Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

HHS Public Access

Author manuscript

Int J Drug Policy. Author manuscript; available in PMC 2023 June 01.

Published in final edited form as:

Int J Drug Policy. 2022 June ; 104: 103678. doi:10.1016/j.drugpo.2022.103678.

The introduction of fentanyl on the US–Mexico border: An ethnographic account triangulated with drug checking data from Tijuana

Joseph Friedman[a,b,*], **Philippe Bourgois**[a], **Morgan Godvin**[c,d], **Alfonso Chavez**[e], **Lilia Pacheco**[e,f], **Luis A. Segovia**[e], **Leo Beletsky**[d,g,h], **Jaime Arredondo**[i]

[a]Center for Social Medicine and Humanities, University of California, Los Angeles, CA, United States

[b]Medical Informatics Home Area, University of California, Los Angeles, CA, United States

[c]School of Public Health, Oregon Health Sciences University-Portland State University, Portland, OR, United States

[d]Health in Justice Action Lab, Northeastern University, Boston, MA, United States

[e]Prevencasa, A.C, Tijuana, Baja California, Mexico

[f]Universidad Xochicalco, Facultad de Nutrición, Campus Tijuana, Mexico

[g]School of Law Northeastern University, Boston, MA, United States

[h]Department of Health Sciences, Northeastern University, Boston, MA, United States

[i]Canadian Institute for Substance Use Research (CISUR), Victoria, Canada

Abstract

Background: Illicitly-manufactured fentanyls (fentanyl) have changed the risk environment of people who use drugs (PWUD). In California and many western US states, the opioid overdose rate spiked from 2016 to 2021, driven largely by fentanyl. Mexican border cities act as transit through-points for the illicit drug supply and similar evolving health risks are likely to be present. Nevertheless, due to data gaps in surveillance infrastructure, little is known about fentanyl prevalence in Mexico.

Methods: We employ intensive ethnographic participant-observation among PWUD, as well as key informants including harm reduction professionals, EMTs, and physicians on the front lines in

*Corresponding author: joseph.robert.friedman@gmail.com (J. Friedman).

Declarations of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics

This study was approved by the Institutional Review Boards at the University of California, San Diego, and the University of California, Los Angeles, in California, United States, and the Institutional Review Board of Prevencasa, A.C., in Baja California, Mexico.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi: 10.1016/j.drugpo.2022.103678.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Tijuana, Mexico. We triangulate interview data and direct observations of consumption practices with $n = 652$ immunoassay-based fentanyl tests of drug paraphernalia from mobile harm reduction clinics in various points throughout the city.

Results: PWUD informants described a sharp increase in the psychoactive potency and availability of powder heroin—referred to as "china white"—and concomitant increases in frequency of overdose, soft tissue infection, and polysubstance methamphetamine use. Fentanyl positivity was found among 52.8% (95%CI: 48.9–56.6%) of syringes collected at harm reduction spaces, and varied strongly across sites, from 2.7% (0.0–5.7%) to 76.5% (68.2–84.7%), implying strong market heterogeneity. Controlling for location of collection, syringe-based fentanyl positivity increased by 21.7% (10.1–42.3%) during eight months of testing. Key informants confirm numerous increased public health risks from fentanyl and describe the absence of a systematic or evidence-based governmental response; naloxone remains difficult to access and recent austerity measures have cut funding for harm reduction in Mexico.

Conclusions: Fentanyl, linked to powder heroin, is changing the risk environment of PWUD on the US–Mexico border. Improved surveillance is needed to track the evolving street drug supply in Mexico and related health impacts for vulnerable populations. Structural factors limiting access to naloxone, harm reduction, substance use treatment, and healthcare, and minimal overdose surveillance, must be improved to provide an effective systemic response.

Keywords

US-Mexico Border; Fentanyl; Ethnography; Epidemiology; Drug Checking; Mixed methods

Introduction

The evolving street drug supply is fundamentally changing the risk environment for people who use drugs (PWUD) (Ciccarone, 2017; Beletsky & Davis, 2017; Brinkley-Rubinstein et al., 2018; Lambdin et al., 2019; Shover et al., 2020; Ciccarone, 2021), understood as the space, both at an individual and societal level, where factors interact to increase the harm of substance use (Rhodes, 2002). In particular, the rise of illicitly-manufactured-fentanyls (hereafter fentanyl) is of urgent concern as it is driving steeply rising overdose rates and other health risks for PWUD in North America. Fentanyl is a family of synthetic opioid agonists many times stronger than heroin. Sold in pure form, mixed with heroin, erroneously sold as heroin itself, or, increasingly pressed into pills (especially imitating oxycodone and benzodiazepines), fentanyl is increasingly present in the illicit opioid supply (Ciccarone, 2017; Ciccarone, 2021). The increasing volatility of the drug supply—where presence or concentration of fentanyl are not known by consumers—is implicated in the worst overdose crisis seen in the United States to date, which claimed nearly 600,000 lives in the decade ending in 2020 (Friedman & Akre, 2021).

Fentanyl's transformative power in the risk environment reflects its pharmacological properties and their behavioral implications. When compared to non-synthetic opioids, fentanyls have a shorter half-life, but higher potency. This necessitates more frequent injection, as analgesia and euphoria wane, and withdrawal symptoms present more quickly (Mayer et al., 2018). Increased injection occurrence has been hypothesized to elevate the

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

risk of myriad deleterious health outcomes, such as overdose, soft-tissue infection, and the transmission of infectious diseases such as HIV and Hepatitis C (Lambdin et al., 2019; Bobashev et al., 2019).

Drug market shifts have both local importance, and international implications, given the global nature of the drug supply. In the United States, the prevalence of fentanyl was initially heavily concentrated in Eastern US states (Ciccarone, 2017; Shover et al., 2020). However, in recent years it has begun moving Westward, including proximate to the US–Mexico border (Shover et al., 2020). According to the US Drug Enforcement Agency, the vast majority of the opioid supply in the US originates from Mexican drug trafficking organizations (Ciccarone, 2017; Drug Enforcement Administration, 2020).

Other than relatively isolated populations of PWUD in the country's largest cities, opioid injecting occurs almost exclusively along Mexico's northern border (Goodman-Meza et al., 2018; Bucardo et al., 2005). In this context, fentanyl is likely to be having similarly transformative effects on the risk environment for PWUD in Mexico, to those recently seen in California and other US border states (Friedman & Akre, 2021). Further, given that Mexican border cities act as transit through-points for the US illicit drug supply, fentanyl surveillance in US–Mexican border cities could provide early evidence about shifts that will subsequently occur in the US. Nevertheless, there is a dearth of drug surveillance data in Mexico, largely stemming from structural limitations on epidemiological and drug checking data streams. Toxicological and autopsy data is extremely limited in Mexico (West et al., 2020), and most overdose deaths are coded with so-called 'garbage codes' such as 'cardiac arrest' which are not informative as to the true underlying cause of mortality (West et al., 2020; Híjar et al., 2012). A previous study in three border cities in Mexico found a near absence of self-reported fentanyl use among PWUD, although individuals may be unaware of the composition of substances purchased on illicit and unregulated markets (Fleiz, 2019). A prior study in Tijuana tested a convenience sample of $n = 89$ syringes and additional components of injection equipment, and noted the presence of fentanyl (Fleiz et al., 2020). Given limitations of the existing data, we draw on complementary methodologies to describe the shifting drug supply and risk environment for PWUD on the US–Mexico border.

