.
- From 2017 through 2019, the average price per unit of Edibles in the AUMJ and MMJ markets were comparable at around \$16, illustrated by the solid lines in the figure to the top right.
- The dotted lines in the top right figure illustrate the average cost of 1 milligram of THC in Edible form for each market on the right axis, both exhibiting slight downward trends over time. In the AUMJ market, 1 milligram of THC in Edible form averaged \$0.20 in 2020, while the average cost per milligram of MMJ Edible THC was \$0.05.
- In 2019, the average price per unit of Edibles (solid lines) was \$16.16 in the AUMJ market, declining to \$15.16 in 2020. MMJ Edibles increased from \$16.25 in 2019 to \$21.28 in 2020.
- This uptick in the price of MMJ edible units coincides with a significant increase in the average amount of THC per MMJ Edible package, as shown in the figure to the bottom left. Since mid-2018, MMJ edibles have increased from an average of 400 milligrams of THC per package to almost 800 milligrams of THC in 2020.
- In 2018, a rule was imposed to limit the amount of THC in AUMJ Edible packages to 100 milligrams, which is reflected in the flat THC content levels for AUMJ Edibles.
- The increase in the average price of MMJ Edibles packages may be explained by additional production costs associated with increasing the THC content.

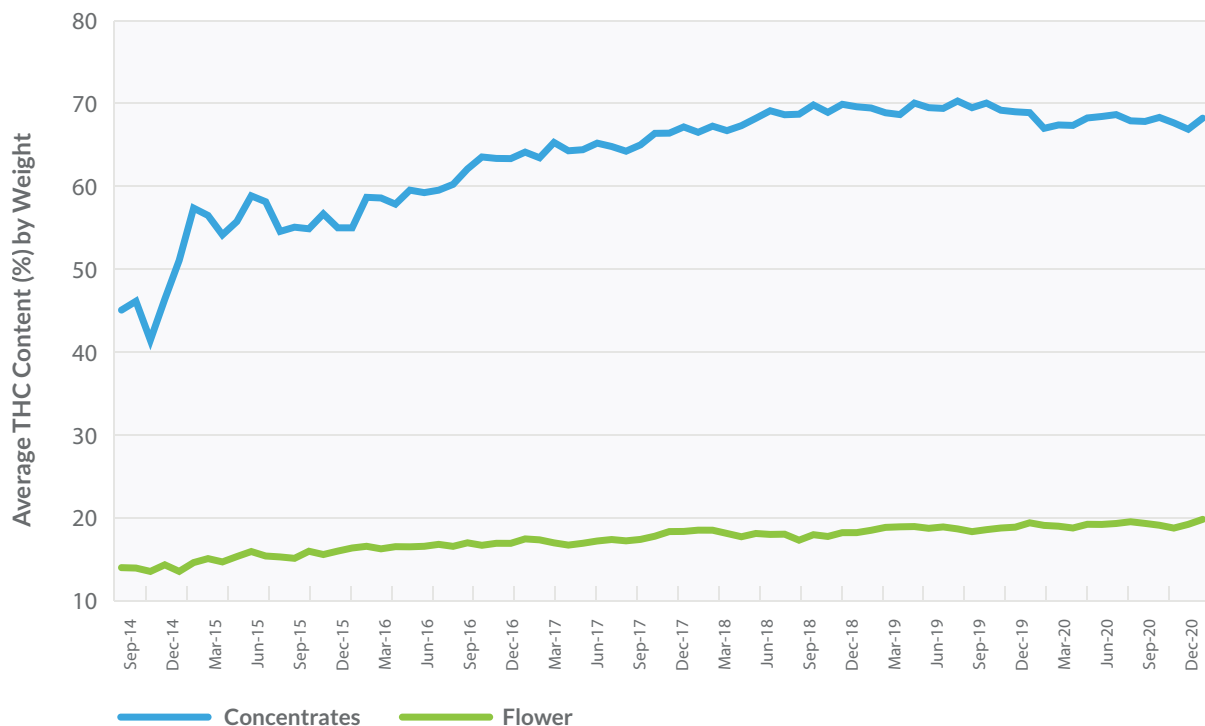
AVERAGE PRICE PER PACKAGED EDIBLE UNIT & MILLIGRAM OF THC



AVERAGE THC CONTENT PER PACKAGED EDIBLE UNIT (MG)



Average THC Content (%) per Gram of Flower & Concentrate



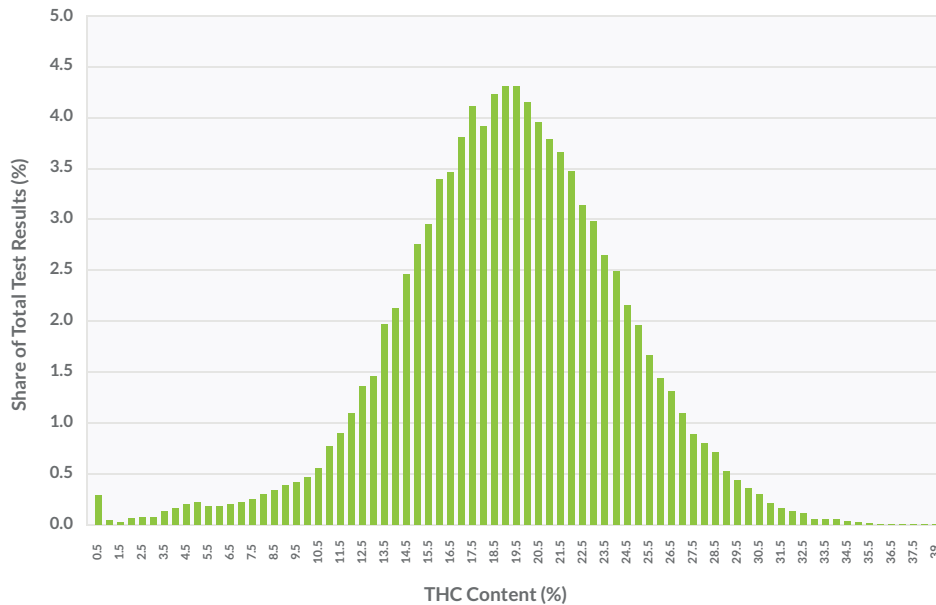
2020 AVERAGE THC CONTENT (%), BY DETAILED PRODUCT TYPE

Product	Avg THC %
Flower (g)	19.17%
Shake/Trim (g)	17.03%
Concentrates (g)	67.82%
500mg Cartridge (each)	79.67%
Oil (g)	73.60%
Resin (g)	71.60%
Shatter (g)	70.97%
Sugar (g)	70.93%
Wax (g)	70.93%
Butter (g)	67.14%
Hash (g)	61.40%

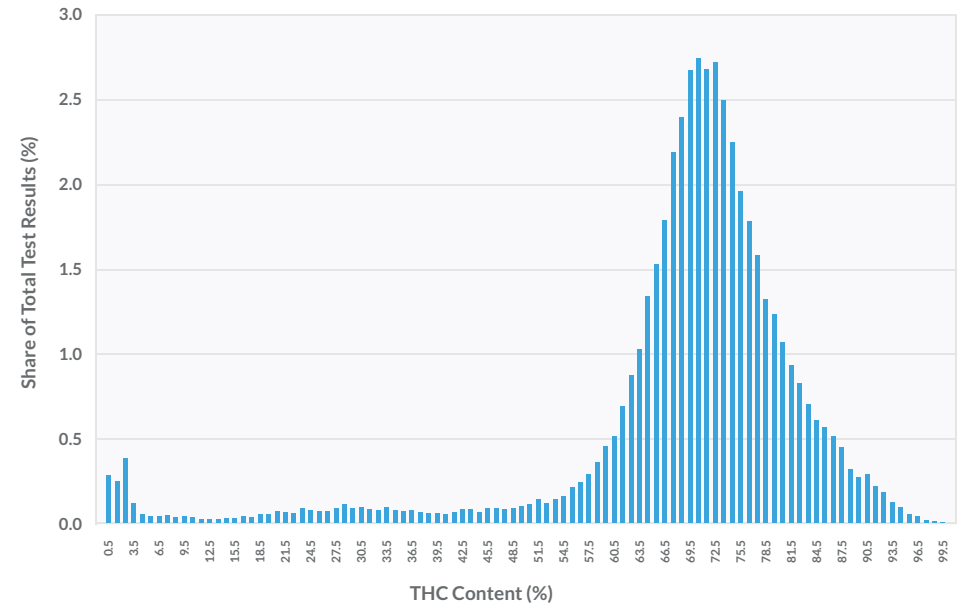
- The average THC content of Flower continued a modest upward trend in 2020, increasing to 19.2 percent potency from 18.8 percent in 2019 (a 2.1 percent increase). The Flower potency trend likely reflects continued improvements in genetics and production processes as growers strive to produce the most efficient THC possible, especially for manufactured and infused products.
- The average THC of Concentrate products sold by the gram decreased slightly in 2020 to 67.8 percent from 69.4 percent in 2019. This change is statistically significant, although in practicality somewhat mixed across product types. Among the Concentrate product types, Sugar, Butter, and Hash all declined in average THC content while Oil, Shatter, Wax, and Resin all had slight increases.
- The average 500 milligram vaporizer cartridge increased in THC content, from 69.1 percent in 2019 to 79.7 percent in 2020. This increase likely corresponds to both improvements in production processes and market demand for a convenient and discrete cannabis product.

