

Recent Trauma is Associated with Antiretroviral Failure and HIV Transmission Risk Behavior Among HIV-Positive Women and Female-Identified Transgenders

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Published online: 17 March 2012
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Abstract Trauma and posttraumatic stress disorder disproportionately affect HIV-positive women. Studies increasingly demonstrate that both conditions may predict poor HIV-related health outcomes and transmission-risk behaviors. This study analyzed data from a prevention-with-positives program to understand if socio-economic, behavioral, and health-related factors are associated with antiretroviral failure and HIV transmission-risk behaviors among 113 HIV-positive biological and transgender women. An affirmative answer to a simple screening question for recent trauma was significantly associated with both outcomes. Compared to participants without recent trauma, participants reporting recent trauma had over four-times the odds of antiretroviral failure (AOR 4.3; 95% CI 1.1–16.6; $p = 0.04$), and over three-times the odds of reporting sex with an HIV-negative or unknown serostatus partner (AOR 3.9; 95% CI 1.3–11.9; $p = 0.02$) and <100% condom use with these partners (AOR 4.5; 95% CI 1.5–13.3; $p = 0.007$). Screening for recent trauma in HIV-positive biological and transgender women identifies patients at high risk for poor health outcomes and HIV transmission-risk behavior.

Resumen Trauma y el trastorno de estrés postraumático afectan desproporcionalmente a mujeres VIH positivas. Una creciente literatura sugiere que ambas condiciones pueden predecir salud pobre y comportamientos de riesgo de transmisión de VIH. Este estudio analizó datos de un programa de prevención con personas VIH positivas para entender si los factores socioeconómicos, conductuales y de salud están asociados a fracaso antirretroviral y comportamiento de riesgo de transmitir VIH en 113 mujeres biológicas y transexuales VIH positivas. La respuesta afirmativa a una simple pregunta de detección de trauma reciente fue asociada significativamente a ambos resultados. En comparación con los participantes sin trauma reciente, aquellos que reportaron reciente trauma tienen una tasa cuatro veces más alta de fracaso antirretroviral (ORA 4.3; 95% IC 1.1–16.6; $p = 0.04$), y tres veces más alta de reportar sexo con una pareja VIH negativo o desconocido estado serológico (ORA 3.9; 95% CI 1.3–11.9; $p = 0.02$) y < 100% de uso de condones con estas parejas (ORA 4.5; 95% CI 1.5–13.3; $p = 0.007$). La detección de trauma reciente en mujeres biológicas y transexuales identifica a los pacientes con alto riesgo de resultados de salud pobres y comportamiento de riesgo de transmisión de VIH.

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Keywords Women living with HIV/AIDS · Trauma ·
PTSD · Antiretroviral failure · Prevention with positives

Background

In the United States (US), the prevalence of HIV in women has more than tripled since 1985. Women now account for at least 27% of all new HIV/AIDS diagnoses, up from 8% in 1985 and 14% in 1992 [1–3]. Globally, women now

represent 50% of those living with HIV/AIDS [4]. Women of color are disproportionately affected. More than three-quarters (77%) of women recently diagnosed with HIV/AIDS in the US are Black or Latina, despite these groups representing only 25% of the population [1].

Women face unique barriers to timely HIV diagnosis [5], engaging in care [6–11], being prescribed and adhering to antiretroviral medications [12–14], and achieving optimal health outcomes [15, 16]. As such, despite the existence of effective antiretroviral therapy (ART), women with HIV have surprisingly high rates of morbidity and mortality. HIV/AIDS is a leading cause of death for Black and Hispanic women aged 15–54 in the US [3]. Numerous calls have been made to identify and respond to factors associated with the high prevalence and poor outcomes of HIV in women [17, 18].

HIV-positive women are disproportionately affected by sexual and physical trauma in both childhood and adulthood as well as by posttraumatic stress disorder (PTSD) compared to the general population of women [19]. Studies increasingly demonstrate that trauma and PTSD are likely significant factors contributing to the high prevalence and poor outcomes of HIV in women. For example, both trauma and PTSD are known to predispose women to becoming infected with HIV [20–25]. Once infected, both trauma and PTSD are increasingly recognized as contributors to poor health outcomes, such as poor health-related quality of life, medication non-adherence, and increased mortality [26–31], as well as higher transmission risk behavior [21, 32–37].

