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Changes in Online Illegal Drug Buying during COVID-19: Assessing Effects due to a Changing Market or Changes in Strain using a Longitudinal Sample Design

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Abstract
This research uses longitudinal data to investigate if illegal online drug purchases changed over time during the COVID-19 pandemic, and if these changes were primarily driven by users adjusting to market conditions or by a heightened level of pandemic-induced strain that could drive a greater demand for drugs. Data were collected across four waves between fall 2019 and fall 2021 using an online survey. Data showed an increase in reported online drug purchases across the waves, but the online drug purchases remained consistent for the first year of the pandemic, but increased by approximately 44% between the fall 2020 and fall 2021 when over 13 percent of the sample admitted to buying illegal drugs online. Strain was also related to buying illegal drugs online as those respondents who made illegal online purchased had an average of 5.2 strain events in the past 12 months compared to only 2.4 events among those who did not report purchasing illegal drugs online. However, the influence of strain on online purchases remained consistent across time. These results suggest that the increase in online drug purchases was primarily driven by users adapting to changing market conditions rather than the cumulative strains associated with the pandemic producing a greater effect on purchases. Policy implications are also discussed.

Keywords Online Drug Markets · Cryptomarkets · General Strain Theory · Crime during COVID-19

Life as we knew it was dramatically altered when the first cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) were reported in December 2019. By early 2020, COVID-19 had been identified in most countries, and by mid-March, the World Health Organization declared COVID-19 a global pandemic (WHO,

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2020). While responses to the pandemic varied (Capano et al., 2020; Sedgwick et al., 2022), many governments enacted lockdown measures that enforced stay-at-home orders (Welker et al., 2020). These measures created numerous challenges in almost every aspect of life as people adapted to a "new normal." To meet these challenges, many took advantage of new computer-enabled technologies and turned to telehealth, remote learning, e-commerce, virtual meetings, and online religious services. A number of our leisure activities also relied heavily on computing technology, including some people's pursuit of illegal drugs. For example, online sales of cannabis reportedly increased in the first three months of COVID-19 pandemic (see Groshkova et al., 2020; EMCDDA, 2020b; Reinstadler et al., 2021), as did the sale of many new psychoactive substances, including new cathinones (i.e., bath salts), opioids, synthetic cannabinoids, and psychedelics (Catalani et al., 2021; Di Trana et al., 2020).

Several scholars have discussed how COVID-19 could alter drug use, prices, purity, and markets, and many of these scholars discussed plausible reasons for the increase in online drug purchases (e.g., Aldridge et al., 2021; Barratt & Aldridge, 2020; Dietze & Peacock, 2020; Groshkova et al., 2020; Reinstadler et al., 2021; UNODC, 2020). However, little research has gone beyond theorizing the market changes that could possibly affect drug use and sales and documenting if illegal purchases of drugs have indeed occurred. We aim to fill that gap by using longitudinal data to investigate if illegal online drug purchases changed over time, and if these changes were primarily driven by users adjusting to market conditions or by changes in other criminogenic factors induced by the pandemic such as heightened levels of strain that could drive a greater demand for drugs.

COVID-19's Influence on Drug Use

Most evidence suggests illegal drug use decreased when the pandemic first upended social life. For example, preliminary findings suggest an overall decline in drug use in Europe during the early stages of the pandemic, and this was especially true for amphetamine, cocaine and MDMA use (Been et al., 2021; EMCDDA, 2020a; Sande et al., 2021). Similarly, among electronic dance music partiers in New York, self-reported use of cocaine, MDMA, and LSD decreased during the early stages of COVID-19 (Palamar et al., 2020). In Australia, users noted that cocaine and methamphetamine became harder to obtain, and most of those surveyed reported either no change or a reduction in their use since COVID-19 restrictions were introduced (Price et al., 2022). There were also localized shortages of heroin in many European countries (Aldridge et al., 2021; EMCDDA, 2020a).

Yet, the pattern of decreasing rates of use were not universal nor long lasting. For example, amphetamine use increased in Finland (Finnish Institute for Health and Welfare, 2020), Norway, and Belgium (Been et al., 2021; EMCDDA, 2020a), and marijuana use reportedly increased, at least among more habituated users (EMCDDA, 2020a). Data from the U.S. suggests that, while the use of most drugs was stable, the rate of illicit drug use among those over the age of 18 increased slightly in 2020 as compared to 2019 (SAMHSA, 2021). Moreover,

among those who used drugs other than alcohol during the past year, nearly 60% reported using these drugs "about the same" as they did prior to the pandemic and over 10% reported using drugs "a little more or much more" than they did before the pandemic began. This increase in reported use was especially true for those between the ages of 12 and 25 (SAMHSA, 2021).