Methods

We integrated fentanyl checking methodologies (leveraging fentanyl testing strips) (Fleiz et al., 2020; Ti et al., 2020) with participant observation ethnography among PWUD and other interlocutors. Through a longitudinal sample we documented geographic coverage of fentanyl positivity among syringes, monitored change over time and in different areas. Our mixed methods approach (Anguera et al., 2018) entailed integrating the quantitative drug market data offered by this testing with ethnographic observations about drug market and use characteristics, and their variation over time and geography. The mixing of ethnographic and drug checking data offers powerful insights. For instance, in this analysis, ethnographic data and harm-reduction practice enabled the design and ongoing tailoring of data collection and analysis of findings–including specific selection of micro-neighborhood drug testing sampling sites and focus of ethnographic data collection.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

This offers an understanding of the process by which fentanyl was introduced to the drug supply in Tijuana and its impact in increasing risks for PWUD as the drug supply shifted more broadly.

Fentanyl positivity testing methods

Fentanyl positivity was determined using a sample of $n = 652$ syringes collected at 4 mobile medical/harm reduction clinics locations throughout the city of Tijuana, Mexico, coordinated by the non-governmental harm reduction organization, Prevencasa A.C. Clinic locations were chosen in geographically diverse parts of the city, known to harm reduction providers as having PWUD living and working nearby. Sites covered both East and West Tijuana, and key areas identified in previous geospatial analyses in Tijuana (Gaines et al., 2015). Drug checking data collection spanned September 2020 to April 2021.

Sterile syringes are routinely distributed at outreach sites, and used syringes are collected. Following each mobile clinic event, a random sample of about 20 syringes per date-location was selected and tested for the presence of fentanyl analogues using immunoassay-based strips produced by BTNX laboratories (Forecast Project Executive Summary, 2018; McCrae et al., 2020). Strips provide a binary presence/absence indicator of fentanyl presence, and have been shown to be extremely sensitive (Forecast Project Executive Summary, 2018). A precise protocol was followed for each testing event to ensure staff safety and standardize the data generating process (see supplemental methods).

Fentanyl positivity trends were overlaid by location on maps and graphed by location and date. We used ordinary least squares regression to examine the relationship between site and location-specific fentanyl-positivity $Pf_{d,l}$, and the passage of time ($Time_{d,l}$) controlling for the location of syringe collection with site-specific fixed effects (β_{1-3}). $Time_{d,l}$ was operationalized as the time passed since the first day of data collected in years, so the coefficient multiplied by the 8-month study duration can be interpreted as the total change in fentanyl positivity in the observed period, adjusting for site-specific heterogeneity in level. Formally we modeled:

$$Pf_{d,l} = \beta_0 + \beta_1 \cdot Site_2 + \beta_2 \cdot Site_3 + \beta_3 \cdot Site_4 + \beta_4 \cdot Time_{d,l}$$

Ethnographic methods

Ethnographic data was collected as part of a wider study examining shifting risk environments of PWUD in North America (Auyero et al., 2015). Here we draw primarily from data collected in Tijuana, Mexico, involving intensive participant-observation by JF and PB, collected during 30+ months in the 2018–2021 period. Fieldwork was initially targeted towards harm reduction venues (mobile and fixed-location harm reduction clinics) and organically extended to drug consumption sites, residences, homeless encampments, and other street-based income-generation environments (e.g. accompanying informants as they work odd jobs for shopkeepers, or find goods to sell in informal markets). Informants were recruited using the classic street-based ethnographic techniques available during longitudinal participant observation fieldwork (Bourgois & Schonberg, 2009; Bourgois, 2003). PB and especially JF accompanied informants (and interviewed them while they

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

participated in) routine daily activities enabling documentation of high-risk and stigmatized practices (e.g., injecting, fighting, scavenging) in real-time in their natural environment. This anthropological approach to ethnography enabled access to 'common-sense' understandings of drug use dynamics—pertaining to where and how PWUD generate income, purchase and consume drugs, access needed resources (e.g., syringes, clean water, food, shelter), and evade police and cartel violence. Urgent strategies are routinely discussed by PWUD in their daily scramble but can be difficult to confirm in formal questionnaire formats. Through long-term, empathetic, iterative, relationship-building and direct observation of drug consumption practices, we reduce desirability biases inadvertently arising when PWUD interface with public health, medical, or harm reduction practitioners often perceived as unrealistically hypersantitary (Bourgois & Schonberg, 2009; Friedman et al., 2019; Bourgois, 1998). With IRB approvals, we conducted interviews in conversational formats, often audio and/or video-recording them with participant permission. Interviews and analysis were conducted in English, Spanish, or Spanglish based on participant preference. Most participants were more formally interviewed multiple times during longitudinal relationships and featured in numerous field notes. All ethnographers were bilingual, and textual data were translated to English for presentation in the article by the first author or the ethnographer who collected the relevant data. More targeted topical conversations were conducted with strategically selected key informants (e.g. physicians, street outreach workers, law enforcement officers) because of their specialized knowledge of crucial components of the risk environment (e.g., injection practices, drug supplies, treatment services, de facto criminal justice practices).

The ethnographic database consisted of $n = 77$ transcribed recordings, 300+ pages of fieldnotes, 500+ photographs, and dozens of videos documenting practices in natural environments unfolding in real time. Data were entered into NVivo and analyzed for emergent themes. In particular relevance for this analysis, direct observations of divergent consumption practices between sites and PWUD narratives of drug supply differences over time and between regions of the city, and their relevance for shifts in the risk environment, were assessed using crosscutting memos after primary coding. As drug testing samples accumulated, ethnographic findings were brought into conversation along with qualitative key informant conversations and accompaniment strategies were further refined. For instance, targeted ethnographic exploration of the drivers of drug market composition in light of fentanyl positivity results.

Results

Study population and setting

PB's Fieldnotes, Tijuana, February 2019—We run out of free emergency survival supplies (bottled water, socks, sandwiches, Narcan, syringes, alcohol wipes) earlier than usual at this mobile harm reduction clinic in Tijuana. The clinic is perched on the embankment of the gargantuan concrete infrastructure of the Tijuana River canal, which carries sewage along the international border wall. As always, the doctors and nurses are in high demand, busy lancing abscesses, cleaning cuts, treating respiratory diseases and skin rashes. In one particularly hair-raisingly painful case—I watched them set a broken

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

bone, with the patient stoically stuffing a rag into his mouth—agony literally etched into his deeply creased frown lines. I don't think I've ever seen so much raw, unmet desperate need and physical suffering. Still, most people somehow seems to be in a good mood, and thankful for the care and fellowship they are getting.

