



# Syndemic Profiles for HIV, Hepatitis C, and Sexually Transmitted Infections Among Mexican American Women Formerly Affiliated with Youth Street Gangs

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## Abstract

We examine syndemic profiles of intimate partner violence, mental health, drug use, incarceration, and infectious diseases (HIV, HCV, and STIs) among a sample of adult Mexican American women who were affiliated with youth street gangs during adolescence through their relationships to boys and men. Latent class analysis included multiple factors along the following dimensions: intimate partner violence, drug use, mental illness, and incarceration. Five unique syndemic profiles were found with varying associations to HIV, HCV, and STI: (1) no syndemic, (2) intimate partner violence, no syndemic, (3) drug use, mental health, and incarceration syndemic, (4) intimate partner violence, drug use (without injection drug use), and mental health syndemic, and (5) intimate partner violence, drug use with injection drug use, mental health, and incarceration syndemic. To successfully prevent HIV, HCV, and STI among gang-involved girls and women, it is necessary to address syndemic factors.

**Keywords** HIV · Sexually transmitted infections · HCV · Syndemic · Women · Violence

## Introduction

Poverty and economic marginality, along with racial/ethnic marginality, in the United States during the last few decades has led to despair and the proliferation of youth street gangs in many minoritized communities [1–7]. A plethora of research has documented the link between youth gang membership and multiple health risks, including drug use and misuse [8, 9], interpersonal violence, injury, and mortality [10–13], and risky sexual behavior (e.g., non-condom use) [14–17]. Research also consistently shows that male youth street gangs are hyper masculine in structure, status hierarchies, and activities, and, like other male-dominated settings (e.g., fraternities, military), they are important for shaping peer gender dynamics [18–20]. Relatively little attention,

however, has been focused on girls (e.g., adolescent and pre-adolescent) association with male street gangs and the long-term health consequences for this population. An estimated one-quarter to one-third of all youth street gang members in the United States are girls [21]. More commonly, girls become affiliated with street gangs through their everyday association with boys and men (e.g., boyfriends, brothers, cousins) [21, 22]. The gender dynamics of gangs place girls at high risk for gendered violent victimization, such as physical assault with injury and sexual assault victimization [22–28]. How is this context of violence associated with HIV-related risk for girls and women?

There are two theoretical perspectives that can help answer this question: syndemic theory and feminist pathways theory. For women in the United States, interpersonal violence is closely associated with substance use and misuse, poor mental health, and HIV risk; they are closely entwined and mutually exacerbating health problems forming a health syndemic [29]. Feminist pathways theory asserts that female criminality is largely survival-based and tied to a constellation of factors including experiencing trauma and living in poverty, and therefore experiencing interpersonal violence is a common pathway to incarceration for women [30]. Similarly, being affiliated with youth street gangs is a

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pathway into early delinquency and criminality. Incarceration and cycling between the community and criminal justice system leads to profound destabilization [31] compounded by poverty, housing insecurity, racism, and other structural inequalities [32] all placing women at higher HIV risk. Recently released women are at high risk for HIV for many reasons. Many recently released women report competing priorities following release from confinement, including health, housing, employment, and children [33]. Yet, release from prison and jail is characterized by poor transitional care within the context of high emotional distress [34]. Subsequently, many HIV negative people engage in high-risk substance use and sexual behaviors putting them at high risk of HIV acquisition.

We argue that given the overwhelming potential for incarceration to exacerbate health issues, and given that women who experience interpersonal violence, drug use and misuse, poor mental health, and HIV risk are overrepresented in U.S. jails and prisons, the syndemic model should be extended to consider histories of criminal justice involvement, especially for the growing population of women who were affiliated with street gangs during adolescence given that gang involvement is underappreciated in HIV research. Thus, the goal of this paper is to apply and extend the syndemic framework in consideration of the feminist pathways theory, and recent scholarship conceptualizing incarceration as a structural risk factor for poor health, to examine syndemic profiles of intimate partner violence, mental health, drug use, incarceration, and infectious diseases (HIV, HCV, and STIs) among a sample of adult Mexican American women who were affiliated with youth street gangs during adolescence through their relationships to boys and men.

