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Prevalence and Correlates of ‘Agua Celeste’ Use among Female Sex Workers who Inject Drugs in Ciudad Juarez, Mexico

Meghan D. Morris¹, Patricia Case², Angela M. Robertson¹, Remedios Lozada^{3,4}, Alicia Vera¹, John D. Clapp⁵, Maria Elena Medina-Mora⁶, and Steffanie A. Strathdee¹

¹ University of California San Diego

² The Fenway Institute, Fenway Health, Boston, MA

³ Prevencasa, AC, Baja California, Mexico

⁴ ISESALUD, Baja California, Mexico

⁵ San Diego State University

⁶ Instituto Nacional de Psiquiatría Ramón de la Fuente, Mexico City

Abstract

Background—*Agua celeste*, or “heavenly water,” is the street name for a sky-blue colored solvent reportedly inhaled or ingested to produce an intoxicating effect. Study aims were to (1) describe prevalence of *Agua Celestse* (AC) use, and (2) identify correlates of lifetime and recent use of AC use among female sex workers who also inject drugs (FSW-IDUs) in northern Mexico.

Methods—Between 2008 and 2010, baseline data from FSW-IDUs ≥ 18 years old living in Tijuana or Ciudad Juarez participating in a longitudinal behavioral intervention were analyzed using logistic regression.

Results—Among 623 FSW-IDUs (307 from Tijuana and 316 from Ciudad Juarez (CJ)), 166 (26%) reported ever using AC, all of whom lived in CJ. Among the CJ sample, lifetime prevalence of AC use was 53%, median age of first use was 16 years (IQR: 14–23), and 10% reported it as their first abused substance. Ever using AC was independently associated with ever being physically abused and younger age, and was marginally associated with initiating injection drug use and regular sex work at age eighteen or younger. Among those ever using AC, 70/166 (42.2%) reported using it within the last 6 months, which was independently associated with using drugs with clients before or during sex, being on the street more than 8 hours per day, and younger age.

Discussion—We observed considerable geographic variation in the use of AC in northern Mexico. Future studies exploring factors influencing use, its precise formulation(s), and its potential health effects are needed to guide prevention and treatment.

Keywords

Inhalant abuse; female sex workers; injection drug use; agua celeste; Mexico

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Correspondence to: Steffanie A. Strathdee, PhD, University of California San Diego, School of Medicine, 9500 Gilman Drive, Mail Code 0507, La Jolla CA 92093-0507. Phone: (858) 822-1952, fax: (858) 534-7566. sstrathdee@ucsd.edu.

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1. INTRODUCTION

The relative inexpensiveness, ease of availability, and rapidly achieved intoxicating effects of inhalants make them particularly attractive to adolescents. There are four main types of inhalants: volatile solvents, gases, aerosols and nitrites. Inhalants may alter moods and create a euphoric state that can be accompanied by lightheadedness and hallucinations (Feron et al., 1998). Nitrites, sometimes known as “poppers,” may enhance sexual pleasure. Sometimes referred to as “sniffing”, “huffing”, or “bagging”, the primary objective of inhaling volatile substances is to deliver the highest concentration of the substance to the lungs and subsequently the brain (Espeland, 2000). “Sniffing” typically means the solvent is inhaled from an open container, whereas “huffing” refers to covering the nose and mouth with a solvent-soaked cloth while inhaling. “Bagging” involves placing a solvent soaked bag over one’s mouth while inhaling. “Huffing” and “bagging” are especially harmful because solvents are often ingested during the inhalation process (Brouette and Anton, 2001). Independent of the mode of delivery, the intoxication typically lasts only a few moments, requiring inhalant users to engage in repeated use in order to prolong the effects. Serious health effects may occur with successive inhalations, including loss of consciousness, seizures, nervous system damage, and even death (Flanagan and Ives, 1994; Kurtzman et al., 2001). Cognitive damage is a particularly serious health effect, especially common in individuals who huff the solvents (Lubman et al., 2008).

According to data from Mexico’s 1998 National Survey on Addictions, inhalants were the third most prevalent drug used in Mexico after marijuana and cocaine (Secretaria de Salud, 1998). In 1998, household surveys conducted in urban areas throughout Mexico among populations 12 to 65 years of age provided a cumulative prevalence of lifetime inhalant use of 0.80%, with prevalence at 1.07% in Tijuana and 0.30% in Ciudad Juarez, suggesting some degree of regional variation (Medina-Mora and Ortiz, 1988; Secretaria de Salud, 1998). By 2005, the prevalence of inhalant use had increased to 2.83% in Tijuana and to 0.78% in Ciudad Juarez (Rojas Guiot et al., 2009).