> A long line of men, and a few women, seeking treatment sit patiently in the dozen-or-so flimsy plastic chairs that serve as both "consult room and operating table." It's been raining exceptionally hard these past few days and people look more disheveled than ever–ragged shoes full of holes bursting at the seams and everything covered in mud. I chitchat with a few people in the line. Most are deportees from Los Angeles eager to reminisce, homesick for their long-lost childhood neighborhood and speak perfect English–often with old-school So-Cal accents. Many are also heavily tatted-up with LA gang insignias adding the stigma of visible deportation status to their homeless injection drug user stigma.
>
> A particularly friendly older guy is excited by my interest in the visibly changing heroin and fentanyl offered at salespoints in this neighborhood. He finally succinctly and emphatically clarifies my confusion over sometimes seeing the traditional "black tar heroin" but increasingly seeing the new incredibly light fine powder heroin "China White" morphing into dramatically different colors on my different visits (bright white, bright yellow, orange or brown). He dismisses the significance of powder colors "nah the china [white] is all the same. The same 'cartel' puts it all out right here and their different batches come out different colors. But the quality is always damn good." To quantify more precisely he explains, "Two people can split a 50 peso [US$2.5] bag and get real loaded." He critiques the quality of the black tar suppliers who are, "losing out in the market. They've gotta improve their quality or they'll just be a thing of the past!"
>
> He speaks about shifting opioid availabilities here with the impassioned precision of a California luxury wine afficionado talking about the latest year's harvest and it seems to have triggered withdrawal symptoms because sweat is beading on his forehead, and he has started fidgeting. Suddenly he interrupts himself frowning and announcing, "Sorry, gotta run to go score." Noting my disappointment, he smiles, motioning for me to follow him. We trot to the edge of the super steep–at least 45°–concrete embankment incline at least 30 meter high and I suddenly find myself slipping and sliding unable to keep up with him. Klutzily terrified I almost fall head over heels cursing. This cracks him up (and me).
>
> We are heading to the largest of the homeless encampments in the shade of a bridge carrying half a dozen lanes of speeding highway traffic over the river/sewage/rainwater runoff concrete canal infrastructure of the Tijuana River. He clambers adroitly over a wobbly ten-foot length of crushed aluminum highway guard rail that serves as a bridge over the fast-flowing sewage canal full of black, foul-smelling rushing water. Again, I pause klutzily and also repulsed. This unstable "bridge" and the gross smell/appearance of the water obviously protects this encampment (somewhat) from surprise police raids.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Most of the 75 or so people milling around here seem relaxed. Many are sitting or lying on top their ragged bundles of possessions and scuffed up plastic bags. A few people are moving around in an almost surreal, slow-motion, drug-induced dance which doesn't seem to bother anyone. Most people are too busy nodding —often super heavily–from what is the presumably the highly potent "powder fentanyl-heroin" sold here. Some are standing still but with knees sagging slowly lower and lower until they snap back up to standing attention, only to start sagging back down again. Two tough looking men are embracing in an ecstatic slow-motion dance—smiles on their faces oblivious to everyone. Another guy is starting to irritate people for waving his arms around too fast, intimidatingly, in a helicopter motion obviously in a manic burst of methamphetamine energy.

My new friend disappears into the crowd, so I walk aimlessly and embarrassed to the back edge of the encampment along a gargantuan highway bridge pillar and find myself among a group of men and a few women half-lying, half-sitting or just squatting looking at the ground avoiding eye contact with anyone. Most appear to be obsessively hyper-focused on poking and re-poking themselves in multiple different parts of their body in search of a healthy vein. Several have blood dripping off their bodies and appear frustrated and desperate. Others are patiently smiling as they poke and then delicately wiggle the needle point around under their skin–as if feeling no pain.

To my delight, a friendly older man in a wheelchair calls out to me in perfect LA deportee English, "Yo professor! Come talk to me!" Somehow, he already seems to know what I'm interested in and immediately launches into his life story: taken to California as a baby, early gang involvement, perpetrating and suffering from violence, started using drugs in juvenile jail, incarcerated federally for a decade as an adult, deported to Tijuana, and becoming homeless on the streets of Tijuana, and having his ID card stolen by Tijuana cops, becoming effectively stateless. "I forgot all my Spanish by the time I was 20, and when I was deported (early 30s) I had to completely relearn Spanish in Tijuana. Back there [LA] they called me 'dirty Mexican' and here they call me 'gringo'". He was shot in his rear as a teenager in a drive-by shootout. Doctors inserted a metal plate into his back and down his thigh. He used to be able to walk. "Then three years ago [scowling] here in Tijuana," the police chased him from his salespoint by the side of the highway. Desperate to avoid arrest, a beating, and the loss of his precious stash he could be killed for not paying back, he sprinted into speeding traffic. Struck by a Chevy Suburban, he was left paralyzed from the waist down. His body is visibly broken down, his eyes are bloodshot, and his skin is covered by mushy, small abscesses. He is obviously in pain, squirming to try to get more comfortable, but also enjoying his effusive pouring-out of his life story.

His tattoos are exceptionally well done. His gang namesake, "Eastside" wraps 360 around the entire front and back of his throat and neck. He flutters his eyelids down and urges me to photograph them. They are both delicately tattooed with the exact same "Eastside" balloon script as his neck, but in tiny, fine script. I complement

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

him for the quality of his tattoos, but that makes him sad, “They don’t mean the same thing here. They don’t mean the same thing to me no more.”

The ethnographic sample reflects a population of mostly-male identified, precariously housed or unhoused individuals who inject and/or smoke heroin daily. Most participants reside in dense, low-income micro-neighborhoods across Tijuana with illicit drug and/or sex-work markets. Most are deracinated deportees from the US; their noticeable accent and tattoos reduce their linguistic, social, and cultural capital as native Mexicans (Pinedo et al., 2017). They often bemoan lost contact with parents, siblings, children, and spouses in the US. Many of the key micro-neighborhoods in our fieldwork are pressed up against the border. Consequently, many of our informants carry out their lives in the literal shadow of the border wall that separates them from the lives they built and lost in the United States.

Although life is hard on the streets of Tijuana, most of our informants were remarkably adept at quickly raising money by deftly navigating the informal markets and street interactions of the city. Most men generate income by 1) cleaning cars in traffic jams; 2) sweeping and running errands for local residents; 3) recycling scrap metal; 4) selling retail drugs for cartel networks; and/or 5) selling snacks and tourist trinkets “on the line [la linea]” (the hours-long line of vehicles waiting at US border checkpoints). Women and transgender individuals are less numerous in injection drug use scenes but are highly visible as desired sexual and/or emotional companions who generate funds quickly and reliably through sex work. Most report high rates of sexual coercion and rape. Male PWUD also frequently trade sex for drugs and money, but typically more clandestinely due to homophobic stigma.

Remittances from US-based family-members represent an especially large source of income for individuals lucky enough to receive them. Such individuals are more likely to secure stable housing, and purchase larger, cheaper quantities of drug supplies. With the exception of those who spend their remittance checks in a single binge, housing stability reduces their risk-taking, and shields them from the “everyday emergency” of the moment-to-moment day-and-night scramble for survival resources and physical safety which destabilize lowest-income PWUD in Mexico and most of the rest of the world (Scheper-Hughes & Bourgois, 2004). Unhoused individuals often struggle for the 50-peso cost (about $2.5 USD) of a “*curita*” (retail bag of heroin). Consequently, they often *“hacer un vaquero* [pool resources]” multiple times per day to prevent withdrawal symptoms, avoid physical violence and humiliation and/or pursue ecstatic highs. These logics promote risky sharing practices, and are consistent with ethnographic and epidemiological evidence documented across the globe (Bourgois, 1998; Karandinos et al., 2014; Rhodes et al., 2012). Those who are lucky enough to end the day with 100–200 pesos (~$5-$10 USD) can purchase a night’s stay at one of the bargain hotels catering to sex workers and their clients, but many of our informants spend most or all nights outside.