## Conceptual Overview

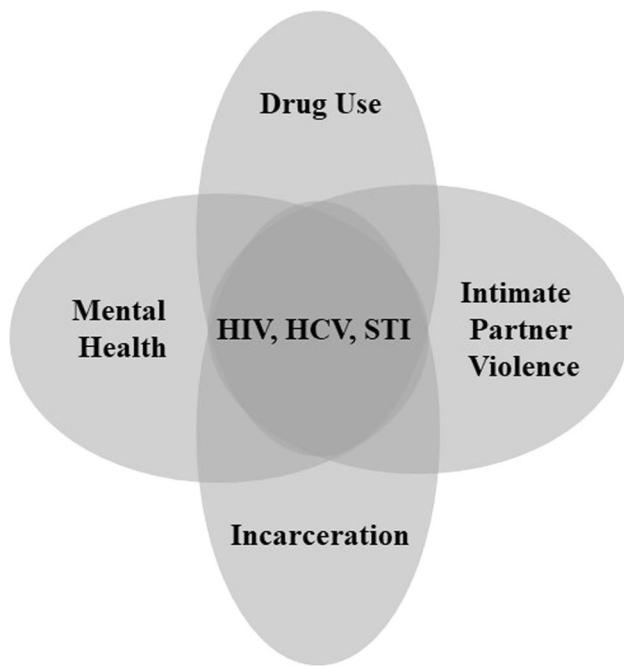
The syndemic model of health is a biosocial approach to health that examines why certain diseases cluster and the ways in which social environments contribute to disease clustering [29]. Originally conceptualized as the “SAVA syndemic,” Singer [35, 36] argued that substance abuse, violence, and HIV/AIDS (SAVA) were closely entwined and mutually exacerbating health problems among women. Indeed, a plethora of research has documented the interrelatedness of substance misuse, violence, poor mental health, and HIV for women. For example, among women attending a family justice center, a history of sexual assault was associated with higher odds of acquiring HIV/STIs in the past year [37]. Recent intimate partner violence is associated with greater odds of ever having an STI [38] and HIV [39]. Poor mental health and substance use are also common outcomes associated with intimate partner violence, including

low self-esteem, depression, suicidality, PTSD, and misuse of tobacco, alcohol, or drugs [40, 41].

For women, experiencing interpersonal violence is a common pathway to incarceration [30], as women’s responses to trauma are often criminalized (e.g., running away from home, homelessness, drug use, survival crimes) [31]. Similarly, although girls join gangs for many of the same reasons as boys, girls are more likely to be seeking safety from emotionally, physically, and sexually abusive homes [21]. Women who are involved in the criminal justice system report extensive histories of sexual and physical violence with consequent mental health and substance use problems [42, 43]. A study of women in jail found that experiencing intimate partner violence victimization increased women’s risks for engaging in criminalized behaviors including property crimes, drug offending, and sex work [44]. Witnessing caregiver violence was also associated with running away as a teenager, which is a status offense.

Overall, people involved with the criminal legal system have a rate of HIV that is three times that of the general population, and an estimated one in seven people infected with HIV passes through the criminal legal system in any given year [45, 46]. An estimated one-in-four people in prison and jail are HCV-positive [47]. Psychiatric and substance use disorders are highly prevalent among people with HIV, HCV, and STIs. For example, within an urban HIV clinic population, Shacham et al. [48] found high levels of alcohol and cocaine/crack dependence, major depressive disorder, and generalized anxiety. Fifty-one percent of women attending an HIV clinic experienced psychological, physical, and/or sexual intimate partner violence in the past year, and violence was associated with having a low CD4+ count and a detectable viral load [49]. Critically, incarceration is increasingly being recognized as an important structural factor that shapes race/ethnic disparities in the United States [50, 51]. For Latino groups, there are additional threats to personal wellbeing due to increasing “cimmigration” [52]. In the United States, Latino people simultaneously occupy multiple racialized legal statuses, which increases their chances for involvement with the criminal legal system [53]. For Latinas, gendered expectations surrounding motherhood contribute to additional stigma, which has detrimental consequences for women who use drugs, affiliate with criminal groups, or become involved with the criminal legal system [22, 54].

Following recent studies applying the syndemic health model [55–58], we use latent class analysis to identify unique combinations of risk factors that may form a syndemic among our sample of adult Mexican American women who were affiliated with youth street gangs during adolescence. Multiple factors are included along the following dimensions: intimate partner violence, drug use, mental illness, incarceration, and infectious diseases (Fig. 1). Latent class analysis (LCA) allows for the identification of unique



**Fig. 1** Syndemic model for HIV, HCV, and STIs among adult Latina women who were affiliated with street gangs during adolescence

combinations of syndemic risk factors. Traditionally, the most common methodology employed in assessing syndemics is the use of cumulative indices, which count the number of factors present assuming a unidimensional syndemic and that each factor has an equivalent impact [59, 60]. Our goal is to document clusters or patterns of risk for HIV, HCV, and STI among former gang-involved women.

## Methods

The San Antonio Latina Trajectory Outcomes (SALTO) study is a longitudinal community-based study examining the long-term health outcomes of drug use and intimate partner violence among a cohort of Mexican American women that were originally recruited and interviewed as adolescents between 1999 and 2001 [18, 22, 61–66]. Eligibility criteria for Proyecto SALTO and the original study included being a Mexican American female, being aged 14–18 at the time of the original study, and being associated with one of 27 male street gangs from the catchment area [67, 68]. The San Antonio population is more than 1 million, of which more than 50% is of Mexican descent. San Antonio is among the top 10 cities with the largest number of people living in distressed zip codes and it has the highest level of spatial inequality between zip codes [69]. The most distressed zip code was the site for the current study. Girls were recruited due to their affiliation with male youth gang members, as friends, partners, and or relatives.

The follow up study (collected March 2016–May 2020) employed a concurrent mixed-method (CMM) nested longitudinal cohort design, including the collection of biological, survey, and qualitative data. Data from the original sample collected over 15 years ago served as Time 1 (adolescence); Time 2 was collected using the Natural History Interview (NHI) technique [70, 71] covering the 15-year retrospective period; and current (cross-sectional) data at the time of the most recent interview served as Time 3. All study protocols were approved by the University Institutional Review Board at University of Southern California and informed written consent was obtained from all participants included in this study.

