RESEARCH

Characteristics of online pharmacies selling Adderall

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ABSTRACT

Objectives: Adderall (amphetamine-dextroamphetamine) is a controlled substance with harmful adverse effects if abused or misused. We assessed the availability of Adderall from common search engines, and evaluated the safety and marketing characteristics of online pharmacies selling Adderall.

Design: Cross-sectional study.

Setting and participants: From December 2019 to February 2020, the phrase "buy Adderall online" was queried in four search engines: Google (N = 100), Bing (N = 100), Yahoo (N = 50) and DuckDuckGo (N = 50). Online pharmacies that claimed to sell Adderall and had unique Uniform Resource Locators, were active, free-access, and in English language were included.

Outcome measures: Online pharmacies were categorized as rogue, unclassified, or legitimate on the basis of LegitScript classifications. Safety and marketing characteristics, and costs were collected.

Results: Of the 62 online pharmacies found to sell Adderall, 61 were rogue or unclassified. Across all rogue and unclassified online pharmacies, prescriptions were not required (100%), pharmacist services were not offered (100%), and quantity limits were not placed on the number of Adderall purchases (100%). Rogue and unclassified online pharmacies appealed to cost, offering price discounts (61%), bulk discounts (67%), and coupon codes (70%). Contrary to their claims, cheaper prices were available for all formulations and dosages of Adderall from GoodRx than from these online pharmacies. Rogue and unclassified online pharmacies promoted and enabled the illicit purchase of Adderall, appealing to privacy (74%), offering purchase through cryptocurrency (74%), and claiming registration or accreditation of their sites (33%).

Conclusion: Rogue online pharmacies are pervasive in search engine results, enabling the illicit purchase of Adderall without a prescription. Consumers are at risk of purchasing Adderall, a medication with high abuse potential, from unsafe sources. Law enforcement, regulatory agencies, and search engines should work to further protect consumers from unregistered and illegitimate online pharmacies selling Adderall.

Background

Adderall (amphetamine/dextroamphetamine [Shire U.S. Inc]) is a central nervous system stimulant medication commonly used to treat attention deficit hyperactivity disorder (ADHD). Although effective in its treatment of ADHD, Adderall carries a high potential for abuse and dependence—its nonmedical use among college students for neurocognitive enhancement has been well documented, with a prevalence estimated from 9% to 23%.[1-3] The overall nonmedical use of prescription stimulants has been estimated at approximately 8% in adults.[4] Inherent to the abuse of amphetamines are risks including weight loss, cardiovascular events, psychological dependence, and morphologic brain changes.[5-10] Owing to its high potential for abuse, which could lead to severe psychological or physical dependence, Adderall is classified by the U.S. Drug Enforcement Administration (DEA) as a schedule II medication.[11]

Online pharmacies have emerged as a popular destination for the purchase of prescription drugs. Although the overall volume varies on a daily basis, 30,000-35,000 online pharmacy websites were found to be accessible in 2016.[12] Online pharmacies can be defined by whether they operate as legitimate and registered pharmacies or whether they are

Key Points

Background:

- The online pharmacy marketplace is saturated with illegitimate retailers that sell prescription medications without requiring a valid prescription.
- No-prescription access to Adderall, a schedule II medication with a high potential for abuse, poses a threat to public health.
- This article is the first to investigate the safety, marketing, and cost characteristics of online pharmacies selling Adderall.

Findings:

- Adderall is readily accessible with no prescription through common search engines — of 62 online pharmacies analyzed, 61 permitted access to Adderall without a prescription.
- For all formulations, doses, and quantities, Adderall was on average more expensive from illegitimate online pharmacies than prices advertised on GoodRx, suggesting additional costs to obtain Adderall without a prescription.
- More efforts to monitor and remove illegitimate online pharmacies are required by law enforcement, regulatory agencies, and search engines.

illegitimate and in violation of U.S. pharmacy laws and practice standards.[13] According to LegitScript, a verification and monitoring service, 96% of the accessible online pharmacies are illegitimate, of which 92% are rogue, meaning that they sell drugs without a valid prescription.[12] Given the high prevalence of rogue online pharmacies, the ease of access to medications with abuse potential is of particular concern.