The mechanism(s) by which trauma and PTSD impact HIV-related health outcomes and transmission risk behavior have been the subject of increasing analysis. Prior studies demonstrate an association between trauma and/or PTSD and non-adherence to ART [38–45]. Drug abuse and mental health problems (e.g., depression) have also been identified as potential, often interrelated, mediating factors between trauma, medication non-adherence, and poor HIV-related health outcomes [41, 46–48].

One prior study reported a positive association between past trauma and ART failure in a cohort of HIV-positive men and women [27]. Additional studies are needed to better understand the complex relationship between trauma exposure and HIV-related health and transmission risk outcomes, including an examination of the timing of the trauma exposure.

To better understand which factors are significantly associated with ART failure and HIV transmission risk behavior, a cross-sectional exploratory analysis of socio-economic, behavioral, and health-related data was performed within an existing prevention-with-positives program that serves a population of predominately minority, HIV-positive women and female-identified transgenders in San Francisco.

Methods

Recruitment

Study participants included the first 113 HIV-positive female-identified individuals enrolled in a prevention-with-positives program called The Sexual Health and Empowerment Program (+SHE). The program started in 2006 and is ongoing. Participants for +SHE are recruited on-site at the two principal clinical programs caring for HIV-positive women and female-identified transgenders in San Francisco. All women receiving care at these sites are recruited for the program regardless of perceived characteristics, behaviors, or clinical status.

Survey Instrument and Measures

As part of routine enrollment in +SHE, a trained female harm-reduction counselor conducts a semi-structured, detailed, 97-question intake interview to collect information about an array of characteristics and behaviors potentially associated with health outcomes and secondary HIV transmission. The questionnaire covers a variety of subject domains including socio-economic characteristics, sexual behaviors, substance use, health-related history, and emotional experiences. The interviews by the harm reduction counselor are done in person; verbal responses to the stated questions are recorded on a standardized data collection form.

Information about health outcomes was derived from a review of medical records. HIV viral load and CD4 cell count data were included as long as the values were determined <5 months prior to the interview or within one month afterwards. Values determined within one-month after the intake interview were allowed given that all interventions started at least one-month after such interviews. The results closest to the interview date were utilized for the study.

Independent and Dependent Variables

Independent variables utilized in the study analyses were collected by the intake interview or a review of the medical records, described above and included: age, race, CD4 count, depression, drug use, recent and lifetime trauma exposure, recent and lifetime coerced sex, self-efficacy, social support, and transgender status. Dependent variables were similarly obtained from the intake interview or medical records review and included: sex with partners who are HIV-negative or unknown status, <100% condom use with HIV-negative or unknown status partners, and ART failure. ART adherence data, obtained from the intake

interview, was analyzed both as an independent and dependent variable.

Interview questions were drawn from standardized instruments where available, but were condensed due to time limitations in an active clinical program. Self-efficacy (a person's belief about his or her capabilities to produce levels of performance sufficient to influence the events that affect his or her life) was measured using nine questions drawn from the Empowerment Scale, a validated 28-question scale designed for use among those with mental health disorders [49]. The nine questions were selected because they specifically addressed the aspects of empowerment related to self-efficacy. Questions about social support were drawn from the California Health Interview Survey Adult Questionnaire Version 5.1 [50]. ART adherence over the past 30-days was assessed using a visual analog scale; participants taking ART pointed to the percentage of doses taken over the past month [51]. The time frame for all sexual and substance-related behavioral variables was recent ("within the past 6 months"). Condom use within the past six months for vaginal and/or anal intercourse was assessed separately for partners who were: (1) HIV-negative or of unknown serostatus or (2) HIV-positive. The interview also included two simple screening questions for current and past traumatic events: "In the past 30 days, have you been abused, threatened, or the victim of violence?" and "Have you ever been abused, threatened, or the victim of violence?" Standardized scales to measure traumatic events or posttraumatic symptoms were not included because the questionnaire was designed as a broad and exploratory survey for clinical use prior to our knowledge of the impact of trauma on the outcomes and behaviors of participants.