The pandemic also influenced problematic use of illicit drugs (SAMHSA, 2021). For example, opioid overdoses increased after the COVID-19 emergency declarations (American Medical Association, 2022; Ochalek et al., 2020; Slavova et al., 2020), with the most noteworthy increases for fentanyl, methamphetamine, cocaine, and heroin (Wainwright et al., 2020). Early data from the Center for Disease Control and Prevention's Center for Health Statistics estimates overdose deaths from synthetic opioids (primarily fentanyl), stimulants, and natural and semi-synthetic opioids increased substantially during the 12-month period ending in April 2021 (CDC, 2021). Similarly, drug-related traffic fatalities increased dramatically during the pandemic, and the proportion of drivers testing positive for opioids in mid-March 2020 was more than double the number in October 2019, and marijuana prevalence increased by approximately 50% during that time (Thomas et al., 2020).

In addition to affecting the rates of use and rates of problematic use, the pandemic also changed the nature of buying and selling illicit drugs. Most evidence suggests that the lockdown orders and other pandemic-induced restrictions led to a contraction of traditional, in-person drug markets (EMCDDA, 2020b). Although the effects of lockdowns on drug markets were likely dependent on the intensity and timing of lockdowns (Aldridge et al., 2021), disruptions in supply chains reportedly led to shortages, reductions in purity, and increase in prices for drugs like cocaine and heroin around the world (Aldridge et al., 2021; Barratt & Aldridge, 2020; UNODC, 2020). Moreover, the closure of usual recreational settings such as nightclubs, bars, and dance clubs likely led to a decrease in the sale of stimulants (see Winstock et al., 2020; Palamar et al., 2020).

Yet, as with past market disruptions, drug dealers and users adapted to the changing market conditions. It appears the pandemic and the resulting lockdowns led to an increase in darknet drug purchases (Groshkova et al., 2020; EMCDDA, 2020b; contrast Namli, 2021). This increase was mostly related to cannabis products as online cannabis sales increased by 27% during the first three months of the pandemic (EMCDDA, 2020b). The increase in online cannabis sales was primarily driven by a relatively dramatic increase in sales of smaller quantities as estimates of total revenue generated fell by 17% over the same period (EMCDDA, 2020b).

Assuming there was an increased use of online drug markets, the question remains why this happened during the pandemic. There are several plausible explanations, but two seem to be particularly likely. The first possible reason is that users adapted to the changing market and turned to online purchases in response to decreased opportunities to obtain their drugs of choice using traditional, face-to-face offline purchases. The second possible reason is that there was greater demand for drugs as COVID-19 and the resulting lockdowns led to heightened strains. All else being equal, the increase in demand for drugs would likely lead to an increase in purchases, including online purchases. These reasons will now be discussed.

Market Adaptations or Strain Driving Increased Online Purchases?

While online sales are only a small fraction of the total global drug trade, there was already a considerable online drug market prior to the pandemic.[1] For example, according to a 2016 study, over 75% of illegal darknet sites on the Tor (The Onion Router) network are marketplaces, and recreational and pharmaceutical drugs were the most popular products on these marketplaces (Govind, 2021). Christin and Thomas (2019) estimated that drug sales on cryptomarkets generated approximately €750,000 per day from European vendors alone, and illegal drug sales generated approximately $27 million between December 2013 and July 2015 in the U.S. (Statista, 2016). While the pre-pandemic market was relatively small yet impressively lucrative given they emerged only about a decade ago, the number of cryptomarket vendors have increased over time (Soska & Christin, 2015) and online drug purchases have increased considerably in recent years (UNODC, 2021). For example, from 2011 to 2017, drug sales on the dark web were estimated to be worth approximately $80 million per year; however, between mid-year 2017 and 2020, sales have increased to approximately $315 million per year (UNODC, 2021).

This increase in online drug purchases is undoubtedly due in part to natural increases in e-commerce that have been observed with other products; however, the pandemic likely contributed to this growth significantly if one considers how cryptomarkets operate. Online drug markets host multiple vendors who earn commission on sales in return for providing drug buyers anonymity via encrypted messaging and payments. To reduce visibility and discoverability by law enforcement, the drugs are then typically delivered through official mail systems or by hiding them in a prearranged public location (see Aldridge & Askew, 2017; Barratt & Aldridge, 2016; Fader, 2016; Jardine, 2021). Given there are multiple vendors and buyers rely on the vendors' reputation score to decide from whom to purchase drugs, the online drug trade does not require buyers to have access to drugs through their existing social networks. Therefore, cryptomarkets allow buyers to purchase drugs from a far wider selection of dealers—and dealers to reach a far broader market of buyers—than would ever be possible with face-to-face trade.

The increased access to drugs via numerous vendors is particularly important in the context of COVID-19. First, stay-at-home orders and other restrictions on in-person interactions would likely limit access to the offline drug-dealing networks one has. With online purchases, however, dealers and buyers need not interact face-to-face and postal deliveries would allow the illicit drug trade to operate even under lockdown (Barratt & Aldridge, 2020).