National organizations have been combating the proliferation of illegitimate online pharmacies. The BeSafeRx campaign of the Food and Drug Administration (FDA) and the Buy Safe Rx campaign of the Alliance for Safe Online Pharmacies (ASOP) empower consumers by raising awareness of the dangers of purchasing medications from illegitimate online pharmacies, as well as providing information on the warning signs that an online pharmacy might be operating illegally.[14,15] The National Association of Boards of Pharmacy (NABP) lists accredited digital pharmacies on its website.[16] NABP also offers a verification service for legitimate online pharmacies through which they can receive a ".pharmacy" domain, increasing consumers' visibility of legitimate pharmacies. LegitScript allows consumers to enter a uniform resource locator (URL) to determine a pharmacy's legitimacy.[17] Moreover, beyond raising public awareness, regulatory and legal actions are ongoing against illegitimate online pharmacies. Operation Pangea, a cooperative effort led by Interpol in conjunction with FDA and the U.S. Department of Justice (DOJ) has led to the removal of thousands of illegitimate online pharmacies.[18] LegitScript has also partnered with the FDA to identify and close illegitimate online pharmacies. Still, illegitimate online pharmacies remain challenging to control

because there are innumerable URLs under which they can operate.

Despite these organizational attempts, rogue online pharmacies remain pervasive and many consumers remain unaware of the associated dangers. In choosing rogue online pharmacies, consumers opt out of medication counseling, monitoring, and drug-drug interaction checking that pharmacists and health professionals offer.[19] The use of such resources in health care has been shown to improve patient outcomes.[20] Concerns regarding insufficient safety measures are further exacerbated by the marketing methods that illegitimate online pharmacies use to attract consumers.[21,22] Although it has been shown that patients using no-prescription online pharmacies are at greater risk of developing treatment-related adverse events, there is a lack of current data on how rogue online pharmacies approach patient safety and what marketing methods they employ, particularly for medications with high abuse potential.[23]

The accessibility of Adderall online is a public health hazard.[24-26] We investigated the availability of Adderall from online pharmacies through search results of common search engines and documented the websites' safety and marketing characteristics, as well as the costs of Adderall.

Objectives

Assess the availability of Adderall from common search engines, and evaluate the safety and marketing characteristics of online pharmacies selling Adderall.

Methods

The website selection was conducted from December 2019 to February 2020 using 4 different search engines (Google, Bing, Yahoo, and DuckDuckGo) with the phrase "buy Adderall online." These 4 search engines were chosen on the basis of user traffic, and for DuckDuckGo specifically, its emphasis on user privacy. Search algorithms on these websites already incorporated synonyms of the search terms. The first 100 results of Google and Bing, and the first 50 of Yahoo and DuckDuckGo were screened, incorporating more results from the more popular search engines. Websites were included if they claimed to sell Adderall, were active websites, were free to access, were in English language, and had a unique URL. Information for websites selling either Adderall immediate release (IR) or Adderall extended release (XR) were collected because these products contain the same active ingredient (amphetamine/dextroamphetamine). Websites that required 1 extra click to reach the website selling the product were also included. Screenshots were taken of the website pages to ensure the internal validity of results.

The legitimacy of the websites was assessed using LegitScript, a verification and monitoring service that has monitored more than 70,000 online pharmacies.[17] Among other criteria, LegitScript classifies pharmacies depending on licensure or registration in affiliated jurisdictions, sale of controlled substances, prior discipline, requirement of valid prescriptions, protection of privacy, patient services offered, transparency, and domain name registration.[27] The websites in this analysis were classified as LegitScript defines them: rogue—"these merchants engage in

illegal, unsafe, or misleading activities like selling prescription drugs without a prescription;" legitimate—"these merchants are registered with a LegitScript certification program and have passed LegitScript certification criteria;" or unclassified—no information was available from LegitScript.[28]

The average monthly traffic to website domains defined as unique visits from any country was obtained using www.SimilarWeb.com. This website aggregates information on website traffic from a variety of sources, including open exchange of first-party data and survey of public data sources. The Internet protocol (IP) addresses of websites were checked using www.IP2location.com, which retrieves geographic information on the basis of IP addresses. The registered geographic locations of the IP addresses were compared with the listed website locations.

