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# Co-occurring psychosocial conditions are associated with increased HIV acquisition and transmission risk among young transgender women in Lima, Peru

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In Peru, transgender women (TW) are highly burdened by the HIV epidemic and stigma-related psychosocial conditions. Yet, a dearth of research has assessed co-occurring psychosocial conditions and HIV vulnerability among young TW. From February–July 2022, a community-recruited sample of young TW ages 16–24 years ( $N=211$ ) completed a cross-sectional socio-behavioral survey and HIV testing in Lima. Poisson regression models with robust variance estimated the association of indexes of co-occurring psychosocial conditions—childhood (family rejection, bullying, adverse childhood experiences, childhood sexual abuse), violence (psychological, physical, sexual, police violence), mental health (psychological distress, posttraumatic stress disorder, alcohol use disorder, non-injection drug use), and all (range = 0–12)—with past 6-month anal or vaginal condomless sex. Median age was 23 years, the majority were ethno-racial minority (35.1% Indigenous, 34.1% Mestiza, 12.3% Afro-Peruvian), 50.7% reported past 30-day sex work, 33.6% were HIV seropositive, and 42.0% reported past 6-month condomless sex. In separate multivariable sociodemographic-adjusted models, each index was associated with elevated prevalence of past 6-month condomless sex (all  $p < 0.05$ ). For the overall index, each psychosocial condition increased the prevalence of past 6-month condomless sex by 16% (range = 8–23%). Understanding and intervening on co-occurring psychosocial conditions will be vital to mitigate HIV vulnerability among young TW in this context.

**Keywords** HIV, Transgender, Adolescent, Syndemic, Latin America, Peru

Globally, transgender women (TW) are highly burdened by the HIV epidemic, including in Latin America, where the estimated HIV prevalence is 25.9% (95% Confidence Interval = 20.0–31.8%)<sup>1</sup>. New HIV cases are increasing in Latin America, including among TW and other key populations, and existing interventions such as HIV self-testing and pre-exposure prophylaxis (PrEP) have lagged to reach those with the highest vulnerability<sup>2</sup>. In Peru, HIV prevalence among TW ranges from 19.7 to 30.9% compared to the general population at 0.4%<sup>1–3</sup>. For TW, biological risks for HIV occur in the context of pervasive socioeconomic marginalization, stigma and social exclusion, violence victimization, and the mental health-related sequelae of stigma<sup>4</sup>. Young TW ages 16–24 years are a critical and high-priority population for HIV prevention efforts in Peru. Studies suggest that young TW in Latin America, compared to older TW, have higher HIV prevalence, engage in more HIV-related risk behaviors, and have lower rates of engagement with HIV prevention strategies like PrEP<sup>1,5–8</sup>. Many young TW migrate to urban centers such as Lima, the capital of Peru, to pursue gender affirmation and economic

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opportunities<sup>9</sup>. Research is needed to understand the developmental milieu and context of HIV vulnerability among young TW in urban settings to inform HIV prevention and HIV care services tailored to their needs<sup>9,10</sup>. Additionally, in the Peruvian context, TW have traditionally been subsumed under the umbrella of men who have sex with men, rendering their unique lived experiences invisible, and underscoring the need for distinct HIV research centering young TW communities<sup>11,12</sup>.

TW face a myriad of psychosocial challenges, including family rejection due to gender identity<sup>9,13</sup>, interpersonal violence such as bullying, childhood, and partner violence<sup>14,15</sup>, and structural violence like police brutality<sup>16–18</sup>. The health-related sequelae of these exposures manifest in high morbidity of mental health conditions among TW, such as depression<sup>14,19</sup>, posttraumatic stress disorder (PTSD)<sup>19,20</sup>, and substance use<sup>21</sup>. Further, prior TW research demonstrates that psychosocial conditions do not occur in isolation, but have a high prevalence of co-occurrence<sup>22,23</sup>. However, research is needed to assess co-occurring psychosocial conditions among young TW in Peru. Childhood exposures, violence victimization, and mental health conditions may synergistically potentiate HIV vulnerability for young TW and adversely impact biobehavioral HIV prevention and treatment targets, including sex with condoms<sup>24</sup>. In a study assessing the association between various psychosocial factors and sexual HIV risk behavior among young TW in the U.S., low self-esteem, polysubstance use, victimization related to transgender identity, intimate partner violence, and social marginalization indicators (e.g., history of commercial sex work, homelessness, and incarceration) were positively and additively associated with sexual HIV risk behavior<sup>24</sup>. Although psychosocial factors such as violence and mental health conditions are highly prevalent for young TW in other geographic settings<sup>24–27</sup>, scant research exists among young TW in Peru<sup>9</sup>. Given the recent classification of transgender identity as a mental illness by the Peruvian Ministry of Health<sup>28</sup>, there is a critical need for research that examines this issue within Peru's unique geo-sociopolitical context.

Consistent with the Life Course Health Development Model, both psychosocial health and HIV vulnerability for young TW occur in a critical period of biological, psychosocial, and cognitive maturation<sup>9</sup>. Factors such as negotiating gender identity development, including with family and through medical affirmation, if desired, and exploring gender in dating and interpersonal relationships are unique to young transgender people<sup>9</sup>. Adolescence and emerging adulthood are critical developmental periods when many mental health and psychosocial conditions, such as depression and PTSD, often first emerge<sup>29</sup>. Thus, concomitant mental health and psychosocial conditions may potentiate HIV vulnerabilities during formative developmental years for young TW.