The final sample size is 225 women. Eight cases were removed from the current analysis due to missing data for a final sample size of 217. It should be noted that while the total sample consists of 225 women, biological specimens were not collected for 49 women. Of these women, 10 had collapsed veins and blood was not able to be drawn, 3 were pregnant and were advised not to complete the blood draw, 17 refused to consent to laboratory testing, 7 partially completed their interview (without laboratory) and refused or were unable to reschedule their laboratory appointment to complete specimen collection, and 12 interviews were completed after March 2020, at which time the research team did not have permission to collect biological specimens due to the COVID-19 pandemic.

## Measures

### Intimate Partner Violence Dimension

Intimate partner violence (IPV) was assessed using the Revised Conflict Tactics Scale victimization items referring to any violence within their lifetime [72]. Prevalence for the five subscales were reported: negotiation ( $\alpha=0.85$ ), psychological aggression ( $\alpha=0.76$ ), physical assault ( $\alpha=0.81$ ), sexual coercion ( $\alpha=0.76$ ), and injury ( $\alpha=0.84$ ).

### Drug Use Dimension

Current poly drug use was assessed as use of at least two of the following substances in the past 30-days: marijuana, methamphetamines, cocaine/crack, and heroin. Lifetime problematic use of marijuana ( $\alpha=0.85$ ), cocaine ( $\alpha=0.85$ ), methamphetamines ( $\alpha=0.85$ ), and opioids ( $\alpha=0.85$ ) was measured using the 5-item substance dependence severity scale (SDS) [73]. For this summative scale, a score of 3+ indicates a likely diagnosis of substance dependence according to the DSM. However, we used more conservative cut-off scores as suggested by other researchers: a score of 4+ for marijuana [74], 3+ for cocaine [75], 4+ for

methamphetamine [76], and 5+ for opioids [77]. A binary measure of lifetime injection drug use (no/yes) was also included.

### Mental Health Dimension

Depression was measured using the eight-item version [78] of the Center for Epidemiological Studies Depression Scale (CES-D), which measures depressive symptomatology, not a clinical diagnosis of depression [79] ( $\alpha=0.92$ ). PTSD was measured using the PTSD Checklist—Civilian Version (PCL-C) [80, 81], a 17-item scale of self-reported PTSD symptoms based on DSM-IV criteria ( $\alpha=0.95$ ). Unlike other versions of the PCL, the PCL-C measures symptoms in relation to “stressful experiences” to account for multiple traumas, to be used by any population [82, 83]. Psychological distress was measured using the 28-item version of the General Health Questionnaire (GHQ-28) [84]. An overall symptom score for psychological distress was included ( $\alpha=0.92$ ).

### Incarceration Dimension

Total years of incarceration was calculated as the total time spent imprisoned across incarceration episodes (up to 10 episodes lasting 30 days or longer) as reported during an incarceration history questionnaire. This measure represented total lifetime exposure to jail and prison conditions. The total number of incarceration episodes lasting 30 days or longer was also included (0 episodes, 1 episode, 2 or more episodes) as well as a bivariate measure of lifetime incarceration.

### Infectious Diseases

Biological specimens were testing using HSV-2 type-specific IgG antibody test with an index ratio  $> 0.9$  (HerpeSelect HSV-2 ELISA, Focus Technologies, Cypress, CA); Human Immunodeficiency Virus (HIV) 1/O/2 (HIV-1/O/2) antigen/antibody test with cascade reflex to supplementary testing; hepatitis C (HCV) antibody assays using Abbott HCV EIA 3.0 procedure for encoded antigens (recombinant c100-3, HC-31, and HC-34) confirmed by RIBA; and a PCR (Polymerase Chain Reaction) test technique for molecular detection of the bacterial DNA using 10 ml of urine for *Neisseria gonorrhoea* (NG) and *Chlamydia trachomatis* (CT) screening.

### Analysis

We use a person-oriented approach as suggested by Nurius and Macy [85] who specify that “person-oriented analytic tools help ascertain whether there are common types of patterned interrelationships that constitute an empirical

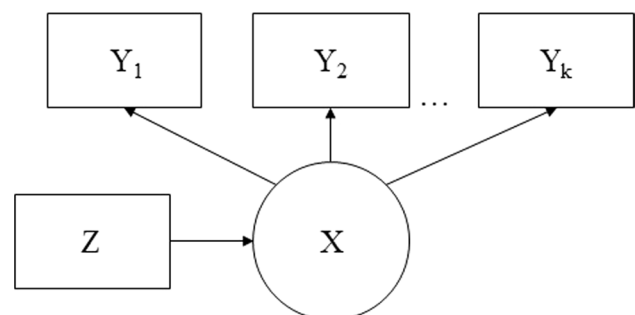
**Table 1** Model fit statistics for latent class analysis