Police violence and extortion was an ever-present strain on our informants, who we would often find with new police-inflected wounds or bemoaning the theft of recently generated funds to avoid incarceration. Although possession of small quantities of illicit drugs has been decriminalized in Mexico, it is well-documented in the literature that many police are unaware of these legal shifts (Arredondo et al., 2018). In practice, ‘looking homeless’, not

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

having a government-issued ID, possessing a syringe, or simply being 'known to police' triggers chronic cycles of short-term incarceration for 12 to 36 h cycles, which may or may not include a gratuitous police beat-down, even in broad daylight.

Ethnographic taxonomy of opioids in Tijuana

In Tijuana, two main forms of heroin can be purchased in retail narcotics markets: 1) *goma negra*, the classic Mexican black tar heroin also available over the past decades in Western US states; (Bobashev et al., 2019) and 2) *china white*, powdered heroin that is typically white, but sometimes shades of brown or bright yellow/orange/brown depending on processing logistics, impurities, or possibly dyes added for brand recognition. Black tar heroin was consistently reported to have been available for 'as long as anyone can remember.' However, *china white* was described as a recent arrival to the scene, but increasingly available and potent in the past several years (~2018/~2021). It was portrayed as both continuously expanding to a wider range of locations across the city, and also increasingly present at each *connecta* [purchase point]. For example, some *conectas* were reported to have suddenly switched to *china white* and no longer offer black tar heroin.

Healthcare/outreach providers frequently link powder heroin to overdose (OD) risk. PWUD agree, but simultaneously praise its psychoactive impact:

> "*People are way more likely to OD with 'china' than with 'black'. Recently china is really becoming more of a thing, you know. When I first got here to TJ [~2017] china wasn't a big thing. Once in a while you'd see some powder stuff, but a lot of people didn't even know about it. Now most people around here are using china 'cuz it's way better than black. Stronger. Way stronger. I'm using almost entirely china these days 'cuz I like that rush, I want that rush that only china gives*."
>
> -Vanessa, F, 30, Injects Opioids and Methamphetamine

Strong preferences are emphatically expressed for each available heroin product. Older PWUD who have used black tar for decades often prefer its psychoactive effects. They describe it as "purer" or "the only real heroin." They frequently claim it is a safer option than *china white* for overdose and other health risks—especially soft-tissue infection.

> "*Drugs are for making you feel alright, getting high, and having fun, it's not worth dying over them, so I mostly only use 'goma'. I just feel like it's safer. I understand it better. China is stronger, and once in a while I'll snort some, if it's the only thing I can get, but I'd rather just stick with the goma*."
>
> -Ricardo, M, 55, Smokes and Sniffs Opioids

In contrast, younger PWUD often prefer powder heroin, prioritizing its cost effectiveness. When sales points offer both black tar and powder heroin options, *china white* is usually regarded as "more potent". It is variably described as shorter-acting or as having a comparable duration to that of black tar heroin prior to the onset of withdrawal pangs. Both can be mixed with methamphetamine in preparation of a single injection, but power heroin is more soluble and is typically preferred for this purpose (Bourgois & Schonberg, 2009). Both can be smoked or injected, but black tar is typically considered more appropriate for smoking due to its texture.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Even among PWUD who eagerly transitioned to *china white* when it became available, favoring its increased potency, many were initially weary about the health implications of its use. Concerns were especially related to an increased risk of soft tissue infection:

> "*Man, I been using china for like two 2 weeks now and pura goma [just black tar] before that. But that china is real bad, man. With china, your body eats its itself bit by bit. Carne y hueso [flesh and bone], but you don't feel a thing. You see people with these big open wounds, carne y hueso an' they don't care, because that china white is just too good. That doesn't happen with goma. That shit didn't use to happen*."
>
> -Enrique, M, 40, Injects Opioids and Methamphetamine

Abscesses and soft tissue infections were highly prevalent among PWUD in Tijuana even before powder heroin became commonplace. At harm reduction clinics, physicians would often treat an assortment of remarkably large and painful ulcers, abscesses, and other wounds, which were frequently accompanied by limb edema, and signs of systemic infections. With the advent of powder heroin, many harm reduction physicians worried that this already widespread problem was worsening rapidly.

Confirmation and geographic variation of fentanyl positivity

The "common-sense" understandings that PWUD convey about the differences between heroin varieties and potencies are strongly suggestive of the presence of fentanyl in powder heroin. Not only do they praise its psychoactive qualities and relatively recent arrival, but many (although not all) criticize its decreased duration of effect. Interestingly, some claim that its withdrawal symptoms are not as intense as those of black tar heroin. Confirmation with quantitative testing data offers a helpful point of confirmation and triangulation to better understand the shifts in the local street-level retail sales market. It also provides a window of insight into the global illicit drug market, as shifting wholesale supplies are smuggled through Tijuana on their way to the US and Canada.

Among n = 652 syringes collected at 4 harm reduction clinics during an 8-month period, fentanyl positivity was 52.8% (95%CI: 48.9–56.6%). Clearly delineated micro-geographic variation was observed at salespoints across the city (Fig. 1). Site 1 is a fixed location while sites 2–4 are mobile clinic/outreach locations. Site 1 is the closest to the concentrated drug and sex tourism markets of *Zona Norte* and consequently served the highest number of female and trans identified sex workers. Site 3 had the highest fentanyl positivity of 76.5% (68.2–84.7%). This represented the only site where only powder heroin, and not black tar, was available in the locally proximate sales points. Site 4 had the lowest fentanyl positivity of 2.7% (0.0–5.7%), and only black tar heroin was sold nearby. Testing sites 1 and 2 are located near the city center, proximate to a large concentration of *connectas* (drug sales points) and drug consumption spaces. Both black tar and powder heroin are sold in these areas—although specific sales points may sell only one or the other—and the market is highly mixed. These sites had intermediate fentanyl positivity prevalence of 56.7% (51.3–62.1%) and 69.6% (61.1–78.2%) at Site 1 and Site 2, respectively. This geographic variation indicates a highly heterogenous drug market and confirm that fentanyl positivity is strongly ecologically linked to the sale of powder heroin.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

At each of the sites, an increase in fentanyl positivity was noted over time (Fig. 2). In linear regression, controlling for the site of collection, fentanyl positivity increased by 21.7% (95% confidence interval: 10.1–42.3%) during 8 months of testing.

The geographic variability of fentanyl positivity observed in the mapping exercise highlights the heterogeneity of the drug supply in Tijuana. The city is a key international passthrough point for large volumes of illicit drugs heading North. Several rival international drug trafficking organizations notoriously vie for monopoly in Tijuana, competing—often violently—for local sales points, influence over local and regional politicians and militarized police units, and border crossing routes. Fentanyl can therefore be added to the drug supply to differential degrees by distinct groups, and at different points along the heroin production/distribution chains. The result is high uncertainty of potency in the retail drug landscape. In ethnographic conversations, PWUD involved in retail sales frequently reported that fentanyl was added to the heroin supply at the level of the local neighborhood *conecta* (sales point):

JF: “Why do you think so many people overdosed this week?”

