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REVIEW



How will cannabis legalization affect health, safety, and social equity outcomes? It largely depends on the 14 Ps

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ABSTRACT

Jurisdictions considering or implementing alternatives to cannabis supply prohibition will confront several decisions that will influence health, safety, and social equity outcomes. This essay highlights 14 of these design considerations, which all conveniently begin with the letter *P*: 1) Production, 2) Profit motive, 3) Power to regulate, 4) Promotion, 5) Prevention and treatment, 6) Policing and enforcement, 7) Penalties, 8) Prior criminal records, 9) Product types, 10) Potency, 11) Purity, 12) Price, 13) Preferences for licenses, and 14) Permanency. For each factor, the paper explains why it is important, describes the various approaches, and highlights how some of the jurisdictions that have legalized have addressed these choices. The primary audiences are decision makers considering alternatives to prohibiting cannabis supply and analysts making projections or conducting evaluations of these changes.

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Introduction

Canada, Uruguay, and 11 jurisdictions in the United States have removed the prohibition on cannabis and have legalized supply for adults. This is very different from the more common approach known as “decriminalization” which typically removes the criminal penalties for possessing small amounts but keeps supply a criminal offense. Many of these jurisdictions allow large-scale production and retail sales, but this is not the only way to legalize cannabis. Those considering or implementing alternatives to cannabis supply prohibition will confront several decisions that will influence health, safety, and social equity outcomes.

This essay highlights 14 of these design considerations which all conveniently begin with the letter *P*. It builds on previous efforts to highlight the various supply architectures and regulatory decisions surrounding cannabis legalization (e.g., 1,2,3,4), and two publications using a similar alliterative framework (5,6). The primary audiences are decision makers considering alternatives to prohibiting cannabis supply and analysts making projections or conducting evaluations of these changes.

The 14 Ps

For each decision, the paper will generally follow a similar structure: Why is this an important factor,

what are the various approaches, and highlight how some of the jurisdictions that have legalized have addressed these choices.

Production

The cost of producing cannabis will plummet with legalization (7). Removing the prohibition means producers no longer need to hide or be compensated for their risk of arrest or incarceration (8). These costs will further decline if governments allow producers to compete and grow on industrial-sized outdoor farms (9). We see price declines happening now in Colorado where the average price for a pound of high-potency cannabis in the licensed wholesale market declined more than 60% from January 2015 to October 2018, from \$2007 to \$759 (10). Some suggest the wholesale price drop in Oregon has been even more severe (e.g., 11).

How quickly the wholesale prices decline will depend on how much cannabis is allowed to be produced and the regulations imposed on producers. Jurisdictions could be strategic and control the amount of cannabis (or THC) produced, or they could simply give production licenses to anyone who applies and passes a background check. This not only has implications for what happens to the size of the illicit market, but also for the economic opportunities in the licit

market. If licensed growers make a serious investment to grow in the licit market and the wholesale prices collapse, some of the producers – especially the smaller ones – may find it unprofitable to operate. Indeed, some may go bankrupt and end up worse off than if they had not entered the cannabis business in the first place. There is already anecdotal evidence of this happening in Washington, where license values are dropping and it is estimated that only about half of the licensed canopy allocation for production is being used (12).

Initially, Uruguay limited its two licensed producers to grow no more than 4 metric tons, but this approach is not the norm. Except for Washington, none of the US states allowing commercial production set a cap on the total amount of cannabis (or THC) that can be produced and sold in the licit market. (Washington initially limited production to 2 million square feet of canopy, but this cap was eventually lifted and now it is reported that the state now licensed more than 12 million square feet; but as noted, not all of it is being used.) Canada has licensed more than 120 producers for its non-medical market and has not formally limited production (13); however, their model allows each province and territory to control the wholesale and retail markets which, in essence, gives each government the power to control how much can be sold at the retail level and at what price (14).

So far, jurisdictions allowing non-medical retail cannabis sales limit production to domestic sources. If this changes and importation of cannabis produced in other countries is allowed, this will accelerate the price decline and dramatically change the cannabis-related economic opportunities in the importing and exporting countries.