Due to their accessibility, the most commonly abused inhalants in Mexico include paint thinner, glues, and aerosol sprays (Medina-Mora et al., 2003; Secretaria de Salud, 2008). A national high school survey conducted in 1998 in Mexico City found that among female adolescents, inhalants were the most common drug used after marijuana (Medina-Mora et al., 2003). The most recent school surveys in Mexico show inhalants are the most common substance of abuse among male and female students between 7th and 9th grade (Villatoro et al., 2009). Inhalant use is more common within this age group than marijuana use, with 7.4% of males and 6.7% of females reporting inhalant use compared to 5.6% and 2.7% respectively for marijuana (Villatoro et al., 2009).

In the context of an ongoing study of female sex workers who inject drugs (FSW-IDUs) in Tijuana and Ciudad Juarez, our study team became aware that some participants were using an inhalant referred to as *agua celeste*, or “heavenly water.” A literature search revealed that *agua celeste* was reported as part of the Mexican pharmacopeia as early as 1885, when it was described as a mixture of copper sulfate and ammonia which creates a sky-blue color (Hagenibuch, 1885). Within Mexico’s illicit drug market, early anecdotal reports suggest that *agua celeste* has mainly been used among children and adolescents along the Mexico-U.S. border (Chacon, 2007), in a similar way that toluene was introduced four decades ago (Medina-Mora et al., 1997).

Although reports of *agua celeste* are lacking in the peer-reviewed literature, one account of *agua celeste* use within the Mexico-US border region dates back more than a decade (Ramos, 1998). A mixed-methods study among not-in-treatment drug users in San Antonio

and El Paso, Texas reported *agua celeste* as a mixture of tannery processing products including benzene, formaldehyde, and methyl ethyl ketone, with a small jar selling for \$2 to \$3 USD (Ramos, 1998). More recently in a Mexican article, *agua celeste* was referred to as a mixture of solvents and ephedrine, a precursor used to manufacture methamphetamine that was recently banned in Mexico. This combination is then reportedly ingested and inhaled from soaked cloths (Chacon, 2007). An article from the Washington Post described *agua celeste* as a “cheap industrial solvent” (Booth and Fainaru, 2009). Although the exact formulation of *agua celeste* may have changed over time and may differ depending on which solvents are regionally available, repeated exposure to these agents can lead to short and long term health damage (Beaeza et al., 2009).

Mexico’s 2008 National Household Survey reported that the national lifetime prevalence of *agua celeste* use was 0.83%, with all cases detected in the central state of Aguascalientes and northeastern state of Chihuahua (Secretaria de Salud, 2008). In Mexico City, 0.2% of high school students reported use of *agua celeste* (Villatoro et al., 2009), and an ongoing study of drug users in treatment who report use of *agua celeste* refer to its effects as similar to the euphoric effects of toluene but stronger (Ortiz, 2010). Use of a similar compound has been reported in other regions; 30% of 8th grade students in Leon, Guanajuato, (central Mexico) who were asked to list the different substances abused in their environment named “*agua de celaste*” (Enriquez Bielma et al., 2006).

The aims of the present study were two-fold. First, we determined prevalence of lifetime and recent use of *agua celeste* within an ongoing study of FSW-IDUs in two northern Mexican cities. Second, we identified factors associated with lifetime and current use of *agua celeste* in this sample. Based on our findings, we suggest areas for future research that have implications for prevention and treatment.

2. METHODS

2.1 Study Setting

This study was conducted in Tijuana and Ciudad Juarez, Mexico, two cities along the Mexico-U.S. border with large populations of female sex workers. Tijuana is adjacent to San Diego, California and is the largest Mexican-U.S. border city. Tijuana and San Diego form the world’s largest and busiest land border crossing (U.S. Department of Transportation, 2008). Ciudad Juarez is adjacent to El Paso, Texas and is the largest city in the Mexican state of Chihuahua. In 2000, 36% of Ciudad Juarez inhabitants were born outside of Chihuahua (U.S. Department of Transportation, 2008). In 2008, approximately 18% of FSWs from Tijuana and Ciudad Juarez reported ever injecting drugs, with a higher proportion of FSWs in Tijuana reporting recent injection drug use (15.8%, vs. 8.7%, $p=0.001$) (Strathdee et al., 2008).