> “*That’s fucking obvious dawg! Because of the fentanyl. They cook that shit up every couple a’ days in a pot like this [indicating with both hands a recipient approximately 12 inches in diameter]. That’s only gonna’ be enough for like maybe 3 days, 4 tops. So just depending on the motherfucker that cooked that shit up, it could be super bomb or total bunk. That’s why you got so many fools dying this week. I’m tellin’ you, the shit is good dawg! (laughing)*”
>
> -Guillermo, 30, M, Injects Opioids and Methamphetamine

This contrasts with—although does not necessarily contradict—media reports of fentanyl being added farther up wholesale supply chains, in chemical precursors processing camps in Mexico or those of foreign countries (Inside the Sinaloa Cartel’s Fentanyl Smuggling Operations, 2021; Travère & Giraudat, 2020; Karandinos, 2017). This hyper-local nature of the fentanyl-heroin supply also provides a window of insight into the unique overdose risk that fentanyl has added for people who use illicit drugs, as upstream supplier, and specific concentration of fentanyl used can vary day-to-day at the same site and between very proximate sales point locations.

Mixing with methamphetamine

Co-occurring with fentanyl’s introduction to the drug supply in Tijuana, participants described an increase in methamphetamine polysubstance use, which is also clearly visible ethnographically in the repetitive and energetic behaviors participants would often exhibit after a shot with a higher proportion of *cristal* [methamphetamine] (e.g. manically picking up tiny objects from the ground or scratching at superficial skin wounds).

People using powder heroin, in particular, were observed to frequently prepare injections containing both heroin and methamphetamine, colloquially known as ‘*doing a speedy*’. PWUD who consume *china white* frequently added a small amount of methamphetamine to each shot of heroin or made subsequent injections of methamphetamine after injecting opioids. The ratios and frequency of combined heroin/fentanyl injections versus solo

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

methamphetamine follow-up injections vary, but JF often observed 5-to-10 parts heroin/fentanyl for 1 part *cristal* averaged out over a day. A typical consumer might therefore consume 4, 50-peso *curitas* of powder heroin over a 24-h period, while a *globo* (balloon of methamphetamine) would last for several days, being consumed one small pinch at a time. Reported reasons for polysubstance use included improved overall euphoria, better "rush," increased delay or distraction from painful withdrawal symptoms, and as a strategy to prevent opioid overdose.

> '*Oh! About that [increase in overdose], it's 'cuz the china white around here is fucking crazy….doin' a full 50 [50 peso bag] is enough to kill you. But, I got a secret, you just gotta' mix in a little bit of cristal, and you'll never die. Otherwise, lots of people have been dying around here, but with just a little bit of cristal your heart will keep beating, no matter what.*'
>
> -Javier, M, 45, Injects Opioids and Methamphetamine

In contrast, a distinct subgroup of PWUD in Tijuana do not prefer to use methamphetamine. These were typically long-time consumers of black tar heroin, who were more likely to avoid *cristal* and describe it as ruining the blissful relaxation of the opioid high:

> *Look I've been using heroin for decades. Me and my wife, we go way back. I prefer black [tar heroin], but I'll do powder if it's all I can get. But cristal? Never. I hate the way it makes me feel. I can't sleep! The point of heroin is just to chill out and forget about everything.*
>
> -Ed, M, 50, Injects and Smokes Opioids

Methamphetamine was also frequently smoked by a wide range of individuals in Tijuana who did not consume heroin but frequented the concentrated drug use micro-neighborhoods where this ethnography was focused. It was therefore regularly consumed in social groups of mixed company of those who did and did not consume opioids. Some individuals in the scene exclusively consumed methamphetamine for several years before eventually starting to consume (initially smoked, and often subsequently injected) opioids as a way to "come down" from several-day-long methamphetamine sessions and overcome stimulant-induced insomnia.

Discussion

We characterize the arrival of illicitly manufactured fentanyls into the drug supply of Tijuana, Mexico, linked strongly to the proliferation and consumption of *china white* (powder heroin). In contrast to interviews conducted during 2017–2018 when very few PWUD in Tijuana reported consuming or having knowledge of fentanyl (Fleiz, 2022), during our study we observed a shift to nearly all participants having numerous experiences with fentanyl and clearly defined preferences regarding its use. We observe that fentanyl positivity is very heterogenous across the city, reflecting a criminalized market that is highly segmented because of competing cartels selling visibly distinct products in violent competition with one another. Further, we note a significant increase in fentanyl positivity over the duration of the study, consistent with the widespread notion among PWUD that fentanyl is gradually become more commonplace across the city.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Fentanyl prevalence has been associated with multiple increased health risks, from fatal and nonfatal overdose, to infectious disease transmission (Shover et al., 2020; Bobashev et al., 2019). Our findings indicate that similar shifts are occurring in the Mexican drug supply, including an uptick of fentanyl and polysubstance methamphetamine use (Shover et al., 2020; HAN Archive - 00438 | Health Alert Network (HAN), 2020; Han et al., 2021; Meacham et al., 2015). Yet a lack of reliable government statistics made elucidating the scope of the problem on Mexico's northern border more difficult. Substantial investments are needed in timely overdose and drug market surveillance, as the magnitude of the Mexican overdose crisis is currently unknown. During the COVID-19 pandemic in particular, fentanyl-related overdose deaths in the United States spiked to unprecedented levels (Friedman & Akre, 2021; HAN Archive - 00438 | Health Alert Network (HAN), 2020; Friedman et al., 2020). Although similar increases have likely occurred in Mexico, without more robust toxicology, autopsy, and informatics systems, these deaths will continue to be attributed to other causes.

A slew of structural barriers exist to reducing deleterious health outcomes associated with fentanyl among PWUD in Tijuana. Naloxone is highly sought by PWUD in Tijuana, yet it remains in short supply, difficult and expensive to access. Each injectable 1ml intramuscular dose costs approximately $25 USD on the Mexican market (equivalent to approximately 4 days' wages at the Mexican minimum wage). Moving forward, more user-friendly nasal spray forms should be made widely available and coupled with street-based distribution and education campaigns. Further, access to medications for opioid use disorder must be greatly expanded. Buprenorphine is virtually non-existent in practice for PWUD, and methadone is costly and logistically complex to obtain because of regulations and stigma (Werb et al., 2015). Recent federal austerity measures have also eliminated funding for harm reduction in Mexico, limiting syringe access, frontline medical care, and linkage to services.

Overdose mortality is the worst-case outcome of fentanyl proliferation, but other health risks are more frequent and require increased documentation for developing public health interventions. The high prevalence of soft tissue infection and necrosis reported to be associated with powder heroin by PWUD, healthcare providers, and frontline harm reduction activists requires urgent attention. Soft tissue infection risk depends on multiple factors, but potential mechanisms underpinning this proposed association could include more frequent injection, given the shorter half-life of fentanyl (Lambdin et al., 2019). Alternatively or complementarily, it may simply be because powder heroin does not need the flash boiling required by black tar, removing a key step that can eliminate harmful bacteria (Ciccarone & Bourgois, 2003). For similar reasons, powder heroin and fentanyl consumption has been suggested as an emerging risk factor for HIV and hepatitis C transmission (Lambdin et al., 2019; Bobashev et al., 2019).