Given the widespread co-occurrence of psychosocial conditions among young TW across geographic settings, coupled with the significant burden of HIV among TW in Peru, it is crucial to examine the developmental contexts that contribute to their HIV vulnerability. This study sought to characterize the prevalence of childhood, violence, and mental health psychosocial conditions among young TW, including their co-occurrence, and examine associations with HIV vulnerability to inform future early HIV prevention efforts.

## Materials and methods

### Participants

A cross-sectional quantitative study was conducted with a non-probability sample of 211 YTW in Peru between February–July 2022. The study protocol included an interviewer-administered socio-behavioral survey designed to take 60 min to complete and biological testing for HIV. Eligibility criteria included identifying as a transgender woman, being ages 16 to 24 years, and residing in the metropolitan region of Lima, Peru. Transgender woman was defined as a person identifying on the transfeminine continuum who was assigned a male sex at birth, regardless of any medical gender affirmation procedures. Formative research was conducted with the study population<sup>9</sup>. The study was conducted in partnership with Féminas, a community-based organization led by transgender women in Lima. Participants were recruited from Féminas and through peers. Six study offices were placed in six different districts giving the study wide coverage of metropolitan Lima. The fieldwork team consisted of two peer survey interviewers, a laboratory technician, and one counselor. Survey interviewers were transgender women in their early twenties. Detailed study procedures have been described elsewhere<sup>30</sup>. Informed consent was obtained from all participants prior to initiation of study activities. The Institutional Review Board at The University of Peru Cayetano Heredia reviewed and approved the study. This study was conducted in accordance with U.S. and international ethical standards, guidelines, and regulatory requirements governing human subjects research.

### Measures

#### Outcome: HIV acquisition/transmission risk behavior in last 6 months

Participants were queried about their HIV sexual risk behaviors, including total number of sexual partners and the number of sexual partners with whom they engaged in condomless anal or vaginal sex within the last 6 months. HIV acquisition/transmission risk behavior (yes/no) was operationalized as any self-reported anal or vaginal condomless sex with a sexual partner who was HIV-positive or HIV status unknown in the last 6 months.

### Psychosocial conditions

Three psychosocial domains were operationalized, each comprised of four binary (yes/no) variables. *Childhood psychosocial conditions*: Participants were asked about four adverse childhood exposures including family rejection (“My family accepts and supports my gender identity”; strongly disagree/disagree vs. neither agree nor disagree/agree/strongly agree), peer bullying before age 18 years (sometimes/often/rarely vs. never), adverse childhood experiences of neglect and trauma occurring at age 16 years or younger using the validated Adverse

Childhood Experiences (ACES) Questionnaire with a score of at least one considered a positive screen, and childhood sexual abuse defined as occurring before age 18 years (someone  $\geq 5$  years older ever touched you or tried to make you touch them sexually or forced you to have sexual relations)<sup>31</sup>. *Violence psychosocial conditions*: Four violence-related conditions were assessed. Psychological violence, physical violence, and sexual violence used questions adapted from the Conflicts Tactics Scale<sup>32</sup>. Police violence was operationalized as lifetime arrest, lifetime jail, or past-year police interaction<sup>17</sup>, given the high likelihood of TW experiencing police violence in these contexts<sup>33</sup>. *Mental health conditions*: Four mental health conditions were queried. Past 30-day psychological distress was measured using the validated six-item Kessler-6 scale with a validated cut-point score  $\geq 13$ , indicating serious psychological distress<sup>34</sup>. Post-traumatic stress disorder was assessed using the validated five-item Primary Care PTSD Screen with a score  $\geq 4$ , indicating a positive screen for probable PTSD in the past 30 days<sup>35</sup>. Past 12-month alcohol use was captured using the Alcohol Use Disorders Identification Test (AUDIT-C)<sup>36</sup> with a score  $\geq 3$  indicating probable alcohol use disorder. Past 6-month non-injection drug use (e.g., cocaine, methamphetamine, hallucinogens) was assessed using TransPOP survey measures<sup>37</sup>.

For each psychosocial domain, a summary index (count variable) ranging from 0 to 4 was constructed. When operationalizing the count variables for each psychosocial condition, participants missing data for one or more syndemic indicators were coded as 0 for that indicator to preserve sample size. An overall count of all co-occurring psychosocial conditions was also coded ranging from 0 to 12.

## Covariates and confounders

The survey included sociodemographic characteristics including age in years, Indigenous identity, educational attainment, and recent income from sex work in the past 30 days. Gender-affirming hormone use was assessed by asking participants if they had ever used hormones to medically affirm their gender. HIV serostatus was derived using a combination of biologically-confirmed HIV status ( $n = 164$  participants completed HIV testing as part of the study protocol) or self-reported HIV serostatus ( $n = 47$  participants who did not opt-in for HIV testing). HIV testing was performed by using two rapid HIV tests [(Alere Determine™ HIV-1/2 Ag/Ab Combo - Alere, Waltham, MA, USA) and SURE CHECK™ HIV 1/2 Assay (Chembio Diagnostic Systems Inc, NY, USA)] in parallel. Pre-test counseling was provided by a certified HIV test counselor following Peruvian guidelines. In cases where the results of the two rapid HIV tests were serodiscordant, confirmatory testing was conducted using a combination of regular enzyme immunoassay (Genscreen ULTRA HIV Ag-Ab Assay) and Western blot (NEW LAB-BLOT HIV-1, BioRad, France) to confirm HIV infection. This approach ensured that all participants received accurate diagnoses per Peruvian guidelines. Those diagnosed with HIV were referred to the National Antiretroviral Treatment (Programa TARGA). For participants not opting-in for HIV testing in the study, the derived variable was self-reporting as HIV-positive, HIV-negative, of HIV unknown (not getting tested during the study and reported never getting tested for HIV in their lifetime, not knowing the results of their most recent test, or missing responses to the survey questions. Missingness on these variables:  $n = 1$  on ever test,  $n = 1$  refused to answer,  $n = 14$  didn't know results of last HIV test.