2.2 Study Population and Sample

Between November 2008 and July 2010, FSW-IDUs from Tijuana (N=307) and Ciudad Juarez (N=316) were recruited using convenience sampling into a behavioral intervention study designed to reduce both high risk injection and sexual behaviors. Eligibility criteria included being ≥ 18 years of age; having had unprotected vaginal or anal sex with a male client at least once during the previous month; having shared syringes or injection paraphernalia (i.e. cookers, cotton, rinse water) at least once within the past month; ability to speak Spanish or English; ability to provide informed consent; and having no plans to move out of the city in the next 12-months. Trained, bilingual interviewers collected baseline data from all eligible subjects independent of their HIV status. Women were reimbursed \$15 USD for their participation in the baseline interview. The Institutional Review Board of the

University of California, San Diego and the Ethics Boards of the Tijuana General Hospital and Universidad Autonoma de Ciudad Juarez approved all study protocols.

2.3 Measures

We restricted this analysis to baseline data from this longitudinal intervention study. Participants underwent an interview-administered survey eliciting information on sociodemographics, sexual risk behaviors, injection risk behaviors, and experiences representing their physical, social, and economic environments in their lifetime and over the last six months. Sociodemographic questions included age, marital status, city of birth, migration history, sexual and physical abuse history, income and living arrangements. Questions on history of sexual behavior included age at initiation into sex work, reasons for entering sex work, and protected and unprotected sex acts with regular and casual clients and intimate partners.

Questions on history of drug use behaviors included age of first use and/or injection of specific drugs alone and in combination, sharing of injection equipment and drug use with clients. Two dependent variables guided the analysis. First, a single “yes/no” item asking participants if they had ever used *agua celeste* defined lifetime *agua celeste* use. Second, a follow-up question about the frequency of *agua celeste* use in the past 6 months was asked of all participants who reported “ever” using *agua celeste*. This multiple response item (never, once a month or less, 2–3 days a month, once a week, etc.) was then collapsed into a dichotomous outcome of “recent use” versus “no recent use.”

2.4 Laboratory Tests

The “Determine”[®] rapid HIV antibody test was administered to determine the presence of HIV antibodies (Abbott Pharmaceuticals, Boston, MA). All reactive samples were tested using an HIV-1 enzyme immunoassay and immunofluorescence assay at the County of San Diego, Public Health Laboratory. Those testing HIV-positive were referred to the local municipal health clinics in Tijuana or Ciudad Juarez for monitoring and care.

Syphilis serology used the rapid plasma reagin (RPR) test (Determine[™] Syphilis TP). RPR-positive samples were subjected to confirmatory testing using the *Treponema pallidum* particle agglutination assay (TPPA) (Fujirebio, Wilmington, DE, USA) at the County of San Diego, Public Health Laboratory.

Initially, Gonorrhea and Chlamydia were detected using a rapid test kit (BioStar[®] OIA[®] GC and CHLAMYDIA) and positive samples were confirmed on urine specimens using APTIMA COMBO 2[®] Assay (Genprobe, San Diego, CA). However, upon release of recommendations from the U.S. Centers for Disease Control and Prevention that questioned the sensitivity of the Biostar rapid GC test, this test was discontinued on March 24, 2009. After this date, all participants provided urine for GC screening using a transcription-mediated assay (Genprobe, San Diego, CA). Samples were batched periodically and shipped to the San Diego County Health Department for confirmatory testing. Women with reactive STI tests were provided with free on-site treatment in accordance with U.S. and Mexican guidelines.

2.5 Statistical Analysis

Prevalence of lifetime and recent *agua celeste* use was calculated for respondents in Tijuana and Ciudad Juarez. Given that all use of *agua celeste* was reported in Ciudad Juarez, remaining analyses were restricted to respondents from this city. First, FSW-IDUs who reported lifetime use of *agua celeste* were compared to FSW-IDUs who reported never using *agua celeste*. Second, among those who reported ever using *agua celeste*, FSW-IDUs

who reported any use within the past six months were compared to FSW-IDUs who reported not using *agua celeste* in the past six months. Wilcoxon rank sum tests and Chi-Square tests were used to examine distributional differences between groups for continuous and binary variables.