Our findings indicate that overdose mortality in Tijuana is most likely being increasingly driven by polysubstance combinations of synthetic substances, including fentanyls and methamphetamine. As novel polysubstance formulations of synthetic drugs are increasingly implicated in overdose mortality in numerous countries globally (Shover et al., 2020; Laing et al., 2021; Otiashvili et al., 2016), investments in toxicological testing and autopsy services are urgently needed to precisely track overdose deaths in Mexico. Additionally, street-based

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

drug checking services at harm reduction settings represents a promising avenue for tracking rapid shifts in the drug supply (Drug Supply Assessment, 2021). We posit that these methods may be especially powerful when combined with rich qualitative work that can help elucidate gaps in quantitative data, and when important shifts may be occurring (Messac et al., 2013).

Limitations

The fentanyl testing strips employed here provide a binary presence/absence indication. They are known to be very sensitive and show positivity even at very small concentrations of fentanyl analogues. This was a desired property given our study design, as we tested residues on injection equipment, where quantities available for testing may be minimal. Nevertheless, information about the quantity of fentanyl contained in drug samples is not available, which limits interpretation of the findings. Further, false positives using these strips have been reported in the presence of very high concentrations of stimulants and certain contaminants (Lockwood et al., 2021). Those circumstances are unlikely to affect this study given that we were testing syringes, not drug samples directly, nevertheless, the possibility for false positives should be considered. Further, it is important to consider the information offered in this analytical approach, as the unit of analysis is the syringe, not the individual injection. Each positive or negative test is representative of the internal environment of the syringe at the time of collection. This is likely most representative of the last drug combination prepared for use, however it could indicate fentanyl positivity in a previous drug preparation event, especially if the syringe was not rinsed between uses. In sum we would argue that our results indicate a reasonable proxy of the level of exposure of people in the population to fentanyl analogues on a given day but may overestimate the level of fentanyl presence in any given drug sample.

Our study is also limited by the relative paucity of women in the ethnographic scene. We have included some limited data from female participants, but it was much more difficult to follow them ethnographically in the context of a sexist and structurally violent environment towards women and trans individuals.

Conclusions

Fentanyl has become commonplace in Tijuana’s heroin supply and appears to be increasing in prevalence. Fentanyl predominates in various points throughout city and is strongly linked to white powder heroin. Heterogeneity was observed between distinct parts of city, and overall fentanyl prevalence increased by about 20% during the 8-month study period.

Structural factors related to criminalization, regulation, austerity budgets and discretionary practices of frontline criminal justice personnel appears to be limiting effective systemic responses to a shifting risk environment due to fentanyl. Further surveillance is needed to quantify the magnitude of growing overdose and other health risks. Timely documentation is of binational interest given the linked nature of the US/Mexico drug supply-chains and their health implications. Investments in drug checking and toxicological testing are needed to better track shifting patterns of mortality and the contents of the illicit drug supply. Further, harm reduction resources are urgently needed to address the growing health risks of fentanyl

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

and polysubstance methamphetamine injection drug use. In particular, large-scale efforts are needed to render naloxone cheap and widely available to PWUD (Doe-Simkins et al., 2009). The provision of fentanyl-testing services, and overdose prevention spaces, are additional important strategies (Beletsky et al., 2018). Finally, more research is needed regarding the link between fentanyl contamination and novel health risks, such as soft tissue infection, hepatitis C, and HIV infection and polysubstance methamphetamine use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

This study was funded by a grant from the San Diego Center for Aids Research (P30 AI036214). JF received support from the UCLA Medical Scientist Training Program (National Institute of General Medical Sciences training grant GM008042). The funders played no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

References

Anguera MT, Blanco-Villaseñor A, Losada JL, Sánchez-Algarra P, & Onwuegbuzie AJ. (2018). Revisiting the difference between mixed methods and multimethods: Is it all in the name? Quality and Quantity, 52, 2757–2770.

Arredondo J, Gaines T, Manian S, et al. (2018). The law on the streets: Evaluating the impact of Mexico's drug decriminalization reform on drug possession arrests in Tijuana, Mexico. International Journal of Drug Policy, 54, 1–8. [PubMed: 29306177]

Auyero J, Bourgois P, & Scheper-Hughes N (2015). Violence at the urban margins. Cambridge: Oxford University Press.

Beletsky L, & Davis CS. (2017). Today's fentanyl crisis: Prohibition's Iron Law, revisited. International Journal of Drug Policy, 46, 156–159. [PubMed: 28735773]

Beletsky L, Baker P, Arredondo J, et al. (2018). The global health and equity imperative for safe consumption facilities. Lancet, 392, 553–554. [PubMed: 30152386]

Bobashev G, Mars S, Murphy N, Dreisbach C, Zule W, & Ciccarone D (2019). Heroin type, injecting behavior, and HIV transmission. A simulation model of HIV incidence and prevalence. PLoS One, 14, Article e0215042.

Bourgois P (1998). The moral economies of homeless heroin addicts: Confronting ethnography, HIV risk, and everyday violence in San Francisco shooting encampments. Substance Use & Misuse, 33, 2323–2351. [PubMed: 9758016]

Bourgois P (2003). In search of respect: Selling crack in El Barrio. New York: Cambridge University Press.

Bourgois P, & Schonberg JR (2009). Dopefiend. Berkeley: University of California Press.

Brinkley-Rubinstein L, Macmadu A, Marshall BDL, et al. (2018). Risk of fentanyl-involved overdose among those with past year incarceration: Findings from a recent outbreak in 2014 and 2015. Drug and Alcohol Dependence, 185, 189–191. [PubMed: 29459328]

Bucardo J, Brouwer KC, Magis-Rodríguez C, et al. (2005). Historical trends in the production and consumption of illicit drugs in Mexico: Implications for the prevention of blood borne infections. Drug and Alcohol Dependence, 79, 281–293. [PubMed: 16102372]

Ciccarone D (2017). Fentanyl in the US heroin supply: A rapidly changing risk environment. International Journal of Drug Policy, 46, 107–111. [PubMed: 28735776]

Ciccarone D, & Bourgois P (2003). Explaining the geographical variation of HIV among injection drug users in the United States. Substance Use and Misuse, 38, 2049–2063. [PubMed: 14677781]

Ciccarone D (2021). The rise of illicit fentanyls, stimulants and the fourth wave of the opioid overdose crisis. Current Opinion in Psychiatry, 34, 344–350. [PubMed: 33965972]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Doe-Simkins M, Walley AY, Epstein A, & Moyer P (2009). Saved by the nose: By-stander-administered intranasal naloxone hydrochloride for opioid overdose. American Journal of Public Health, 99, 788–791. [PubMed: 19363214]

DRUG ENFORCEMENT ADMINISTRATION. 2020 National drug threat assessment. Drug Enforcement Administration, 2020.

Drug Supply Assessment (Q1 2021): Philadelphia, Pennsylvania, USA. NPS Discovery. 2021; published online March 2. https://www.npsdiscovery.org/drug-supply-assessment-q1-2021-philadelphia-pennsylvania-usa/(accessed Sept 6, 2021).