Potency Distribution for Flower & Concentrates

2020 FLOWER POTENCY DISTRIBUTION

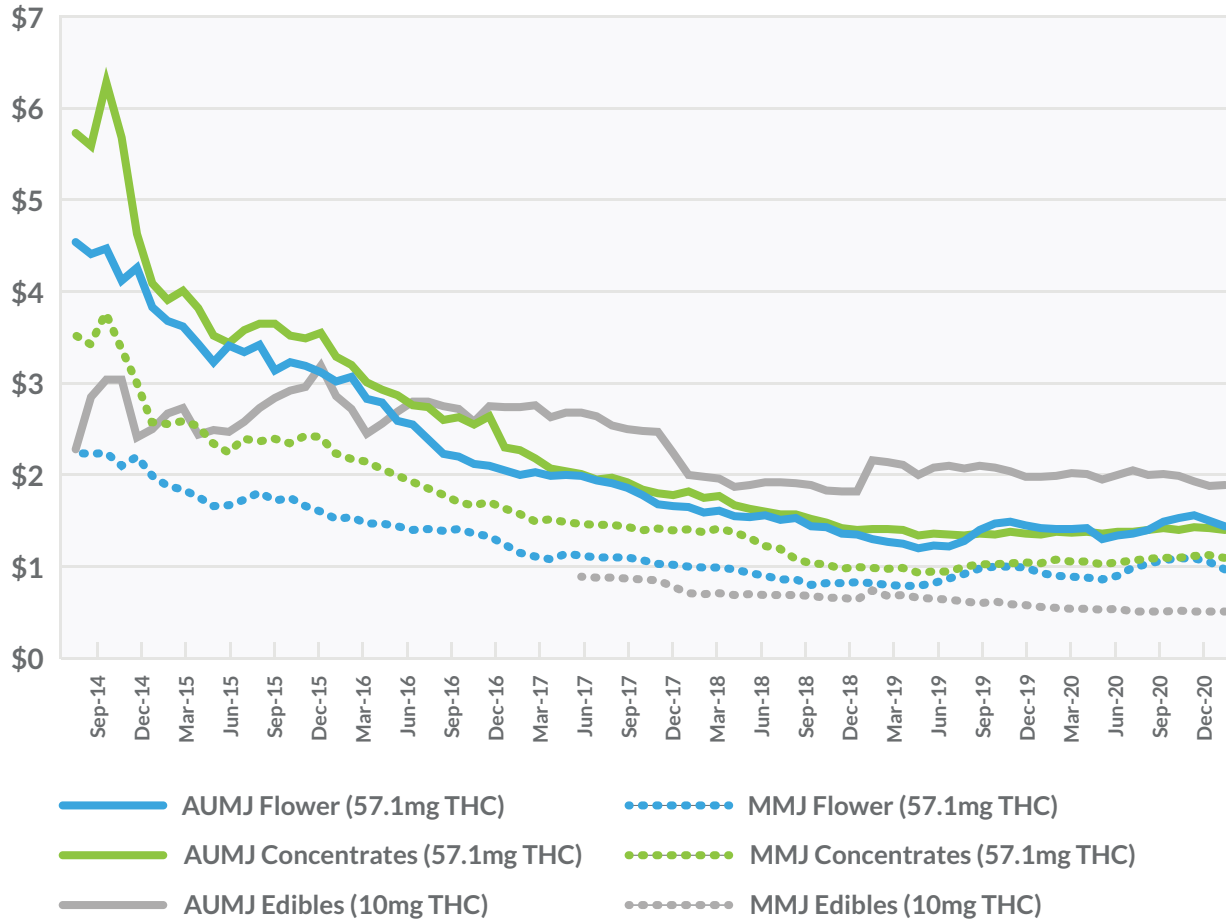


2020 CONCENTRATE POTENCY DISTRIBUTION



- This year's report also examines the distribution of Flower and Concentrate THC content data, in addition to the time series analysis presented on the previous slide. These charts represent the percentage of THC test results that fall within a given range. For example, 4.3 percent of all Flower tests had a total THC content of 19.0 percent.
- In both product categories, there is a normal Bell-shaped distribution around the average, with a node at the left side of the distribution indicating a number of tests with near-zero THC content. These low-THC products include CBD products that are intentionally produced with minimal THC, as well as products that unintentionally had low THC such as a pollinated crop of flower or a bad batch of concentrates resulting from equipment error.

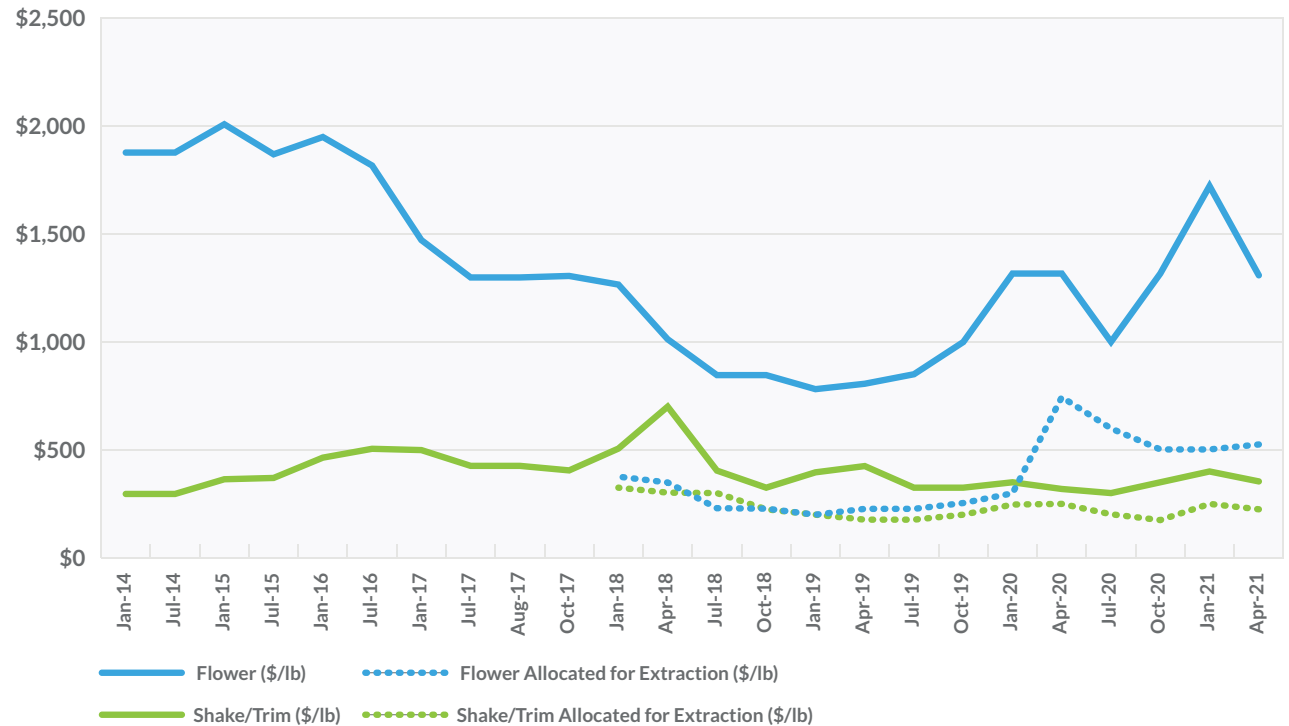
Average Price per THC Dose, by Product



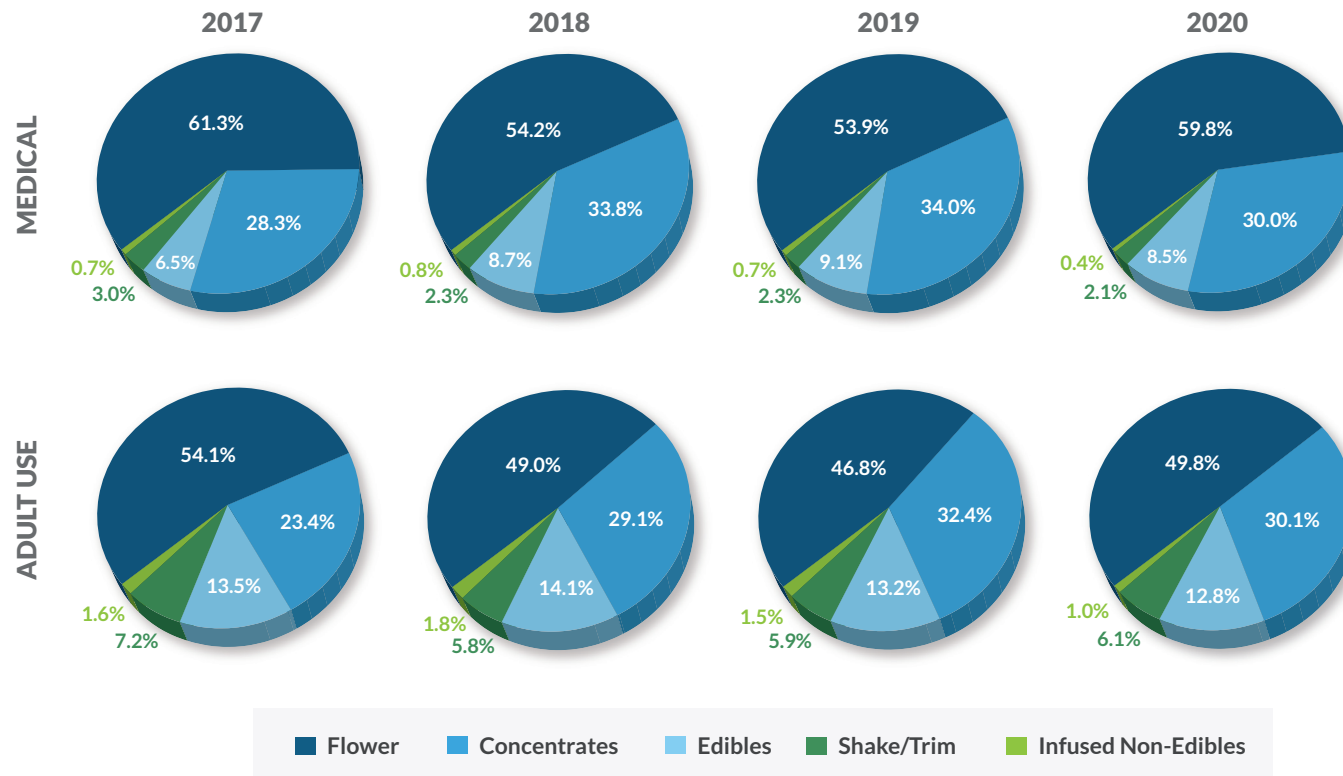
- Colorado has defined a dose of THC as 57.1 milligrams of inhaled THC, or 10 milligrams of ingested THC, based on MPG findings in the [2015 Equivalency Study](#).
- The Inventory Tracking System data on price per gram and THC potency is combined with these definitions to examine the average price per dose of THC across the three primary product types: Flower, Concentrates, and Edibles.
- The trends and rankings of price per dose have remained quite consistent since early 2019. AUMJ edibles were the most expensive form of THC dose in 2020 at \$1.98, followed by AUMJ Flower at \$1.43 and AUMJ Concentrates at \$1.39.
- On a per dose basis, MMJ products are cheaper across the board, with an average 2020 price per dose of \$1.08 for MMJ Concentrates, \$0.98 for MMJ Flower, and \$0.52 for MMJ Edibles.
- In 2019 and 2020, the rate of change in both prices and potency have stabilized across the market, leading to the more consolidated and consistent prices seen in this figure.