Safety

Characteristics related to safety were selected on the basis of previous literature and obtained from each included website.[13,19,21,29,30] The characteristics were collected as binary variables: whether the website displayed or required such characteristics or not, and were examined across rogue, unclassified, and legitimate pharmacies. The characteristics of interest included (1) requirement of a prescription; (2) requirement of a health-related questionnaire; (3) offer to speak with a pharmacist; (4) drug-related warnings and precautions on the product page; (5) drug information on the product page, including class of medication; (6) controls on the amount of Adderall that could be ordered (e.g., restricting patients to a 90-day supply); and (7) country match between website location listed vis-à-vis IP address location.

Marketing

Characteristics related to marketing were selected on the basis of previous literature.[13,19,21,22,29,30] The following marketing characteristics were gathered from each website: (1) claims a "discount" compared with other pharmacies; (2) offers bulk discounts; (3) offers a "promo code" or coupon on checkout; (4) facilitates purchases using cryptocurrency (e.g., Bitcoin); (5) has drug-specific advertisements pertaining to Adderall; (6) displays advertisements for other products on the page advertising the sale of Adderall; (7) has a phone number or WhatsApp contact information listed; (8) includes an offer to speak with an associate; (9) claims pharmacy registration (e.g., Professional Compounding Centers of America [PCCA] or NABP Digital Pharmacy Accreditation); (10) includes customer testimonies; and (11) offers privacy reassurances (e.g., discrete packaging or protection of health- or billing-related information).

Cost

The price and shipping costs of 30 mg Adderall IR and Adderall XR at the most frequently sold quantities of 60, 90, 120, 180, and 240 tablets or capsules were collected. The price per tablet or capsule of Adderall IR and Adderall XR was calculated after accounting for shipping costs. The shipping costs were distributed among the total quantity of pills or capsules in an order. Online pharmacy prices were compared
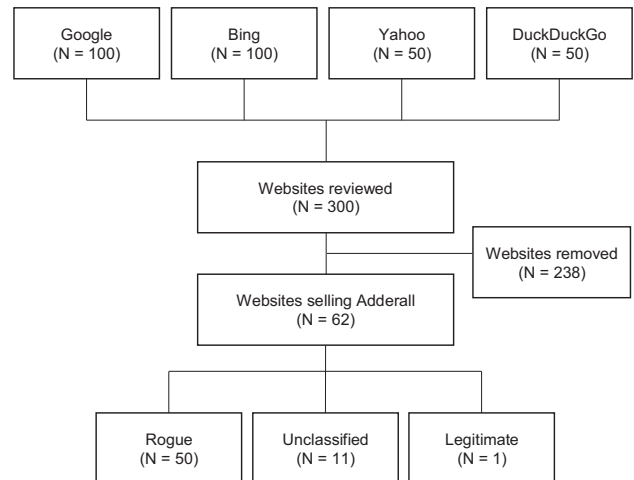

Figure 1. Search strategy used to collect online pharmacies selling Adderall.

with the prices offered through GoodRx, an online prescription drug coupon site, which is what a U.S. consumer might expect to pay out-of-pocket without insurance at a brick-and-mortar store.[31]

Results

Through searching Google, Bing, Yahoo, and DuckDuckGo with the query "buy Adderall online," we identified a total of 62 online pharmacies claiming to sell Adderall (Figure 1). Of these online pharmacies, LegitScript classified 50 as rogue, whereas 11 were unclassified (i.e., no information about these sites was available through LegitScript), and only 1 site was legitimate. Traffic to these websites, as determined by www.SimilarWeb.com, differed depending on the classification as outlined in Figure 2. The traffic to rogue and unclassified websites was low, with most receiving fewer than 5000 unique monthly visits. The monthly traffic of the 1 legitimate website was comparatively much larger at 1-2 million unique monthly visits.
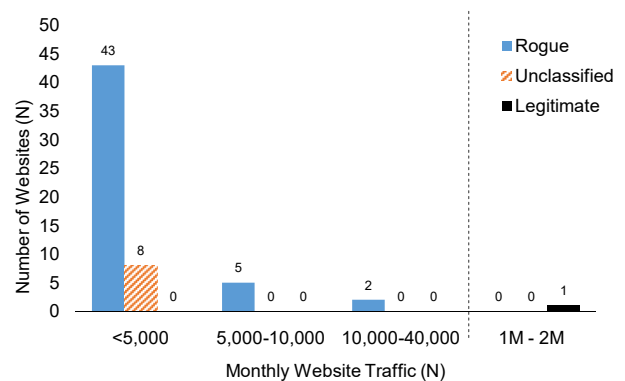

Figure 2. Monthly website traffic (unique visits) to online pharmacies of different types. Three "unclassified" results had no information regarding website traffic. Abbreviation used: M, million.