Fleiz C 2022 Cuqueando la chiva: Contextos del consumo de heroina en el norte de mexico. Instituto nacional de psiquiatria. https://www.researchgate.net/publication/331907471_Cuqueando_la_Chiva_Contextos_del_consumo_de_heroina_en_la_frontera_norte_de_Mexico.

Fleiz C, Arredondo J, Chavez A, et al. (2020). Fentanyl is used in Mexico's northern border: current challenges for drug health policies. Addiction, 115, 778–781. [PubMed: 31837278]

Forecast Project Executive Summary. Johns Hopkins Bloomberg School of Public health. https://www.btnx.com/files/Johns_Hopkins_Fentanyl_Executive_Summary.pdf (accessed Sept 20, 2018).

Friedman J, & Akre S (2021). COVID-19 and the drug overdose crisis: Uncovering the deadliest months in the United States, January −July 2020. American Journal of Public Health, e1–e8.

Friedman J, Karandinos G, Hart LK, Castrillo FM, Graetz N, & Bourgois P (2019). Structural vulnerability to narcotics-driven firearm violence: An ethnographic and epidemiological study of Philadelphia's Puerto Rican inner-city. PLoS ONE, 14, Article e0225376.

Friedman J, Beletsky L, & Schriger DL. (2020). Overdose-related cardiac arrests observed by emergency medical services during the US COVID-19 epidemic. JAMA Psychiatry, published online Dec 3.. 10.1001/jamapsychiatry.2020.4218.

Gaines TL, Beletsky L, Arredondo J, et al. (2015). Examining the spatial distribution of law enforcement encounters among people who inject drugs after implementation of Mexico's drug policy reform. Journal of Urban Health, 92, 338–351. [PubMed: 25300503]

Goodman-Meza D, Medina-Mora ME, Magis-Rodríguez C, Landovitz RJ, Shoptaw S, & Werb D (2018). Where is the opioid use epidemic in Mexico? A cautionary tale for policymakers south of the US–Mexico border. American Journal of Public Health, 109, 73–82. [PubMed: 30495992]

HAN Archive - 00438 | Health Alert Network (HAN). 2020; published online Dec 17. https://emergency.cdc.gov/han/2020/han00438.asp (accessed Dec 25, 2020).

Han B, Cotto J, Etz K, Einstein EB, Compton WM, & Volkow ND. (2021). Methamphetamine overdose deaths in the US by sex and race and ethnicity. JAMA Psychiatry, published online Jan 20.. 10.1001/jamapsychiatry.2020.4321.

Híjar M, Chandran A, Pérez-Núñez R, Lunnen JC, Rodríguez-Hernández JM, & Hyder AA. (2012). Quantifying the underestimated burden of road traffic mortality in Mexico: A comparison of three approaches. Traffic Injury Prevention, 13, 5–10. [PubMed: 22414122]

Inside the Sinaloa Cartel's Fentanyl Smuggling Operations. https://www.vice.com/en/article/pkyk37/inside-the-sinaloa-cartels-fentanyl-smuggling-operations (accessed April 22, 2021).

Karandinos G (2017). How the war on drugs fueled the fentanyl crisis. The Guardian published online Aug 29 https://www.theguardian.com/commentisfree/2017/aug/29/war-on-drugs-fueled-fentanyl-crisis (accessed Feb 6, 2022).

Karandinos G, Hart LK, Montero Castrillo F, & Bourgois P (2014). The moral economy of violence in the US inner city. Current Anthropology, 55, 1–22. [PubMed: 25067849]

Laing MK, Ti L, Marmel A, et al. (2021). An outbreak of novel psychoactive substance benzodiazepines in the unregulated drug supply: Preliminary results from a community drug checking program using point-of-care and confirmatory methods. International Journal of Drug Policy, Article 103169.

Lambdin BH, Bluthenthal RN, Zibbell JE, Wenger L, Simpson K, & Kral AH. (2019). Associations between perceived illicit fentanyl use and infectious disease risks among people who inject drugs. International Journal of Drug Policy, published online Nov 13. 10.1016/j.drugpo.2019.10.004.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Lockwood T-LE, Vervoordt A, & Lieberman M. (2021). High concentrations of illicit stimulants and cutting agents cause false positives on fentanyl test strips. Harm Reduction Journal, 18, 30. [PubMed: 33750405]

Mayer S, Boyd J, Collins A, Kennedy MC, Fairbairn N, & McNeil R (2018). Characterizing fentanyl-related overdoses and implications for overdose response: Findings from a rapid ethnographic study in Vancouver, Canada. Drug and Alcohol Dependence, 193, 69–74. 10.1016/j.drugalcdep.2018.09.006. [PubMed: 30343236]

McCrae K, Tobias S, Grant C, et al. (2020). Assessing the limit of detection of Fourier–transform infrared spectroscopy and immunoassay strips for fentanyl in a real-world setting. Drug and Alcohol Review, 39, 98–102. [PubMed: 31746056]

Messac L, Ciccarone D, Draine J, & Bourgois P (2013). The good-enough science-and-politics of anthropological collaboration with evidence-based clinical research: Four ethnographic case studies. Social Science & Medicine, 99, 176–186. [PubMed: 23664236]

Meacham MC, Rudolph AE, Strathdee SA, et al. (2015). Polydrug use and HIV risk among people who inject heroin in Tijuana, Mexico: A latent class analysis. Substance Use and Misuse, 50, 1351–1359. [PubMed: 26444185]

Otiashvili D, Tabatadze M, Balanchivadze N, & Kirtadze I (2016). Policing, massive street drug testing and poly-substance use chaos in Georgia – a policy case study. Substance Abuse Treatment, Prevention, and Policy, 11, 1–12. [PubMed: 26733043]

Pinedo M, Beletsky L, Alamillo N, & Ojeda VD. (2017). Health-damaging policing practices among persons who inject drugs in Mexico: Are deported migrants at greater risk? International Journal of Drug Policy, 46, 41–46. [PubMed: 28601020]

Rhodes T (2002). The ‘risk environment’: A framework for understanding and reducing drug-related harm. International Journal of Drug Policy, 13, 85–94.

Rhodes T, Wagner K, Strathdee SA, Shannon K, Davidson P, & Bourgois P (2012). Structural violence and structural vulnerability within the risk environment: Theoretical and methodological perspectives for a social epidemiology of HIV risk among injection drug users and sex workers. In O’Campo P, & Dunn JR (Eds.), Rethinking social epidemiology: towards a science of change (pp. 205–230). Netherlands: Dordrecht: Springer.

Scheper-Hughes N, & Bourgois PI. (2004). Violence in war and peace: an anthology. Oxford: Blackwell.

Shover CL, Falasinnu TO, Dwyer CL, et al. (2020). Steep increases in fentanyl-related mortality west of the Mississippi River: Recent evidence from county and state surveillance. Drug and Alcohol Dependence, 216, Article 108314.

Ti L, Tobias S, Lysyshyn M, et al. (2020). Detecting fentanyl using point-of-care drug checking technologies: A validation study. Drug and Alcohol Dependence, 212, Article 108006.

Travère A, & Giraudat J (2020). Revealed: how Mexico’s Sinaloa cartel has created a global network to rule the fentanyl trade. The Guardian published online Dec 8. https://www.theguardian.com/world/2020/dec/08/mexico-cartel-project-synthetic-opioid-fentanyl-drugs (accessed Feb 6, 2022).