## Data analysis

Descriptive statistics were calculated for all continuous (median, interquartile range [IQR]) and categorical (frequency, proportion) variables overall in the total sample and stratified by past 6-month HIV acquisition/transmission risk behavior. To examine differences in past 6-month HIV acquisition/transmission risk behavior by psychosocial conditions, Kruskal-Wallis tests for continuous data and Chi-square ( $\chi^2$ ) tests for categorical variables (Fisher's exact tests were used for cell sizes  $n < 5$ ) were implemented. Next, we assessed associations between indexes of childhood, violence, and mental health psychosocial domains using age-adjusted Poisson regression models for these count data estimating adjusted incidence rate ratios (IRR) and 95% confidence intervals (95% CI). Examination of deviance residuals to assess for potential over- and under-dispersion of counts and appropriate specification of the model revealed no violation of the distribution assumption that the variance was equal to the mean; thus, robust standard errors were not utilized.

We then fit bivariate and multivariable Poisson regression models with robust variance estimation to test the association of indexes of psychosocial conditions with HIV acquisition/transmission risk behavior in the past 6 months. Each psychosocial domain count was modeled separately (Model 1: Childhood, Model 2: Violence, Model 3: Mental health), followed by a total psychosocial condition count across all domains (Model 4: All co-occurring psychosocial conditions). Crude and adjusted prevalence ratios (PR) and 95% CI were estimated. Multivariable models were a priori adjusted covariates and confounders of age, Indigenous identity, educational attainment, recent income from sex work, gender-affirming hormones, and HIV serostatus.

Finally, we calculated public health impact measures (relative risk, attributable risk, attributable risk percent, population attributable risk, and population attributable risk percent) based on different thresholds of co-occurring conditions ( $> 5$  for all conditions,  $\geq 2$  for each psychosocial domain) to evaluate the population impact of co-occurring conditions on past 6-month HIV acquisition/transmission risk behavior. The attributable risk is the proportion of disease in the exposed group that is attributable to the exposure. The attributable risk percent refers to the percentage of disease in the exposed group that can be attributed to the exposure. The population attributable risk is the proportion of disease in the study population (exposed and unexposed) due to exposure (i.e., that would be eliminated in the study population if the exposure were eliminated). The population attributable risk percent is the percentage of the proportion of disease in the study population due to the exposure, a measure of the potential impact of intervention in a population. All analyses were conducted in R statistical software version 4.3.3<sup>38</sup> with statistical significance at the alpha 0.05-level.

## Results

### Descriptive characteristics

Descriptive characteristics of the overall study sample and stratified by past 6-month HIV acquisition/transmission risk are presented in Table 1. The sample median age was 23 years. The majority identified as a non-White ethno-racial identity (35.1% Indigenous, 34.1% Mestiza, and 12.3% Afro-Peruvian). 72.0% had  $\geq$  high school diploma, 50.7% reported income from sex work in the past 30 days, 49.8% had used gender-affirming hormones for feminization, and 33.6% were HIV-positive, 56.9% were HIV-negative, and were 9.5% unknown. Overall, 42.0% reported HIV acquisition/transmission risk behavior in the past 6 months. Identifying as an ethno-racial minority, reporting recent income from sex work, and taking gender-affirming hormones were each associated with past 6-month HIV acquisition/transmission risk (all  $p < 0.05$ ); age, educational attainment, and HIV status (test result or derived from self-report) were not associated with recent condomless sex.

### Psychosocial conditions and their associations

Individual variables across the three psychosocial domains (childhood, violence, and mental health) are displayed in Table 2 with bivariate comparisons for the past 6-month HIV acquisition/transmission risk. Negative childhood psychosocial exposures were: 18.0% family rejection due to gender identity, 82.5% bullying by peers, 77.7% ACES, and 47.4% childhood sexual violence. Experiences of violence were commonly reported: 56.4% psychological, 44.5% physical, 26.1% sexual, and 42.2% police violence. Mental health conditions included:

	Total Sample N = 211		HIV acquisition or transmission risk behavior, past 6 months N = 76 (42.0%)		No HIV acquisition or transmission risk behavior, past 6 months N = 105 (58.0%)		p-value*
	N	%	N	%	N	%	
<b>Age in Years (Median, IQR)</b>	23.0	21.0–24.0	23.0	21.0–24.0	22	20.0–24.0	0.689
<b>Ethnoracial Identity</b>							0.045
Indigenous	74	35.1	15	19.7	48	45.7	
Mestiza	72	34.1	25	32.9	35	33.3	
Afroperuvian	26	12.3	12	15.8	11	10.5	
White	15	7.1	6	7.9	7	6.7	
Missing/Other	24	11.4	18	23.7	4	3.8	
<b>Education</b>							0.793
< High School Diploma	58	27.5	21	27.6	26	24.8	
$\geq$ High School Diploma	152	72.0	55	72.4	79	75.2	
Missing	1	0.5	0	0.0	0	0.0	
<b>Recent Income from Sex Work<sup>1</sup></b>							< 0.001
Yes	107	50.7	54	71.1	37	35.2	
No	100	47.4	21	27.6	67	63.8	
Missing	4	1.9	1	1.3	1	1.0	
<b>Gender-Affirming Hormone Use</b>							0.001
Yes	105	49.8	49	64.5	38	36.2	
No	101	47.9	27	35.5	64	61.0	
Missing	5	2.4	0	0.0	3	2.9	
<b>HIV Status (Test Result)<sup>2</sup></b>							
Positive	68	41.5	28	44.4	28	37.8	0.542
Negative	96	58.5	35	55.6	46	63.3	
<b>HIV Status (Derived Variable)<sup>3</sup></b>							0.093
Positive	71	33.6	28	36.8	31	29.5	
Negative	120	56.9	44	57.9	58	55.2	
Unknown	20	9.5	4	5.3	16	15.2	