Profit motive

Jurisdictions considering legalization need to decide whether to allow profit-maximizing firms to enter the market. It is unclear how legalization will play out and allowing business and their lobbyists to gain power will make it more difficult to make course corrections as the industry develops. Allowing innovative firms will lead to a proliferation of new products which could improve consumer welfare over other more restrictive models. On the other hand, Pareto's Law is in effect when it comes to cannabis: It is the daily and near-daily cannabis users which account for about 20% of past year users and about 80% of expenditures (15). To be profitable, most firms will need to maintain and encourage heavy use which could have serious implications for rates of cannabis use disorder and other public health outcomes (16).

Much of the cannabis debate in the US is focused on a false dichotomy of keeping supply prohibited or “regulating cannabis like alcohol.” Figure 1 displays several alternatives to status quo supply prohibition, showing that there are many middle-ground options jurisdictions could pursue, ranging from home production to government monopoly to allowing socially responsible businesses that do not exclusively focus on profit (3,17). Cautious jurisdictions may want to consider some of these other approaches before embracing the commercial, profit-maximization model. It is also the case that jurisdictions could choose different options for different market levels (e.g., for-profit production and state-controlled retail stores; also see 18).

While most of the jurisdictions in the US have gone the commercial route, both Vermont and Washington, DC have limited supply to home grows and gifting. Canada's new model is a hybrid where the federal

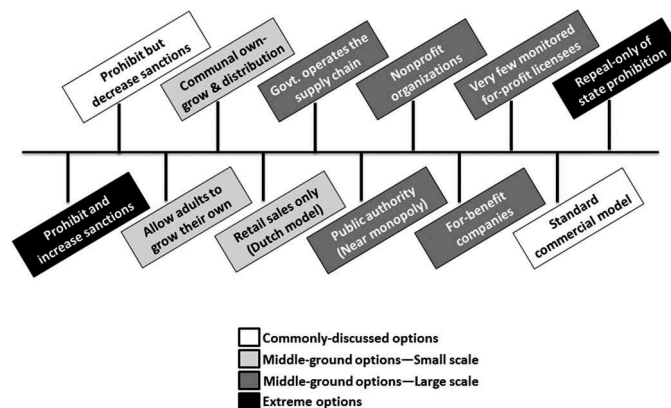


Figure 1. Twelve alternatives to status quo prohibition of cannabis supply.

Source: Caulkins and Kilmer (17)

government licenses producers (most are for profit and some are publicly traded), and the provincial governments serve as the sole wholesaler, allowing the state to control products and prices if it wishes. Some provinces are also limiting retail sales to government-run stores.

Outside of the home-grow only models, Uruguay has imposed the most restrictive legalization model to date: Adults must register with the government to obtain legal cannabis and must choose from one of three supply options: produce at home; join a cannabis co-op, or purchase from participating pharmacies (19–21). Only two firms are permitted to produce cannabis for the pharmacies and the state determines the price and product availability.

Power to regulate

The type of agency or agencies tasked with regulating and/or enforcing the regulations in the new legal regime could have profound consequences for health and other outcomes. Government agencies can have very different goals and approaches to accomplishing them (22). For example, giving the regulatory authority to a public health agency might lead to more of a focus on health outcomes than if the liquor control commission is tasked with this authority (and largely treats cannabis like alcohol products). Of course, this does not mean that non-health specific agencies do not care about health outcomes.

In Colorado, the Department of Revenue was charged with regulating the new market while in Oregon it was the state Liquor Control Commission. In Canada, the federal health agency is regulating the licensed producers, and the provinces and territories are responsible for the lower levels of the market. In some places like Uruguay, an entirely new agency was created to regulate the market.

Jurisdictions must also decide whether they want to allow representatives of the cannabis industry to be involved in developing regulations. For example, Alaska's Marijuana Control Board was "established as a regulatory and quasi-judicial agency for the control of the cultivation, manufacture and sale of marijuana in the state" includes five members, one of which is currently from the industry (23). While industry expertise can be insightful, its direct involvement in decision-making increases the risk of regulatory capture.

Promotion

If retail sales are allowed, there will be great incentives for firms to advertise and build their brands. Advertising can increase consumption (e.g., 24,25)

and as discussed earlier, most profit-maximizing firms will focus on creating and nurturing heavy users. While an advantage of the state monopoly approach is that the government can control advertising, that does not mean it will. In the US, many government agencies heavily market state-sponsored lotteries to boost revenues (26), and the Liquor Control Board of Ontario – one of the world's largest buyers and suppliers of alcohol – "is widely regarded as the leader in liquor retailing and marketing" (27).