Next, separate univariate and multivariate logistic regression analyses identified factors associated with lifetime and recent *agua celeste* use. For both analyses, all variables attaining a significance level of $p \leq 0.10$ in univariate models were considered for inclusion in multivariate models. These variables were entered into multivariate logistic regression models in a manual forward stepwise fashion. The likelihood ratio statistic was used to compare nested models, retaining variables that were significant at an alpha level of 0.05. Since this was a descriptive study, all two-way interactions were assessed. Lack of multicollinearity between the predictor variables in the final model was confirmed by appropriate values of the largest condition index and variance inflation factors.

3. RESULTS

3.1 Overall Sample Characteristics

Among the 307 participants in Tijuana, median age was 33 years (intra-quartile range [IQR]: 28–41) and 59% had at least a primary school education. Heroin was the drug most commonly injected in the past month (59%), followed by a combination of heroin and methamphetamine (“speedball,” 34%). Prevalence of lifetime *agua celeste* use in Tijuana was 0%.

Of the 316 participants in Ciudad Juarez, the median age was 33 years (IQR: 27–39), and 35% had at least a primary school education. Heroin was the drug injected most often over the previous month (82%), followed by speedball (15%). In Ciudad Juarez, over half of women (53%) reported ever using *agua celeste*, and the median age of first *agua celeste* use was 16 years (IQR: 14–23 years). The median duration of *agua celeste* use was 12 years (IQR: 5–18) (Table 1).

Results reported hereafter are restricted to the Ciudad Juarez sample. Among those who ever used *agua celeste*, (N=166), 10% reported using it earlier than their first use of marijuana, methamphetamine, heroin, or cocaine. Among these 166 women, 45% used *agua celeste* prior to initiating injection drug use and 40% reported using *agua celeste* prior to initiating regular sex work (data not shown). Additionally, 83% had experienced physical or sexual abuse prior to *agua celeste* use. Among those ever using *agua celeste*, 42% reported using it within the last six months, of whom 24% reported using at least once daily, 30% used it at least one day per week, and 46% at least once per month.

3.2 Correlates of Lifetime Use of Agua Celeste

Compared to FSW-IDUs who had never used *agua celeste*, those who had ever done so were younger (31 years vs. 35 years, $p < 0.001$), less likely to have ever traveled to the U.S. (42% vs. 54%, $p = 0.04$), and marginally more likely to have ever been arrested (85% vs. 77%, $p = 0.06$) (Table 1). Those who had ever used *agua celeste* were significantly younger when they began injecting drugs (18 years vs. 22 years, $p < 0.0001$) and when they began regularly participating in the sex trade (18 years vs. 20 years, $p < 0.0001$). *Agua celeste* users were also more likely to have ever been physically abused (72% vs. 54%, $p = 0.002$) and marginally more likely to have ever been raped (66% vs. 56%, $p = 0.08$). There were no differences between groups with respect to HIV prevalence, active syphilis infection, Chlamydia, or gonorrhea infection, nor were there differences relating to birthplace, sexual orientation, educational level, marital status, or the duration of time injecting drugs or trading sex regularly.

3.3 Factors Independently Associated with Lifetime Use of Agua Celeste

Two factors were independently associated with ever using *agua celeste* (Table 2), which included being younger (adjusted odds ratios [AOR]: 0.97 per 1-year increase (95% confidence interval [95% CI]: 0.94–0.99) and ever being physically abused (AOR: 2.03; 95% CI: 1.25–3.31). Two additional factors were marginally associated with lifetime use: initiating drug injection at age 18 years or younger (AOR: 1.73 per year; 95% CI: 0.99–3.03) and beginning regular sex work at age 18 or younger (AOR: 1.55 per year; 95% CI: 0.97–2.72).

3.4 Correlates of Recent Use of Agua Celeste

Among those who had ever used *agua celeste* (N=166), 70 (42.2%) reported using it in the past six months. Recent *agua celeste* users were marginally younger than those who had not used it in the past 6 months (Table 3). FSW-IDUs who recently used *agua celeste* were significantly more likely to have used non-injection heroin in the past month compared to non-current users (30% vs. 9%, $p<0.001$). Compared to non-current users, FSW-IDUs who recently used *agua celeste* reported spending more hours on the street per day (median: 12 vs. 8.5 hours, $p=0.01$), and were more likely to live and work at the same location (34% vs. 19%, $p=0.02$).