Second, restrictions on social gatherings and lock-down orders would limit the number of people in public spaces that need to be observed, face-to-face drug transactions likely involved greater risk of detection during the pandemic than they did prior to the pandemic. Police presence on the street continued to be heavy and

[1] A number of scholars have discussed online drug markets prior to the pandemic (e.g., Christin & Thomas, 2019; Demant et al., 2018; Duxbury & Haynie, 2021; Jardine, 2021; Jardine & Lindner, 2020; Norbutas, 2020); interested readers should consult these works.

border controls became more robust (UNODC, 2021), and border patrol seized more drug shipments in the first months of the pandemic than in the three months before the pandemic (UNODC, 2021). Because of the pandemic induced lockdown orders, individuals stayed home and shifted many of their daily activities online. On the now-empty streets, dealers and buyers would become significantly more visible. These circumstances may have initiated market adaptation, where drug transactions were shifted online and drug delivers are made via postal or individual courier services. Thus, the anonymity of online drug dealing and use of postal deliveries may reduce risks of detection (see Barratt & Aldridge, 2020; Dietze & Peacock, 2020). Limiting face-to-face contact would also reduce the risks of contracting the virus. Thus, online drug purchases would likely appeal to those wanting to avoid potential legal and health consequences.

Finally, as noted previously, the apparent increase in online drug sales during the pandemic was primarily driven by online cannabis sales. While cannabis has always dominated online drug sales (Christin & Thomas, 2019), the market growth after the pandemic began was primarily driven by a dramatic increase in sales of smaller quantities of cannabis as estimates of total revenue generated fell by 17% during the period (EMCDDA, 2020b). It is possible this market adjustment was due to those who typically buy larger quantities for resale limited their purchases while casual users increased their purchases. The increase of small-quantity purchases could have been due to existing online cannabis buyers stockpiling their drug of choice in case of market disruptions or users who had not previously made online purchases turning to online purchases as a means of securing their drugs (see Groshkova et al., 2020; EMCDDA, 2020b).

Consequently, the COVID-19 pandemic may have induced changes in the drug market just as market adjustments contributed to the rise of crack cocaine during the 1980s (see Turner, 2017; Hawdon, 2005) and enforcement efforts led to a shift in production methods and trafficking patterns for amphetamine (see Grundetjern &Tchoula, 2021; DEA, 2020; Copes et al., 2018). Yet, an increase in online drug purchases could also result from other, non-market related factors. Instead of adjusting to changes in the market supply of drugs, increased online purchases could also simply reflect a greater pandemic-induced demand for drugs. The pandemic has been extremely disruptive in numerous ways, and this disruption in our daily routines undoubtedly contributed to strains. As Agnew (1992) argues, strain results from failing to achieve a positive goal, the removal of positive stimuli, or the addition of negative or noxious stimuli. The pandemic undoubtedly was a source of all these types of strain to many people. According to Agnew's General Strain Theory (GST), strains produce a range of negative emotions such as anger, guilt, anxiety, fear, and depression. These negative emotions, especially anger and depression, can mediate the relationship between strain and crime by reducing concern for the overall costs associated with crime and increasing an individual's disposition for committing crime. In addition, the negative emotions can condition strain's effect on crime by interfering with one's ability to manage situations effectively and cope with the strain, thereby a given level of strain may produce crime when social support and coping skills are lacking but not when these skills and support structures are more pronounced (Agnew & White, 1992).

Overall, existing literature finds general support for the claim that strain is related to illegal drug use (Agnew, 1992; Agnew & White, 1992; Drapela, 2006; Harrell, 2007), even if the relationship between strain and illegal drug use may be conditioned by race (Ash-Houchen & Lo, 2020; Peck et al., 2018), sex (Drapela, 2006; Glassner & Cho, 2018; Mazerolle, 1998), social bonds, and deviant affiliations (Mazerolle & Maahs, 2000; Mazerolle et al., 2000). Strain also appears to be related to online drug purchases. For example, in a sample of young adults from the United States and Spain, purchasing illegal drugs online was related to higher psychological distress, which can be considered a manifestation of strain, even after controlling for self-control, social bonds, excessive gambling behaviors, and excessive internet use (Oksanen et al., 2021).

While strain appears to be related to drug use and online drug purchasing in general, studies analyzing the relationship between drug use and strain and negative emotions during the COVID-19 pandemic also suggest that pandemic-induced strains could lead to an increased drug use. For example, increased use of cannabis and benzodiazepines was reported due to the general feeling of stress caused by the pandemic and associated restrictions (Winstock et al., 2020). In addition, online opioid purchases were associated with lower self-control, elevated social anxiety, heavy gambling, and Internet use (Cebo, 2022). Cebo's (2022) findings directly suggest that the increase in online drug purchases during the pandemic could be due to heightened levels of strain. Similarly, in a study of Slovenian licit and illicit drug users who used more drugs during the pandemic than before, Sande et al. (2021) found that three quarters of the respondents increased their use during the pandemic out of boredom, followed by anxiety (37.4%), restlessness (36.4%), depression (30.4%), and feelings of alienation (29.0%). Carlyle et al. (2021) also identified boredom, anxiety, enjoyment, loneliness, and depression as correlates of increased use during the pandemic. It is worth noting that other than enjoyment, these factors can be all considered stressors (Brooks et al., 2020).