Table 1
Safety characteristics stratified by rogue, unclassified, and legitimate pharmacies

Characteristics	Rogue (N = 50)		Unclassified (N = 11)			Legitimate (N = 1)		
	Yes (%)	No (%)	Yes (%)	No (%)	NR (%)	Yes (%)	No (%)	NR (%)
Prescription required	0	50 (100)	0	11 (100)	0	1 (100)	0	0
Health-related questionnaire required	0	50 (100)	0	11 (100)	0	0	1 (100)	0
Offer to speak with pharmacist	0	50 (100)	0	11 (100)	0	1 (100)	0	0
Drug precautions on product page	33 (66)	17 (34)	6 (55)	4 (36)	1 (9)	0	0	1 (100)
Drug information on product page	45 (90)	5 (10)	9 (82)	1 (9)	1 (9)	0	0	1 (100)
Quantity control	0	50 (100)	0	11 (100)	0	1 (100)	0	0
Location listed on website and location of server match	8 (16)	42 (84)	4 (36)	7 (64)	0	1 (100)	0	0

Abbreviation used: NR, not reported.

The safety characteristics of all online pharmacies selling Adderall are described in Table 1. Among rogue and unclassified pharmacies, prescriptions and health-related questionnaires were not required (100%), none offered pharmacist services (100%), and none placed a quantity limit on the number of Adderall tablets or capsules that could be ordered (100%). Rogue and unclassified pharmacies commonly offered some form of drug warnings and precautions (64%), and nearly uniformly provided some form of drug information (89%). The locations of rogue and unclassified online pharmacies were not listed on nearly half (49%) of their websites. Overall, the locations listed on rogue and unclassified online pharmacy websites were not consistent with the locations of their servers as determined by www.IPLocation.net (80%). Server locations and the respective website-listed locations of online pharmacies in our sample are depicted in Figure 3.

The marketing characteristics of all online pharmacies selling Adderall are described in Table 2. Rogue and unclassified online pharmacies often made cost arguments by claiming a price discount compared with other pharmacies (61%), providing bulk discounts (67%), and offering coupon or promotional codes (70%). Other marketing characteristics included the use of advertisements in various forms: customer testimonies (66%); Adderall-specific ads (31%); and ads for other products on the product page (84%). Rogue and unclassified online pharmacies stressed their accessibility by offering a phone number or WhatsApp contact information (82%), and

nearly uniformly offered customers the opportunity to speak with an associate through a "Contact Us" page or chat feature (98%). Privacy was stressed—rogue and unclassified online pharmacies provided privacy assurances on either patient information or "discreet package delivery" (74%). Privacy was also offered by accepting cryptocurrency such as Bitcoin (74%). Rogue and unclassified online pharmacies often declared some form of registration or verification through varied accrediting bodies and agencies such as the PCCA or NABP Digital Pharmacy Accreditation, in turn suggesting product quality and safety (33%).

For rogue and unclassified online pharmacies, the cost per tablet of 30 mg Adderall IR and cost per capsule of 30 mg Adderall XR at quantities of 60, 90, 120, 180, and 240 tablets or capsules are displayed in Figure 4. At all dosages and quantities, the prices for Adderall IR and Adderall XR online were higher than the price offered through the coupon site GoodRx.