A significantly greater proportion of FSW-IDUs who recently used *agua celeste* reported often or always using drugs with their clients (73% vs. 56%, $p=0.03$). Although women tended to report using heroin (82%) or cocaine/crack (10%) with clients, of the four women reporting that they used other drugs with clients, three reported using *agua celeste* with clients in the past month. There were no differences found in terms of type of recent sexual behaviors, income, ease of acquiring drugs, homelessness, condom use, recent sexual abuse, or relationship status.

3.5 Factors Independently Associated with Recent Use of Agua Celeste

Recent use of *agua celeste* was independently associated with often or always using drugs with their clients before or during sex (AOR: 2.08; 95% CI: 1.04–4.15) and being on the street for more than 8 hours per day (AOR: 2.70; 95% CI: 1.36–5.33). Being younger was also independently associated with recent *agua celeste* use, with those 18–25 years old having a three-fold higher odds of using *agua celeste* (AOR: 3.00; 95% CI: 1.02–8.86), compared to those 40 years and older (Table 4).

4. DISCUSSION

To our knowledge, this is the first study to describe correlates of *agua celeste* use. Overall, *agua celeste* was widely used among FSW-IDUs in Ciudad Juarez but was not used at all among FSW-IDUs in Tijuana. In Ciudad Juarez, over half of FSW-IDUs had used *agua celeste* in their lifetime, which was associated with ever being physically abused and marginally associated with initiating injection drug use and sex work at a young age. Among those who ever used *agua celeste*, nearly half had used it in the past six months. Recent *agua celeste* users were more likely to report using drugs with sex work clients before or during sex and to spend more time on the street per day, suggesting a higher risk profile.

Our prevalence estimates contrast the estimates of general inhalant use in Mexico, which show higher overall inhalant use in Tijuana compared to Ciudad Juarez (Medina-Mora and Ortiz, 1988; Secretaria de Salud, 1998). However, our findings are consistent with the results from the National Household Survey that detected *agua celeste* use only in two states, one being Chihuahua (Rojas Guiot et al., 2009). Although our data support the notion that there is substantial current geographic variation in *agua celeste* use, given the high

levels of population mobility in the Mexico-U.S. border region (Wagner et al., 2011), its use could spread to other cities on either side of the US-Mexico border.

Lifetime *agua celeste* use was marginally associated with beginning to engage in sex work at a younger age, which is consistent with other studies of inhalant use in Mexico (Loza et al., 2010; Wu and Howard, 2007). In a previous study of adult FSWs in Tijuana and Ciudad Juarez by members of our team, Loza et al. showed that after adjusting for age, FSWs who initiated sex work prior to 18 years were nearly three time more likely to have used inhalants prior to initiating sex work (Loza et al., 2010). In our study, 40% of *agua celeste* users in our study began using *agua celeste* prior to initiating sex work.

We found that women who had ever used *agua celeste* were younger than those who had never used the drug, and that 10% of users reported using *agua celeste* as their first drug of use. These findings are similar to literature suggesting that inhalants may play an important early role in individuals' drug use trajectories leading to later use of heroin and/or injection drug use. For example, in a prospective study of 600 African American youth from Chicago, Johnson et al. reported that those who used inhalants prior to age 16 were 9 times more likely to subsequently use heroin later in life (Johnson et al., 1995). Data from the 1990 U.S. National Household Survey on Drug Abuse demonstrated that after adjusting for sex, age, race, socioeconomic status and use of marijuana, inhalant users were more than 5 times more likely than non-users to transition to injection drug use (Schutz et al., 1994).

FSW-IDUs who had a history of sexual or physical abuse were significantly more likely to report ever using *agua celeste*. While the direction of this relationship cannot be discerned from this study, the majority of women who reported ever using *agua celeste* did so after their first report of physical or sexual abuse. In ethnographic studies of drug-involved adults in New York City, Fendrich et al. found that heavy inhalant use was associated with physical abuse during childhood (Fendrich et al., 1997). In a cross-sectional study of public high school students in South Carolina, Zullig et al. found lifetime inhalant use to be strongly associated with life dissatisfaction, especially among students with a history of abuse (Zullig et al., 2001). In Mexico, children working or living on the streets, those with unstable family environments and who have been abused are most often the ones who use inhalants (Medina-Mora and Berenzon, 1995; Tapia-Conyer et al., 1995). These findings suggest that women in our study may have turned to *agua celeste* as a way to cope with the emotional and psychological effects of physical and sexual abuse or other negative events experienced in childhood or adolescence.