Therefore, the COVID-19 pandemic could lead to increases in online drug purchases (1) by forcing users and dealers to adapt to changing market conditions, (2) by inducing more strain and negative emotions therefore producing greater demand for drugs, or (3) by a combination of inducing demand for drugs through heightened strains and forcing users to adapt to changing market conditions. We try to disentangle these possible effects by analyzing illegal online drug purchases over time as the pandemic unfolds. This combination of factors has led us to three hypotheses:

Hypothesis 1: There was an increase in purchasing illegal drugs online during COVID-19;
Hypothesis 2: Individuals who were more strained were more likely to have purchased illegal drugs online;
Hypothesis 3: There is an interaction between strain and COVID-19, such that the combination of strain and COVID-19 increased the purchasing of illegal drugs online.

Table 1 Comparison of Sample Demographics

	Fall 2019 (Sample 1)	Spring 2020 (Sample 2)	Fall 2020 (Sample 3)	Fall 2021 (Sample 4)
% White	73%	73%	74%	74%
% Male	49%	49%	47%	46%
% College Degree or greater	52%	59%	45%	47%
% over $100 k	22%	32%	19%	22%
% Hispanic	17%	12%	13%	12%
Mean Age	44	47	45	43

Methods

Data were collected using an online survey. We utilized online panels provided by Dynata (formerly SSI), which is the world's largest first-party data platform. Dynata uses random digit dialing, banner ads, and other permission-based techniques to recruit respondents and create a database. They then select samples for surveys and respondents are contacted via email. As a for-profit market research company, Dynata's exact methods are proprietary; however, generally they use pre-existing databases, quota targets, and automated algorithms (e.g., Imperium's QualityScore™) to ensure that participants fit the requested profile and pay attention when answering questions. Participants who complete the survey and who are not removed due to patterns of fraud or speed receive a small fee or reward from Dynata. As such, the participants are motivated to successfully complete the survey. In terms of data quality, population representation, honesty, and attention of participants, prolific panel platforms such as Dynata provide higher quality samples compared to self-service survey platforms such as MTurk, CloudResearch, Prolific, and SurveyMonkey (Eyal et al., 2021; Kimball, 2019). Moreover, Dynata is one of the highest data quality prolific panel providers (Eyal et al., 2021).

The authors coded the survey using the Qualtrics online platform. The survey included several parts. First, a brief statement reported Institutional Review Board (IRB) requirements and that the research had received IRB approval. Second, a series of demographic and computer use questions provided a baseline to ensure the sample was within the expected margin of error for a nationally representative sample when compared to U.S. Census data. Third, questions related to cybervictimization and cyber offending were asked. These questions were derived from prior research and included 10 individual acts of offending and victimization (e.g., Bossler & Holt, 2010; Donner et al., 2014; Higgins, 2004). Finally, participants were asked a series of questions that reflect concepts from various criminological theories. These items were part of a larger project. In this paper we utilized questions about general strain theory that were derived from Hinduja and Patchin (2007).

Data were collected across multiple waves. Table 1 shows the characteristics of each wave. The first wave, Fall 2019, was prior to COVID-19 shutdowns. The rest of the waves were during or after COVID-19 lockdowns (i.e., Spring 2020, Fall 2020,

Table 2 Illegal Online Drug Purchases and Wave

Wave	Fall 2019	Spring 2020	Fall 2020	Fall 2021
Total Sample	1,101	1,037	1,250	1,205
Participants Reporting **No** Illegal Online Drug Purchases	1,021	962	1,153	1,042
Participants Reporting Illegal Online Drug Purchases	80	75	97	163
Percent of Participants Reporting Online Illegal Drug Purchases	7.27%	7.23%	7.76%	13.53%

and Fall 2021). Across all four waves there were 4,653 participants, however, listwise deletion of missing data resulted in 60 respondents who did not respond to the drug question being dropped from the analysis. Listwise deletion was used because there were no discernable patterns related to the missing data as they appear to be missing at random. All samples were balanced according to census data on sex, ethnicity, and race. Online samples are generally found to be similar to random probability-based samples (MacInnis et al., 2018; Simmons & Bobo, 2015; Weinberg et al., 2014). This is especially true when strategies, such as eliminating those who take the survey too quickly, are utilized (Evans & Mathur, 2005; Wansink, 2001).

The survey took an average of 15 min 45 s across all waves. The shortest wave was the first COVID-19 wave (wave 2), which averaged 13 min and 51 s, and the longest was the pre-COVID 19 wave (wave 1), which averaged 19 min and 21 s. The average difference can be accounted for by difference in which theories were included on the survey as some theories require more items to test than do others. These other theories were part of a larger project and not tested in this paper.