**Table 1.** Characteristics in a sample of young transgender women in the metropolitan region of Lima, Peru overall and stratified by past 6-Month HIV acquisition or transmission risk behavior (N = 211). <sup>1</sup> Defined as reporting sex work in the past 30 days. <sup>2</sup> Based on HIV test results; among n = 164 participants who participate in study HIV testing. <sup>3</sup> Derived variable based on test results for those who participated in HIV testing and self-report for participants who did not receive HIV testing. Unknown level is defined as not getting tested during the study and reporting either never getting tested for HIV, not knowing the result for the most recent test, or missing responses to the survey questions (n = 17 never tested for HIV, n = 1 missing on ever tested, n = 1 refused to answer, n = 1 didn't know results of last HIV test). \*P-values estimated with missing data excluded using chi-square tests for categorical data and Kruskal-Wallis tests for continuous data (age).

	Total Sample N= 211 (100.0%)		HIV acquisition or transmission risk behavior, past 6 months N= 76 (42.0%)		No HIV acquisition or transmission risk behavior, past 6 months N= 105 (58.0%)		p-value*
Individual Domains:	N	%	N	%	N	%	
CHILDHOOD							
<b>Family Rejection Due to Gender Identity</b>							0.009
Yes	38	18.0	22	28.9	13	12.4	
No	168	79.6	52	68.4	90	85.7	
Missing	5	2.4	2	2.6	2	1.9	
<b>Bullying by Peers<sup>1</sup></b>							0.005
Yes	174	82.5	55	72.4	94	89.5	
No	36	17.1	21	27.6	11	10.5	
Missing	1	0.5	0	0.0	0	0.0	
<b>Adverse Childhood Experiences<sup>2</sup></b>							0.308
Yes	164	77.7	64	84.2	80	76.2	
No	45	21.3	12	15.2	24	22.9	
Missing	2	0.9	0	0.0	1	1.0	
<b>Childhood Sexual Abuse<sup>3</sup></b>							0.685
Yes	100	47.4	39	51.3	49	46.7	
No	109	51.7	37	48.7	55	52.4	
Missing	2	0.9	0	0.0	1	1.0	
VIOLENCE							
<b>Lifetime Psychological Violence</b>							< 0.001
Yes	119	56.4	65	85.5	38	36.2	
No	89	42.2	11	14.5	65	61.9	
Missing	3	1.4	0	0.0	2	1.9	
<b>Lifetime Physical Violence</b>							< 0.001
Yes	94	44.5	55	72.4	30	28.6	
No	111	52.6	21	27.6	70	66.7	
Missing	6	2.8	0	0.0	5	4.8	
<b>Lifetime Sexual Violence</b>							0.001
Yes	55	26.1	30	39.5	17	16.2	
No	155	73.5	46	60.5	88	83.8	
Missing	1	0.5	0	0.0	0	0.0	
<b>Police Violence<sup>4</sup></b>							0.002
Yes	89	42.2	45	59.2	36	34.3	
No	119	56.4	31	40.8	68	64.8	
Missing	3	1.4	0	0.0	1	1.0	
MENTAL HEALTH							
<b>Serious Psychological Distress (Kessler-6)</b>							< 0.001
Yes	42	19.9	27	35.5	11	10.5	
No	165	78.2	48	63.2	93	88.6	
Missing	4	1.9	1	1.3	1	1.0	
<b>Post-Traumatic Stress Disorder (PTSD)</b>							< 0.001
Yes	28	13.3	21	27.6	5	4.8	
No	182	86.3	55	72.4	100	95.2	
Missing	1	0.5	0	0.0	0	0.0	
<b>Alcohol Use Disorder (AUDIT-C)</b>							0.936
Yes	135	64.0	52	68.4	68	64.8	
No	23	10.9	9	11.8	10	9.5	
Missing	53	25.1	15	19.7	27	25.7	
<b>Any Non-Injection Drug Use, Past 6 Months</b>							0.002
Yes	80	37.9	39	51.3	28	26.7	
Continued							

	Total Sample N = 211 (100.0%)		HIV acquisition or transmission risk behavior, past 6 months N = 76 (42.0%)		No HIV acquisition or transmission risk behavior, past 6 months N = 105 (58.0%)		p-value*
Individual Domains:	N	%	N	%	N	%	
No	125	59.2	37	48.7	74	70.5	
Missing	6	2.8	0	0.0	3	2.9	
Indexes of Co-Occurring Psychosocial Conditions:	Median (IQR)		Median (IQR)		Median (IQR)		p-value+
CHILDHOOD							
Median (IQR) (range 0–4)	2.0 [2.0–3.0]		2.0 [2.0–3.0]		2.0 [2.0–3.0]		0.500
VIOLENCE							
Median (IQR) (range 0–4)	2.0 [0.0–3.0]		3.0 [2.0–3.0]		1.0 [0.0–2.0]		< 0.001
MENTAL HEALTH							
Median (IQR) (range 0–4)	1.0 [1.0–2.0]		2.0 [1.0–3.0]		1.0 [1.0–2.0]		< 0.001
ALL (range: 0–12)							
Median (IQR) (range 0–12)	5.0 [3.0–7.0]		7.0 [5.0–8.0]		4.0 [3.0–5.0]		< 0.001