Werb D, Wagner KD, Beletsky L, Gonzalez-Zuniga P, Rangel G, & Strathdee SA. (2015). Police bribery and access to methadone maintenance therapy within the context of drug policy reform in Tijuana, Mexico. Drug and Alcohol Dependence, 148, 221–225. [PubMed: 25655577]

West BS, Abramovitz DA, Gonzalez-Zuniga P, et al. (2020). Drugs, discipline and death: Causes and predictors of mortality among people who inject drugs in Tijuana, 2011–2018. International Journal of Drug Policy, 75, Article 102601.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

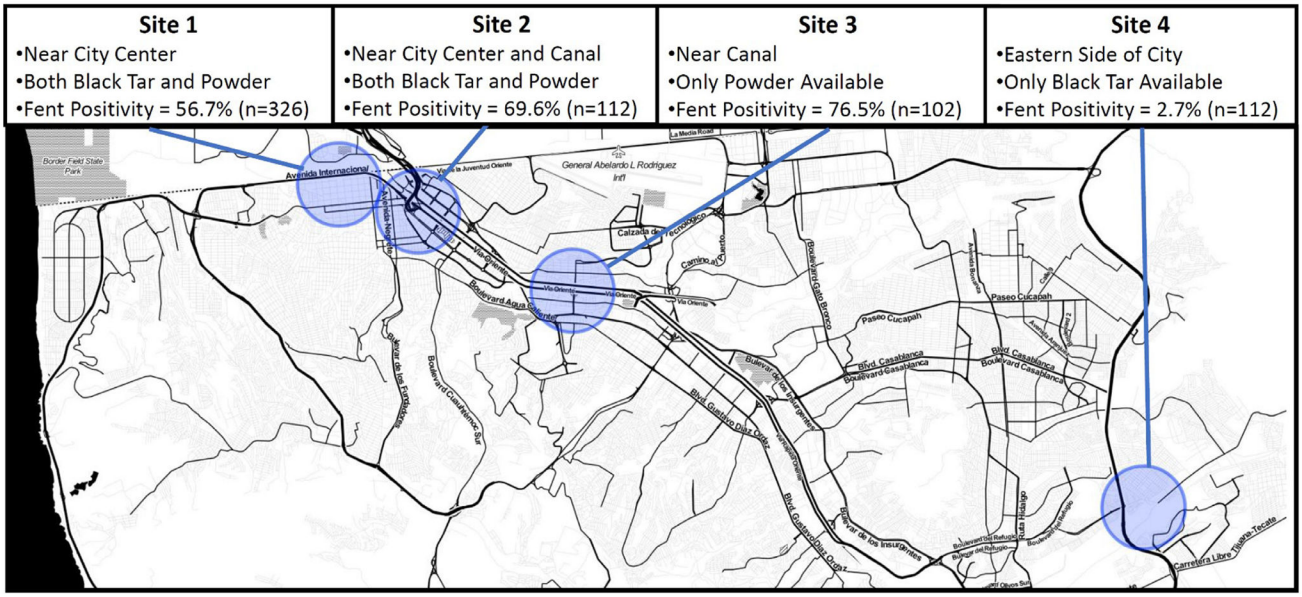


Fig. 1.

Fentanyl positivity rates at four mobile clinic locations throughout the city.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

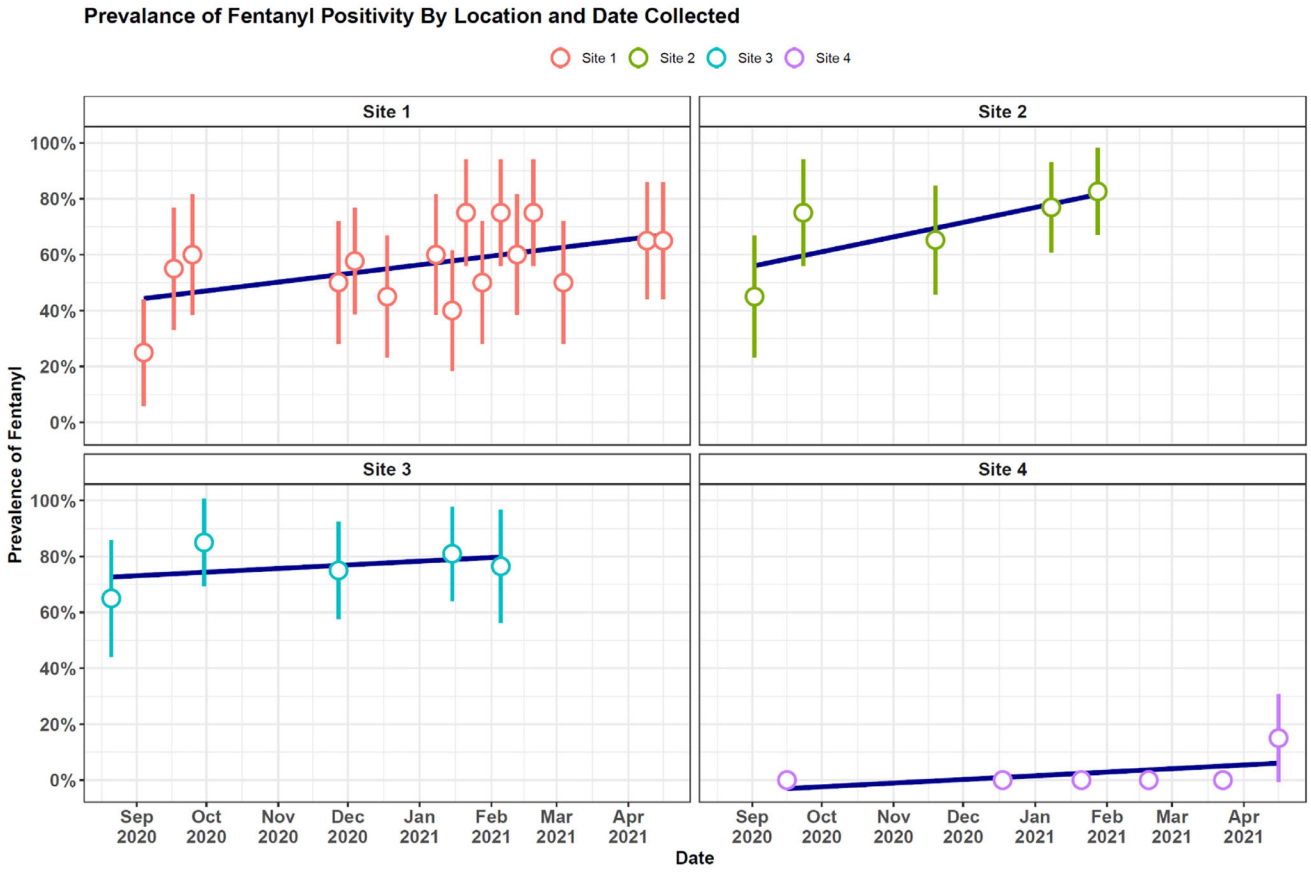


Fig. 2.

Fentanyl positivity rates at four mobile clinic locations throughout the city, by location and date. Points shown with 95% confidence intervals. A bivariate line of best fit is shown for each location.