Measures

The focus of our research pertains to illegal online drug purchases. As such, our dependent variable was a binary question, "In the past 12 months have you bought prescriptions (without a prescription) or other drugs on online pharmacies or websites." Of the 4,593 respondents with complete data, 415 (9.04%) said they had bought drugs online in the past 12 months (Table 2).

Our primary independent variables were the wave of data (pre/post COVID-19) and general strain. To measure general strain, we used questions developed by Hinduja and Patchin (2007). We adjusted the questions to be more appropriate for an adult sample. For example, instead of asking whether the individual has received a bad grade in the past 12 months, we asked if they recently got a bad grade, performance review, or evaluation. A total of nine questions were asked about strain. These were then summated into a general strain scale. The general strain scale had a range of 0–9, indicating all possible levels of strain across participants. The average strain score was 2.61 ($SD = -2.32$) For all individual strain questions see Table 3.

We also included a series of control variables. These encompassed gender, race, ethnicity, family income, education, and age (see Table 4 for categories of income and education). Age was measured continuously. Due to low numbers of

Table 3 General Strain Theory Index Measures

In the past 12 months have you…	Yes	Percent
Been treated unfairly	1,857	41.40
Received a bad grade, performance review, or evaluation	691	15.28
Got into a disagreement with a family member	2,224	49.11
Had a death or hospitalization of a close friend or family member	1,603	35.39
Got into a disagreement with a friend	1,655	36.57
Had to deal with money problems	2,038	45.06
Broke up with a significant other	713	15.76
Parents divorced	455	10.07
Been the victim of a crime	677	14.97

several genders and races, these variables are coded as binary variables (Male and White). Ethnicity was also dichotomized (Hispanic = 1; not Hispanic = 0). While gender and race were balanced during data collection, family income, education and age were not. Nevertheless, these variables still appear comparable to U.S. averages. For example, the median age in the United States is 38 years old (Knoema, 2020), and the samples' median age was 43. Given that the sample does not include those under 18, our sample is likely very close to the U.S. median. For further information on control variables see Table 4.

Results

In total, 415 (9.04%) respondents reported buying illegal drugs online. Males were more likely to have bought illegal drugs online, with 11% reporting illegal purchases ($\chi^2 = 21$, $p < 0.001$). The average age of those who reported purchasing illegal drugs online was 36 compared to those who reported not purchasing illegal drugs online at 45 ($t(4504) = 11.7$, $p < 0.001$).

H1: To examine the first hypothesis, wave of data was used to predict online purchases. Generally, we see an increase in reported online drug purchases across the waves (see Table 2 for specific differences). In 2019, 7.2% of the sample reported purchasing illegal drugs online, whereas in the fall of 2021, 13.5% of the sample reported the same behavior. A chi-square analysis revealed this to be a significant difference ($\chi^2 = 40$, $p < 0.001$).
H2: Testing the second hypothesis, a t-test revealed a significant difference between those participants who bought illegal drugs online and those who did not in terms of their reported levels of strain. Participants who reported buying illegal drugs online had an average of 5.2 strain events in the past 12 months compared to only 2.4 events among those who did not report purchasing illegal drugs online ($t(4,436) = -24.46$, $p < 0.001$).

Table 4 Control Variable Descriptive Statistics

Gender	Male	Female	LGBTQ/Non-Binary	No answer			
	2,217 (48%)	2,325 (51%)	33 (1%)	16(0%)			
Education	Less than High School	High School	Some College	College Degree	MA/ Professional/ PhD		
	147 (3%)	1,045 (23%)	1,095 (24%)	1,485 (32%)	843 (18%)		
Race (multiple allowed)	White	Black	American Indian	Asian	Pacific Island/Hawaiian	Other/Prefer not to Answer	
	3,422 (74%)	750 (16%)	95 (2%)	276 (6%)	24 (1%)	182 (4%)	
Household Income	< $25 k	$25 k-$50 k	$50 k-$75 k	$75 k-$100 k	$100 k-$150 k	$150 k-$250 k	> $250 k
	882 (20%)	1,093 (24%)	799 (18%)	624 (14%)	619 (14%)	315 (7%)	113 (3%)
Hispanic	Yes	No					
	626 (14%)	3,968 (86%)					
Age	Mean	Median	SD	Min	Max		
	45	43	16	18	94		

While independent analyses revealed both the wave and GST influenced online illegal purchasing, the potential interaction of these factors was also analyzed. To do so, we utilized several logistic regressions. All models met the basic assumptions of logistic regression in that the observations were independent, there were no problems of multicollinearity, and the samples were sufficiently large. First, we examined a logistic regression that included all four waves of data as discrete variables and the measure of GST. For easy comparison, the base wave was Fall 2019, which was the only pre-COVID-19 data. The subsequent two waves, Spring 2020 and Fall 2020, were not a significant predictor of online drug purchases. However, Fall 2021 and the GST index were significant. Overall being in the Fall 2021 wave increased the chance of participants reporting purchasing illegal drugs online by 73% compared to the pre-COVID-19 data. Additionally, a one-event increase in strain increased the odds of purchasing illegal drugs online by 59%. Table 5 reports the results of the logistics regressions.