Survey questions with answer options in scales were dichotomized for analysis. Adherence measures using the visual analog scale were analyzed as being <90% versus $\geq 90\%$, which reflects a level of adherence likely adequate for viral suppression across current antiretroviral regimens [52, 53]. For self-efficacy, the cumulative results of four-item Likert scales were dichotomized to high (strongly or somewhat agree) or low self-efficacy (strongly or somewhat disagree) using a composite score of the nine questions. Similarly, for social support, the cumulative results of five-item Likert scales were dichotomized to high (most or all of the time) or low social support (none, a little, or some of the time) using a composite score of the five questions. The point of dichotomization was chosen such that the degree of the variable endorsed by the participant was likely to have a meaningful clinical impact on health outcomes and/or transmission risk behavior. ART failure was defined as having a detectable viral load (≥ 75 copies/mm) with self-reported antiretroviral use.

Data from the interviews and chart reviews were entered into a computer database using unique patient identifiers. Participants were incentivized by the +SHE program with a \$10.00 grocery gift certificate to complete the approximately one-hour structured interview. The protocol for this study was approved by the University of California, San Francisco Committee for Human Research.

Statistical Analysis

The study is a cross-sectional analysis of survey and laboratory data acquired in the course of a clinical program. Data were explored and assessed descriptively. Bivariate analysis to compare biological versus transgender women was conducted using Fisher Exact and Wilcoxon tests. Standard univariate and multivariate linear and logistic regressions were performed to assess correlates of ART adherence, ART failure, and HIV transmission risk behavior. Age and number of sexual partners of HIV negative or unknown serostatus were treated as continuous variables. All other variables were analyzed dichotomously with the referent category being the absence of the variable (e.g., African-American vs. not African-American, $CD4 < 200$ cells/ml vs. $CD4 \geq 200$ cells/ml). Multivariate logistic regressions were performed only when more than one independent variable was found on univariate analysis to be significantly associated with the dependent variable. Analyses involving ART adherence and ART failure were performed separately and only included those participants on ART. Multicollinearity was assessed through bivariate correlation of independent variables. Statistical significance was considered $p \leq 0.05$. All statistical tests were done using SAS 8.0 software (SAS Inc., Cary, NC).

Results

Socio-Economic, Health-Related, and Behavioral Characteristics

Table 1 describes the socio-economic characteristics of the study population. The mean age was 44.6 (SD 9.1) years. The majority were biologically female (71.7%), African-American (64.6%), low income (89.3% made $< \$1,000.00$ per month), and marginally housed (58.4% did not rent or own an apartment or house).

Table 2 describes the health-related characteristics of the study participants. Recent trauma (within the past 30 days) was reported by 17.3% participants; lifetime trauma was reported by 71.8%. Recent coercion to have sex (within the past 30 days) was reported by 8.2%; lifetime sexual coercion was reported by 64.5%.

Table 1 Socio-economic characteristics

Description	Sample size	Number (%) of participants with each characteristic
Gender	113	
Biological female		81 (71.7%)
Transgender female		32 (28.3%)
Mean age	113	44.6 (\pm 9.1) years; range 20.2–61.9
Race/ethnicity	113	
African-American		73 (64.6%)
White		23 (20.4%)
Latina		8 (7.1%)
Asian/Pacific Islander		3 (2.7%)
Native American		2 (1.8%)
Other/mixed		4 (3.5%)
Monthly income	113	
<\$500		17 (15.0%)
\$500–\$1,000		84 (74.3%)
\$1,001–\$2,000		8 (7.1%)
\$2,001–\$3,000		2 (1.8%)
>\$3,000		2 (1.8%)
Housing (in the past 30 days)	113	
Home or apartment		47 (41.6%)
With friend, family, or partner		11 (9.7%)
Single room occupancy hotel		25 (22.1%)
Residential program or shelter		24 (21.2%)
Street		3 (2.7%)
Other		3 (2.7%)

Over half of the study population reported an active mental health diagnosis, most commonly depression in 47.7%. Low social support was reported by nearly half (48.7%) of participants. Just over 16% of participants reported low self-efficacy. The median CD4 cell count nearest to the time of the enrollment interview was 387 (interquartile range [IQR] 270–599 cells/ml). The majority (56.3%) reported being on ART. A significant minority (18.9%) had a detectable viral load despite reporting ART use (i.e., “ART failure”). Among those on ART, adherence <90% was reported by 23.8%.