Model	Obs	Log likelihood	df	AIC	BIC
2 Classes	217	- 5139.1	45	10,368.1	10,520.2
3 Classes	217	- 4928.1	66	9988.1	10,211.2
4 Classes	217	- 4789.7	88	9755.4	10,052.8
5 Classes	217	- 4708.1	108	9632.3	9997.3
6 Classes	217	- 4652.5	120	9544.9	9950.5

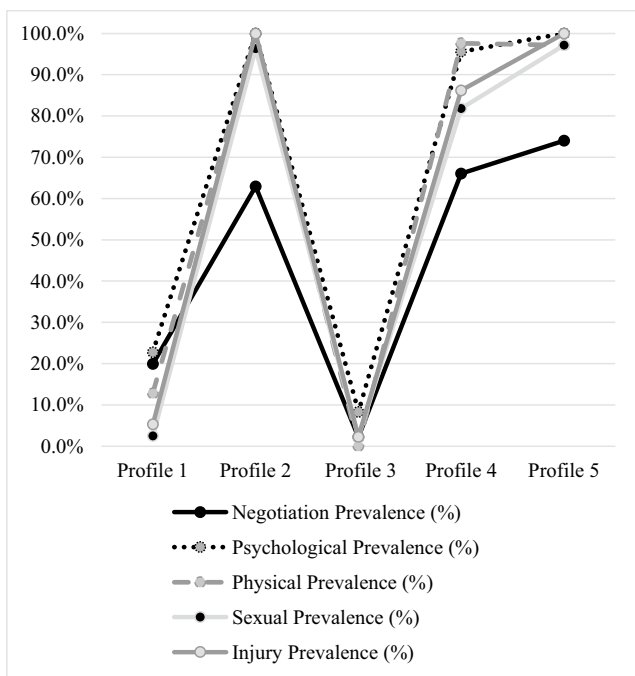
structure of heterogeneity; that is, clusters of theoretically meaningful characteristics that are shared within subgroups and that distinguish subgroups from one another” (p. 393). LCA models were estimated using generalized structural equation modeling (GSEM) (Fig. 2) in Stata 15 [86]. GSEM can fit multiple family and link options (e.g., logit, mlogit, Poisson, etc.) simultaneously. The model for the currently analysis included binary (logit), ordinal (ologit), and continuous (Gaussian) factors. Models randomly assigned observations to initial classes using 15 draws, set seed value, and 5 EM iterations. Models with two through five classes were estimated and compared, and the optimal model was selected based on likelihood ratios and information criteria (e.g., Akaike Information Criterion and Bayesian Information Criterion), which compared relative fit of competing models with penalties for complexity. Age and highest year of education were included as control covariates and were assessed using multinomial logistic regression. We estimated the probabilities of class membership and the estimated mean for each item in each class. Finally, latent class membership was used to predict the binary outcomes for HIV, HCV, and STIs. Chi-square and one-way ANOVA were used to test for significant associations among the classes.

### Results

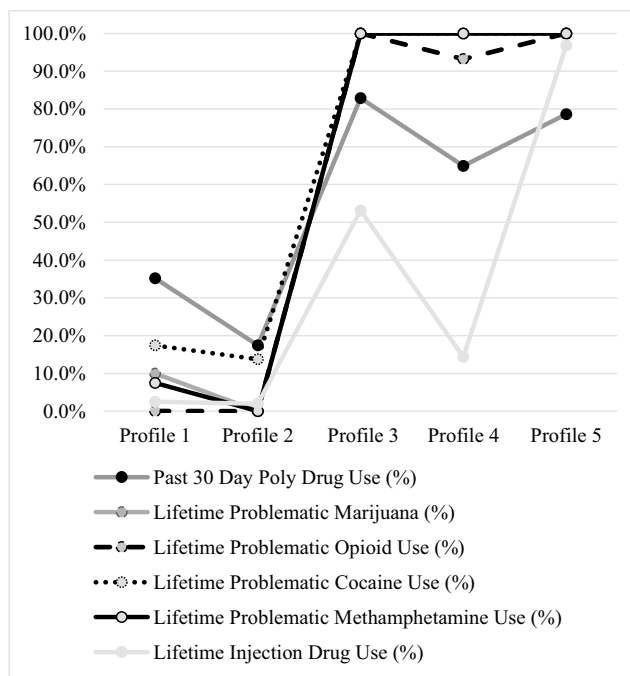
Women reported an average age of 33.1 years, and all identified as Mexican American. Approximately 48% were employed full or part-time, with an average 11.1 years of



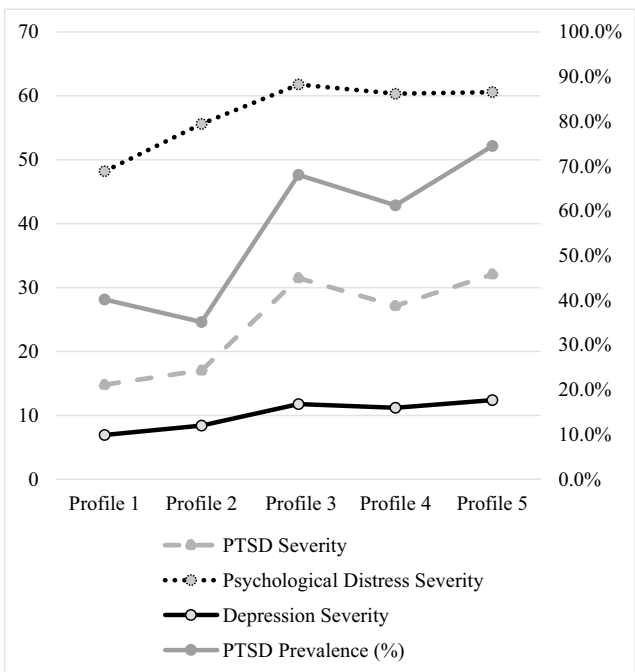
**Fig. 2** Analytic model for latent class analysis. Note: X=latent classes; Y=observed items; Z=covariates