Recent *agua celeste* use was three times more prevalent among women between 18 and 25 years old compared to older women. Using U.S. National Surveys on Drug Use and Health data from 2002 and 2003, Wu et al. also found that the pattern of inhalant use in the previous year was inversely related to participant age (Wu and Ringwalt, 2006) which is also the case in Mexico (Secretaria de Salud, 2008; Villatoro et al., 2009).

While our cross-sectional study precludes inferences about predictors of recent *agua celeste* use, the finding that recent users spent more time on the street per day suggests that these women may comprise a more marginalized or socioeconomically disadvantaged group of drug users. Anecdotal accounts by study staff suggest *agua celeste* may be an alternative when their drug of choice (e.g., heroin) is not available to help them cope with withdrawal symptoms. Future qualitative studies to explore motivations for current *agua celeste* use are necessary to better understand this relationship.

Finally, women who recently used *agua celeste* had greater odds of using drugs with clients before or during sex compared to non-current users. Since our study instrument did not specifically inquire about use of *agua celeste* use with clients, we are likely under-

estimating the prevalence of its use in the context of sexual transactions. Our findings do suggest, however, that recent *agua celeste* users are more likely to be ‘high’ during their sexual transactions. This could compromise their ability to negotiate condom use or have control over other circumstances in the context of sexual transactions, possibly increasing the potential for exposure to HIV/STIs or violence.

Limitations of our analysis include a cross sectional analysis that limits our ability to draw causal inferences or clearly establish temporality. Self-reported data may also be subject to recall and social desirability bias. We lacked detail on some critical measures pertaining to *agua celeste* use (e.g. reasons for use, social context of use, etc.), which reduced our ability to examine factors that motivated initial and continued use. Since the study sample was recruited into a behavioral intervention study designed to reduce injection and sexual risk behaviors among FSW-IDUs, we may have over-estimated the prevalence of *agua celeste* use in this highly marginalized population. However, since our study excluded women below age 18, we may have under-estimated the prevalence of recent *agua celeste* use, since it is reportedly common among youth (Chacon, 2007).

While this descriptive study offers information about *agua celeste* users in Ciudad Juarez, we lacked information about the composition of the drug, routes of administration, and immediate short and long term health effects. Anecdotal information on *agua celeste* suggests that the drug can be made from a variety of volatile organic substances. The toxic substances that comprise *agua celeste* and the repetitive exposure to the substance could place users at high risk of both acute and long term health effects including damage to the central nervous system, respiratory arrest, cancer, and even death (Lolin, 1989; Meadows and Verghese, 1996; National Toxicology Program, 2010). Ethnographic and epidemiological studies are needed to better understand the contents of the drug and the motivations and social context surrounding initial, recent, and continued use of the drug. These studies will help inform potential avenues for prevention and treatment.

Our findings build on previous literature showing that inhalant use is an important risk factor for subsequent injection drug use. The majority of epidemiologic studies group all inhalants together when estimating prevalence of use, or include inhalants in a wider group of illegal drugs, thus biasing prevalence estimates and preventing a more nuanced understanding of the role of specific inhalants in individuals’ drug use trajectories. To our knowledge, this is the first community-based study to estimate *agua celeste* use and describe correlates of its use. Although findings cannot be generalized to other populations, the widespread use of *agua celeste* among FSW-IDUs in Ciudad Juarez is concerning. In a population already experiencing elevated risk for STIs, HIV and other blood borne pathogens and high exposure to violence, the use of *agua celeste* may pose yet an additional danger.

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Table 1

Characteristics of Ever Using *Agua Celeste* Among Female Sex Workers Who Inject Drugs in Ciudad Juarez, Mexico (N=316)