Average Market Price (Wholesale Transactions)

- Each quarter, the Office of Research and Analysis (ORA), Taxation Division, and the MED calculate an Average Market Rate (AMR) for the purpose of imposing excise tax on unprocessed retail marijuana that is sold or transferred from cultivation facilities to product manufacturing facilities or retail stores, as required by law.
- The data began distinguishing between Flower and Shake/Trim transferred to retailers and Flower transferred to manufacturers for extraction in 2018, providing valuable insights into the Cost-of-Goods-Sold inputs that could affect retail prices.
- Wholesale Flower prices exhibit a similar upward trajectory as observed in retail prices on previous slides, beginning in 2019 with sustained price increases through 2020. These price increases likely contribute directly to increased retail prices for Flower, as well as Concentrates and Edibles that use Flower as an input.
- Shake/Trim wholesale prices have remained more consistent over the observed timeframe.
- The observed retail prices in Concentrates and Edibles, in combination with the wholesale pricing, suggest that retail Concentrate prices are more influenced by Flower wholesale prices, while retail Edible prices may be more aligned with Shake/Trim wholesale pricing.



Product Shares, by Annual Sales



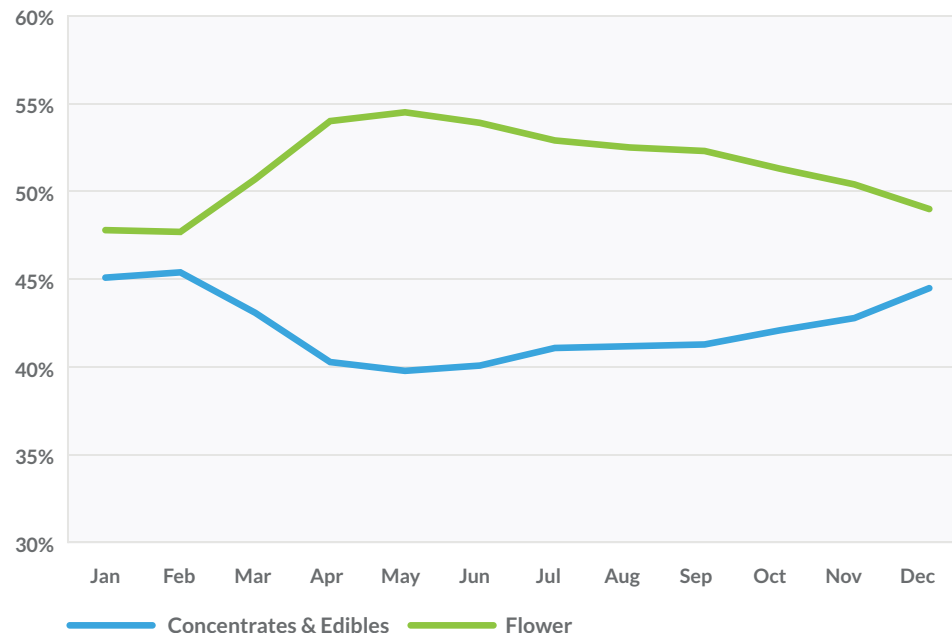
- Since 2014, Flower has held the largest market share in both the AUMJ and MMJ markets. However, each year Flower continued to shrink in market share while Concentrates and Edibles increased, until 2020.
- Market share data from 2020 represents the first year in which Flower has increased compared to the previous year, increasing from 53.9 percent of all MMJ sales to 58.9 percent, and from 46.8 percent of all AUMJ sales to 49.8 percent.
- The unexpected market share shift back toward Flower is interesting since it occurred during a year defined by COVID-19 lockdowns and quarantines. The following slide provides a more detailed monthly view of the 2020 market share by product.

Note: Figures above may not add due to rounding and a very small amount of "other" product sales such as seeds and clones (i.e., < 0.1%).

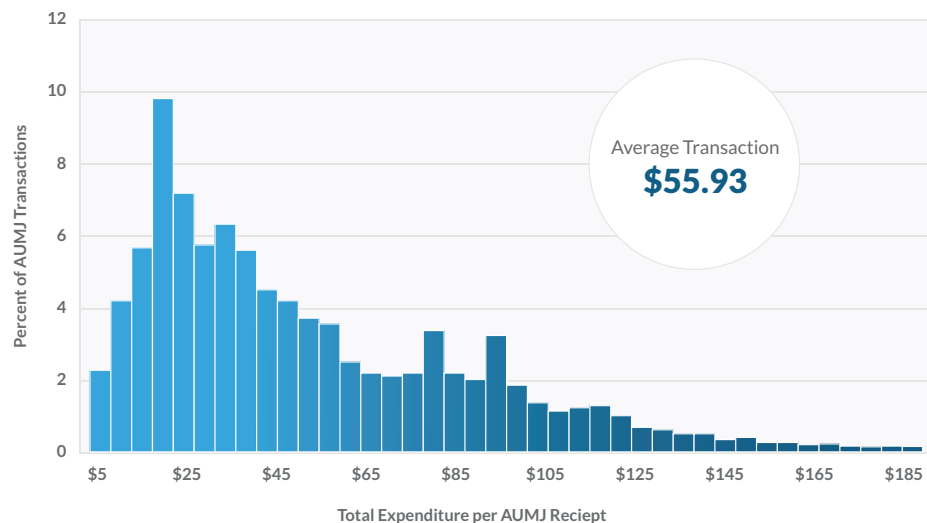
2020 Monthly Product Mix

- COVID-19 had a pronounced impact on the market product mix as flower sales (as a share of all sales) grew significantly from February to May before trending to previous levels. The market share of Flower started the year at 47.8 percent of all sales, reaching a maximum of 54.5 percent in May.
- The combined share of Concentrates and Edibles, the next two most popular product categories (by sales) was inversely-related over the same period, suggesting that consumers switched to flower as the state imposed restrictions, and then gradually transitioned back toward those products later in the year. Concentrates and Edibles comprised 45.1 percent of all sales in January, falling to 39.8 percent in May.
- Comparing the January and May market shares in terms of total sales illustrates the magnitude of this shift – in the month of May alone, there was a \$23.2 million shift in sales from Concentrates and Edibles to Flower.
- The increase in demand for Flower at the beginning of Colorado’s COVID-19 public health quarantine could be due to several factors:
 - Consumers may have shifted preferences to Flower as a result of spending more time at home where the discreteness and convenience of edibles or vaporizer cartridges weren’t as important. A divergence in prices could have potentially explained this further, however previous slides demonstrate similar price trends across product types.
 - The retail availability of Concentrates and Edibles may have decreased relative to Flower, potentially as producers rushed to keep flower on the shelves, bypassing manufacturing and transferring more flower directly to retailers. Page 38 of this report illustrates that Flower Equivalent transfers to manufacturing licensees from cultivators increased in 2020, however transfers from manufacturers to retailers decreased from 2019 levels, providing some supporting evidence.

MARKET SHARE BY PRODUCT CATEGORIES



Transaction Analysis – Total Expenditures per Transaction



- The figures to the left show the average receipt expenditure as a percentage of all 2020 transactions. Each bar represents a \$5 range, where the furthest left bar in AUMJ indicates that approximately 2.4 percent of all AUMJ transactions were less than \$5, approximately 4.4 percent were between \$5-10, and so forth.
- The most common transaction value for AUMJ was between \$15-20, accounting for approximately 9.8 percent of all AUMJ transactions.
- 22 percent of all AUMJ transactions are for less than \$20, and almost 84 percent for less than \$100.
- Only 14 percent of MMJ transactions were less than \$20, while 64 percent were less than \$100.
- The overall average AUMJ transaction was \$55.93, nearly half the average \$100.49 MMJ receipt.
- Regulated marijuana purchases are still primarily in cash. The 2019 report identified a “\$20-bill effect” where receipts tend to clump around \$20 intervals. This is most apparent in AUMJ transactions, with spikes in transaction frequencies at \$20, \$80, and \$100.
- This effect is less pronounced in MMJ transactions, though still observable.

MARKET STRUCTURE

Introduction

Since its inception, the Colorado marijuana market has evolved from numerous small retail operations to include large operators with multiple retail licenses. This section provides information on the number of licenses and industry concentration, which have recently begun signaling a more mature market while retaining a healthy competitive landscape.

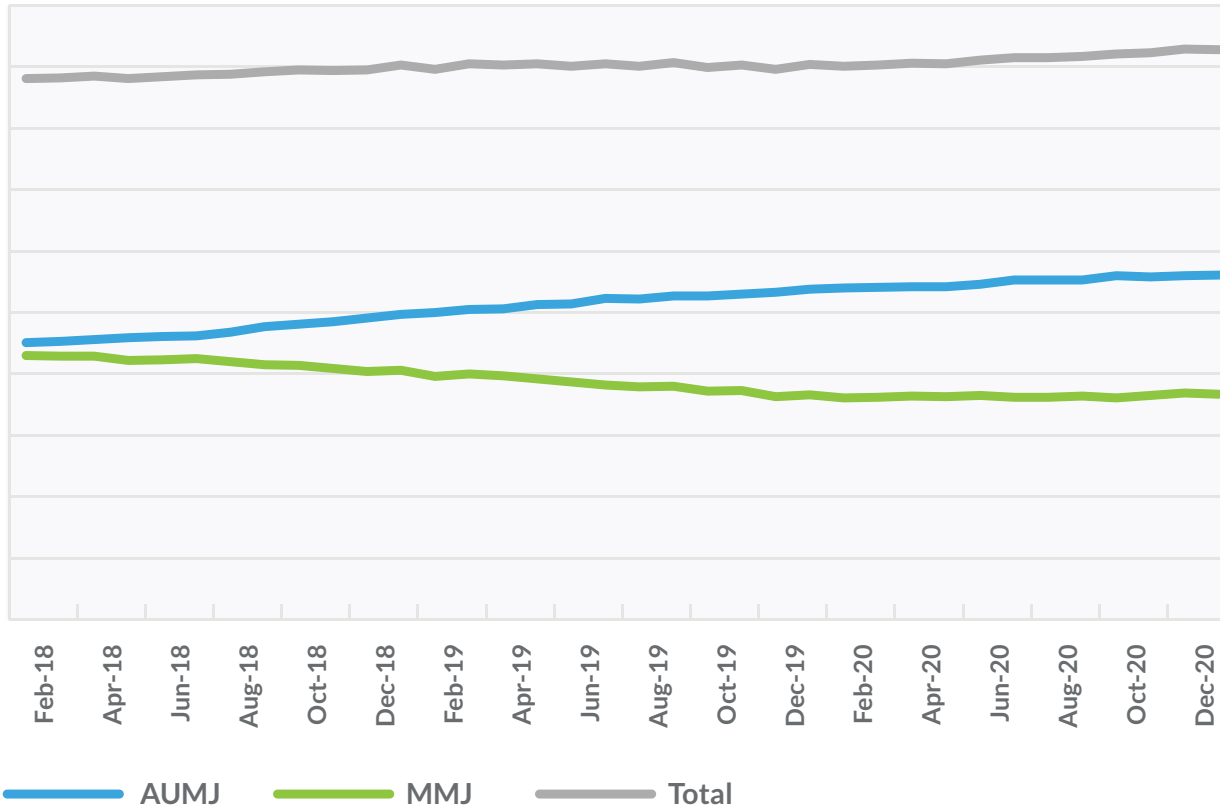
- 1. Growth in license numbers continued, but more slowly.** The total number of licensed marijuana businesses increased again in 2020, following a steady trend that has been observed since 2014. However, the rate of new licensees decelerated compared to previous year-over-year increases, suggesting that there is less incentive or opportunity to establish new businesses. In other words, the market is reaching a steady-state where the number of retail store fronts will eventually approach a saturation point.
- 2. Colorado is competitive.** Industry concentration can be measured through the share of market-wide sales by the largest five operations, which account for 16.7 percent of all sales in 2020. The Herfindahl-Hirschman Index (HHI), another commonly used measure of market competitiveness, was 97.5 in 2020. Both measures indicate a very competitive market. Market concentration is evident in the pace of

transactions, but the industry is still much more competitive than other large national or international industries. New local jurisdictions still opening in Colorado, further adding a dynamic to the concentration picture.