H3: We then proceeded to examine the third hypothesis by testing if there was an interaction between strain and wave of data collection with another logistic regression. These interactions test if strain and COVID-19 cumulated to create a heightened chance of buying illegal drugs online beyond any main effects. None of the interaction terms achieved statistical significance. Moreover, the addition of the interactions did not significantly increase the explained variance. As such, the final model does not include interaction terms.

The final model includes the wave of data, GST and a series of control variables, including gender, race, ethnicity, age, income, and education. The final model produced similar results as the earlier main-effect model for both the wave variables and GST. The first two waves were not statistically significant, while the final wave and GST were significant predictors of online purchases. Similar significance and odds ratios were found across both the first and third model. These results show that control variables did not influence the relationship between online drug purchases and wave of data collection or strain. However, several control variables were also significant predictors of online drug purchases. Being male increased the likelihood of buying drugs online by 57% ($p < 0.001$). Being white decreased the odds of purchasing drugs online by 26% ($p = 0.001$). Having higher income also increased the odds of purchasing illegal drugs online. For every bracket income increase (see Table 5) the likelihood that a participant would report illegal online drug purchases increased by 31% ($p < 0.001$). Education was similarly related as each bracket increase in education was associated with a 29% increase in online purchase ($p < 0.001$). Finally, online illegal drug purchase decreased with age, with every year of age, the likelihood of purchasing illegal drugs online decreased by approximately 4% ($p < 0.001$). Of note as well was the variable that failed to achieve statistical significance. Hispanic ethnicity was not significantly related to online drug purchases ($p = 0.85$, respectively).

Table 5 Logistic Regressions predicting Illegal Online Drug Purchases

	Base				Interaction				Full Model			
Variable	B	SE(B)	p	OR	B	SE(B)	p	OR	B	SE(B)	p	OR
Spring 2020*	.03	.18	.856	1.03	-.37	.42	.369	.69	-.03	.20	.870	.97
Fall 2020	-.02	17	.903	.98	-.01	.38	.974	.99	.17	.19	.353	1.19
Fall 2021	.55	.16	.001	1.73	1.02	.34	.003	2.76	.54	.17	.002	1.72
GST	.46	.02	< .001	1.59	.49	.06	< .001	1.63	.42	.03	< .001	1.53
GST#Spring 2020*					.09	.08	.268	1.09				
GST#Fall 2020					-.00	.07	.962	1.00				
GST#Fall 2021					-.10	.07	.122	.90				
Male (binary)									.45	.13	.001	1.57
White (binary)									-.30	.14	.028	.74
Non-Hispanic (binary)									-.03	.17	.853	.97
Income									.27	.04	< .001	1.31
Education									.26	.07	< .001	1.29
Age									-.04	.01	< .001	.96
Constant	-4.21	.16	< .001	.01	-4.32	.28	< .001	.01	-4.36	.33	< .001	.013
Pseudo R^2	.18				.19				.25			
LR Chi^2	493 (n = 4,438)				501(n = 4,438)				619 (n = 4,172)			

Notes: *base comparison wave is Fall 2019

Discussion

The paper explored illegal online drug purchases during the pandemic and if these were related to time (i.e., wave of data collection), strain, or the interaction of time and strain. In a national sample of adult Americans, we analyzed data collected at four different times, once before the pandemic (Fall, 2019) and three times as the pandemic unfolded (in Spring 2020, Fall 2020, and Fall 2021, respectively). Because of lockdown measures and greater difficulties and dangers associated with traditional street-based drug dealing, we hypothesized that online drug purchase would increase during the pandemic (H1). We also hypothesized that strain would increase online drug purchasing (H2). Furthermore, we expected that strain and time into the pandemic would interact to increase the purchase of illegal drugs online above the main effect associated with time and strain (H3). That is, we hypothesized that the influence of strain on drug purchases would increase over time as the pandemic's adverse effects began to accumulate for individuals. The first two hypotheses were supported by our analysis; however, the data do not support the argument that strain's effect on illegal online drug purchases increased over time.

These findings suggest that market forces were likely the primary driver of the increased use of online drug markets during the COVID-19 pandemic. As noted above, the dynamic nature of retail distribution allows for adaptations to changing circumstances (Hamilton & Stevens, 2020; Price et al., 2022). As the pandemic disrupted traditional drug markets by halting shipments and allowing for increased police presence on streets, it likely triggered an increased use of digital technology in drug distribution, including increased mail delivery and contactless methods for reaching buyers such as web-based purchases (UNODC, 2021). However, our data shows that this increase was delayed, not truly increasing until Fall 2021. Conversely, while strain increases the likelihood of purchasing drugs online, the effect of strain on online purchases remained consistent across time as the pandemic unfolded. Therefore, it does not appear that any heightened strains experienced because of the pandemic drove the greater use of online markets observed in our data. Although people undoubtedly experienced greater strains during the pandemic, and this may have driven greater drug use, there is no evidence that these strained drug purchasers were more likely to buy their drugs online than they were prior to the pandemic. Online drug purchasers tend to have additional characteristics beyond strain, such as low levels of self-control, excessive gambling behaviors, excessive levels of internet use, and relatively weak offline social bonds (see Oksanen et al., 2021). Thus, increased stain alone may not produce enough motivation to turn to the internet for drug purchases. In addition, having strong offline social networks could provide greater access to drugs without relying on internet sells.