Table 3 describes the behavioral characteristics of study participants. Sexual activity within the past 6 months was reported by 54.0% of participants. For sexually active participants, the median number of main sexual partners was 1 (IQR 0–1); the median number of casual sexual partners, if such partners were reported, was 1 (IQR 0–1). Of those who were sexually active, the great majority (83.6%) reported having sex with an HIV-negative or unknown-serostatus partner. Of those who were sexually active with an HIV-negative or unknown-serostatus partner, over half did not always disclose their HIV-status

Table 2 Health-related characteristics

Description	Sample size	Number (%) of participants with each characteristic
Mental health	111	
Depression		53 (47.7%)
Bipolar		8 (7.2%)
Anxiety		9 (8.1%)
Schizophrenia/psychosis		3 (2.7%)
Other		4 (3.6%)
Low self-efficacy	109	18 (16.5%)
Low social support	113	55 (48.7%)
Trauma		
Abused, threatened, and/or victim of violence in the past 30 days	110	19 (17.3%)
Abused, threatened, and/or victim of violence in lifetime	110	79 (71.8%)
Coerced to have sex in the past 30 days	110	9 (8.2%)
Coerced to have sex in lifetime	110	71 (64.5%)
Median CD4 count (cells/ μ l)	93	387 (range 0–1363)
Viral load (copies/ml)	90	
<75		33 (36.7%)
75–9,999		30 (33.3%)
10,000+		27 (30.0%)
Antiretroviral therapy		
On ART	112	63 (56.3%)
On ART and detectable viral load	90	17 (18.9%)
Self-reported adherence <90%	63	15 (23.8%)

ART highly active antiretroviral therapy

(56.9%), did not always use condoms (60.8%), or had a detectable viral load while on ART (58.8%). A significant minority of those who were sexually active with an HIV-negative or unknown-serostatus partners (16 of 51; 31.4%) reported all three of these key transmission risk behaviors (i.e., did not always disclose their status, did not always use condoms, and had a detectable viral load).

Crack cocaine, heroin, and/or methamphetamine-use within the past 6 months were reported by 40.5% of participants. Injection drug use within the past 6 months was reported by 9.8% of participants, almost half of whom (45.5%) reported sharing needles and over half (54.5%) had detectable virus.

Correlates of ART Failure, ART Adherence, and Transmission Risk Behavior

Table 4 describes the correlates of ART failure and ART adherence among the subset of participants on ART. Recent trauma was the single statistically significant

Table 3 Behavioral characteristics

	Sample size	Number (%) of participants with each characteristic
Sexual activity		
Any sexual activity in the past 6 months	113	61 (54.0%)
With a main partner	61	43 (70.5%)
Median number of main partners (if any)		1 (range 1–2)
With casual partners	61	23 (37.7%)
Median number of casual partners (if any) ^a		1 (range 1–25)
Sex with any HIV negative or unknown serostatus partners (if sexually active) in the last 6 months	61	51 (83.6%)
Disclosure of HIV status less than all of the time with these partners	51	29 (56.9%)
Using condoms less than all of the time with these partners	51	31 (60.8%)
Detectable viral load	51	30 (58.8%)
Disclosure of HIV status less than all of the time, and using condoms less than all of the time, and a detectable viral load	51	16 (31.4%)
Substance use (any, recent)		
Cigarettes	110	71 (64.5%)
Alcohol	111	50 (45.0%)
Marijuana	111	39 (35.1%)
Crack/cocaine, heroin, and/or methamphetamines	111	45 (40.5%)
IDU ^b	112	11 (9.8%)
IDU who share needles	11	5 (45.5%)
IDU who have a detectable viral load	11	6 (54.5%)