- 3. Sales at individual retail locations increased.** As with multi-location entities, individual retail locations have also grown in size. In 2019, 53.1 percent of all locations reported sales over \$1 million, increasing to 62 percent in 2020. The number of locations reporting sales over \$5 million increased from 10 percent to 11 percent. These established business likely enjoy the benefits of customer loyalty and economies of scale through their supply chains. As existing businesses become more entrenched, new entries will likely be more difficult to sustain.
- 4. The number of registered MMJ patients started a sustained upward trend for the first time since 2014.** The number of registered medical marijuana patients has steadily declined since the inception of the AUMJ market in 2014. However, in April 2020 the number of patients began an upward trend, increasing from 80,257 to 85,814, coinciding with the onset of the pandemic and an increase in the MMJ market size.

Active Store License Count, 2018-2020

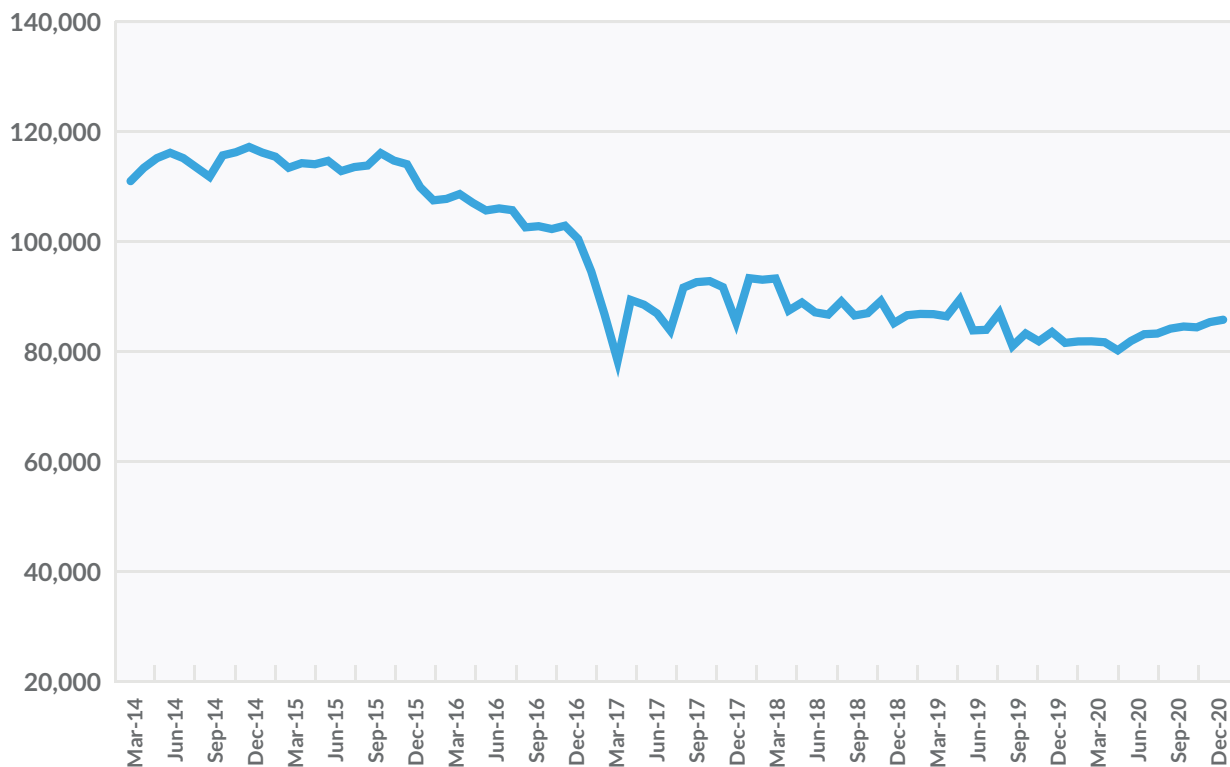
TOTAL AUMJ & MMJ ACTIVE RETAIL LICENSES



- The total number of regulated cannabis retailers continued to increase in 2020, averaging 915 across all 12 months and reaching 928 by December (compared to the 2019 average of 902, and 904 in December 2019). The growth rate of licensees has slowed to around 1.4 percent, compared to 1.5 percent growth from 2018 to 2019.
- The growth in AUMJ retail licenses appears to have stabilized around 560 in the last quarter of 2020, while MMJ retailers have remained around 365 since late 2019.
- The stabilization of licensees and prices further suggests that the market may be close to an equilibrium point where the number of licensees and prices can support demand and remain profitable.
- Further consolidation may retain or reduce the total number of licensees from this level while increasing the average sales per licensee.

Medical Marijuana Patients

REGISTERED MEDICAL MARIJUANA PATIENTS, BY MONTH



Source: [Colorado Department of Public Health and Environment](#)

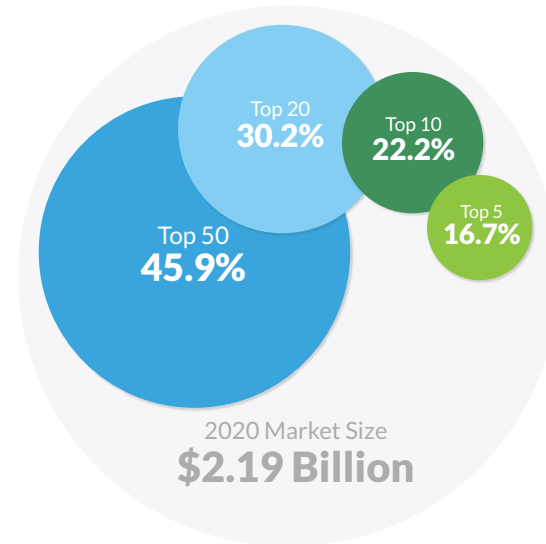
- According to the Colorado Department of Public Health and Environment, the number of registered medical marijuana patients has steadily declined since the inception of the AUMJ market in 2014.
- In April 2020, however, the number of patients began an upward trend, increasing from 80,257 to 85,814, coinciding with the onset of the pandemic.
- The 2020 increase corresponds to the observed growth in MMJ sales.
- Three potentially interrelated explanations for the 2020 growth include:
 - An increase in AUMJ prices may have made the lower MMJ prices more appealing to consumers and made them more willing to pursue the registration process;
 - An Executive Order from the Governor's Office temporarily allowed for telemedicine appointments making it easier to obtain and maintain registration; and
 - The COVID-19 restrictions may have led to increased purchases per consumer, which could have increased consumers' sensitivity to prices.

Market Concentration

- License ownership data collected by the MED groups individual retail licensees into their ownership entities. In 2020, the total count of corporate entities was 388, down 6.7 percent from 2019. This decrease, combined with an increased market size, continues a trend in which companies merge and aggregate to create fewer but larger entities. Corporate entities in this context include businesses that share common ownership across multiple retail locations.
- The figure to the right shows that the top 5 corporate entities account for 16.7 percent of all retail sales. The other bubbles further demonstrate that the largest companies are capturing a large share of the market over time.
- The Herfindahl-Hirschman Index (HHI) is a commonly used measure of market competitiveness, where an HHI lower than 100 indicates a highly competitive market, and above 2,500 indicates a highly concentrated market.
- The Colorado regulated marijuana industry had an HHI of 97.5 in 2020. Market concentration continues to increase at a moderate pace; however, the industry is still much more competitive than other large industries, illustrated in the bottom right table.

In 2020 the MED updated the license ownership data collection and reporting methods to more accurately reflect changes over time. This new data is not directly comparable with ownership data from previous reports.

2020 MARKET SHARE BY TOP MARKET SHARE GROUPS



HHI INDEX COMPARISON

Industry	HHI
Tobacco (2013)	3,100
Beer (2013)	725
Pharmaceuticals (2016)	210
Colorado Marijuana (2020)*	97.5

Source: The Roosevelt Institute; Hawkins, B., et. al. 2016.
* HHI by corporate entity

SUPPLY & DEMAND

Introduction (1 of 2)

This section includes an updated review of Colorado's regulated marijuana production trends, product transfers, and an analysis of the effects of the COVID-19 restrictions on sales and consumption patterns. In order to examine production trends, inventory tracking system data on the number of plants grown and harvested by cultivators is combined with the allocated plant counts issued by the State. Business-to-business product transfers are analyzed by first converting all product categories to their respective Flower Equivalent quantities, and then calculating the volume of marijuana that is transferred between all license types, and ultimately sold to consumers. The effects of COVID-19 on daily sales volume, average expenditures and items per receipt, and total daily transactions provide insights into how consumers responded to quarantines and restrictions on social activities.