Jurisdictions have to choose whether they want to allow advertising, and if so, which kinds. Uruguay has banned all advertising while US states allow it. Indeed, there are questions about how much this advertising can be limited in the US because of its commercial free-speech doctrine. Currently, US states typically impose some constraints (e.g., cannot target ads in places where >30% of the viewers are under 21, no cartoons on packages), but it is very difficult to control what happens on social media. Canada seems to be somewhere in the middle with its requirements for plain packaging and mandatory health warnings (28).

Prevention and treatment

Legalizing jurisdictions will need to decide whether to devote additional resources to prevention and treatment services, and if so, when will these funds be made available. Those hoping to use cannabis tax revenues to fund these activities may be waiting for a significant amount of time before significant resources are made available to them. In the case of prevention, health-focused jurisdictions will want to test new messaging strategies and deploy them before supply is legalized.

After initially stumbling with the "Don't be a Lab Rat" campaign, the state of Colorado created a folksy "Good to Know" education campaign (29); early evaluations of the latter suggest it achieved its goals of improving knowledge of the new laws and the health effects of cannabis (30). California also filled the airwaves with ads about the dangers of driving under the influence of cannabis in the days before retail stores opened in January 2018 (31).

Prevention is about more than developing community and/or school-based campaigns; it is also about preventing access. All legalizing jurisdictions to date have created minimum age requirements, and many jurisdictions are conducting undercover buys to verify compliance (also referred to as controlled purchasing programs). Limiting days and hours of operation have been important for preventing access to alcohol and this will likely apply to cannabis (4).

Policing and enforcement

One argument made for legalizing cannabis is that it will reduce the time and effort law enforcement officials spend on cannabis offenses. This would also decrease the number of people arrested for cannabis offenses, many of whom then must confront the collateral consequences of being arrested or convicted a drug offense (32). Given the well documented racial and ethnic disparities in cannabis-related offenses (e.g., 33), a reduction in arrests could have important implications for social equity outcomes.

Legalization will not eliminate police-related cannabis contacts (e.g., there will still be arrests for driving under the influence of cannabis, underage possession, public consumption, illicit growing). In fact, if a jurisdiction is committed to reducing the size of the illicit market as quickly as possible, it may seek to significantly ramp up enforcement against unlicensed producers and sellers. Thus, an important choice confronting jurisdictions is how much time and effort they want to devote to enforcing cannabis laws (including DUI) *after* a decision is made to legalize.

There is also a possibility that legalization could influence non-cannabis specific offenses, especially if it affects the use of substances like alcohol which have stronger connections to criminal activity. That said, it is hard to predict the effect on crime as the evidence about whether alcohol and cannabis are substitutes or complements is mixed, and it is unclear how applicable it will be in the post-legalization world (3,34,35).

Penalties

A related choice confronting legalizing jurisdictions is whether they will change the penalties for those convicted of a cannabis offense post-legalization. This will have implications for social equity, health, and safety. For example, should possession of cannabis by those under age remain a criminal offense, or should it be akin to a traffic citation? Another important choice will be the penalties for those producing or selling outside of the licensed system. Will it just be a fine or would a conviction lead to a criminal offense? Similar questions can be asked for those in the licensed system who illegally divert product, but in that situation, there are additional options: revoking or suspending the license.

Another decision confronting legalizing jurisdictions is whether there will still be penalties for probationers and parolees who are ordered to urinalyses and test positive for cannabis. In some jurisdictions, those subject to

community corrections are ordered to abstain from alcohol (which is legal for the rest of the population 21 years and older), but this is often because alcohol consumption was believed to be related to the offense.

Penalties for driving under the influence of cannabis are a contentious issue, especially since it is difficult to determine if a driver is under the influence of cannabis. While the bulk of the research suggests that driving under the influence of alcohol is more dangerous than driving under the influence of cannabis, driving under the influence of cannabis is still more dangerous than driving sober; further, the bulk of the research suggests that drivers under the influence of both alcohol and cannabis are reported to be much more likely to get in an accident (16). Some researchers argue that because the risks of driving under the influence of cannabis alone are so much lower than they are for alcohol, the penalty for the former should not be a criminal offense (36).