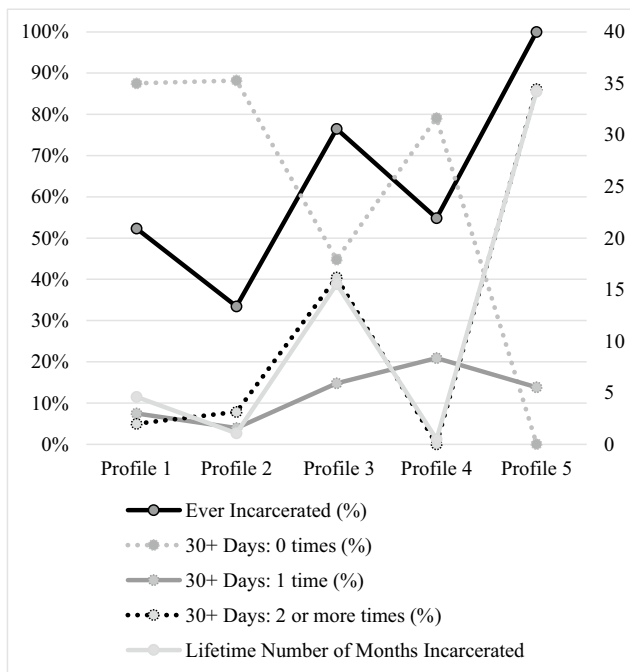
Panel A: Intimate Partner Violence Dimensions



Panel B: Drug Use Dimensions



Panel C: Mental Health Dimensions



Panel D: Incarceration Dimensions

**Fig. 3** Item-response probabilities across syndemic domains. Note: Profile 1: “no syndemic”; Profile 2: “intimate partner violence, no syndemic”; Profile 3: “drug use, mental health, incarceration syndemic”; Profile 4: “intimate partner violence, drug use (without injection drug use), and mental health syndemic”; Profile 5: “intimate partner violence, drug use with injection drug use, mental health, and incarceration syndemic”

education. Almost all women (94%) had at least one child, with an average of 3.3 children per participant. Forty-six percent were married or living with a stable partner.

We found a five-class solution based on fit indices (Table 1) and interpretability of the profiles (Table 2). While the six-class solution has better fit indices, the sample size

**Table 2** Five syndemic classes among Mexican American who were affiliated with street gangs during adolescence: class prevalence and item-response probabilities (N = 217)

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	$\chi^2/F$	p
	18%	24%	22%	20%	16%		
	(n = 40)	(n = 51)	(n = 47)	(n = 44)	(n = 35)		
<b>Intimate partner violence dimensions</b>							
Negotiation prevalence <sup>a</sup>	20.0%	<b>62.9%</b>	2.2%	<b>66.1%</b>	<b>74.0%</b>	71.58	<0.001
Psychological prevalence <sup>a</sup>	22.8%	<b>100.0%</b>	8.3%	<b>95.6%</b>	<b>100.0%</b>	161.88	<0.001
Physical prevalence <sup>a</sup>	12.8%	<b>100.0%</b>	0.0%	<b>97.6%</b>	<b>97.1%</b>	190.35	<0.001
Sexual prevalence <sup>a</sup>	2.5%	<b>96.3%</b>	2.1%	<b>81.8%</b>	<b>97.1%</b>	170.82	<0.001
Injury prevalence <sup>a</sup>	5.3%	<b>100.0%</b>	2.2%	<b>86.2%</b>	<b>100.0%</b>	183.79	<0.001
<b>Drug use dimensions</b>							
Past 30-day poly drug use <sup>a</sup>	35.2%	17.4%	<b>82.9%</b>	<b>64.9%</b>	<b>78.6%</b>	60.07	<0.001
Lifetime problematic marijuana <sup>a</sup>	10.0%	0.0%	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	202.01	<0.001
Lifetime problematic opioid use <sup>a</sup>	0.0%	0.0%	<b>100.0%</b>	<b>93.2%</b>	<b>100.0%</b>	205.61	<0.001
Lifetime problematic cocaine use <sup>a</sup>	17.4%	13.8%	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	165.39	<0.001
Lifetime problematic methamphetamine use <sup>a</sup>	7.5%	0.0%	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	205.49	<0.001
Lifetime injection drug use <sup>a</sup>	2.5%	2.0%	<b>53.1%</b>	14.4%	<b>96.8%</b>	124.18	<0.001
<b>Mental health dimensions</b>							
PTSD prevalence <sup>a</sup>	40.2%	35.1%	<b>68.0%</b>	<b>61.3%</b>	<b>74.5%</b>	20.85	<0.001
PTSD severity <sup>b</sup>	14.8	17.0	<b>31.5</b>	<b>27.1</b>	<b>32.1</b>	26.6	<0.001
Psychological distress severity <sup>b</sup>	48.2	55.6	<b>61.8</b>	<b>60.3</b>	<b>60.6</b>	17.7	<0.001
Depression severity <sup>b</sup>	6.9	8.4	<b>11.8</b>	<b>11.2</b>	<b>12.4</b>	16.6	<0.001
<b>Incarceration dimensions</b>							
Ever incarcerated <sup>a</sup>	52.3%	33.4%	<b>76.5%</b>	54.9%	<b>100.0%</b>	45.69	<0.001
Incarcerated for 30+ days at a time <sup>a</sup>						120.56	<0.001
0 times	<b>87.5%</b>	<b>88.2%</b>	44.8%	<b>79.1%</b>	0.0%		
1 time	7.5%	3.9%	<b>14.8%</b>	<b>20.9%</b>	13.8%		
2 or more times	5.0%	7.9%	<b>40.5%</b>	0.0%	<b>86.1%</b>		
Lifetime number of months incarcerated <sup>b</sup>	<b>4.6</b>	1.1	<b>15.5</b>	0.5	<b>34.2</b>	8.64	<0.001

