COVID-19 pandemic's impact on online sex advertising and sex trafficking

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Disruptive social events like the Covid-19 pandemic can have significant impact on the commercial sex industry, yet these effects have been little understood. This paper examines the effect of the pandemic on one part of the commercial sex industry: sex trafficking. Our results from scraped sexual service advertisements show that the pandemic has had measurable impact on online advertising for sex trafficking in the United States, with a significant decrease associated with stay-at-home orders followed by an increase to levels well above prepandemic levels as Covid-related restrictions were relaxed. We contribute to the policy landscape by showing that the initial decrease was associated with a loss of demand for sexual services due to pandemic-related health concerns, but that a confluence of factors, including the lack of economic and social support, increased the number of people vulnerable to being exploited. This study can assist policy makers in predicting future changes in the sex industry to support a more just and inclusive society. In the context of future health crises, natural disasters, and major social disruptions it can guide policy makers in apportioning public aid in a way that does not leave vulnerable populations and existing sex workers powerless to being trafficked.

Keywords: sex trafficking; online advertising; Covid-19 pandemic; commercial sex

1. Background: sex trafficking and social disruption

Sex trafficking is a criminal enterprise in which a trafficker uses force, fraud, coercion, or age to exploit individuals through the forced performance of sex acts. Sex trafficking is often depicted in mainstream media, and this media coverage plays an important role

in the public understanding of human sex trafficking. Examples include the 2019 U.S. media reporting on the involvement of well-known public figures such as Jeffrey Epstein in sex trafficking and the oft-repeated, but not evidence-supported, media claim that sex trafficking increases in response to singular events such as the Super Bowl. This type of coverage sensationalizes the crime and presents it as a response to specific, unusual events in a community. Such attention does not necessarily lead to positive outcomes (Ahmad & Sheshu, 2012; Caulkins et al., 2019; Lederer & Wetzel, 2014). Sex trafficking is an everyday problem that is widespread throughout the United States. The Covid-19 pandemic has the potential to substantially affect sex trafficking, and policy-makers need rigorous analysis of sex trafficking and its prevalence.

Sex trafficking primarily provides financial benefit to the traffickers and consequently traffickers must generate demand for the services of their victims. The primary way in which they do this is through online advertising (Boecking et al., 2019). Online advertising thus provides insight into the state of the sex trafficking in the United States. We focused on the subset of online advertisements with sex trafficking indicators: specifically, on indicators that the sex worker is managed by a third party.

Too often, research and reporting on sex trafficking focuses on unique social events (e.g., the Superbowl, the North American International Auto Show; Martin & Hill, 2019). Focusing only on one-off events reinforces the idea that sex trafficking happens only a few times a year or that it is a problem associated with the transportation of victims into a community and supported by an influx of buyers from outside that community. The term “trafficking” can be confusing in this context; sex trafficking is a criminal enterprise that exploits victims 365 days of the year and does not have to include movement. A victim of sex trafficking could be trafficked within their own home or neighborhood (Shively et al., 2012).

Rather than focusing on transportation of the victim, a better way to frame the idea of sex trafficking is to consider the presence of third-party management as a proxy. An indication of a third-party manager in an advertisement for commercial sexual services suggests that the provider is not an independent sex worker. While it is possible that an individual who is voluntarily participating in sex work may have a third-party manager, our informal interviews with law enforcement experts and others familiar with the sex trafficking industry suggest that this situation is rare¹. Third-party management is thus strongly indicative of the individual being trafficked, as indicated in previous literature (Ibanez & Gazan, 2016).

While sex trafficking occurs in all facets of the commercial sex industry, this paper focuses only on sex trafficking through online ads for in-person sex work. This distinction is important to understand the later claims we make about the connection between sex work and the Covid-19 pandemic. We recognize there is no one-size-fits-all portrayal of sex trafficking victims, as they can be found throughout the highly stratified and segmented commercial sex industry market, stretching from in-person street prostitution to brothels, massage parlors, clubs, exclusive escort services, and online virtual sex work (Shively et al., 2012). However, although they are not a direct measure of sex trafficking or available sex services, the volume of advertisements for in-person sexual services is a useful measure, as it helps characterize demand and supply (Ahmed & Seshu, 2012).

2. Hypothesis

While often repeated media claims about that the presence of sex trafficking may lead one to believe sex trafficking is episodic and only associated with large events (Martin

¹ We are not attributing any feedback to a particular interviewee in order to honor their need to remain anonymous.