	Ever used <i>Agua Celeste</i> N=166	Never used <i>Agua Celeste</i> N=150		Univariate Odds Ratio (95% confidence interval)
	N (%)	N (%)	p-value	
<i>Sociodemographic characteristics</i>				
Median age at time of interview (IQR)	31 (25–36)	35 (30–41)	0.0002	0.95 (0.93–0.97)
Ever married	82 (49)	78 (52)	0.6440	0.90 (0.62–1.31)
Has at least one child	153 (92)	142 (94)	0.3733	0.663 (0.31–1.42)
Median number of children (IQR)	3 (2–4)	3 (2–4)	0.2207	0.92 (0.82–1.03)
Mexican region of birth				
Northern States ^a	36 (23)	30 (21)	0.7270	0.69 (0.37–1.33)
Baja California	0	1 (<1)	__ ^b	--
Chihuahua	113 (71)	104 (73)	0.6853	1.31 (0.75–2.29)
Central States	6 (4)	6 (4)	0.8512	1.35 (0.34–5.33)
Southern States	4 (3)	1 (<1)	0.4839	1.38 (0.26–7.31)
Ever traveled to U.S.	70 (42)	81 (54)	0.0355	0.62 (0.43–0.90)
Sexual orientation (heterosexual)	142 (86)	135 (90)	0.2289	0.66 (0.37–1.2)
Completed more than primary school	53 (32)	59 (39)	0.1693	0.72 (0.49–1.07)
Ever been arrested	141 (85)	115 (77)	0.0610	1.71 (1.07–2.77)
HIV prevalence	33 (5)	30 (5)	0.8099	0.88 (0.32–2.42)
Active syphilis ^c	20 (13)	14 (10)	0.4210	1.34 (0.65–2.78)
Chlamydia	28 (17)	17 (12)	0.2001	1.53 (0.79–2.92)
Gonorrhea	5 (3)	3 (2)	0.6249	1.43 (0.34–6.11)
<i>Past Drug Use Behaviors</i>				
Median age began injecting drugs (IQR)	18 (16–23)	22 (17–30)	<0.0001	0.94 (0.92–0.96)
Median years injecting drugs (IQR)	10 (4–17)	10 (3–16)	0.5348	1.01 (0.99–1.03)
Began injecting drugs at 18 years or before	88(53)	48 (32)	0.0002	2.40 (1.63–3.52)
Ever used heroin (non-injection)	85 (51)	53 (35)	0.0045	1.92 (1.31–2.81)
Ever used methamphetamine (non-injection)	36 (22)	11 (7)	0.0003	3.50 (1.92–6.40)
Ever used cocaine (non-injection)	122 (73)	96 (64)	0.0685	1.56 (1.04–2.33)
Ever used marijuana	166 (88)	109 (73)	0.0006	2.75 (1.67–4.50)
Ever been in drug treatment	108 (65)	81 (54)	0.0452	1.59 (1.09–2.31)
<i>Past Sexual Behaviors</i>				
Median age first sold sex for money, goods, food, housing (IQR)	17 (15–20)	20 (17–28)	<0.0001	0.90 (0.87–0.93)
Median age began selling sex regularly (IQR)	18 (15–20)	20 (17–29)	<0.0001	0.90 (0.88–0.93)
Median number of years trading sex regularly (IQR)	12 (6–19)	12 (6–17)	0.5022	1.01 (0.99–1.03)
Began selling sex regularly at 18 years old or before	98 (59)	55 (36)	<0.0001	2.49 (1.70–3.64)
<i>History of Abuse</i>				
Ever been raped	109 (66)	84 (56)	0.0785	1.50 (1.03–2.20)

	Ever used <i>Agua Celeste</i> N=166 N (%)	Never used <i>Agua Celeste</i> N=150 N (%)	p-value	Univariate Odds Ratio (95% confidence interval)
Median age first time raped (IQR)	15 (11–20)	16 (11.5–23)	0.1874	0.09 (0.95–1.01)
Ever been physically abused	119 (72)	82 (54)	0.0017	2.1 (1.42–3.11)
Median age first time physically abused (IQR)	18 (16–25)	19 (16–26)	0.4415	0.98 (0.96–1.02)
Physical or sexual abuse preceded first <i>agua celeste</i> use ^d	137 (83)	--	--	--

Median (interquartile range [IQR]) reported for continuous variables **Bold** indicates p-values <0.10

^a Northern states excluding Baja and Chihuahua

^b p-value not estimated due to zero cell counts

^c active syphilis defined as $\geq 1:8$ titer at baseline

^d Among those who reported ever using *agua celeste*, age of first physical or sexual assault/abuse act was younger than first reported use of *agua celeste*

Table 2

Factors Independently Associated with Ever Using *Agua Celeste* Among Female Sex Workers Who Inject Drugs in Ciudad Juarez, Mexico (N=316)