**Table 2.** Prevalence of childhood, violence, and mental health conditions and indexes of co-occurring conditions in a sample of young transgender women in the metropolitan region of Lima, Peru (N= 211). <sup>1</sup> Bullying operationalized as “ever” vs “never” age < 18. <sup>2</sup> ACEs measured as occurring at age 16 or younger, excluding childhood sexual abuse; operationalized as “any” vs “none”. <sup>3</sup> Childhood sexual abuse defined as occurring age < 18, operationalized as “any” vs “none”. <sup>4</sup> Operationalized as lifetime arrest, lifetime jail, or past year police interaction. IQR = Interquartile Range. \*P-values estimated with missing data excluded using chi-square tests. Fisher’s exact test was used cell sizes ≤ 5. +P-values estimated using Kruskal-Wallis tests to compare medians.

19.9% serious psychological distress, 13.3% PTSD, 64.0% probable alcohol use disorder, and 37.9% non-injective drug use in the past 6 months (excluding marijuana use).

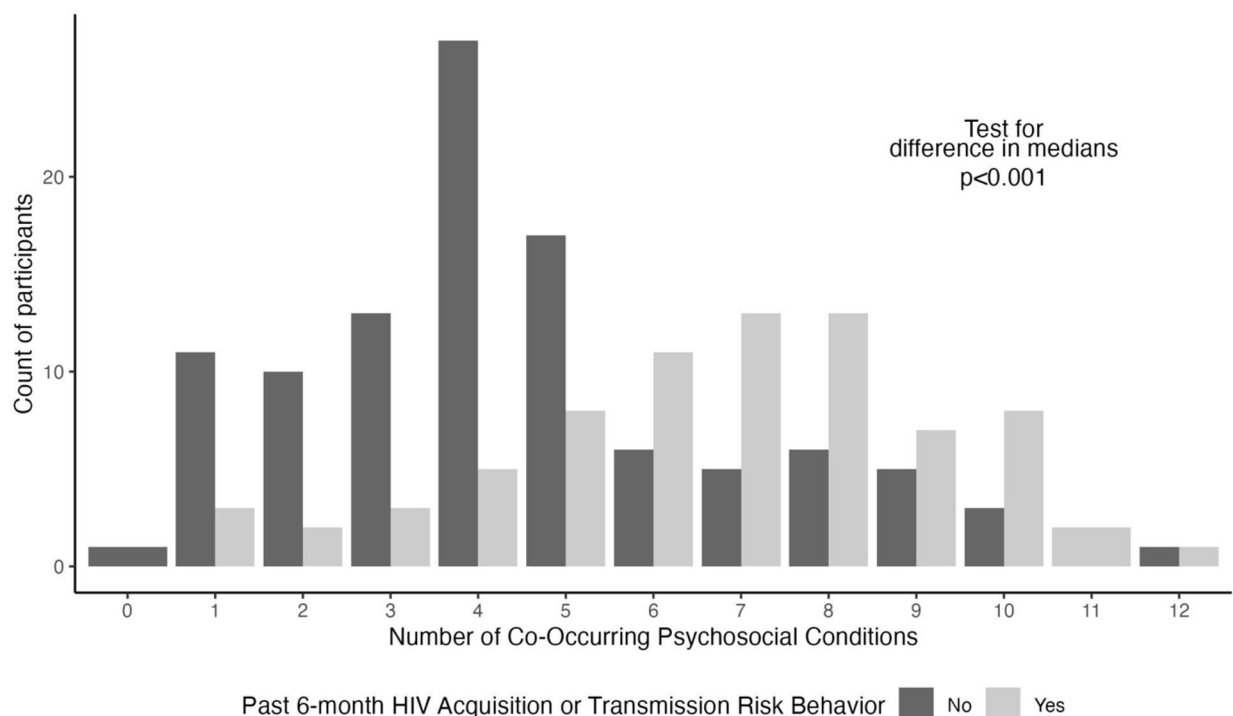
Indexes for each psychosocial domain and the total count across all co-occurring psychosocial conditions are in Table 2 (overall sample and stratified by past 6-month HIV acquisition/transmission risk behavior). In bivariate comparisons, the childhood domain was not statistically associated with past 6-month HIV acquisition/transmission risk behavior; however, violence and mental health domains were each associated with HIV acquisition/transmission risk behavior in the past 6 months. The total index of co-occurring psychosocial conditions was also associated with past 6-month HIV acquisition/transmission risk behavior (overall sample median = 7; median count for condomless sex = 7 vs. median no condomless sex = 5;  $p < 0.001$ ). The overall psychosocial condition count by condomless sex is visually displayed in Fig. 1.

Table 3 presents age-adjusted associations between childhood, violence, and mental health psychosocial domain indexes. The psychosocial condition counts were highly associated across the three domains (aIRRs ranged from 1.11 to 1.41;  $p < 0.05$ ).

**Bivariate and multivariable models of past 6-Month HIV acquisition or transmission risk behavior**

Bivariate and multivariable model results are presented in Table 4. In multivariable models adjusted for age, Indigeneity, educational attainment, recent income from sex work, gender-affirming hormones, and HIV serostatus, each psychosocial domain index was associated with elevated prevalence of past 6-month HIV acquisition/transmission risk behavior: childhood (Model 1: aPR = 1.24; 95% CI = 1.02–1.51), violence (Model 2: aPR = 1.35; 95% CI = 1.17–1.55), and mental health (Model 3: aPR = 1.29; 95% CI = 1.14–1.47). The overall psychosocial condition count was also associated with a statistically significantly higher prevalence of past 6-month HIV acquisition/transmission risk behavior (Model 4: aPR = 1.16; 95% CI = 1.08–1.23). In these models, recent income from sex work (aPRs ranged from 1.73 to 2.16;  $p < 0.05$ ) was associated with increased prevalence of HIV acquisition/transmission risk behavior in the last 6 months. Indigeneity vs. non-Indigeneity (aPRs ranged from 0.44 to 0.52;  $p < 0.05$ ) was associated with decreased past 6-month HIV acquisition/transmission risk behavior.