Higher response probabilities within each item marked in bold to facilitate interpretation. Numbers of individuals in each class are based on the maximum posterior probability of membership controlling for age and education

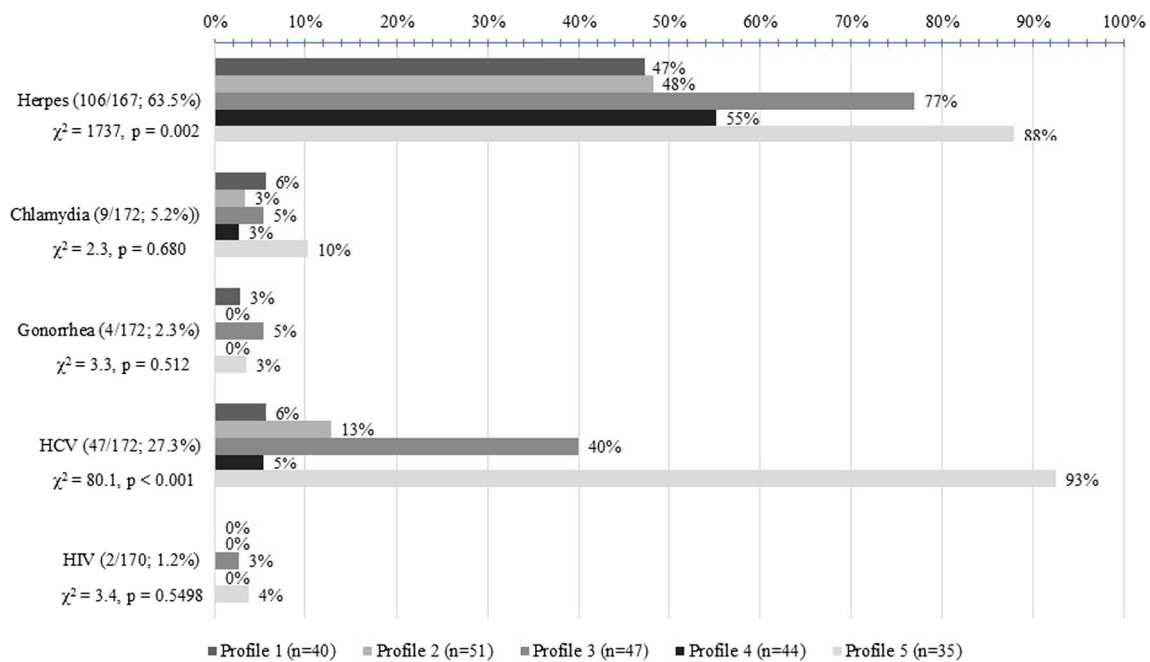
Profile 1: “no syndemic”; Profile 2: “intimate partner violence, no syndemic”; Profile 3: “drug use, mental health, incarceration syndemic”; Profile 4: “intimate partner violence, drug use (without injection drug use), and mental health syndemic”; Profile 5: “intimate partner violence, drug use with injection drug use, mental health, and incarceration syndemic”

<sup>a</sup>Chi-square test

<sup>b</sup>Oneway ANOVA

for two of the classes were small (< 10%) and hindered interpretability. Profile 1 represented 18% of women (n = 40) and was characterized as “No Syndemic.” Relative to the other profiles, the women in this profile had lower reporting across all dimensions. Profile 2 was characterized as “Intimate Partner Violence, No Syndemic” and was the largest (24%, n = 51). While women in this profile reported near 100% rates for psychological, physical, sexual, and injury related intimate partner violence, they reported relatively low levels across the drug use, mental health, and incarceration items. Profile 3 was characterized as “Drug Use, Mental Health, and Incarceration Syndemic” (20%, n = 44). This profile was essentially the mirror opposite of Profile 2.