& Hill, 2019), sex trafficking is a persistent reality and outside events have an effect on its magnitude and profitability. Better understanding the relationship between sex trafficking and outside events could help multiple stakeholders such as law and policy makers and law enforcement to predict future changes and adapt to the changing nature of the industry. It can also help policy makers better understand the effects—and limitations—of existing policies during times of social disruption.

We hypothesized that the onset of social-distancing orders had a dampening effect on commercial sex and sex trafficking due to client and provider reluctance to contract the virus and a reduction in regular travel away from home for work and recreation on the part of potential clients. However, we also hypothesized that this temporary decrease would be accompanied by a confluence of other factors that would lead to a rapid increase in sex trafficking after restrictions lifted. These factors are detailed in the Discussion section. Prior to the discussion on factors, however, we first organize the article to detail the materials and methods used for our analysis. We test the hypotheses by collecting commercial sex advertising data scraped from a popular website, focusing on a subset of advertisements with strong indicators of trafficking and then testing for statistically significant changes in advertising volume.

3. Materials and methods

Building off other antitrafficking research (Boecking et al., 2019; Latonero, 2011; Nagpal et al., 2015), we used the volume of sex advertisements as an indicator of the prevalence of sex work in a given region.

3.1 Data

The internet hosts numerous online platforms for sexual services advertisements, which serve as a basis for providers to connect with buyers of commercial sex work. The landscape of available platforms has changed rapidly in the past year. Prior to the

United States’ legislative enactment of Fight Online Sex Trafficking Act—Stop Enabling Sex Trafficking Act (FOSTA-SESTA; Allow States and Victims to Fight Online Sex Trafficking Act, 2018), Backpage.com and Craigslist.com had become the favored sites to facilitate sex work and sex trafficking (DeLateur, 2016). After FOSTA-SESTA took effect, legislation effectively rendered Backpage.com’s and Craigslist.com’s personals advertisements ineffective on the internet for commercial sex advertising. Our informal expert interviews with law enforcement consistently inform us that a single replacement has not emerged to replace Backpage.com. Instead, websites spring up periodically and “hobbyist” and “mongers” (the terms used to describe frequenters of these websites) find their way to them by word of mouth (Feeney, 2013). However, in these conversations, one site that was consistently mentioned as a leading advertisement site was Rubratings.com.

Data used in this research consisted of over 1 million sex ads from the online platform Rubratings.com. This research is the first that we have been able to find that addresses sex trafficking anomaly detection in a post-FOSTA-SESTA era. We recognize that without one lead website that hosts the majority of advertisements to replace Backpage.com, we are analyzing only a portion of all existing online commercial sex advertisements online, potentially impacting our assessment. However, our interviewees indicated that despite the changes brought about by the FOSTA-SESTA era, online advertisements are still helpful indicators of the market for commercial sex in a given region.

The data from Rubratings.com were scraped in the Python programming language with the use of the BeautifulSoup package. This facilitated a regular automated scrape of the website from 140 cities across 47 U.S. states. The automated scrapers for this analysis retrieved 1,019,709 total advertisements in the United States

over the period from January 3, 2020 to September 29, 2020. Data collected include paid advertisements used by clients to browse photos, services, rates, and other descriptions of sex workers. Typically, the advertisement will list an email address, a phone number, or both, in order for the client to make contact and set up a “date.” The collected data were the pageid, date modified, description text, location, phone number, and date scraped.

We were unable to obtain completely continuous data (i.e., every day) over the time period selected, as the Rubratings.com website and other similar websites are evolving and becoming more savvy about how to block scraping. Over the 270 days between January 3, 2020 and September 29, 2020, there were 57 days on which the scraper did not run or was actively blocked. However, it is common for a given advertisement to be listed on the site for multiple days. This duplication means that most advertisements that ran on days the scraper was not running were caught by the scraper on a different day. The data for the remaining 213 days are thus likely representative of the entire time period under study. With this in mind, we removed the duplicated advertisements to accurately characterize the actual daily advertising behavior and to prevent inadvertently overweighting advertisements. We accomplished this by comparing the dates the advertiser posted the ad with the date the scraper captured the ad. If those dates matched we identified this as the advertisement’s unique appearance, appended that advertisement to the analytic sample, and deleted any identical copies. This procedure reduced the data set significantly (Fig. 1).