- 1. Production has steadily increased over time.** Each year since legalization, the number of plants grown and harvested has increased to supply a steadily growing demand for Colorado marijuana. In 2020, AUMJ and MMJ cultivators grew a combined 1.24 million plants, utilizing approximately half of the allocated capacity. When converted to outgoing cultivation transfers, this amounts to 662.3 metric tons of Flower Equivalent entering the supply chain in 2020, compared to 552.8 metric tons in 2019. The output from cultivators is then transferred directly to retailers, or to manufacturers for extraction and infused product manufacture. The shift toward more Flower sales is also evident, where a higher proportion of all cultivation output was transferred to retailers to be sold as Flower or Shake/Trim.
- 2. The supply chain likely responds to and influences retail product mix.** In 2020, the supply chain shifted to provide retailers with more Flower than in previous years, which correlates directly to the fact that Flower sales increased. These two conditions likely influence one another, where suppliers try to provide the most demanded products, but consumers are also likely to purchase the most available products. This is especially notable in a year in which COVID-19 may have affected both the supply and demand for regulated marijuana.
- 3. Indicators show the industry maintains strong accountability and transparency.** Residual marijuana product is not accounted for in sales or year-end inventory. The residual includes all production that cannot be directly traced from production to sale and includes seized or

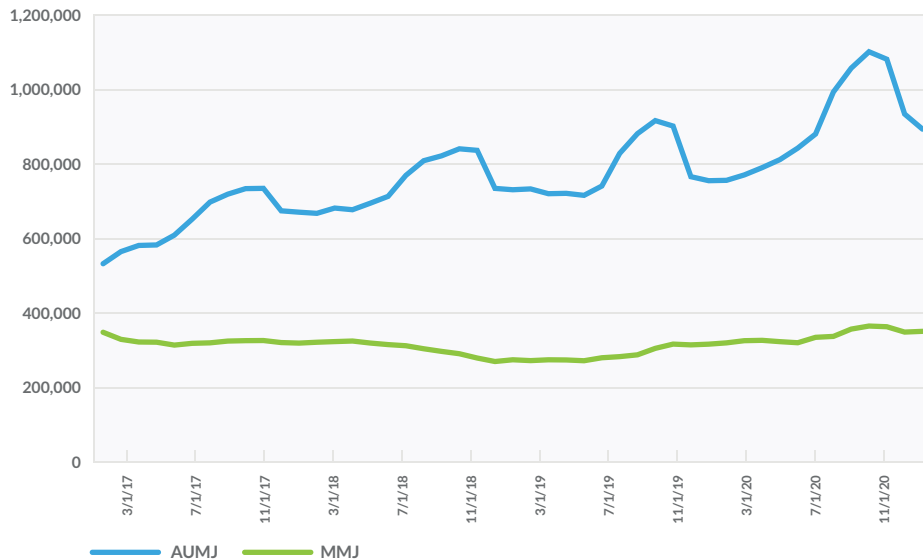
Introduction (2 of 2)

destroyed products by law enforcement, weight loss during post-harvest curing and drying, data entry errors, extraction yield inefficiencies, quality control, and supply chain loss. In 2020, the residual maintained a steady trend in share of total production to date, demonstrating continued compliance and transparency within the inventory tracking system.

- 4. COVID-19 had a pronounced effect on the market.** In March 2020, Colorado imposed restrictions in response to the pandemic. The effect of these restrictions was seen in multiple data analyses, including a spike in daily sales metrics in March when consumers were uncertain whether marijuana retailers would close. The consumption effects of the pandemic likely contributed to the shift towards flower sales and production.

Supply – Plant Count (1 of 2)

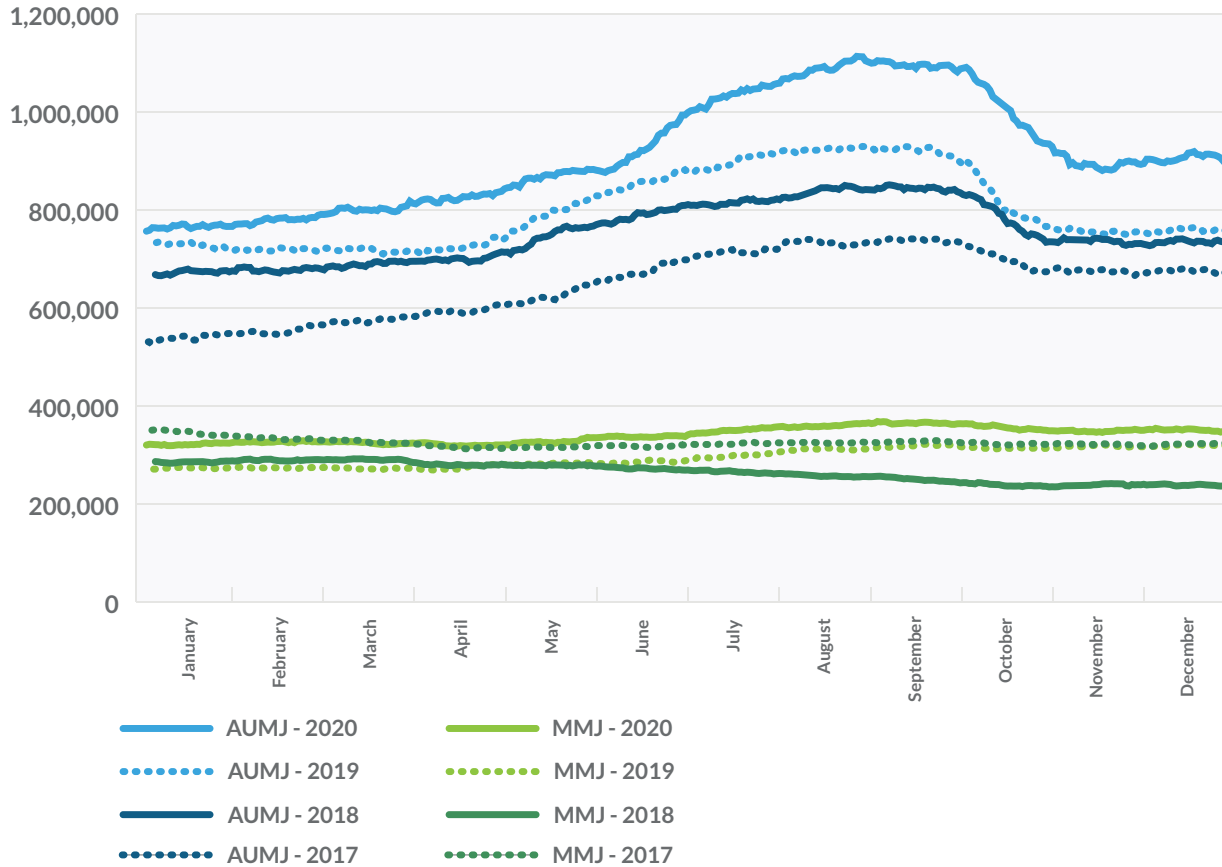
- The figure below presents the combined average daily Vegetative and Flowering plant count from 2017 through 2020. This measure represents the number of plants ‘in the ground’ at any given point in time.
- Seasonality is pronounced in the number of AUMJ plants as plant counts increased significantly during the outdoor grow season from May through November.



- The number of MMJ plants is much more stable without exhibiting any notable seasonality, potentially due to MMJ cultivation being linked closely to patient plant allocations.
- The table below shows the annual growth in Vegetative and Flowering plant count from 2017 through 2020, showing that plant counts increased by 14.5 percent in the AUMJ market and 15.5 percent in the MMJ market.

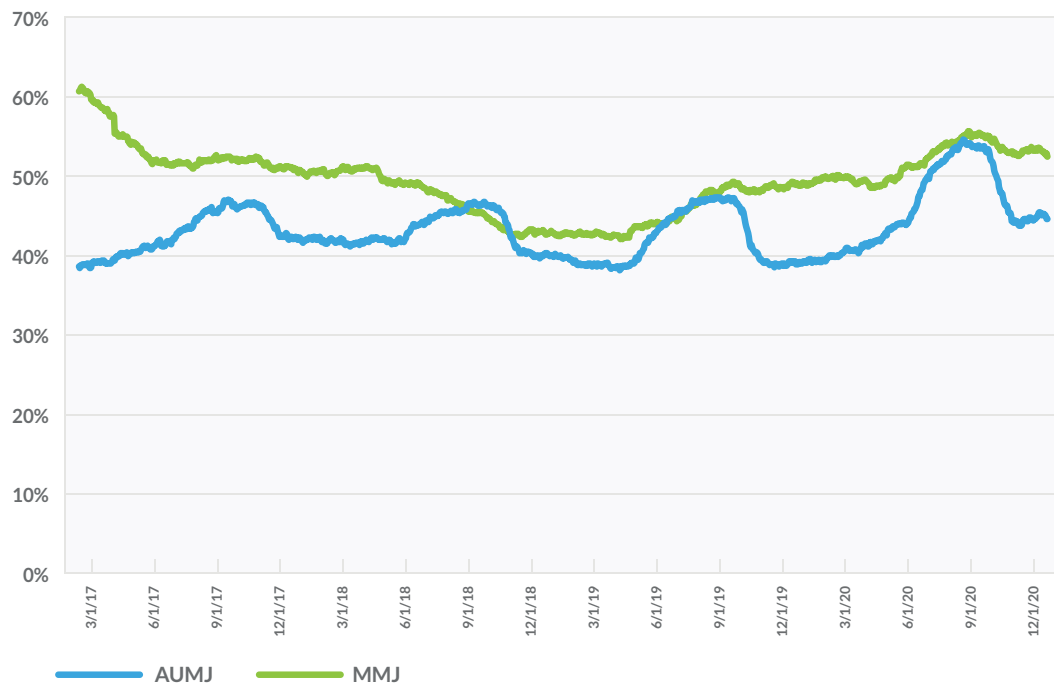
	AUMJ	MMJ
2017 Average	650,085	324,943
<i>% Change</i>	n/a	n/a
2018 Average	753,806	301,209
<i>% Change</i>	16.0%	-7.3%
2019 Average	800,988	294,995
<i>% Change</i>	6.3%	-2.1%
2020 Average	917,046	340,851
<i>% Change</i>	14.5%	15.5%

Supply - Plant Count (2 of 2)