To date, every jurisdiction that has legalized still prohibits driving under the influence of cannabis as a criminal offense; however, the thresholds used to determine if someone is under the influence is different. For example, Colorado and Washington have a 5-nanogram of THC per milliliter of blood (ng/ml) limit for drivers, but similar thresholds were not implemented in Oregon or California. In Canada, they also have instituted a 5 ng/ml THC threshold for a criminal offense, but there are also consequences for those with lower amounts of THC in the blood. Those with two or more ng/ml but less than five could still be subject to a noncriminal offense that could lead to a fine of up to \$1000. Because of the risks associated with driving under the influence of both alcohol and cannabis, it is also a criminal offense to have a blood alcohol concentration of 0.05% and more than 2.5 ng/ml of THC in the blood (37).

Prior criminal records

Given the aforementioned racial and ethnic disparities associated with cannabis prohibition, there is a growing discussion about what jurisdictions should do about those who were convicted of cannabis-related offenses that are now legal. This not only has wide-ranging implications because of the various collateral consequences associated with having a drug arrest or conviction on your record, but it can also influence who gets to participate in the newly legal market.

Jurisdictions not only have to decide whether to remove or expunge these from individual's criminal records, but they also have to make decisions about

which offenses: All cannabis offenses? Just possession? If jurisdictions do create a pathway to expungement, they must also decide how easy it will be to expunge these offenses. Will the onus be on the individuals to go through the process, or will the new legislation require state officials to automatically delete these offenses from their records?

The early legalization initiatives passed in the United States were largely silent when it came to addressing those with criminal records for cannabis offenses. This started to change when Oregon voters passed legalization in 2014 and made it easier to seal previous convictions for cannabis offenses. Then in 2016, California's initiative authorized "resentencing or dismissal and sealing of prior, eligible marijuana-related convictions" (38); however, the responsibility to petition the courts was still with the individuals who had been convicted. In September 2018, California's Governor Brown signed a bill which changes this by streamlining and automating the process for what could be more than 200,000 individuals (39). Other jurisdictions have implemented or are considering similar approaches (e.g., Denver, the entire state of Massachusetts).

Product types

Jurisdictions considering legalization also have decisions to make about the types of cannabis products allowed in the market. Beginning with loosely regulated medical cannabis markets, the number of cannabis products available to consumers in commercial markets has proliferated. For example, a new store in Oakland, California reports selling over 500 products (40) and data from sales in Colorado and Washington suggest that flower accounts for a decreasing share of cannabis products purchased (41,42). While edibles and THC-infused beverages account for some of the non-flower market, the fastest growing segment of the markets are the extracts for inhalation which include vaporizer pens, oils, and waxes.

We know very little about the health consequences – both the benefits and risks – of most of the products sold in retail stores in jurisdictions that have legalized (43). Indeed, most of the health research cited in legalization debates is largely focused on studies conducted on those who were smoking lower potency flower in the 1980s and 1990s (44). Jurisdictions making decisions about these products must also consider the consequences of keeping some prohibited; will consumers simply purchase banned in the unregulated illicit market or from a neighboring jurisdiction (allowing the other place to pocket the tax revenue)?

So far, none of the US states have banned certain products from being sold in licensed non-medical stores. Uruguay, on the other hand, only allows a few strains of flower to be sold in participating pharmacies. When the stores opened in Canada in October 2018, only flower products and oils were allowed to be sold. Health Canada is taking more time to develop regulations for edibles and waxes.

Potency

Closely related to the choice about product types is the decision about whether to limit the potency of certain products. There is not a large literature on this, but a review by Englund et al. (45), reported there were a few studies finding higher-potency cannabis to be associated with negative mental health outcomes. They also cautioned:

"[o]nly since 2009 have studies differentiated between types of cannabis based on their THC content. However, most of these studies have not measured THC and cannabidiol content directly but have used indirect measures of potency, such as strengths reported in studies of cannabis from police seizures or coffee shops, and have relied on self-report measures."