Figure 1. Data stratification for online advertising scraped from Rubratings.com from January 3, 2019 to September 29, 2020.

3.1.1 Data stratification

Exploring the website and probing some advertisements quickly made it clear that many of these advertisements were actually scams attempting to obtain credit card information. Classified advertisements are fertile ground for scammers (Al-Rousan et al., 2020; McCormick, 2013), and our informal interviews with anti-trafficking experts agreed that this is a common practice on these types of websites. One co-author (Guikema) confirmed this by sending emails to all advertisers in Ann Arbor, Michigan, who listed only an email address and found that all of them were scams attempting to steal credit card information. In related research in the context of spam detection, researchers found that 78% of fake or spam advertisements did not include phone numbers, while 87% of real advertisements did include phone numbers (Tran et al., 2011). For these reasons, the analytic sample includes only the advertisements with phone numbers for further analysis.

The data are also stratified to characterize the impact of sex trafficking separate from the impact of independent commercial sex work. Previous researchers based their characterization on a “new to town” stratification that labels advertisements that had recently appeared in that region (Boecking et al., 2019). We contend that this labeling is potentially misleading because it bounds sex trafficking to movement. As mentioned earlier, sex trafficking does not require movement, and this characterization may overlook the persistent risk to victims every day. Furthermore this characterization ignores the reality that independent commercial sex workers move around and work in different cities as well. Instead of a “new to town” stratification, this research uses phone number clustering. Some advertisements point to the same phone number, whereas other phone numbers have single appearances in our data set. The informal interviews we conducted with law enforcement, current and former sex workers, and antitrafficking experts suggested that multiple advertisements pointing to one phone number are evidence of a call center or third-party management. These experts confirmed that the use of third-party management (or “pimps”) is a likely indicator of sex trafficking.

This notion is further reinforced by the informal interviews we conducted with current and former independent (non-trafficked) commercial sex workers, who described their phone number as their “lifeline” and a way to stay in touch with their “regulars,” thereby suggesting that their singular advertisement would be connected only to their number. We incorporated this concept into our data by parsing the advertisements that had a relationship with only one phone number that did not appear to be related to any other advertisement (1:1 relationship between phone number and ad) from the clusters of many ads that pointed to one phone number (1:n>1 relationship between phone number and ads). We recognize that some sex trafficking victims are

likely using one phone number that will not appear elsewhere. We also recognize that the use of short-term phone numbers associated with a disposable phone or a “soft”/internet phone number is common in nefarious practices; this labeling will not capture those third-party managers who cycle through multiple disposable numbers (Chen et al., 2019). We do not wish to exclude these victims, but rather use this labeling as a generalized sex trafficking indicator. Figure 1 summarizes the stratification of the data set.

3.1.2 Data limitations

Despite the richness of the data scraped from the online advertisements, there are admittedly many limitations as well. First, as mentioned previously, the automated scrapers did not capture advertising activity every day as intended. Instead, there were days when the scraper did not run or was actively blocked by the website. Despite regular retooling and restructuring of the scraper, some partial or entire days were not scraped; these were distributed at random throughout the entire data set. This observation is consistent with other similar research (Boecking et al., 2019). We also recognize that the shutdown of websites like Cityxguide.com, a site that gained popularity after the passage of the FOSTA-SESTA anti-sex trafficking legislation, could affect our analysis.

Other limitations include the imperfect way the data are stratified for detection of scams and sex trafficking labeling. Research suggests that trafficking detection can be also done through analyzing the advertisement description itself through various types of machine-learning classification and by identifying movement patterns (Ibanez & Suthers, 2015; Nagpal et al., 2015; Szeckely et al., 2015). Lastly, we recognize that law enforcement and antitrafficking nonprofit organizations place decoy advertisements on these types of websites to disrupt the criminal activity of those seeking paid sexual

services. These decoys have the ability to add noise to the data, as they could be counted as either advertisements for commercial sex or for sex trafficking.

3.2 Methods

Following the data stratification, we were left with 369,280 advertisements that reflected indications of our sex trafficking indicators; see Table 1.