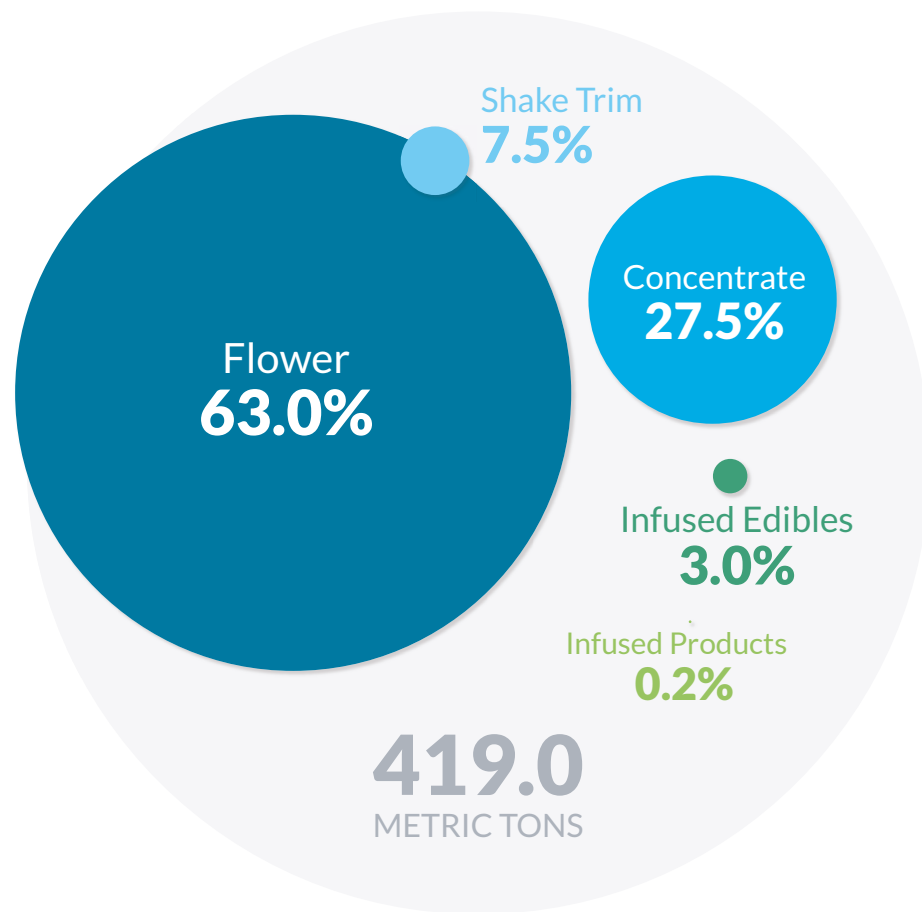
- This figure presents the year-over-year total plant count, illustrating the consistent annual growth in AUMJ plant counts.
- AUMJ seasonality is becoming more pronounced over time as outdoor growing becomes more popular, leading to an increased capacity for plant production.
- MMJ has remained much more consistent across the years.
- 2020 marks the first year since 2016 that MMJ plant count and market size have increased.

Supply – Plant Count Utilization Rate



- The plant allocation utilization rate shows the portion of the total market plant allocation being utilized over time, calculated by dividing total Vegetative and Flowering plants by the total number of plants allocated to all cultivation licensees.
- As a smaller market, MMJ has a lower cumulative plant count allocation, but cultivators utilize a higher number of their allocated plants, with the utilization rate fluctuating between 40-60 percent.
- The 2020 data shows that the MMJ market has increased its production relative to the total potential plants allocated, corroborating its increased market size in 2020.
- The overall allocations for the AUMJ market are significantly higher, with cultivators historically utilizing less of their maximum plant production.
- In 2020, the AUMJ reached over 50 percent of allocations for the first time during the outdoor grow season, illustrating the seasonal influx of outdoor harvests.
- This data illustrates that both markets have the capacity to nearly double their production to meet demand under the current plant allocations.

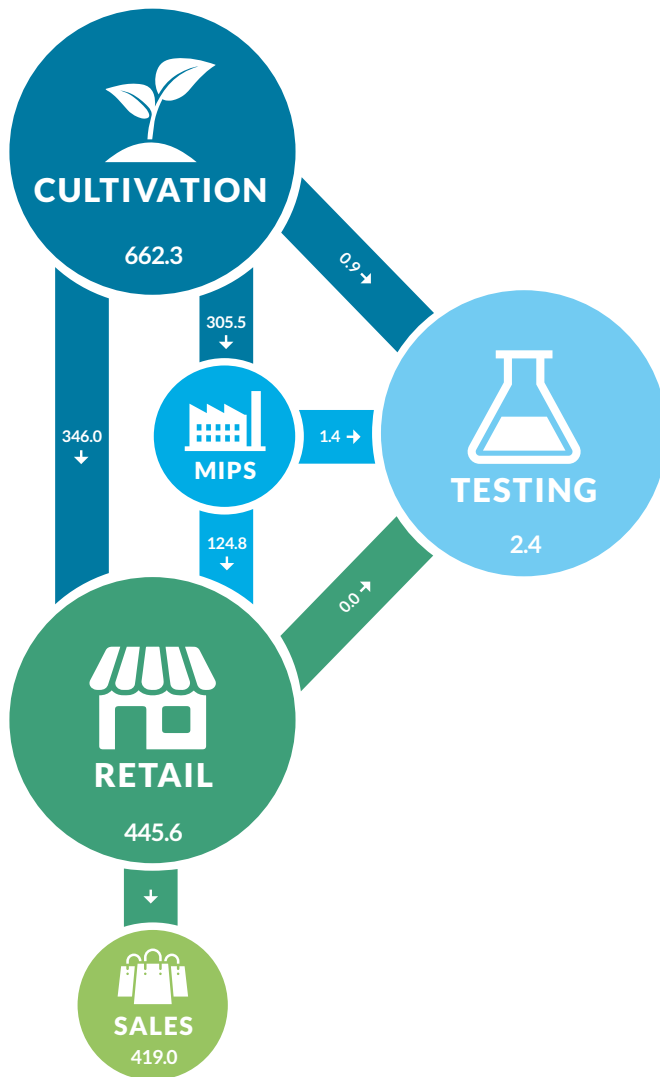
2020 Actual Sales: Metric Tons (MT) of Flower Equivalent (FE)



- The quantity of each product type is converted into its Flower Equivalent quantity.
- Based on 2020 sales data, the quantities sold for each product type are:
 - 263.9 metric tons of Flower (63 percent);
 - 35.5 metric tons of Shake/Trim (7.5 percent);
 - 21.2 metric tons of Concentrate material (21.1 percent);
 - 11.5 million units of packaged Concentrates (5.1 percent);
 - 14.8 million Infused Edible units (3.0 percent); and
 - 762,858 units of Infused products (0.2 percent).
- Combining these total quantities with the updated THC testing data, the total demand for regulated Colorado marijuana was 419 metric tons in 2020, a 17.2 percent increase over the 357.5 metric tons sold in 2019.
- Raw flower accounted for 63 percent of all demand (up from 61.6 percent in 2019), while Concentrates made up 26.2 percent (down from 27.5 percent).
- The other product categories were essentially the same as in 2019, accounting for a combined 10.8 percent of all demand.

Note: Figures above do not add to 100% as a result of rounding involved with converting product types to Flower Equivalent units.

2020 Transfer Flows of Flower Equivalent (FE), in Metric Tons (MT) (1 of 2)



- Combining the Flower Equivalent construct with business-to-business transfer data from the Inventory Tracking System allows a full quantification of the supply chain from cultivation to testing, manufacturing and processing, and then to final consumer sales.
- This approach gives valuable insights into the decisions for businesses to transfer raw Flower and Shake/Trim directly to retailers for consumer sales, or to transfer their raw products to manufacturers for processing into Concentrates, Edibles, and other manufactured goods.
- The figure to the left illustrates cumulative 2020 transfers between each license type.
- All regulated marijuana products begin as raw Flower or Shake/Trim produced by cultivation licensees and then are transferred down the supply chain. The analysis reveals that cultivators produced a total of 662.3 MT of FE, a 19.8 percent increase over 2019 levels. The cultivators then transferred:
 - 346 MT of FE to Retailers (53 percent)
 - 305.5 MT to Manufacturers (46.8 percent)
 - 0.9 MT to Testing Labs (less than 1 percent)
- Manufacturing licensees received 305.5 MT of FE in incoming transfers and transferred out the following amount of FE in manufactured and processed products:
 - 124.8 MT of FE to Retailers
 - 1.4 MT to Testing facilities
- Between cultivators and manufacturers, retailers received a total of 445.6 MT of FE in incoming transfers.
- Total sales from retailers to end use consumers amounted to 419 MT of FE.
- The difference between input and output transfers at any given step along the supply chain may be explained by on hand inventory and extraction / production inefficiencies in manufacturing.

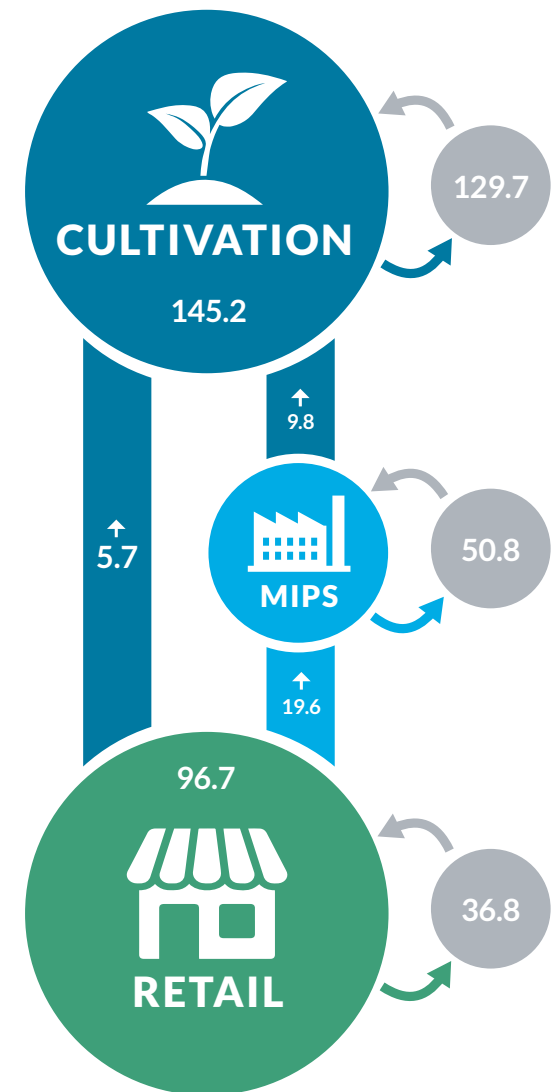
Transfer Flows of Flower Equivalent (Metric Tons), 2020 (2 of 2)

The numbers in this chart with arrows pointing upward represent upstream transfers, which include the following transfer types:

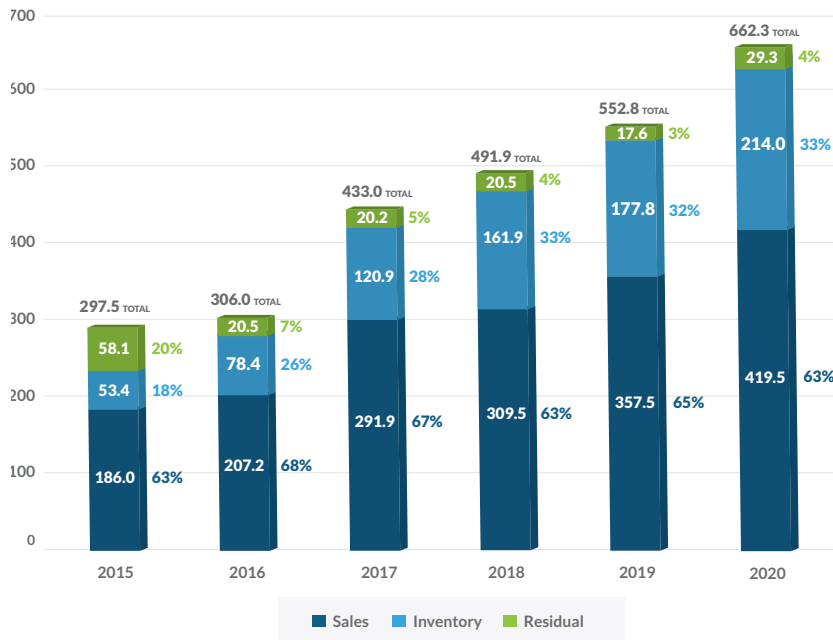
- Upstream transfers refer to those that go in the opposite direction compared to standard supply chain transfers, where products flow from production to sales.
- Transfers among vertically integrated businesses for inventory management;
- Returns or exchanges; and
- Products sent by retailers to manufacturers for processing into other product types:
 - 19.6 MT of FE were transferred from retail to manufacturer licensees
 - 5.7 MT were sent from retailers to cultivation licensees
 - 9.8 MT were sent from manufacturers to cultivation licensees

The lateral arrows represent lateral transfers. Lateral transfers occur between two entities of the same license type.

- **Cultivation:** Cultivation licensees transferred 129.7 MT to other cultivation facilities, mostly for inventory management purposes among vertically integrated organizations. An example would be two cultivation licenses under common ownership, transferring all production to one license for consolidated outgoing transfers.
- **Manufacturers:** Manufacturers transferred 50.8 MT to other manufacturers. These transfers largely represent secondary processing stages. For example, one manufacturer would extract THC and oils from raw Flower, and then transfer them to a second manufacturer to process the THC into Edibles.
- **Retailers:** Retail licensees transferred 36.8 MT to other retail locations, most often for inventory management purposes among vertically integrated organizations. For instance, one retailer under common ownership might send or receive transfers of a product from another retailer to replenish depleted inventory.



Transfer Flow Inventory & Residuals, 2020

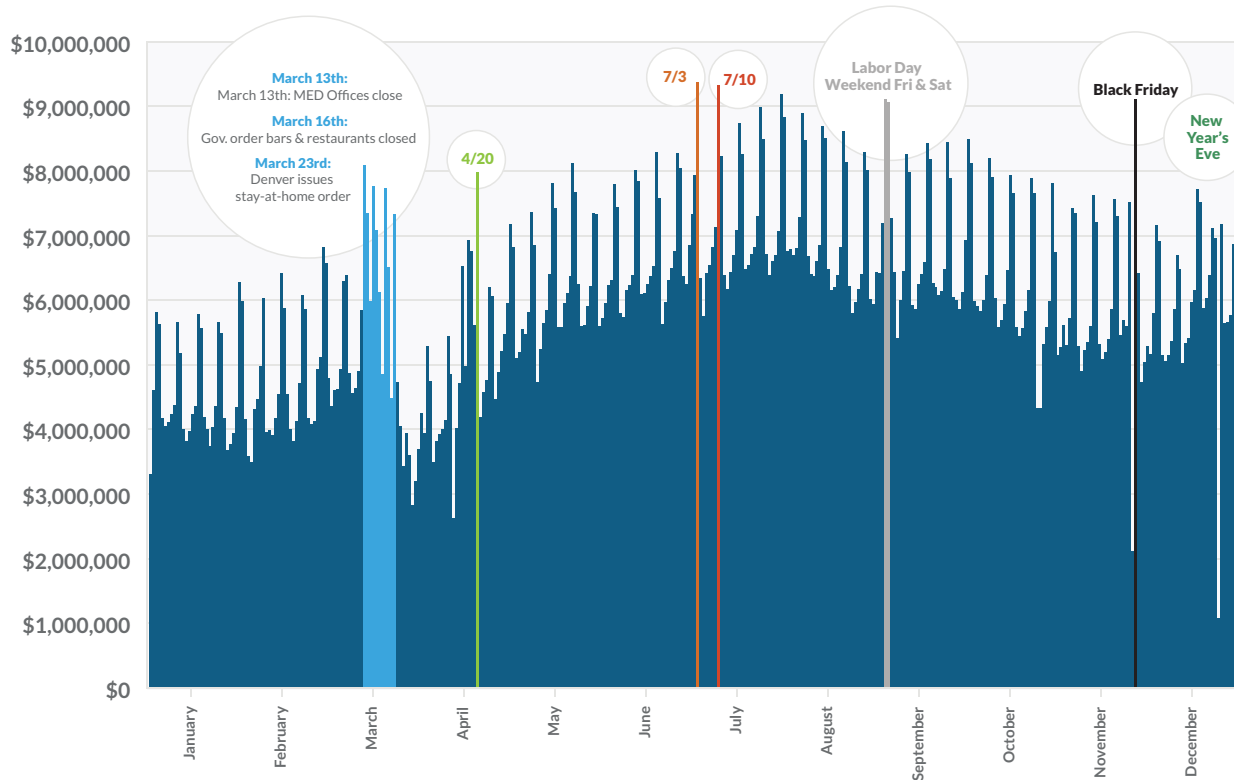


- Each year, the report calculates residual marijuana products that cannot be accounted for as sales or inventory. This analysis compares the sum of all 2020 transfers to the total on-hand inventory on January 1, 2021 to determine the end-of-year balance in Flower Equivalent.
- As indicated to the left, 662.3 MT of FE were transferred from cultivation licenses, and 419 MT of FE were sold to end users.
- As of January 1, 2021, inventory data shows a total of 214.0 MT of FE being held in inventory by cultivation, manufacturer, and retail licensees.
- The remaining 29.3 MT of FE is defined as the residual and calculated as total supply minus sales and inventory. This quantity includes:
 - Seizure or destruction of product by law enforcement
 - Wet versus dry weight entries – post-harvest curing and drying
 - Entry errors in the inventory tracking system database
 - Extraction yield inefficiencies
 - Removal of product for quality assurance purposes
 - Supply chain product loss
- Historically, the residual has shown a declining trend as compliance and record-keeping continue to improve in the regulated market. In 2020, the residual of 29.3 MT of FE accounts for 4.4 percent of the total supply, showing a steady trend, and demonstrating continued compliance and an effective inventory tracking system.

COVID IMPACTS

2020 Daily Sales Volume

- In March 2020, Colorado began imposing restrictions to reduce the spread of COVID-19. The effect of these restrictions is seen in the chart below, with 10 days between March 13th and 23rd showing unseasonably high daily sales volumes as consumers stocked up on many household products ahead of uncertainty.
- Other major dates associated with high cannabis sales are labeled for reference.
- Three notably low sales volume days are holidays – Easter, Thanksgiving, and Christmas.



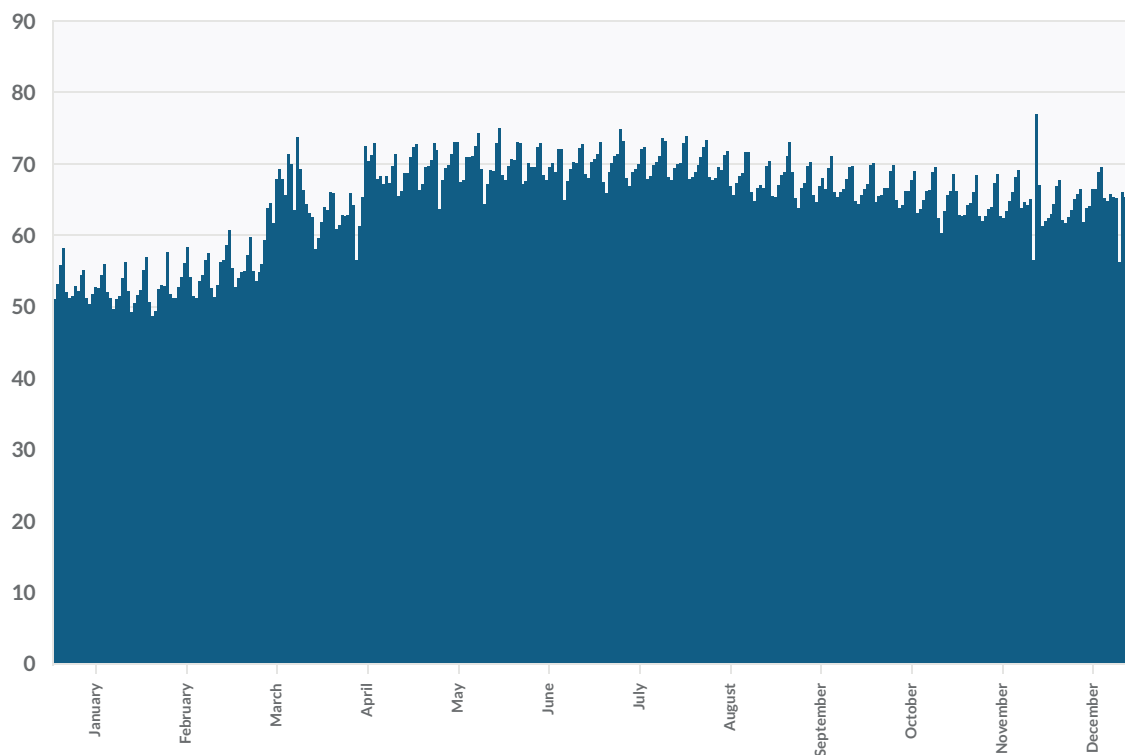
AVERAGE 2020 DAILY SALES

Sunday	\$5,301,824
Monday	\$5,392,949
Tuesday	\$5,407,817
Wednesday	\$5,639,525
Thursday	\$5,837,420
Friday	\$7,351,760
Saturday	\$7,037,744
Overall Average	\$5,994,172

2020 Average Daily Expenditures per Receipt

- The daily average expenditures per receipt show an increase after the mid-March COVID-19 shutdown, where they spiked from around \$50-60 in the first two months to \$65-75 in March and beyond.
- The cluster of days in March with elevated expenditures coincide with the initial State shutdown of businesses, and that level persists for several months before slowly declining in the last quarter of 2020.
- Black Friday is a notable outlier with an average receipt size of \$76.62, the highest of the year.