Women in this group reported the lowest rates of intimate partner violence, yet among the highest rates for the items in the drug use, mental health, and incarceration dimensions. Profile 4 was characterized as the “Intimate Partner Violence, Drug Use (without Injection Drug Use), and Mental Health Syndemic” (20%, n = 44). Like Profile 2, the women in this group had near 100% rates of psychological, physical, sexual, and injury related partner violence with syndemic drug use, except injection drug use, and mental illness. The final profile, Profile 5, was characterized as “Intimate Partner Violence, Drug Use with Injection Drug Use, Mental Health, and Incarceration Syndemic” (16%, n = 35), representing the



**Fig. 4** Prevalence of infectious diseases by latent class. Note: Profile 1: “no syndemic”; Profile 2: “intimate partner violence, no syndemic”; Profile 3: “drug use, mental health, incarceration syndemic”; Profile 4: “intimate partner violence, drug use (without injection drug

use), and mental health syndemic”; Profile 5: “intimate partner violence, drug use with injection drug use, mental health, and incarceration syndemic”

theoretical model in Fig. 2 and hypothesized to be at the highest risk for HIV, HCV, and STI.

Figure 3 shows the variation in the items for each dimension across profiles. Panel A shows that different types of intimate partner violence tend to cluster together. In profiles 2, 4, and 5, at or near 100% of women experienced physical assault, psychological aggression, sexual coercion, and injury by an intimate partner. Negotiation was lower for all three profiles, around 65%. Among profiles 1 and 3, psychological aggression was highest (22.8% and 8.3%, respectively) and sexual coercion was lowest (2.5% and 2.1%, respectively). There was substantive variation in drug use items (Fig. 3, Panel B). The lifetime problematic drug use items grouped together so that profiles were either at or near 100% (profiles 3, 4, and 5) or at or near 0% (profiles 1 and 2). Recent poly drug use in the past 30 days was less variable. Profiles 3, 4, and 5 reported 82.9, 64.9%, and 78.6%, respectively, suggesting that some women in these profiles have stopped use despite lifetime problematic use. Almost 40% of women in Profile 1 (35.2%) and 20% of women in profile 2 (17.4%) reported recent poly drug use, rates higher than reported lifetime problematic use, suggesting a level of controlled (“unproblematic”) use. Items in the mental health dimension (Fig. 3, Panel C) appeared to form flatter lines across profiles. However, PTSD symptom severity for Profile 5 was more than double that of Profile 1 (32.1 vs. 14.8). This was the case for depressive symptomatology as

well. The prevalence of PTSD for all profiles is far greater than the national average (< 10%). Incarceration levels were relatively extreme for profiles 3 and 5 (Fig. 3, Panel D). Over 75% of women in Profile 3 have been incarcerated overnight at least once in their lifetime compared to 100% for Profile 5. Over half of women in Profile 3 have been confined for 30 days or longer at a time. All the women in Profile 5 have been incarcerated for more than 30 consecutive days, with 86.1% serving multiple 30+ day stints. This was reflected in the average number of months incarcerated over the lifespan: 15.5 months for Profile 3 and 34.2 months for Profile 5. It should be noted that, overall, lifetime incarceration was high for this sample of women with rates across profiles ranging from 33.4 to 100%.

Rates of HIV, HCV, and STIs were high overall compared to national estimates for Latinas [87] (Fig. 4), with the following sample prevalence rates: 63.5% herpes (n = 106), 5.2% chlamydia (n = 9), 2.3% gonorrhea (n = 4), 27.3% HCV (n = 47), and 1.2% HIV (n = 2) (note: 5 herpes test results were inconclusive, and 2 HIV tests were inconclusive). Profile 5 had the highest prevalence for all infectious disease outcomes, except for gonorrhea, with 88% testing positive for herpes, 10% for chlamydia, 3% gonorrhea, 93% HCV, and 4% HIV. Profile 3 had the next highest rates, notably 77% herpes prevalence and 40% HCV prevalence.

## Discussion

Five unique syndemic profiles along the dimensions of intimate partner violence, drug use, mental health, incarceration, and infectious diseases were found among adult Mexican American women who affiliated with youth street gangs during adolescence: (1) no syndemic, (2) intimate partner violence, no syndemic, (3) drug use, mental health, and incarceration syndemic, (4) intimate partner violence, drug use (without injection drug use), and mental health syndemic, and (5) intimate partner violence, drug use with injection drug use, mental health, and incarceration syndemic. The women in Profile 5 accounted for 16% of the sample and represented the syndemic relationship presented in Fig. 1 and, consequently, had the highest rates of HIV, HCV, and STI. Importantly, the women in this study are not representative of all Mexican American women in the United States. Rather, they represent a segment of these women living in disadvantaged urban communities across Texas and other southwest states who become involved with youth street gangs during adolescence.