Table 1. Daily descriptive statistics for scraped advertisements (Rubratings.com) January 3, 2020 through September 29, 2020. Compiled, entire data set; Sex Trfk, records that exhibited the sex trafficking indicator; Comm Sex, records that did not exhibit the sex trafficking indicator, proxy for independent commercial sex workers

Data	U.S. Ad Count (total)	Minimum (by day)	Maximum (by day)	Mean (by day)	Std. Dev. (by day)
Compiled	1,019,709	210	8821	3711	1704
Sex Trfk	369,280	183	3194	1718	773
Comm Sex	86,064	93	883	406	274

We then aggregated these remaining advertisements by day and by each individual city. We normalized the number of daily commercial sex online advertisements by assessing an average number of advertisements in equilibrium (pre–Covid-19) and then dividing by that average over the hypothesized anomalous period. We also applied a 3-day moving average to smooth out the noise and emphasize the trends. We took the raw mean number of advertisements pre–Covid-19. Those entries were then divided by the pre–Covid-19 average to produce respective normalized values.

While data were collected from throughout the United States, we highlight eight major U.S. cities from a variety of geographic areas in order to demonstrate the varied impacts across the wide spectrum of stay-at-home order implementation dates. We chose to highlight the following regions based on the variety of stay-at-home implementation dates: Atlanta (April 3, 2019), Dallas/Fort Worth (April 2, 2019), Seattle (March 23, 2019), New York (March 22, 2019), Houston (April 2, 2019),

Miami/Fort Lauderdale (April 3, 2020), and Detroit (April 3, 2019), as well as the entire United States (varied stay-at-home implementation dates; Kaiser Family Foundation, 2020). The process described above was repeated for all eight regions to obtain normalized values for each.

We systematically tested our hypothesis that there existed a decreasing trend of sex trafficking advertisements after stay-at-home orders were instituted by systematically comparing baseline and testing intervals around each individual state's stay-at-home orders (Kaiser Family Foundation, 2020). We tested the days immediately prior to the inflection point in 15-, 30-, 45-, and 60-day increments to the 15-, 45-, and 60-day increments immediately following the lockdown orders. We tested these pairings within the cities mentioned in the main test with a two-sided Welch's t test of the two independent samples. This statistical method tested the null hypothesis that the two samples have the same expected values. If the p value is smaller than .10, we reject the null hypothesis of equal expected values.

This testing helps us draw conclusions about the testing ranges' statistical significance. We are presenting a family of multiple hypothesis tests at the city level. We therefore make a Bonferroni correction at the city level and use a lower p value that accounts for the probability of getting one significant result from the family at the 10% level (Miller, 2012). We use the Bonferroni method because it is one of the most conservative and common ways to account for the number of comparisons. After using these methods to analyze records we categorized as showing indications of sex trafficking, we repeated the same methods for the records that were not classified by our approach as indicative of sex trafficking. We refer to these records later as a proxy for independent commercial sex workers. We conducted this same analysis for all eight cities as well as the United States as a whole.

4. Results

Our results support our hypothesis that online ads indicative of sex trafficking would rapidly decline after stay-at-home orders began, and then rapidly increase after those orders were lifted. Figure 2 presents a time-series graph of total online commercial sex advertising volume and sex trafficking advertising volume for all regions studied.

Figure 2. Number of advertisements for both compiled and “sex trafficking” data sets.
Note. Left (2a): Normalized time-series of daily ad counts of all compiled advertisements.
Right (2b): Normalized time-series of daily ad counts reflecting the sex trafficking indicator.

It exhibits the number of daily online advertisements for both the raw data (Figure 2a) and the trafficking indicator subset (Figure 2b), normalized by the pre-Covid advertising volume at the city level. Included in the graph are Atlanta, Chicago, Dallas/Fort Worth, Seattle, New York, Houston, Miami/Fort Lauderdale, and Detroit, as well as the United States as a whole.

Additionally, we list computed features on the trajectory and behavior of the sex trafficking advertisements for each city (Table 2). The table is sorted by the earliest stay-at-home order, with column descriptions listed (see Appendix for methods of calculation). The table annotates the date at which that city’s decrease in sex trafficking advertisements first began, followed by the average number of advertisements the city evidenced from January 1, 2020 until each city’s decline began. We also calculated the

velocity (approximate slope) at which each city's advertisements declined. The lowest number of advertisements at the bottom of each time series, along with their corresponding dates, follow in the table; all of these figures assist in the calculation of the depth percentage of the decline.