With respect to the high-potency concentrates, Kilmer (46), noted:

Even less is known about the health consequences of cannabis concentrates. As late as 2015, there was no scientific evidence about dabbing, which involves flash vaporization of concentrated cannabis which can exceed 75-percent THC (47). A 2017 study of college students concluded that butane-hash oil (BHO) use was associated with greater physiological dependence on cannabis, but noted that "longitudinal research is needed to determine if cannabis users with higher levels of physiological dependence seek out BHO and/or if BHO use increases risk for physiological dependence (48)."

Of course, when we talk about potency we must also consider other cannabinoids (e.g., THC:CBD ratios; see 45) and whether users are titrating their dosage (e.g., will someone who typically smokes a full joint at 5% THC consume only one-third of a joint if its 15% THC). There are few studies of titration and they seem to be limited to Europe (see, e.g., 49, 50).

None of the legalization states in the US have imposed potency limits on non-edible products. There is some variation with respect to edibles, with some state limiting edible doses at 10 mg of THC per serving and others imposing a lower limit of 5 mg. Uruguay, which only allows flower, initially only allowed product that was

about 2% THC to be sold in the pharmacies, but this was eventually increased to 9% THC.

Canada's legalization task force, which produced the report that served as the basis for the legislation that was eventually passed (51), put a lot of emphasis on potency, recommending that regulators "Develop strategies to encourage consumption of less potent cannabis, including a price and tax scheme based on potency to discourage purchase of high-potency products."

Purity

Just as jurisdictions will need to develop protocols for testing and labeling for cannabinoids, they will also have to make decisions about and develop protocols for the types of pesticides that can be used and other levels of impurities (e.g., mold, bacteria, metals). This not only has health implications for consumers, but it can also create health risks for those working in the cannabis industry (52,53).

Because of the federal prohibition in the US, the agency generally tasked with developing regulations about pesticides and tolerances (Environmental Protection Agency) has not weighed in on cannabis. This has left it up to various state agencies to make these decisions about impurities, creating a patchwork of regulations (see e.g., 54). In contrast, Canada's federally regulated producers are all subject to the same regulations, regardless of location. In November 2018, the Canadian Ministry of Health (2018) published the list and limits of active ingredients, which can differ depending on whether the product is fresh cannabis and plants, dried cannabis, or cannabis oil.

Jurisdictions will also have to decide whether certain substances (e.g., alcohol and tobacco) can be mixed and sold with cannabis. Since the overall health effects of cannabis legalization will be shaped by what happens to the consumption of alcohol, opioids, tobacco and other substances (16), this decision could have important implications for health. So far, no jurisdiction has allowed cannabis products to be infused with alcohol or tobacco. In fact, most places do not allow cannabis to be sold in stores that sell alcohol or tobacco (Nova Scotia which sells both alcohol and cannabis in the same state-run stores is a notable exception). But with some alcohol and some tobacco-related industries making significant investments in cannabis producers in Canada, it is reasonable to ask how long this prohibition on mixing products will last.

Price

Many of the outcomes that get discussed in legalization debates – the size of the illicit market, consumption, tax revenues, business profits – will be shaped by the post-

tax retail price of cannabis after legalization (3,7,55). As discussed earlier, there are several reasons to expect the production costs to plummet after legalization; however, jurisdictions have several tools they could use to increase the retail price if they desire: Minimize competition (e.g., limit wholesale and/or retail market to the government), set the price, set a minimum price, limit quantity discounts (e.g., by limiting the amount that can be purchased), levy taxes and fees, impose costly regulations (e.g., thorough testing and labelling regimes).

Currently, Uruguay is the only jurisdiction to date that sets the price of the cannabis products sold and limits the amount individual can purchase at 10 g per week. Canada and all US jurisdictions limit the amount that can be purchased in one transaction, require some type of testing (some more rigorous than others), and impose taxes. In many places, these are *ad valorem* taxes which are a function of price, but there are several ways to tax cannabis (3,55,56). Indeed, one of the limits of price-based taxes is that revenue will decline as the price falls, unless there is a corresponding increase in consumption.