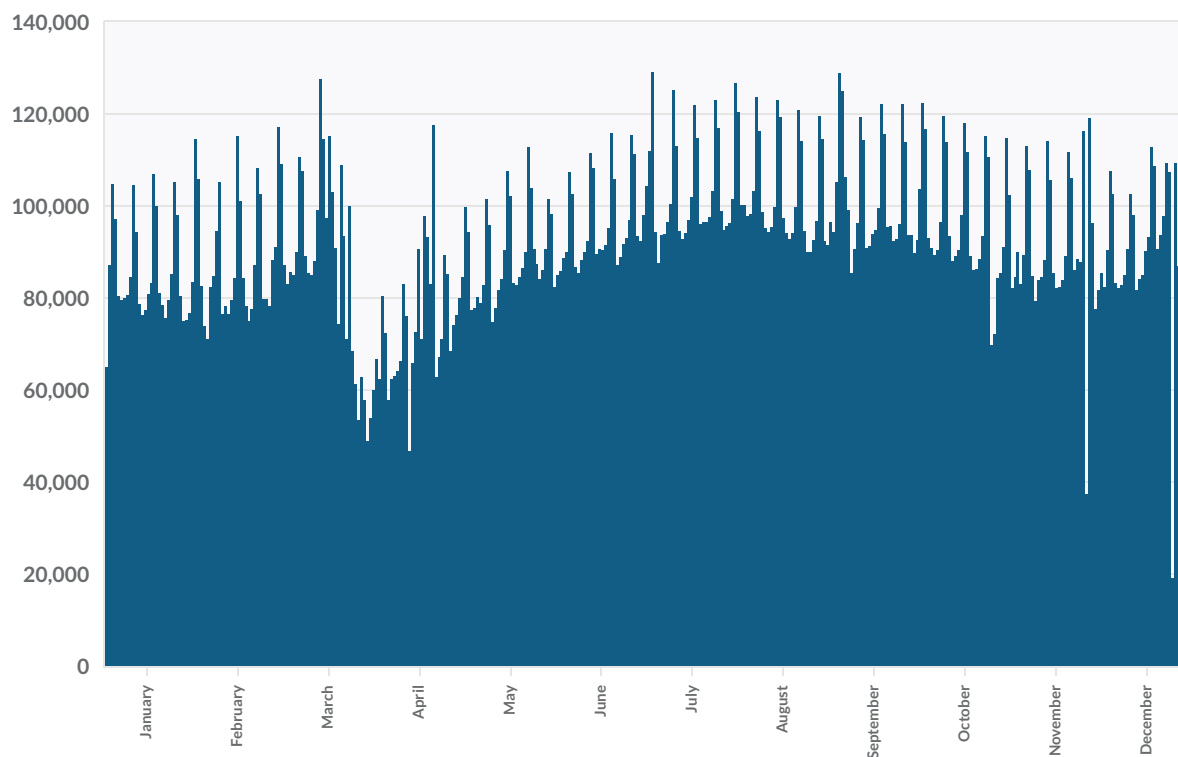
AVERAGE DAILY EXPENDITURES PER RETAIL TRANSACTION



2020 Total Daily Transaction Volume

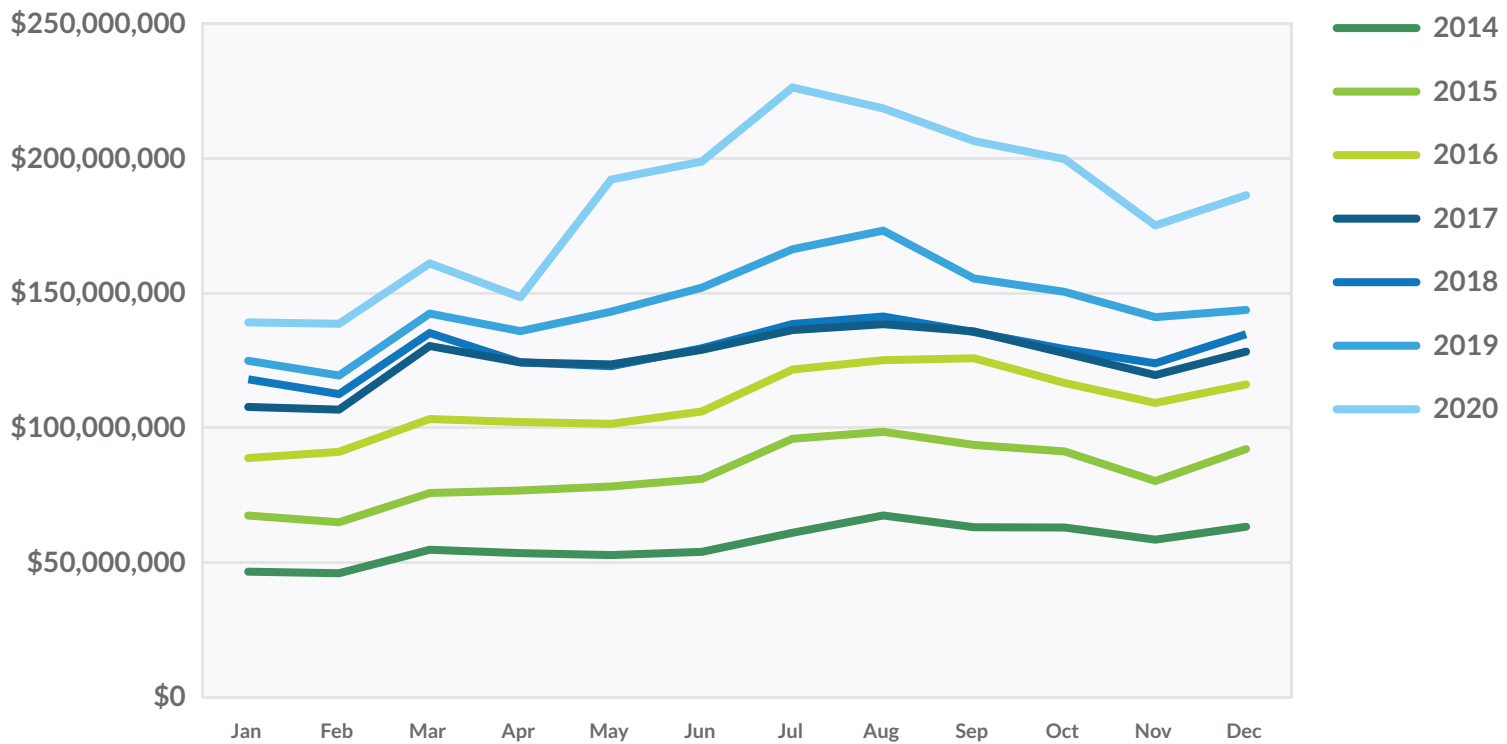
- The receipt data presented in previous slides also describes the total number of receipt transactions per day. On average, the daily number of retail transactions for 2020 was 92,217, with significantly higher numbers on Fridays and Saturdays.
- March 13, 2020, the day the State, and City and County of Denver began declaring emergencies and stay-at-home orders to stop the spread of COVID-19, saw a dramatic spike to 127,392 total transactions. Following the increase in daily transactions that week, the numbers decreased substantially during the last week of March, perhaps as people had bought larger quantities in anticipation of staying at home for an extended period.

TOTAL DAILY RETAIL TRANSACTIONS



Total Monthly Sales, by Year

- Monthly sales have historically exhibited some seasonality with a small boost in March, followed by a drop in April, and then a slow increase through the summer months, falling off again by November.
- Sales data from 2020 follow this pattern, although the higher sales figures starting in May appear relatively higher than in previous years, likely due to increased consumption during the COVID-19 restrictions.
- To quantify this difference, July sales have been 31.2 percent higher than January sales on average from 2014 through 2019. In 2020, July sales were 62.7 percent higher than in January.



APPENDIX

Appendix: Flower Equivalent Calculation

Marijuana consumption, as well as demand and supply quantities, are estimated using different methods. Consumption is based upon demographics, consumer responses to surveys, and pre-existing literature on use. In other words, it must be estimated. In contrast, legal marijuana supply and demand do not need to be estimated – the measures can be counted using official, verified data. In order to standardize different products back into grams of Flower Equivalent, the study team constructed a generalized equivalency approach. The general formula is written. This approach can be used to convert different products such as Edibles, Concentrates, or processed Flower, back into the weight of plant material needed to produce the product. The formula is below:

$$W_{it} = f(n, mg, \pi_t, \sigma_t, L, \varphi_i)$$

Where each component is defined as follows:

- W_{it} is the equivalent weight of Flower or Shake/Trim needed as an input for each product type.
- The index " i " is the type of plant material (Flower or Shake/Trim).
- The index " t " denotes the type of non-Flower product (wax, vaporizer cartridge, Infused Edible, Infused products, etc.) being considered.
- The function, $f(n, mg, \pi_t, \sigma_t, L, \varphi_i)$, depends upon the following input parameters:
 - n is the number of units produced or sold. For example, n equals 2.7 million units in 2017 in the case of Edible marijuana products for Colorado.
 - mg is the weight of the product, in milligrams or grams, of the product sold. For example, "wax" type Concentrates are typically sold in units of 1 gram. Vaporizer cartridges are sold in units of 250 milligrams or 500 milligrams. For Edibles, this weight is set to be the official THC weight itself (e.g., 10 or 100 milligrams).
 - π_t represents the potency of the product, as a percentage of the product weight, using official laboratory test data. If a Concentrate batch test equals 65 percent, then 0.65 is used for π_t .
 - σ_t represents the share of total sales by product type, t . σ_t can be used to compute systemwide supply equivalencies, or it can be omitted from the formula, if only a specific product type is under consideration.
 - L is the loss rate between plant-based input THC and the output THC. The loss rate can vary between 20 percent for Concentrates up to 40 percent for Edibles, if more than one chemical transaction is enacted.
 - φ_i is the THC potency of the input material, based upon official test data. For example, average potency testing for Flower in 2017 suggests potency during that year of 19.6 percent combined THC-A and THC. Shake/Trim potencies were 17.2 percent THC, on average, in 2017.

CONCLUSION

For more information, please visit

www.mpg.consulting

and

www.colorado.edu/business/business-research-division