**Fig. 1.** Distribution of number of co-occurring psychosocial conditions among young transgender women participants with ( $n = 76$ ; 42.0%) and without ( $n = 105$ ; 58.0%) HIV acquisition or transmission risk behavior in the past 6 months in the metropolitan region of Lima, Peru ( $N = 181$ ). +Restricted to  $N = 181$  participants had complete data on the outcome (HIV acquisition or transmission risk behavior, past 6 months). Note: test for difference in median number of co-occurring psychosocial conditions among individuals with and without past 6-month HIV acquisition or transmission risk behavior was estimated using a Kruskal-Wallis test.

	Childhood	<i>p</i> -value	Violence	<i>p</i> -value	Mental Health	<i>p</i> -value
	aIRR (95% CI)		aIRR (95% CI)		aIRR (95% CI)	
Childhood	--	--	1.39 (1.24–1.57)	< 0.001	1.30 (1.14–1.48)	< 0.001
Violence	1.11 (1.04–1.18)	< 0.001	--	--	1.33 (1.22–1.44)	< 0.001
Mental Health	1.11 (1.03–1.20)	0.007	1.41 (1.30–1.54)	< 0.001	--	--

**Table 3.** Age-adjusted associations of indexes of childhood, violence, and mental health co-occurring psychosocial conditions in a sample of young transgender women in the metropolitan region of Lima, Peru ( $N = 211$ ). Note. Estimated using full sample ( $n = 211$ ), not excluding participants missing the outcome variable. Age-adjusted Poisson regression models for count data estimating adjusted incidence rate ratios (IRR) and 95% confidence intervals (95% CI). Variables in the rows were the independent variable, and those in the columns were the dependent variables.

### Public health impact measures

Table 5 displays public impact measures for different thresholds of co-occurring conditions. By way of example, for the exposure of  $\geq 3$  co-occurring conditions: (1) Attributable risk: The attributable risk of past 6-month HIV acquisition/transmission risk behavior among those with  $\geq 3$  co-occurring conditions is 0.276 (or 27.6%), meaning that for every 100 young transgender women with  $\geq 3$  co-occurring conditions, there are 28 more cases of HIV acquisition/transmission risk behavior than would be expected if these individuals had 0–2 co-occurring conditions. (2) Attributable risk percent: The percentage of past 6-month HIV acquisition/transmission risk behavior among those with  $\geq 3$  co-occurring conditions that be attributed to the exposure is 59.8% (and that would be eliminated if exposure were eliminated); (3) Population attributable risk: 0.235 (or 23.5%) of past 6-month HIV acquisition/transmission risk behavior cases in the population of transgender women can be attributed to the exposure of having  $\geq 3$  co-occurring conditions; (4) Population attributable

	Bivariate Models		Model 1 Childhood		Model 2 Violence		Model 3 Mental Health		Model 4 All	
	PR (95% CI)	p-value	aPR (95% CI)	p-value	aPR (95% CI)	p-value	aPR (95% CI)	p-value	aPR (95% CI)	p-value
Indexes of Co-Occurring Psychosocial Conditions:										
Childhood	1.08 (0.9–1.31)	0.42	<b>1.24</b> (1.02–1.51)	<b>0.03</b>	--	--	--	--	--	--
Violence	<b>1.49</b> (1.32–1.67)	<b>&lt; 0.01</b>	--	--	<b>1.35</b> (1.17–1.55)	<b>&lt; 0.01</b>	--	--	--	--
Mental Health	<b>1.38</b> (1.22–1.57)	<b>&lt; 0.01</b>	--	--	--	--	<b>1.29</b> (1.14–1.47)	<b>&lt; 0.01</b>	--	--
All Conditions	<b>1.20</b> (1.12–1.27)	<b>&lt; 0.01</b>	--	--	--	--	--	--	<b>1.16</b> (1.08–1.23)	<b>&lt; 0.01</b>
Covariates and Confounders:										
Age in Years	1.02 (0.94–1.11)	0.69	0.99 (0.9–1.08)	0.84	1.00 (0.92–1.09)	0.95	0.97 (0.89–1.07)	0.57	0.99 (0.91–1.09)	0.86
Indigenous Identity (ref: Non-Indigenous)	<b>0.46</b> (0.28–0.75)	<b>&lt; 0.01</b>	<b>0.44</b> (0.27–0.72)	<b>&lt; 0.01</b>	<b>0.52</b> (0.33–0.82)	<b>0.01</b>	<b>0.50</b> (0.31–0.81)	<b>0.01</b>	<b>0.50</b> (0.31–0.81)	<b>&lt; 0.01</b>
Education (ref: < high school)	0.92 (0.63–1.35)	0.66	0.94 (0.62–1.42)	0.77	0.99 (0.68–1.45)	0.96	1.06 (0.73–1.55)	0.74	1.03 (0.68–1.55)	0.90
Recent Income from Sex Work (ref: None)	<b>2.49</b> (1.64–3.77)	<b>&lt; 0.01</b>	<b>2.16</b> (1.39–3.38)	<b>&lt; 0.01</b>	<b>1.73</b> (1.10–2.71)	<b>0.02</b>	<b>2.06</b> (1.35–3.16)	<b>&lt; 0.01</b>	<b>1.90</b> (1.24–2.90)	<b>&lt; 0.01</b>
Gender-Affirming Hormones (ref: None)	<b>0.53</b> (0.36–0.76)	<b>&lt; 0.01</b>	<b>0.66</b> (0.44–0.97)	<b>0.04</b>	0.78 (0.53–1.13)	0.18	0.72 (0.49–1.05)	0.09	0.71 (0.49–1.04)	0.08
HIV Status (Derived) (ref: HIV-negative)										
Positive	1.1 (0.77–1.57)	0.60	1.25 (0.89–1.76)	0.20	1.17 (0.83–1.65)	0.37	1.21 (0.86–1.70)	0.29	1.24 (0.87–1.77)	0.23
Unknown	0.46 (0.18–1.2)	0.11	1.16 (0.42–3.15)	0.78	1.24 (0.50–3.07)	0.65	1.13 (0.43–2.94)	0.80	1.19 (0.49–2.91)	0.70