Table 2. Statistics by city describing sex trafficking escort advertisement behavior over time. Period covering January 2020 to May 2020, sorted in order of stay-at-home orders.

city	stay at home	dip began	pre Covid avg	dip velocity	lowest ad count	lowest ad date	increase began	depth (%)
Chicago	3/21/20	3/18/20	332.5	-6.24	164	4/14/20	4/30/20	49.32
New York	3/22/20	3/12/20	419.52	-19.53	107	3/28/20	4/14/20	25.51
Seattle	3/23/20	3/12/20	110.98	-2.37	66	3/31/20	4/20/20	59.47
Detroit	3/24/20	3/20/20	22.73	-0.72	4	4/15/20	6/11/20	17.60
Dallas / Fort Worth	4/2/20	3/17/20	606.69	-11.32	335	4/10/20	4/24/20	55.22
Houston	4/2/20	3/11/20	93.25	-1.71	54	4/3/20	5/5/20	57.91
Atlanta	4/3/20	3/16/20	333.21	-6.17	179	4/10/20	4/10/20	53.72
Miami / Ft Lauderdale	4/3/20	3/20/20	64.02	-1.67	29	4/10/20	4/27/20	45.30

We observed these statistics to be consistent with the visualized time-series graph in Figure 2. It is also worth noting that the dips in sex trafficking advertisements all began prior to the state-mandated stay-at-home order. This may have occurred in anticipation of government-required social distancing. Sex trafficked victims and their third-party managers may have known that in-person sex work demand would decline in response, and were perhaps conserving the fees associated with posting advertisements online. In the early days of the outbreak in the United States, the risk communication around New York as the epicenter was clear (McKinley, 2020). We would expect that the response to the danger of the virus to be evidenced in a dramatic and rapid decline of in-person commercial sex, and that is indeed what we find in the data. Table 3 supports this characterization, as New York reflects the fastest velocity toward its lowest ad count.

Table 3 summarizes all of the statistical testing that characterizes the decrease in advertising during lockdown as well as the increase in advertising immediately following the lifting of restrictions for both the population of advertisements that

evidence our trafficking indicator as well as those that we label as independent commercial sex workers.

Table 3. *Summary of testing.*

City	All Escort Ads (Stay at home)	All Escort Ads (Lifted)	Trafficking (Stay at home)	Trafficking (Lifted)	Ind Sex Workers (Stay at home)	Ind Sex Workers (Lifted)
Atlanta	↓ (6)	— (4)	↓ (10)	↑ (8)	↓ (12)	↑ (12)
Chicago	↓ (9)	— (2)	↓ (11)	↑ (12)	↓ (12)	— (3)
Dallas/Fort Worth	— (3)	— (1)	↓ (9)	↑ (11)	↓ (12)	↑ (9)
Seattle	— (3)	↑ (7)	↓ (7)	↑ (12)	↓ (11)	— (4)
New York	↓ (12)	↑ (6)	↓ (12)	↑ (12)	↓ (12)	↑ (8)
Houston	— (2)	↑ (8)	— (3)	↑ (12)	↓ (9)	↑ (6)
Miami/Ft Lauderdale	↓ (12)	— (2)	↓ (6)	↑ (12)	↓ (9)	↑ (8)
Detroit	↓ (8)	— (2)	↓ (9)	↑ (12)	↓ (8)	— (4)
USA	↓ (6)	— (2)	↓ (12)	↑ (12)	↓ (11)	↑ (12)

Each cell represents twelve systematic pairings and the presence of an arrow represents statistical significance in six or more of those testing intervals, and the direction of the arrow indicates an increasing or decreasing trend.

4.1 Decrease in advertising during lockdown

A statistically significant decrease is evident in both compiled advertisements and trafficking advertisements immediately after stay-at-home orders were issued in most but not all cities. The trend of decreased sex advertising during lockdown was consistent for the United States as a whole and specific cities. Taking New York as an example (stay-at-home order on March 22, 2020), we found a pre-Covid mean number of advertisements of 419.52 (see Table 2). The first four entries for the 3-day moving average for New York were 396, 374.4, 350.2, and 331.4. Those entries were then divided by the pre-Covid-19 average to produce their respective normalized values of 0.944, 0.892, 0.835, and 0.790.