Previous scholarship argues that interpersonal violence is syndemic with drug use, mental illness, and infectious diseases for women in the United States [29], and that these intersecting phenomena are often pathways to incarceration for the women that experience them [30]. Therefore, in this paper we tested the syndemic relationship among dimensions of intimate partner violence, drug use, mental health, and incarceration histories and its' consequences for infectious diseases. We found that for women who experienced high levels of intimate partner violence, measured as lifetime exposure, three profiles emerged. First, Profile 3 was characterized as intimate partner violence with no syndemic drug use, mental illness, or incarceration history. The lack of co-occurrence among this profile may be a product of the cross-sectional nature of the study. These women may have experienced intimate partner violence distant in their past (e.g., adolescence) and may no longer experience negative health outcomes. It is also possible that these women engaged in prosocial responses to their violence (e.g., counseling) or had higher levels of protective factors (e.g., familial support), which were not measured in this study. Profiles 4 and 5 also reported extreme levels of intimate partner violence as well as relatively high levels of current poly drug use, lifetime problematic drug use, and mental illness. A notable difference in the drug use dimension for these two groups is that Profile 4 reported a lower prevalence of injecting drug use compared to Profile 5. All the women in Profile 5 experienced incarceration, compared to about half of women in Profile 4. It is possible that women who inject drugs are more likely to be criminalized, which would lead to higher rates of incarceration (see Table 2).

The prevalence of infectious diseases in our sample of women are alarmingly high, even more so than other samples of marginalized women [88–90], apart from HIV. For example, a tested prevalence of 3.3% for HIV was documented among women in the Rhode Island correctional system [91], which is higher than our overall rate of 1% (it is important to note that only 2 women tested positive for HIV). Herpes (HSV-2) infection was the most common infectious disease documented. According to data from the Centers for Disease Control and Prevention, herpes is more common among women than men in the United States, with nationwide estimates for current infection 15.9% and 8.2%, respectively [92]. All five profiles of women have rates of tested herpes substantively higher than national estimates. However, prevalence of HIV, HCV, and STI clustered in varied ways across syndemic profiles. Not surprising, the profiles with the highest rates of injecting drug use also had the highest rates of HCV (Profiles 3 and 5). These profiles also had the highest rates of herpes and were the only profiles with a participant testing positive for HIV.

We infer that the common experience of affiliation with a youth street gang was a significant context that shaped the trauma experienced across their life course, but what are the features of youth street gangs that were most impactful? We hypothesize that the hypermasculine context of youth street gangs amplified these women's risk for gender-based violence, which had a significant, yet varied, impact on their life course. The reported rates of adult intimate partner violence, overall, among the women in this sample far exceed national rates and are more representative of other marginalized women [93], including women who are incarcerated [43, 44]. The high rates of incarceration among the women in this study are likely both an additional cause and a consequence of the social stressors that they face in their everyday lives [94]. It is likely that the larger context in which these women live, characterized by social inequality and injustice [22], contributes to the observed clustering of health conditions and to the vulnerability of these women that are distinct from other Latina women. Future analyses with this cohort will use a longitudinal perspective to discover how these processes unfold over time.

## Limitations

There are several limitations to consider when interpreting the study findings. First, the cross-sectional design of this analysis precludes causal inference and the inconsistent timeframe of the items further limits understanding temporal ordering. This analysis is also limited by including one measure of interpersonal violence—intimate partner



violence. These women have experienced other types of interpersonal violence (e.g., acquaintance rape, child abuse) and contextual violence (e.g., witnessing neighborhood violence, incarceration-related violence), which may alter the syndemic health profiles. Future research should also identify other modifiable factors associated with syndemic profiles (e.g., social support, access to treatment) to improve treatment approaches because addressing syndemic factors among women is necessary for intervening and tempering the negative effects of youth gang affiliations. Understanding how individual cultural factors (e.g., religiosity, acculturation) are associated with syndemic profiles may also help inform targeted interventions. Lastly, research is needed to determine if the syndemic profiles of these women are distinct from other women from these highly marginalized communities that were not gang affiliated as young girls.

## Conclusion

Women who were involved with street gangs during adolescence report overall high levels of intimate partner violence, drug use, mental illness, incarceration histories, and infectious diseases. Our findings highlight the importance of identifying subgroups of gang-involved women who report different combinations of syndemic conditions. Latent class models revealed distinct syndemic profiles across dimensions of intimate partner violence, drug use, mental illness, incarceration, and infectious diseases among Mexican American women formerly affiliated with youth street gangs. The syndemic profiles captured in latent classes have implications for the tailoring of targeted prevention and treatment. To successfully prevent HIV, HCV, and STI among gang-involved girls and women, it is necessary to address syndemic factors as part of treatment for trauma or adapt treatments to work more effectively in the presence of different syndemic factors. Integrated care that considers variations in intimate partner violence, drug use, mental illness, and incarceration histories simultaneously within a single treatment system may lead to better outcomes than care fragmented across multiple separate systems (e.g., legal, psychological, medial, etc.).

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**Data Availability** Data used in this manuscript are available upon request to the senior author.

**Code Availability** The Stata code used to produce this analysis is available upon request from the lead author.

## Declarations

**Conflict of interest** The authors report no conflict of interest.

**Ethical Approval** This study was approved by the Institutional Review Board at the University of Southern California.

**Consent to Participate** All participants provided signed informed consent.

**Consent for Publication** Not applicable.

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