^a One participant had a very high number of sexual partners ($N = 250$) and was excluded from the analysis

^b IDU injection drug use(r)

correlate of ART failure on univariate analysis. Participants reporting recent trauma had greater than four times the odds of ART failure than those who did not report recent trauma (OR 4.3, 95% confidence interval [CI] 1.1–16.6; $p = 0.04$). Low social support was the only statistically significant correlate of ART adherence on univariate analysis (OR 5.6, 95% confidence interval [CI] 1.4–22.5; $p = 0.02$). The correlation of low self-efficacy and recent coerced sex with medication non-adherence approached statistical significance (OR 4.4, 95% CI 0.9–20.7; $p = 0.06$ and OR 6.1, 95% CI 0.9–41.3; $p = 0.06$, respectively). Multivariate analysis for correlates of ART failure and ART adherence was not performed because only one variable was statistically significant on univariate analysis.

Table 5 describes the correlates of transmission risk behavior among all study participants. On univariate analysis, recent trauma, recent coerced sex, age, transgender status, and low self-efficacy were significantly correlated with one or more transmission risk behaviors. On multivariate analyses controlling for variables that were statistically significant on univariate analyses, participants reporting recent trauma had almost four times the odds of sex with HIV-negative or unknown serostatus partners (OR 3.9, 95% CI 1.3–11.9; $p = 0.02$) and over four times the

odds of not always using condoms with HIV-negative or unknown serostatus partners (OR 4.5, 95% CI 1.5–13.3; $p = 0.007$) compared to those who did not report recent trauma. Participants reporting recent trauma may also be more likely to have a greater number of partners who are HIV-negative or unknown serostatus, but this association did not reach statistical significance (1.5 ± 0.8 ; $p = 0.07$). Low self-efficacy was associated with an increased number of HIV-negative or unknown serostatus partners (1.9 ± 0.8 ; $p = 0.02$). Older age was associated with a modest decrease in the odds of reporting sex with HIV-negative or unknown serostatus partners OR 0.9 (0.9–0.96; $p < 0.001$) and not always using condoms with HIV-negative or unknown serostatus partners (OR 0.9, 95% CI 0.9–0.98; $p = 0.004$). Coerced sex was not included in the multivariate model due to multicollinearity with trauma. Specifically, all participants reporting recent coerced sex also reported recent trauma; these two variables had a high degree of correlation (Pearson's $r = 0.65$, $p < 0.001$).

Comparison of Biological and Transgender Women

Biological and transgender women were compared on all variables in Tables 1, 2, and 3 given the potential for

Table 4 Univariate regression analyses for predictors of ART failure among participants on ART ($N = 63$)

	Detectable viral load on ART ^a	<90% ART adherence ^a
Age (increase of 1 year)	OR 1.0 (0.93–1.1; $p = 0.96$)	OR 1.0 (0.9–1.1; $p = 0.92$)
African-American	OR 1.8 (0.6–6.1; $p = 0.32$)	OR 0.7 (0.2–2.2; $p = 0.53$)
CD4 count <200 cells/ μ l	OR 2.1 (0.7–6.5; $p = 0.20$)	OR 0.7 (0.2–2.4; $p = 0.57$)
Depression	OR 0.8 (0.3–2.7; $p = 0.78$)	OR 0.7 (0.2–2.3; $p = 0.55$)
Drug use	OR 1.1 (0.4–3.4; $p = 0.88$)	OR 1.5 (0.5–4.7; $p = 0.53$)
Lifetime coerced sex	OR 1.2 (0.4–3.8; $p = 0.78$)	OR 1.3 (0.4–4.4; $p = 0.66$)
Lifetime trauma	OR 1.2 (0.3–4.5; $p = 0.77$)	OR 0.9 (0.2–3.2; $p = 0.82$)
Low self-efficacy	OR 1.7 (0.4–8.1; $p = 0.50$)	OR 4.4 (0.9–20.7; $p = 0.06$)
Low social support	OR 2.2 (0.6–6.9; $p = 0.18$)	OR 5.6 (1.4–22.5; $p = 0.02$)
Recent coerced sex	OR 1.8 (0.3–12.0; $p = 0.53$)	OR 6.1 (0.9–41.3; $p = 0.06$)
Recent trauma	OR 4.3 (1.1–16.6; $p = 0.04$)	OR 2.3 (0.6–9.4; $p = 0.25$)
Transgender	OR 0.9 (0.2–3.2; $p = 0.84$)	OR 0.4 (0.07–1.9; $p = 0.23$)
<90% ART adherence	OR 1.0 (0.3–3.6; $p = 0.97$)	–