In the New York example, a p value greater than .0087 would indicate that there exists no significant difference in the expected values of the baseline and testing ranges. In Table 3, we see that New York's data show that all range comparisons reveal statistical anomalies. Furthermore, the negative t statistic indicates that the advertising

rate decreased. We can confidently conclude that New York experienced a downward trend of sex trafficking advertisements associated with stay-at-home orders. One can also observe that the decrease began prior to the state-mandated stay-at-home order. We could surmise that advertisements started to drop in preparation for, or perhaps in anticipation of, the orders.

Table 4. New York City intervals before and after stay-at-home order (March 22, 2020).

city	pre-covid	baseline interval (days)	stay_at_home	testing interval (days)	t_stat	p_val
New York	['2020-03-06', '2020-03-21']	15	['2020-03-22', '2020-04-06']	15	-4.770067388	0.0005219
New York	['2020-03-06', '2020-03-21']	15	['2020-03-22', '2020-05-06']	45	-4.675141507	0.000640865
New York	['2020-03-06', '2020-03-21']	15	['2020-03-22', '2020-05-21']	60	-4.374609426	0.001038278
New York	['2020-02-20', '2020-03-21']	30	['2020-03-22', '2020-04-06']	15	-8.211747406	6.86E-08
New York	['2020-02-20', '2020-03-21']	30	['2020-03-22', '2020-05-06']	45	-8.122528606	1.02E-07
New York	['2020-02-20', '2020-03-21']	30	['2020-03-22', '2020-05-21']	60	-7.704002297	2.09E-07
New York	['2019-02-05', '2020-03-21']	45	['2020-03-22', '2020-04-06']	15	-23.85485296	1.67E-46
New York	['2019-02-05', '2020-03-21']	45	['2020-03-22', '2020-05-06']	45	-25.19075404	3.85E-65
New York	['2019-02-05', '2020-03-21']	45	['2020-03-22', '2020-05-21']	60	-23.2173616	2.24E-61
New York	['2019-01-21', '2020-03-21']	60	['2020-03-22', '2020-04-06']	15	-23.85485296	1.67E-46
New York	['2019-01-21', '2020-03-21']	60	['2020-03-22', '2020-05-06']	45	-25.19075404	3.85E-65
New York	['2019-01-21', '2020-03-21']	60	['2020-03-22', '2020-05-21']	60	-23.2173616	2.24E-61

We found statistically anomalous decreases in sex trafficking advertisement in Atlanta, Chicago, Dallas/Fort Worth, Seattle, Miami, Detroit, New York, and the aggregated data across the United States. As Table 5 exhibits, however, most of the tested ranges for Houston evidenced p values greater than our critical value. This finding implies that Houston did not experience a statistically significant dip in sex trafficking advertisement after their stay-at-home order. The result is consistent with media reporting about generalized non-compliance with stay-at-home orders and the accelerated or constant growth rates of new coronavirus cases in those regions (Advisory Board, 2020).

Table 5. *Houston, Texas intervals before and after stay-at-home order (April 4, 2020).*

city	pre-covid	baseline interval (days)	stay_at_home	testing interval (days)	t_stat	p_val
Houston	['2020-03-17', '2020-04-01']	15	['2020-04-02', '2020-04-17']	15	0.169146877	0.866934077
Houston	['2020-03-17', '2020-04-01']	15	['2020-04-02', '2020-05-17']	45	1.692157446	0.104854247
Houston	['2020-03-17', '2020-04-01']	15	['2020-04-02', '2020-06-01']	60	2.96437709	0.006572771
Houston	['2020-03-02', '2020-04-01']	30	['2020-04-02', '2020-04-17']	15	-1.561868154	0.126138093
Houston	['2020-03-02', '2020-04-01']	30	['2020-04-02', '2020-05-17']	45	-0.317110334	0.753009709
Houston	['2020-03-02', '2020-04-01']	30	['2020-04-02', '2020-06-01']	60	0.941790546	0.351941951
Houston	['2019-02-16', '2020-04-01']	45	['2020-04-02', '2020-04-17']	15	-0.435539923	0.6667978
Houston	['2019-02-16', '2020-04-01']	45	['2020-04-02', '2020-05-17']	45	2.116431888	0.03640258
Houston	['2019-02-16', '2020-04-01']	45	['2020-04-02', '2020-06-01']	60	4.123370066	6.73E-05
Houston	['2019-02-01', '2020-04-01']	60	['2020-04-02', '2020-04-17']	15	-0.435539923	0.6667978
Houston	['2019-02-01', '2020-04-01']	60	['2020-04-02', '2020-05-17']	45	2.116431888	0.03640258
Houston	['2019-02-01', '2020-04-01']	60	['2020-04-02', '2020-06-01']	60	4.123370066	6.73E-05