The single legitimate website (www.humanapharmacy.com) required a prescription, offered pharmacist services, and placed a limit on the quantity of Adderall that could be sold, as determined by the quantity written on the prescription. Drug warnings and precautions, drug information, and the price for Adderall could not be observed on this site because consumers were unable to advance without a member identification and prescription. The marketing characteristics of the legitimate website did not place an emphasis on price (there were no listed price or bulk discounts) but did promote accessibility with a
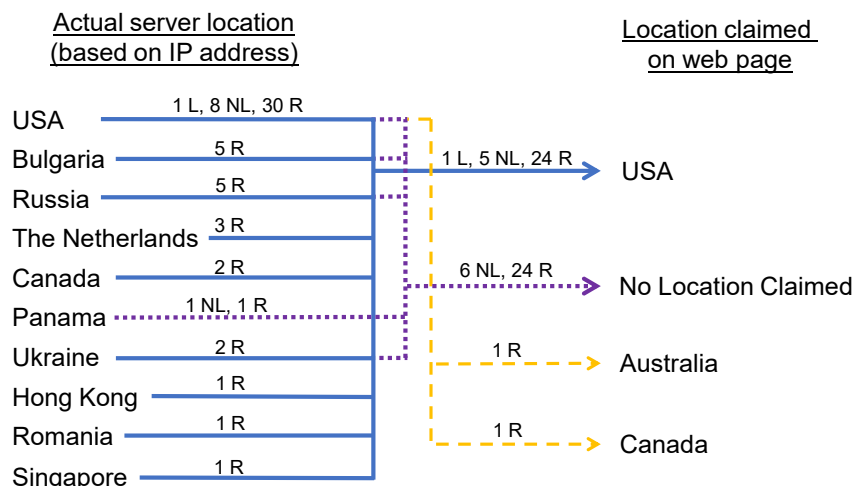

Figure 3. Rogue online pharmacy server locations seldom matched those claimed on the website. Abbreviations used: L, legitimate; NL, not listed by LegitScript; R, rogue.

Table 2
Marketing characteristics stratified by rogue, unclassified, and legitimate pharmacies

Characteristics	Rogue (N = 50)		Unclassified (N = 11)			Legitimate (N = 1)		
	Yes (%)	No (%)	Yes (%)	No (%)	NR (%)	Yes (%)	No (%)	NR (%)
Claims price discount	31 (62)	19 (38)	6 (55)	5 (45)	0	0	1 (100)	0
Bulk discounts	34 (68)	16 (32)	7 (64)	4 (36)	0	0	1 (100)	0
Coupon or promotional code	35 (70)	15 (30)	8 (73)	3 (27)	0	0	0	1 (100)
Accepts cryptocurrency	37 (74)	13 (26)	8 (73)	2 (18)	1 (9)	0	1 (100)	0
Adderall-specific ads	15 (30)	35 (70)	4 (36)	7 (64)	0	0	1 (100)	0
Ads for other products on page selling Adderall	43 (86)	7 (14)	8 (73)	2 (18)	1 (9)	0	0	1 (100)
Phone number or WhatsApp contact information	41 (82)	9 (18)	9 (82)	2 (18)	0	1 (100)	0	0
Offer to speak with associate	49 (98)	1 (2)	11 (100)	0	0	1 (100)	0	0
Registration claims	15 (30)	35 (70)	5 (45)	6 (55)	0	1 (100)	0	0
Customer testimonies	35 (70)	15 (30)	5 (45)	6 (55)	0	0	1 (100)	0
Privacy assurances	37 (74)	13 (26)	8 (73)	3 (27)	0	1 (100)	0	0

Abbreviation used: NR, not reported.

phone number listed and an offer to speak with an associate. The legitimate website offered privacy assurances and advertised its registration and accreditation with NABP, the Utilization Review Accreditation Commission, and the Accreditation Commission for Health Care.

Discussion

We found that most online pharmacies selling Adderall were rogue or unclassified by LegitScript. Of 62 online pharmacies claiming to sell Adderall, only 1 was a legitimate seller. By not requiring a prescription, rogue pharmacies allow the purchase of medications that could be abused, enabling the ill-advised practice of Adderall use without concurrent therapeutic monitoring.

With high doses and repeated use of Adderall, the development of psychological amphetamine dependence and adverse events such as weight loss, psychosis, seizures, and cardiovascular events can occur.[5,6] Although data are sparse, morphologic brain changes and related behavioral alterations—particularly in adolescents with prolonged amphetamine use—are also a concern.[7-9] In addition, although we did not conduct an analysis on drug quality, it is documented that rogue online pharmacies frequently sell substandard and falsified medications.[30] Consumers with and without valid prescriptions face risks when purchasing

from rogue online pharmacies. Those with a valid prescription might receive poor quality medication and be harmed by impurities, fail to achieve therapeutic goals, and suffer from a lack of therapeutic monitoring. Those without a valid prescription, who might be more inclined to abuse Adderall and take more than the necessary dose, are predisposed to the same known risks as those with a prescription, in addition to the potential for an increased frequency of dose-dependent adverse effects.