Our data reveals a robust drug market and innovative adaptations to the new challenges posed to it by the pandemic, but our data suggests it took drug buyers time to adapt to these changing market forces. It was not until the Fall of 2021 that we see a significant increase in online purchases. While we do not

have the data to confirm this assertion, the delayed increase in online purchases may well be because these sales were primarily driven by small quantity purchases rather than the purchases of large quantities for resale (Groshkova et al., 2020; EMCDDA, 2020b). It appears that as the pandemic wore on users who had not previously made online purchases turned to online purchases as a means of securing their drugs. This conclusion is consistent with other known facts about changes in the drug market after the pandemic.

As noted by several multinational reports (EMCDDA, 2020; UNODC, 2021), there was only a temporary reduction of street drug markets and traditional drug markets were quickly restored. Moreover, several studies suggest (Namli, 2021; Sande et al., 2021; Scherbaum et al., 2021) that despite the uptick of digital drug markets during the pandemic, heavy drug abusers continued to buy offline with increased level of precaution such as using non-contact exchanges (Sande et al., 2021). Thus, the delay in increased online sales was likely more a factor of convenience for regular users than a major market adaptation by the large distributors who disproportionately influence online sales (see Christin & Thomas, 2019) or a result of heavy users expanding their drug-purchasing practices because of limited supplies. Either way, the data suggest there was a dynamic adaptation to the pandemic by drug purchasers. Given this change may have been driven more by convenience than any severe disruption in the supply of drugs, it is likely that those who experimented with online drug purchasing during the pandemic will continue this practice after the pandemic.

In addition to our findings concerning online purchases over time and strain, the demographic characteristics of online drug buyers in our study align with many previous findings. First, adolescents and young adults are more likely to use drugs than are older individuals (Chassin et al., 2009; Johnston et al., 2011; Lamptey, 2005; Park et al., 2006), and marijuana use in young adulthood is associated with higher family SES (Patrick et al., 2012). Males are also far more likely to use drugs than are females (Alves et al., 2021; NIDA, 2021). In the current data, participants who purchased illegal drugs online were also disproportionately males, well educated, and have higher incomes. Although, our survey did not allow for a comparison of buyer activity in online and offline drug markets, we suggest that the findings that young, highly educated males with higher incomes are the ones who purchase drugs online might be indicative of different demographic compositions of offline and online drug market customers rather than differences in drug users, per se.

Another factor behind wealthy and highly educated individuals' presence in online marketplaces may relate their relative online savviness and resources needed to do online transactions. Online drug markets are not easily accessible for everyone. Users need a stable internet connection, and must download specific browsers and buy cryptocurrency to be able to purchase on the dark web (Norbutas, 2018; Norbutas et al., 2020). To be comfortable arranging online transactions on the dark web, one needs to be familiar with customer reviews and judge seller and product reliability through social ties and a centralized reputation scoring system (see Diekmann et al., 2014; Jardine, 2021). These skills and familiarization with sellers and market conditions, as well as developing the necessary levels of trust in the marketplace,

requires time and money, conditions that individuals with unstable labor conditions, low paying jobs, and inadequate financial backgrounds may not be able to afford. Thus, it is predicable that the relatively affluent are more likely to use online drug markets.

Our research has policy implications. As we see an increase in illegal online drug purchases, one may ask what authorities can possibly do about it. Although the pandemic-induced market adaptation led to the increase of online drug markets, this increase may not be clear evidence for greater policing of online drug markets. We should learn from the research on the policing of traditional drug markets that highlights the symbolic nature of these approaches and the harms associated with them. Approaches to street dealing are based on research concerning crime hot spots that led policy makers to attempt to better utilize their resources by focusing on crime hot spots rather than dispersing crime across neighborhoods (Sherman & Weisburd, 1995). Moreover, zero tolerance policing became the archetypal prohibitionist approach to drug control as drug war rhetoric provided a popular political tool to tap into "public punitiveness" (Hawdon, 2001; Sprott, 1999). Hot spot policing coupled with the "militarized enforcement" (Lea & Young, 1984) of zero tolerance policing has come to dominate our approach to drug control strategies for some time now (Bacon, 2016); however, its effectiveness in controlling drug trafficking is highly problematic (see Spicer, 2021).