Bold = $p \leq 0.05$

OR odds ratio; values include 95% confidence intervals

^a Analyses conducted using logistic regression models

differences in these populations. Biological women were significantly older (46.9 vs. 43.8 years; $p = 0.03$), and more biological women had stable housing (49% vs. 22% had a home or apartment; $p = 0.01$) and had sex with a main partner in the past 6 months (81% vs. 50%; $p = 0.02$). Additionally, as shown in the univariate regression analysis, transgender status was associated with an increase in the number of sexual partners of HIV-negative or unknown status (1.3 ± 0.7 , $p = 0.049$); however, this finding was not significant on multivariate analysis. No other statistically significant differences were observed between biological and transgender women in this study.

Discussion

This study showed that an affirmative answer to a simple screening question for recent trauma is associated with key

HIV-related health outcomes and transmission risk behaviors among HIV-positive women and female-identified transgenders. To the authors' knowledge, this study is the first that identifies a significant association between recent trauma and ART failure. The magnitude of this relationship was strikingly high: recent trauma was associated with greater than fourfold increased odds of ART failure and greater than threefold increased odds of key transmission risk behaviors (e.g., sex with HIV-negative or unknown serostatus partners and not always using condoms with these partners).

These results are consistent with prior literature demonstrating an association between different types of recent and lifetime trauma and/or PTSD and HIV transmission risk behavior in both HIV-negative and HIV-positive women [20–25, 32–36]. This study adds to an emerging body of literature demonstrating an association between trauma and key HIV-related health outcomes in both men and women [26–31].

Table 5 Univariate and multivariate regression analyses for predictors of HIV transmission risk behavior among all participants ($N = 113$)

	Sex with partners who are HIV(–) or unknown status ^a		<100% condom use with HIV(–) or unknown status partners ^a		Number of sexual partners of HIV(–) or unknown status ^b	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
Age (increase of 1 year)	OR 0.9 (0.9–0.96; $p < 0.001$)	OR 0.9 (0.9–0.96; $p < 0.001$)	OR 0.5 (0.3–0.7; $p = 0.002$)	OR 0.9 (0.9–0.98; $p = 0.004$)	–0.08 (±0.03; $p = 0.02$)	–0.05 (±0.03; $p = 0.16$)
African-American	OR 0.9 (0.4–1.9; $p = 0.71$)	–	OR 0.8 (0.3–1.9; $p = 0.65$)	–	–0.9 (±0.6; $p = 0.14$)	–
Transgender	OR 1.9 (0.8–4.3; $p = 0.14$)	–	OR 1.6 (0.7–3.9; $p = 0.30$)	–	1.3 (±0.7; $p = 0.049$)	0.9 (±0.7; $p = 0.21$)
CD4 count <200 cells/μL	OR 1.1 (0.5–2.3; $p = 0.87$)	–	OR 1.6 (0.7–3.6; $p = 0.31$)	–	0.31 (±0.6; $p = 0.63$)	–
Depression	OR 1.5 (0.7–3.1; $p = 0.32$)	–	OR 1.0 (0.5–2.4; $p = 0.93$)	–	0.8 (± 0.6; $p = 0.21$)	–
Drug use	OR 1.0 (0.5–2.0; $p = 0.90$)	–	OR 1.6 (0.7–3.7; $p = 0.25$)	–	1.0 (±0.6; $p = 0.10$)	–
Low self-efficacy	OR 2.3 (0.8–6.5; $p = 0.12$)	–	OR 2.7 (0.9–7.6; $p = 0.07$)	–	2.3 (±0.8; $p = 0.005$)	1.9 (± 0.8; $p = 0.02$)
Low social support	OR 1.0 (0.5–2.2; $p = 0.18$)	–	OR 1.4 (0.6–3.2; $p = 0.42$)	–	OR 0.8 (±0.6; $p = 0.17$)	–
Recent trauma	OR 3.2 (1.1–9.2; $p = 0.03$)	OR 3.9 (1.3–11.9; $p = 0.02$)	OR 4.0 (1.4–11.2; $p = 0.008$)	OR 4.5 (1.5–13.3; $p = 0.007$)	1.6 (±0.8; $p = 0.04$)	1.5 (±0.8; $p = 0.07$)
Lifetime trauma	OR 2.0 (0.9–4.9; $p = 0.11$)	–	OR 1.8 (0.7–5.0; $p = 0.25$)	–	0.5 (±0.7; $p = 0.44$)	–
Recent coerced sex	OR 2.7 (0.6–11.4; $p = 0.18$)	–	OR 6.4 (1.5–27.6; $p = 0.01$)	^c	3.3 (±1.1; $p = 0.003$)	^c
Lifetime coerced sex	OR 1.9 (0.8–4.1; $p = 0.12$)	–	OR 2.5 (0.99–6.6; $p = 0.05$)	–	0.7 (± 0.6; $p = 0.24$)	–