Concerns related to the purchase of Adderall from rogue online pharmacies are amplified by the marketing characteristics that these pharmacies employ. As evinced in these pharmacies not placing quantity limits on the amount of Adderall for purchase, rogue online pharmacies intend to sell as much of these products as possible. The sale of Adderall is achieved through varied sales arguments—the appeal to cost-savings, constant customer support, and privacy—that are perhaps the most important for consumers who intend to purchase controlled substances without a prescription. Rogue online pharmacies appeal to discrete package delivery, protection of patient information, and the use of de-identified forms of payments involving cryptocurrency. These sales arguments, which are designed to lure consumers into purchasing more medications, run counter to reasonable patient care and sensible legislation that aims to protect the public from drugs with abuse and misuse potential.

Previous studies comparing prescription drug prices between online and brick-and-mortar pharmacies have had mixed results depending primarily on the drug studied, with several finding lower costs online.[32,33] Our investigation into the cost of 30 mg Adderall IR and Adderall XR from rogue online pharmacies revealed that the marketing language detailing "affordability" was not necessarily true for the purchase of Adderall without a prescription. Compared with prices listed on GoodRx, a popular coupon site for patients purchasing medications without insurance, rogue online pharmacy prices, including shipping costs for Adderall IR and Adderall XR, were nearly 5-fold more expensive per unit. The steep price differential is suggestive of the illegal nature of Adderall purchase without a prescription online. Simply from a cost standpoint, patients with a valid prescription have little incentive to purchase Adderall from a rogue online pharmacy. This result supports existing literature that among online pharmacies there is a price markup for the purchase of medications
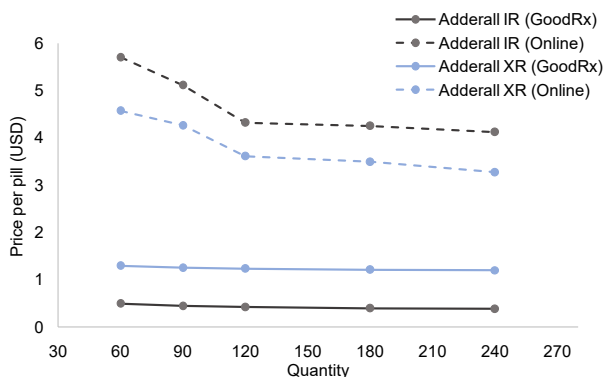

Figure 4. Price per unit of 30 mg Adderall IR and XR online compared with GoodRx price. Abbreviations used: IR, immediate release, XR, extended release; USD, U.S. dollars.

without a prescription.[22] Our results demonstrate that the no-prescription price differential extends to brick-and-mortar pharmacies, which offer cheaper medications.

Organizations that offer registration and accreditation for online pharmacies, such as NABP's Digital Pharmacy Accreditation and LegitScript, enable consumers to confidently identify legitimate online pharmacies. Our research showed, however, that rogue online pharmacies often inauthentically claimed registration. Rogue online pharmacies are creative in their methods to bolster reputability. On their websites' "Home" and "About Us" pages, some claimed registration with NABP, PCCA, or DEA; some claimed to only sell U.S. Food and Drug Administration (FDA)-approved medications (e.g., "100% FDA approved"); some claimed that the World Health Organization recommends their site; and some had seal icons with phrases such as "Verified Seller." Claims such as these might mislead consumers into feeling safe in their purchase of medications. Although some of these claims are difficult to act on, accrediting agencies such as NABP and PCCA should move to improve their online screening and surveillance to (1) ensure that rogue online pharmacies are not falsely registered or accredited, and (2) prevent rogue online pharmacies from misusing the accrediting organizations' logos and names. Although NABP sets the standard in transparency with its list of accredited pharmacies and the promotion of ".pharmacy" domains for verified websites, the screening of individual online pharmacies is important because consumers might not be aware of NABP's running list of accredited pharmacies.