In a recent review, Spicer (2021) summarized evidence-based critiques against traditional policing applied specifically in drug "hot spots" and deemed them harmful, ineffective, and symbolic. First, these tactics do not appear to be effective as the police's intense efforts typically fail to affect drug availability or price. Targeted venues either moved to other locations or reopened shortly after they had temporarily closed. This displacement of drug markets is also likely to happen on cryptomarkets as the cryptomarket ecosystem is remarkably resilient to law enforcement takedowns (Décary-Hétu & Giommoni, 2017; ElBahrawy et al., 2020). Second, hot spot and zero tolerance policing can lead to riskier behavior by those involved in drug dealing and using. For example, heroin dealers might adapt to the increased police presence by storing and distributing heroin caps orally (Spicer, 2021), and users may engage in riskier practices such as sharing of syringes (Bourgois & Schonberg, 2009). Similarly, disrupting cryptomarkets that are mostly involved in the selling of cannabis products can lead to adaptations that lead buyers and users to more dangerous online behaviors or more dangerous drugs. Finally, this style of policing disproportionately affects small-scale drug users and dealers in urban areas where supply and demand are both operating under economic strain (Netherland & Hansen, 2016; Saxe et al., 2001; Spooner & Hetherington, 2004). The racial profiling of drug offenders, and the popular narrative that shifts blame from white "victims" to Big Pharma, disproportionately affects non-whites and non-Hispanic white ethnicities (Campbell et al., 2021; Oliva, 2020), mostly leaving alone well-off white users. As noted above, the growth of online drug transactions appears to have been driven by the greater purchasing of relatively small quantities of marijuana. Thus, just as hot spot zero tolerance policing disproportionately affects small-scale dealers and users, heightened policing of online transactions is likely to affect users rather than large-scale dealers.

Thus, rather than being effective and sustainable, traditional hot spot and zero tolerance policing is a "fire-fighting" approach where police officers "constantly chasing after the next drug market 'fire' that needs to be put out" (Spicer, 2021: 64). This "symbolic policing" (Coomber et al., 2019) of "signal crimes" (Innes, 2014) like drug offenses that are associated with violence and social disorder leads to highly visible drug raids on suspected dealers that are interpreted as signals of control, regardless of their effectiveness and actual influence on drug-related crime. Similar results are likely to happen if we apply this "fire-fighting" approach to online markets. While we are likely to achieve some highly visible disruptions, such as the shutting down of the original Silk Road drug market in 2013, these tactics are unlikely to produce lasting effects. Thus, we should learn from traditional law enforcement efforts to control street-level drug sales and pursue policies that are evidence driven and take advantage of the unique features of cryptomarkets. Rather than adopting a fire-fighter approach, these efforts can target each stage of buyer and seller activities on the darknet markets: 1) informational accumulation; 2) account formation; 3) market use; and 4) delivery/receipt (see Jardine, 2021). By understanding this crime script, we can tailor law enforcement interventions to effectively target each stage (see Jardine, 2021).

Limitations

Although online non-probability samples are generally found to be similar to random probability-based samples (MacInnis et al., 2018; Simmons & Bobo, 2015; Weinberg et al., 2014), a number of studies find that non-probability samples are less reliable than random probability-based samples (e.g., Einarsson et al., 2022; Lehdonvirta et al., 2021; Pickering & Blaszczynski, 2021). Furthermore, although the sample represented Americans with respect to age, sex, race and ethnicity, the survey's validity is vulnerable for a variety of reasons. First, survey participants in paid panels like ours tend to be more educated and disproportionately from higher income brackets (Singer & Kulka, 2002). Second, the observed odds ratios relating our independent variables and drug purchasing are high in the sample (Table 5). However, since buying illegal drugs is a low base-rate behavior (only 7.27%, 7.23%, 8.05%, and 13.53% of participants self-reported it per data collection wave, respectively), a 100% increase chance from 10% is only an additional 10%. Meaning, while the odds ratios are high, they only result in a few percentage points increase in behavior. Although the increase in those purchasing drugs illegal online is significant in the last data collection wave, cautions in drawing dramatic conclusions from this are warranted.

Next, while we know from the sample that males with higher education and higher financial well-being are the most likely to purchase illegal drugs online, the survey did not ask about and could not investigate the reasons why. There is evidence (Daniel, 2021; EMCDDA, 2020b) that the drug market is evolving, but we cannot be sure what circumstances are responsible for some individuals buying drugs online rather than using street markets (Giommoni, 2020). It could be certainty, security,

trust, computer skills, access to internet, being comfortable using cryptocurrency, avoiding street violence or the combination of those; unfortunately, our data do not allow us to say if this is the case for sure.

Conclusion

The COVID-19 pandemic altered life for most people, including illicit drug dealers and drug users. There is evidence that more people turned to the Internet as the pandemic wore on, and the evidence suggests this was likely due to market adaptations rather than how people dealt with the strains of the pandemic. While our findings are telling and point to possible changes in drug transactions that may outlive the pandemic, we need to better understand the characteristics of the drug market realignment and what it means for law enforcement and policymakers. However, one thing appears likely: engaging in symbolic policing and band-aid solutions will disproportionately affect small-scale drug users and dealers and not lead to significant reductions in drug use.

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