**Table 4.** Bivariate and multivariable models: associations of indexes of co-occurring psychosocial conditions with past 6-month HIV acquisition or transmission risk behavior in a sample of young transgender women in the metropolitan region of Lima, Peru ( $N = 175$ ). +Results from Poisson regression models with robust standard errors. PR = Prevalence Ratio. 95% CI = 95% Confidence Interval. aPR = Adjusted Prevalence Ratio. Models included  $N = 175$  participants:  $N = 211$  participants had complete data on the exposure,  $N = 181$  participants had complete data on the outcome (HIV acquisition or transmission risk behavior, past 6 months),  $N = 6$  were excluded due to missing covariate data. Bolded values indicate statistical significance at  $p < 0.05$ .

risk percent: 0.559 (or 55.9%) of all cases of past 6-month HIV acquisition/transmission risk behavior in young TW are attributable to the exposure of having  $\geq 3$  co-occurring conditions.

## Discussion

In this study of young TW in Lima Peru, psychosocial conditions were highly prevalent and co-occurring, consistent with research studies of young TW in other geographic settings<sup>24–27</sup>. The count indexes of childhood, violence, and mental health psychosocial domains were also highly associated with one another, indicating substantial co-morbidities. Further, each psychosocial domain count, as well as the overall index of co-occurring psychosocial conditions, was significantly and additively associated with HIV acquisition or transmission risk behavior in the past 6 months, corroborating research in other contexts<sup>22–24</sup>. Specifically, the presence of an additional adverse psychosocial condition increased the prevalence of HIV risk behavior by 16% (ranging from 8 to 23%) in young TW. Consistent with prior research<sup>24</sup>, our findings suggest the cumulative additive effect of psychosocial adversities on HIV vulnerability for this youth population. Findings from the current study underscore that multiple co-occurring psychosocial conditions are associated with HIV vulnerability, highlighting the need to intervene on co-occurring psychosocial conditions will be vital to addressing the HIV epidemic among young TW in this urban geographic context. Although HIV intervention approaches that focus only on the continuum of HIV prevention and care (e.g., UNAIDS 95–95–95 targets) are important<sup>2</sup>, they are insufficient for made-marginalized groups such as young TW where HIV is a consequence of multiple and intersecting psychosocial disparities.

Young TW in this sample reported co-occurring psychosocial conditions in childhood and persisting into young adulthood across multiple socioecological contexts (individual, interpersonal, and structural) and involving key actors in their lives (family, peers, sexual partners, and police). In childhood, nearly 1 in 5 reported family rejection specifically due to their gender identity, more than 8 in 10 reported peer bullying victimization, more than three-quarters had adverse childhood experiences of trauma and neglect, and nearly half reported childhood sexual abuse. Violence included psychological, physical, and sexual violence, as well as police violence, which was reported by more than 4 in 10 participants. Serious psychological distress, PTSD, alcohol use disorder, and non-injection drug use were highly prevalent in our sample. A global meta-analysis of 192 studies found that 62.5% of mental disorders onset before age 25 years<sup>29</sup>, foregrounding the important



	HIV acquisition or transmission risk behavior, past 6 months N= 76 (42.0%)		No HIV acquisition or transmission risk behavior, past 6 months N= 105 (58.0%)		Risk Ratio (95% CI)	Attributable risk	Attributable risk %	Population attributable risk	Population attributable risk %
ALL SYNDEMICS	N	%	N	%					
3 or More									
3+	71	93.4	83	79.1	2.49 (1.11, 5.59)	0.276	59.8	0.235	55.9
0–2	5	6.6	22	20.9					
4 or More									
4+	68	89.5	70	66.7	2.65 (1.39, 5.06)	0.307	62.2	0.234	55.7
0–3	8	10.5	35	33.3					
5 or More									
5+	63	82.9	43	41.0	3.43 (2.04, 5.76)	0.421	70.8	0.247	58.7
0–4	13	17.1	62	59.0					
6 or More									
6+	55	72.4	26	24.8	3.23 (2.15, 4.87)	0.469	69.1	0.2	50.0
0–5	21	27.6	79	75.2					
CHILDHOOD									
2+	63	82.9	83	79.1	1.16 (0.73, 1.86)	0.060	13.9	0.049	11.5
0–1	13	17.1	22	20.9					
VIOLENCE									
2+	63	82.9	35	33.3	4.10 (2.44, 6.91)	0.486	75.6	0.233	62.7
0–1	13	17.1	70	66.7					
MENTAL HEALTH									
2+	47	61.8	26	24.8	2.40 (1.68, 3.42)	0.311	52.2	0.136	32.3
0–1	29	38.2	79	75.2					