<i>Characteristic</i>	<i>AOR^a</i>	<i>95%CI</i>
Began injecting drugs at 18 years or younger	1.73	0.99–3.03
Began regular sex work at 18 years old or younger	1.55	0.99–2.72
Ever been physically abused	2.03	1.25–3.31
Age at time of interview (per 1-year increase)	0.97	0.94–0.99

^a Adjusted for all other variable in the model (alpha=0.05)

Table 3

Characteristics of Recent^a *Agua Celeste* Use Among Female Sex Workers Who Inject Drugs in Ciudad Juarez, Mexico (N=166)

	Recent <i>Agua Celeste</i> use (N=70)	No recent <i>Agua Celeste</i> use (N=96)	p-value	Univariate Odds Ratio (95% confidence interval)
<i>Sociodemographic characteristics</i>				
Median age at time of interview (IQR)	30.5 (23–35)	31 (26–38)	0.0633	0.96 (0.93–0.99)
Type of sex worker				
Street worker	61 (87)	94 (98)	0.0147	--
Professional brothel worker	3 (4)	1 (1)	--*	--
Other ^b	6 (1)	1 (<1)	--*	--
Income in past month is greater than 3500 pesos	42 (60)	55 (57)	0.7266	1.12 (0.66–1.89)
Median number of hours on street per day (IQR)	12 (8–15)	8.5 (7–12)	0.0101	1.09 (1.03–1.16)
On street more than 8 hours per day	51 (73)	48 (50)	0.0030	2.68 (1.54–4.68)
Homeless ^c in past month	4 (6)	5 (5)	0.8870	1.10 (0.36–3.43)
Live and work at same location ^d	24 (34)	18 (19)	0.0230	2.61 (1.24–4.11)
Spouse or steady partner	27 (39)	41 (43)	0.5925	0.84 (0.50–1.43)
<i>Recent drug use behaviors</i>				
Injected more than one time per day in past month	65 (93)	83 (86)	0.1904	2.04 (0.69–6.0)
Injection drug use in past month:				
Heroin	54 (77)	82 (85)	0.2238	--
Cocaine	0 (0)	3 (<1)	--*	--
Speedball	14 (20)	11 (11)	0.1846	--
Non-injection drug use in past month:				
Marijuana	29 (42)	32 (33)	0.2854	1.42 (0.83–2.42)
Inhalants ^e	15 (37)	0 (0)	--*	--
Non-injection cocaine	34 (51)	44 (46)	0.5783	1.19 (0.71–2.02)
Non-injection methamphetamine	4 (6)	0 (0)	--*	--
Non-injection heroin	21 (30)	9 (9)	0.0006	4.14 (2.02–8.50)
Somewhat or very difficult to get drugs in past month	39 (56)	55 (57)	0.8395	0.94 (0.56–1.58)
Someone else has bought drugs for them in past month	19 (27)	21 (22)	0.4332	1.33 (0.73–2.43)
Substance use with client before or during sex in past month:				
Alcohol use	48 (69)	61 (64)	0.5003	1.25 (0.72–2.17)
Drug use	51 (73)	54 (56)	0.0284	2.09 (1.20–3.64)
Injection drug use	15 (21)	18 (19)	0.6694	1.18 (0.62–2.25)
<i>Recent Sexual behaviors</i>				
Always used condoms with clients in past month	5 (7)	3 (3)	0.7838	0.81 (0.19–3.57)
Forced to have sex against will by client in past month	11 (16)	13 (14)	0.0831	1.19 (0.57–2.47)

Median (interquartile range [IQR]) reported for continuous variables

Bold indicates p-values <0.10

*
p-value not estimated due to zero cell counts

^a Past six-months

^b dance hostess, barmaid, taxi girl, professional brothel worker, call girl, companion

^c Slept most often in abandoned building, shelter, street, or shooting gallery in past month

^d Lives and works in the same location (e.g., some women live in the back of the bar where they work)

^e due to missing values N=77

Table 4

Factors Independently Associated with Recent^a *Agua Celeste* Use Among Female Sex Workers Who Inject Drugs in Ciudad Juarez, Mexico (N=166)

<i>Characteristic</i>	AOR^b	95% CI
Use drugs often or always with client before or during sex	2.08	1.04–4.15
On street for more than an average of 8 hours a day	2.70	1.36–5.33
Age at time of interview		
18 to 25 years	3.00	1.02–8.86
26–39 years	2.03	0.75–5.51
40 years and older	1	--

^aPast six-months

^bAdjusted for all other variable in the model (alpha=0.05)