Although there have been numerous efforts to control the groundswell of rogue online pharmacies, our results suggest that these efforts have not been altogether successful. Operation Pangea, a cooperative effort led by Interpol in conjunction with FDA and DOJ, has led to the removal of thousands of illegitimate online pharmacies.[18] FDA regularly issues warning letters to online pharmacies engaged in illegal activity, and also operates the BeSafeRx campaign, which is a public awareness effort that empowers consumers to recognize and use legitimate online pharmacies.[15,34] Numerous nongovernmental efforts also exist to quell the use of illegal online pharmacies, including ASOP Global Foundation, which conducts research into illegal online pharmacies and informs consumers and policymakers of associated harms.[14] The Center for Safe Internet Pharmacies is another nonprofit organization, founded by Internet service providers and technology companies, with the goal to raise public awareness and, in partnering with LegitScript, provide a platform for patients to verify their online pharmacy with the "Verify Before You Buy" initiative.[35,36] Beyond verification services, LegitScript identifies and notifies registrars to close rogue online pharmacies. LegitScript reported helping to close 6,149 rogue pharmacies in 2019 alone.[37]

However, illegitimate online pharmacies are challenging to control because they regularly re-emerge. Although the overall Web traffic to rogue online pharmacies in our results was relatively low (Figure 2), this could be suggestive of the methods that rogue online pharmacies use to avoid detection, regularly closing and opening new websites under unique URLs. This is supported by our finding that the geographic country locations listed on rogue and unclassified online pharmacy websites were largely (80%) not consistent with the locations of their servers. These results demonstrate that

search engines are not effectively screening for, and removing, rogue online pharmacies from their search results at present. In the absence of efficient methods to regulate and remove rogue online pharmacies, it is imperative that search engines acknowledge the pervasiveness of rogue online pharmacies within their search results and take additional measures of control. Search engines should help lead the effort to create a safer online pharmacy landscape through the generation of search algorithms that select for legitimate online pharmacies.

There were several limitations to our study. We limited our screening to 300 websites owing to feasibility. Given this limitation, numerous online pharmacies remained undetected. This limited screening yielded only 1 legitimate pharmacy, precluding an in-depth analysis comparing the characteristics of rogue pharmacies with those of legitimate pharmacies. However, we believe that our methodology accurately replicates the behavior of a typical U.S. consumer who would only view the first few pages of search results. Although we were able to assess how many unique visits each online pharmacy received from www.SimilarWeb.com, it is not possible to determine how frequently Adderall products were viewed or purchased on each website. We did not attempt to purchase Adderall from any of the included online pharmacies. It is therefore unclear whether an order placed with an online pharmacy included in this sample would have resulted in the delivery of Adderall. Without purchasing the product, we also could not test the quality of the medication. However, we believe that the purchase of prescription drugs from rogue online pharmacies is in itself ethically tenuous. Although we believe that our results are generally applicable to the online pharmacy landscape, given the transient nature of online pharmacies, our results—in terms of particular sites analyzed—are a slice in time, analyzing the sites listed on 4 search engines in the United States from December 2019 to February 2020. Our study also failed to capture the prevalence of Adderall advertising on social media platforms, which is an emerging market for the advertising and person-to-person sale of controlled substances.[38,39] Still, we hold that common search engines remain a relevant and easy access point for consumers to find websites selling controlled substances. Finally, data collection for our study was conducted before the novel coronavirus disease 2019 (COVID-19) pandemic, which saw an increase in rogue online pharmacies peddling no-prescription medications, particularly for treatment of COVID-19.[40] Our results remain relevant and even more important now because online consumption of goods and prescription medications is becoming commonplace, putting more consumers at risk as they purchase from rogue online pharmacies.

Conclusion

Adderall, a controlled substance with high potential for abuse, is readily accessible online without a prescription. While doing little to ensure patient safety, rogue online pharmacies treat patients as consumers with aggressive marketing tactics. In addition to concerted law enforcement and regulatory efforts to remove these websites, common search engines should make efforts to better select for legitimate online pharmacies, deterring the illegal purchase of Adderall and improving the safety of consumers in the online pharmacy

marketplace. In the meantime, organizations should continue to offer and support efforts to warn consumers of the dangers of illegitimate online pharmacies.

Acknowledgments

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