Bold = $p \leq 0.05$

OR odds ratio; values include 95% confidence intervals

^a Analyses conducted using logistic regression models

^b Analyses conducted using linear regression models

^c Variable not used to avoid multicollinearity

The study's findings help better understand the impact of trauma on health outcomes and HIV transmission risk behaviors for several reasons. First, the study identified very simple screening questions for recent and lifetime trauma which can be readily used in clinical practice. Second, the outcome variables included ART failure in addition to other key transmission risk behaviors. Third,

the study found a significant association between recent, rather than lifetime, trauma and ART failure, as well as with other transmission risk behaviors. Fourth, data was collected by female interviewers with training and experience discussing trauma, sexuality, and drug use. Because female respondents may feel more comfortable disclosing violence to other women [54, 55], the study's measurement

of trauma and other potentially stigmatizing issues, such as sexual behavior and drug use, may have been particularly sensitive.

The study findings suggest that screening for recent trauma among HIV-positive biological and transgender women may effectively identify patients at high risk for poor health and transmission risk outcomes. Identifying such patients may allow for a more effective allocation of scarce clinic and/or community resources, such as safety assessment, trauma-related therapy, ART adherence support, and transmission-prevention counseling. The study's findings also offer a focus—recent trauma—for new interventions designed to improve health and transmission outcomes of women with HIV.

This exploratory study was not designed nor powered to clarify the mechanism by which recent trauma is associated with ART failure. Notably, the study did not demonstrate an association between self-reported poor ART adherence and ART failure. While other possible biologic mechanisms have been reported by which trauma could lead to ART failure, such as cortisol levels [56] or pituitary adenylate cyclase-activating polypeptide [57], the measure of adherence utilized by this study was likely not sensitive enough to effectively measure the multifaceted realities of ART adherence. For example, the visual analog scale did not measure regimen concordance (i.e., if the patient was adherent to each antiretroviral medication as it was prescribed) or the use of interfering medications. Moreover, traumatized patients may be less comfortable self-reporting non-adherence.

Prior studies have indeed demonstrated an association between trauma and/or PTSD and ART non-adherence [38–45]. One prior study of HIV-positive women also demonstrated that a history of trauma was associated with reporting not being on ART despite it being medical indicated [58]. While our study did not ascertain the appropriate use of ART (i.e., being on ART when medically indicated), and rather looked at self-reported adherence, a poor relationship with medical providers may partially explain why women who experience trauma have trouble self-reporting non-adherence. Literature from the general population of women supports this possibility; one prior study of African-American women demonstrates that those currently experiencing intimate partner violence were less likely to report that they felt respected and accepted during a medical encounter, and they provided lower ratings of the quality of communication with their providers [59].