4.2 Increase in advertising after lockdown

After lockdown restrictions began to ease, online advertising quickly rose again. Sex trafficking advertisements increased consistently in all regions studied. However, we found differing results for independent commercial sex workers across the different cities. Table 3 and Figure 2 show that in the period following the lifting of restrictions, the change in volume for advertisements associated with independent sex workers are mixed, with some rising rapidly in July (New York, Detroit) while others rise gradually (Dallas) or decline soon after the lifting of restrictions (Miami). By contrast, sex trafficking advertising is seen to rise rapidly in July across all of our tested cities. This discrepancy may be an indication that traffickers may be forcing their victims into dangerous client interactions as soon as possible to drive income, in contrast to their independent peers who may be able to choose to be more risk-averse, waiting to re-enter the market until pandemic conditions improve.

Table 3 shows the results of statistical comparisons of prepandemic advertising to two postpandemic time periods: immediately after stay-at-home orders were issued, and in the longer term after stay-at-home orders were lifted. In addition to the statistically significant decrease associated with the first stay-at-home orders discussed earlier, we also see a statistically significant increase in advertisements with trafficking indicators in all cities when comparing the pre-Covid period with the period

immediately following lifted restrictions. From Figure 2b we see that this advertising increased from between 1.25 and 3.5 times pre-Covid levels, depending on the city.

The substantial and statistically significant increase in sex trafficking advertising could be explained by an increase in the number of sex trafficking victims post-Covid. Alternately, traffickers experiencing significant declines in income due to the pandemic could be attempting to make up for this through increased advertising. As will be discussed below, we believe the former reason may account for some of the rise in advertising, as the increased economic precarity associated with the pandemic may make more people vulnerable to being trafficked.

5. Discussion

5.1 Reasons for trends in sex advertising

The present research confirms the hypothesis. In addition, the observed discrepancy between data for ads we identified as leading to independent sex workers versus sex trafficking victims show a clear difference, indicating that the chosen method of identifying ads linked to trafficking victims was effective.

As discussed above, we would expect the Covid-19 pandemic to lead to a temporary decrease in both commercial sex work and sex trafficking. Under normal conditions, an overall decrease could indicate the favorable outcome of fewer sex trafficking victims. The pandemic's confluence with a variety of socioeconomic, environmental, and policy factors, however, creates a potential wave of sex trafficking victims that should not be disregarded by government policy and decision-makers. Covid-19 will have outsized impacts on a marginalized population whose vulnerability is amplified by the pandemic, making them more likely to enter a trafficking situation, as well as a population of existing sex trafficking victims who are more likely to remain in exploited conditions as a result of the pandemic. A proactive pandemic response

needs concrete policy actions to prevent a likely increase in sex trafficking exploitation. Because sex trafficking by its very nature affects multiple sociopolitical and economic systems and the health of at-risk communities, further analysis of the push and pull factors provides a framework for the estimation of how Covid-19 may impact the commercial sex industry and sex trafficking (Worsnop, 2019).

5.2 Socioeconomic factors

The onset of the pandemic and subsequent social-distancing orders make in-person commercial sex work a risky occupation, placing sex workers and sex trafficking victims in an even more economically insecure state. Furthermore, the economic aid provided by the U.S. government through the Coronavirus Aid, Relief, and Economic Security (CARES) Act is subject to anti-sex work measures built into the eligibility provisions, as the federal regulations determining which businesses may receive such aid overtly discriminate against businesses that derive revenue from services' depictions or displays of a "prurient sexual nature" (Code of Federal Regulations, 2017). This should, over time, make some otherwise independent commercial sex workers more vulnerable to becoming trafficking victims due to increased socioeconomic vulnerability. At the same time, those who have lost jobs due to Covid-19 and work in the gig economy may not have access to unemployment insurance as they are not a part of the formal economy. Qualifying for such benefits will therefore likely be challenging for these individuals and, subsequently, make these individuals more susceptible to sex trafficking. These factors would tend to suggest that the increase in sex trafficking advertising is at least partially due to an increase in the number of sex trafficking victims available to traffickers, allowing them to increase their operations postpandemic.