An alternative approach is to tax cannabis as a function of its THC content (3,55,57). This would be similar to how the US federal government taxes liquor – as a function of its alcohol content. The 2019 Canadian Budget proposes to a tax of \$0.01 per milligram of total THC for cannabis edibles, extracts (which will include oils), and topicals (58). One advantage of this approach is that tax revenue would not fall as market prices decrease. If the THC tax was progressive (i.e., the rate increases as the amount of THC in the product increases), it would make it easier for governments to nudge consumers toward lower-potency products. One could also imagine taxes based on THC: CBD ratios, or other combinations of chemicals.

If the testing and labeling regime is reliable in a jurisdiction – and this is a big *if* – then taxing as a function of THC (or some other combination of cannabinoids) should not be difficult. But as Kilmer (46), notes, "if the testing regimes yields inconsistent results or the system can be corrupted, this creates challenges for labeling and levying THC taxes. In this situation, jurisdictions could consider using the company-stated THC level as the base for an alternative minimum tax."

Preferences for licenses

If jurisdictions decide to legalize and license commercial activity, they will have to decide how to distribute those licenses: Like those applying for alcohol licenses? Regular business licenses? To the highest bidders? Or should they give preferences to non-profits or for-

benefit corporations that are not driven solely by profit? To small businesses? Something else? As discussed in the Profit Motive section, this could have important implications for the health and economic consequences of legalization.

With a goal of advancing social equity outcomes, there has been a movement in some jurisdictions to give preferences for business licenses to those who have been most harmed by cannabis prohibition (e.g., those who live in communities where a disproportionate number of arrests took place, those from certain racial/ethnic groups, and/or those were previously convicted of a cannabis offense). Oakland's first retail store operated by an equity applicant opened in November 2018 (40), San Francisco's program is still being implemented (59), and the licensed retail stores are just opening in Massachusetts; thus, it is too early to know whether these programs have achieved their goal of building wealth and creating economic opportunities for those preferred groups. As part of its medical cannabis program, the state of Ohio sought to make sure at least 15% of the licenses went to minority-owned firms; however, this provision was legally challenged and a judge recently ruled it unconstitutional (60). Whether this decision is upheld remains to be seen, but it highlights one challenge those developing social equity programs may need to overcome.

Another potential challenge is whether those groups receiving preferences for licenses have access to capital and other forms of business assistance to be successful in this industry. In California's new program, up to \$10 million will be dedicated to helping equity applicants, including grants for startup and ongoing costs. Of course, when thinking about these programs as economic engines in certain communities, one must also consider what the price drops will mean for the economic viability of those given preferred licenses. A complementary or alternative approach would be to impose a THC tax that would not be as sensitive to price drops and dedicate some of that revenue to evidence-based programs that can improve economic opportunities for groups and/or communities disproportionately affected by cannabis prohibition. The price drop could also be mitigated by allowing the government to sell the product and/or set the price (61).

Permanency

None of the changes made to cannabis policy need be permanent, whether it is through ballot initiatives or the more traditional legislative process; however, opening the market to profit-maximizing firms makes it harder to make any changes that could significantly

affect their bottom line. As noted above, cautious jurisdictions seeking alternatives to prohibiting cannabis supply may want to consider some of the middle-ground options presented in Figure 1.

Issues of permanency also apply to regulations and product availability. Jurisdictions do not have to allow all cannabis products to be made available for purchase on Day 1; this is a choice. For example, those skeptical about creating a market (and associated advertising) for high-potency waxes could continue prohibiting them with a sunset clause that will end the ban after a fixed period of time unless it is extended by the legislature. Some jurisdictions may also want to impose a similar sunset clause with respect to on-premises consumption since it is unclear what this means for overall impaired driving (62); however, they will need to weigh this against the problems associated with legalizing cannabis but banning public consumption.

Concluding thoughts

Creating a new legal regime for cannabis supply is complex. This article highlights 14 of the main choices; there are obviously others. The bottom line is that jurisdictions have many options and they should not feel as if the Colorado and Washington models that have been replicated in some U.S. states are the only approaches for implementing an alternative to cannabis supply prohibition.

These 14 Ps should also serve as a warning for analysts conducting research on legalization. Using a simple binary variable indicating whether a jurisdiction has legalized or not in a standard differences-in-differences framework is not only crude, but it could lead to incorrect inferences if the jurisdictions have made different choices about these factors (63). Researchers must also consider that states will likely adjust regulations over time, which could have important implications for health, safety, and/or social equity.

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