**Table 5.** Co-occurring psychosocial conditions among young transgender women with ( $n = 76$ ; 42.0%) and without ( $n = 105$ ; 58.0%) HIV acquisition or transmission risk behavior in the past 6 months ( $N = 181$ ) in the metropolitan region of Lima, Peru: public health impact measures (Relative risk, attributable risk, attributable risk %, population attributable risk, and population attributable risk %)+. +Restricted to  $N = 181$  participants had complete data on the outcome (HIV acquisition or transmission risk behavior, past 6 months).

developmental context of adolescence and young adulthood for the emergence of mental health conditions. Utilizing a developmental approach that integrates individual, interpersonal, and structural socioecological contexts is vital for interventions to remediate mental health conditions and the HIV-related sequelae of co-occurring psychosocial conditions for young TW<sup>9</sup>. Further, addressing adverse exposures that all young people may experience, such as physical violence, alongside experiences unique to young TW, such as family rejection due to gender identity, represents an important next step.

Our findings should be interpreted alongside several limitations. First, we utilized an additive approach to assess co-occurring psychosocial conditions. However, summing a count of psychosocial conditions does not capture the synergistic effects of these conditions, nor does it enable an assessment of the syndemic interaction between them and whether the presence of specific conditions amplifies vulnerability to HIV vulnerability in relation to one another<sup>39</sup>. Our sample size, though appropriate for the additive approach undertaken in this study, precluded estimating a fully saturated model with multiplicative interactional effects. An important next step in this line of research is to employ other analytic approaches, such as utilizing multiplicative interactions or latent class analyses to estimate how multiple psychosocial conditions interact with one another to increase HIV vulnerability. Additionally, we may have underestimated the prevalence of each psychosocial condition by categorizing participants who were missing data on some indicators as not having those indicators. Second, this was a non-probability convenience sample of young TW recruited via a TW-led community-based organization and peer networks; findings may, therefore not generalize to all young TW in Lima. Relatedly, although the sample included young TW ages 16–24 years, the median age was 23 years, highlighting the need to recruit younger age TW and adolescents for HIV research. Nonetheless, the sample is fairly homogenous in their

conditions of extreme social vulnerability. Third, as a cross-sectional study, our findings are associational and not causal; public health impact measures should be interpreted accordingly. Future prospective research is warranted to assess the longitudinal effects of psychosocial conditions on HIV acquisition/transmission risk behavior for young TW, as well as the onset, timing, and mechanisms through which co-occurring conditions fuel HIV vulnerability for this youth population.

Our study also has notable strengths, including being one of the first to document the high co-occurrence of psychosocial conditions and their association with HIV vulnerability among young TW in Peru. Additionally, we successfully recruited and enrolled a sample of adolescent and young adult TW experiencing and resisting vicious marginalization rendering visible a historically ignored population in global public health. Moreover, we found that Indigeneity was associated with reduced HIV acquisition/transmission risk behavior in the last 6 months in this sample of young TW. This is partially supported by a large multisite study in Latin America of sexual and gender minority adults assigned male sex at birth (MSM, TW, and nonbinary/gender diverse) which found lower, though not statistically significant, annualized HIV incidence rates in those identifying as *Pardo* or *Mestizo* (mixed-race) relative to White (6.69% [95% CI = 4.52–8.79] vs. 7.28% [95% CI = 2.19–12.31])<sup>40</sup>. Future research is needed to understand HIV vulnerability and risk across ethnoracial identities in Peru to replicate this finding.

## Conclusions

This study highlights the myriad co-morbid psychosocial conditions burdening young TW in Lima, their interrelationship, and their association with recent HIV acquisition or transmission risk behavior. Findings suggest the urgent need for targeted HIV prevention and care interventions that not only address these interconnected psychosocial factors but are also developmentally contextualized for adolescents and young adults. Further, the socioecological environment surrounding the lives of young TW—family, peers, partners, and state actors—also necessitates careful consideration<sup>9</sup>. While several HIV prevention interventions exist for young TW outside of Peru<sup>41,42</sup>, including in Latin America<sup>43,44</sup>, the current study suggests the need for integrated HIV strategies that incorporate services for violence prevention/recovery and treatment for mental health conditions, including modular service delivery models<sup>45</sup>. Given the recent classification of transgender identity as a mental illness by the Peruvian Ministry of Health<sup>28</sup>, integrating structural strategies is a crucial next step. This includes trans-sensitization and psychoeducation for families to improve family support, enforcing protective policies in schools to combat peer bullying, and implementing training for police officers, who may disproportionately engage with young TW due to the high prevalence of transactional sex in this community. Addressing economic factors such as discrimination in school/employment settings and focusing on income-generation other than sex work are also recommended, given the high proportion of this young TW sample engaged in sex work and the association found between sex work and HIV acquisition/transmission risk behavior in this study. Findings demonstrate that young TW in Lima, Peru require multisectoral interventions that address the social and health conditions of extremely vulnerable youth and expand the HIV disease-control focus of existing HIV test-and-treat interventions. Tailored interventions are needed that address the developmental and socioecological circumstances of young TW, including those experienced by all young people irrespective of gender identity, and those unique to being a transgender young woman.

## Data availability

All data generated or analyzed during this study are included in this published article.

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## Author contributions

SLR, AS-S, and AP-B conceptualized the study. AS-S managed the implementation of the study. SLR, AP-B, LH, RA-R, and AS-S oversaw the methodology and implementation. DA and AS-S conducted the data analysis. SLR and IR wrote the original draft; all co-authors contributed and reviewed the final version.

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## Declarations

### Competing interests

The authors declare no competing interests.

## Additional information

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