5.3 Environmental factors

The effects of Covid-19 are most profoundly felt in marginalized communities experiencing heightened vulnerability due to factors such as race, income, gender, and housing instability (Smith & Cockayne, 2020). Consequently, during these unprecedented times, these factors may increase the exploitation of people in vulnerable positions. The U.S. Department of State reports that although sex trafficking affects every demographic, a common factor is the victim's vulnerability to exploitation. Traffickers are able to thrive when inequality exists and where people lack access to social protection and justice (Department of State, 2016). The pandemic creates unique environmental conditions that further restrict the access these already marginalized communities have to social services and amplifies their existing risk of sex trafficking (Todres & Diaz, 2020).

The pandemic intensifies this marginalization, making individuals more likely to stay in a trafficked situation or become vulnerable to sex trafficking. For example, efforts to establish preventive measures to quell the spread of the coronavirus have led to the displacement of already marginalized commercial sex workers in brothels, thereby causing them to become homeless during this crisis (Berger, 2020). Similarly, as federal stimulus unemployment benefits and eviction bans expire across the United States, evictions will likely increase, making vulnerable individuals homeless (Cowin et al., 2020). Further compounding their inequality and lack of a safety net in both cases, this displacement cannot be addressed by conventional solutions because of the unique pandemic environmental conditions that restrict access to essential social services. This confluence of conditions has the potential to keep existing victims in dangerous sex trafficking situations or place others at risk of entering sex trafficking. If governments

do not address the potential effects of the pandemic on marginalized populations, we are likely to see a sustained rise in sex trafficking prevalence.

5.4 Government efforts and policy factors

In addition to policies that continue to stigmatize sex workers during Covid-19, it is important to consider the ways in which public health measures to contain the virus through contact tracing may further exclude sex workers and sex trafficking victims from protection. In most of the United States, because commercial sex work is criminalized, there may be gaps and underreporting in surveillance and tracing, as compliance may jeopardize sex workers' ability to maintain their privacy and client confidentiality. Policing may further threaten the health and financial well-being of sex workers, who may face lost wages or clientele not willing to participate in public health surveillance efforts that may require documentation and reporting. When stay-at-home restrictions lift, it stands to reason that sex workers and traffickers will redouble their efforts to make up for lost wages. In this way, the criminalization of sex work may have an inadvertent influence on increased postpandemic commercial sex and sex trafficking levels.

One way to contain the spread of the virus is to implement policy measures that will not criminalize sex workers, while continuing to advocate for criminalization of all other parts of the sex trafficking enterprise to protect victims. Decriminalization of sex work would not only eliminate the burden of police interactions, but also allow commercial sex workers and sex trafficking victims to qualify for economic relief currently reserved for members of the formal economy. A full decriminalization strategy may face insurmountable legislative constraints, but even temporarily reinforced social services and local policing strategies that limit interactions with sex

workers would help keep them from becoming further marginalized and vulnerable to victimization.

Our data analysis suggests that the rapid increase in sex trafficking that we hypothesized would occur based on socioeconomic, environmental, policy, and regulatory factors is already happening. Sex trafficking advertising has increased substantially above prepandemic levels, and these increases are statistically significant. We urgently need action to prevent this increase from accelerating even more rapidly.

Acknowledgments

We would like to acknowledge the victims of sex trafficking and their continued hardships due to this global crisis. We would also like to thank the insights we gained from the experiences of the antitrafficking professionals at the University of Michigan Human Trafficking Clinic. This research was funded in part by the Omar Bradley Officer Research Fellowship in Mathematics.

Declaration of interest statement

The authors declare no competing interest.

Data Availability

Data and code for this research will be made publicly available upon request.

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Appendix

Notes on Table 2

Table 2 summarized statistics by city describing sex trafficking escort advertisement behavior over time. This data covered the period from January 2020 to May 2020, sorted in order of stay-at-home orders.

The following details how those statistics were calculated:

$$\text{dip_velocity} = \frac{(\text{lowest ad count} - \text{pre Covid avg})}{(\text{lowest ad date} - \text{dip began})}$$

lowest_ad_count = lowest raw number of advertisements

lowest_ad_date = date at which lowest_ad_count captured

increase_began = approximate date at which ad count began to rise again

$$\text{depth}(\%) = \frac{(\text{lowest ad count})}{(\text{pre Covid avg})} * 100$$