The significant or near significant associations of low social support, low self-efficacy, and recent coerced sex with poor ART adherence in our study suggest additional potential mediating and/or moderating factors. Prior studies of HIV-positive women have, in fact, demonstrated an

association between poor social support and/or self-efficacy and poor adherence to ART [60, 61]. Additional studies with larger sample sizes and more in depth adherence measures are needed fully understand the role of poor adherence in the impact of trauma on health outcomes and transmission risk behavior.

Other potential mediating factors between trauma, medication adherence, and HIV-related health outcomes are drug abuse and mental illness, as has been described in prior studies [41, 46–48]. For example, one study found that depression, but not PTSD, was independently associated with a higher viral load in HIV-positive men and women, and the combination of depression and PTSD was most predictive [41]. Another study reported that PTSD was significantly associated with ART non-adherence only in individuals reporting high levels of dissociative symptoms [40]. While our study did not find an association between drug abuse or mental health problems and ART failure, it was not designed to detect such relationships or clarify the many likely correlated factors (e.g., trauma, PTSD, depression, substance use, poor adherence) associated with poor outcomes in HIV-positive women. Additional studies with longitudinal follow-up are needed to fully elucidate the mechanism(s) by which recent trauma is associated with antiretroviral failure and transmission risk behavior in HIV-positive individuals. Such studies would likely benefit from using a hypothesis based on an appropriate conceptual model (e.g., self-efficacy, social cognitive theory) [62–64].

This study has a number of additional limitations given the nature of an exploratory study performed using cross-sectional, clinically-acquired, data. First, the study lacked a validated measure of trauma and instead used single questions asking about recent and lifetime trauma exposure. Although the results of this study suggest that a single screening item may identify those most at risk for the sequelae of trauma, this single item does not provide a full understanding of the nature of the traumatic event, its sequelae, or whether the patient has symptoms of PTSD. For example, it was not possible to determine whether the recent trauma reported by some participants was coerced sex that led to the reported transmission risk behavior. The trauma-screening item also did not address whether the trauma and/or transmission risk occurred in the setting of trading sex for money or support. Prior studies have demonstrated that prostitution is associated with higher rates of trauma and PTSD [65, 66]. Further studies are required to validate this simple trauma screening item alongside previously validated and detailed measures of trauma that include the sexual situations in which trauma often occurs. If validated, the simple trauma screening items used in this study could be readily integrated into clinical practice and provide a time-efficient and evidence-based method to

identify those patients at high risk for poor health and transmission-risk outcomes.

Second, the study relies on self-report for all measures of behavior, which is known to underestimate medication non-adherence and other activities potentially considered to be socially undesirable [67]. The high rates of trauma, active drug use, and unprotected sex disclosed by the participants, however, suggest a high level of trust in the trained harm-reduction counselors who administered the interviews. Furthermore, this limitation would likely underestimate the rates and implications of trauma. Third, transgender and non-transgender women may have differences that influence their health outcomes and risk behaviors. Indeed, the univariate regression analysis indicates that transgender women in the study have more sexual partners of unknown or negative HIV status than the biological women. However, this finding lost significance on multivariate analysis, no significant differences were seen between the two populations in the prevalence of trauma or substance use, and transgender status did not impact any of the other univariate or multivariate analyses. Nonetheless, given the potential for unmeasured differences in these two groups, further study with larger sample sizes will be important. Fourth, the prevention-with-positives program from which the data was obtained did not track the numbers of people who declined to participate or the reasons why they declined, which may limit the generalizability of the study results. Fifth, while we would expect to find a similar correlation between recent trauma and health and transmission risk outcomes among HIV-positive men and other sub-populations of individuals with HIV, the generalizability of the study's findings are limited because data was collected only from HIV-positive women and female-identified transgenders receiving care in San Francisco. Lastly, the cross-sectional nature of the study makes it impossible to draw causal or time-ordering inferences from the identified associations among variables.

Conclusion

Despite these limitations, the study has important and immediate clinical implications. HIV/AIDS has become a serious health issue for minority women and female-identified transgenders in the United States. Trauma and PTSD are emerging as key, largely unaddressed, factors that contribute to the high prevalence and poor outcomes of HIV in these populations, and may also be the case for men. Screening for recent trauma in HIV-positive women and female-identified transgenders identifies patients at high risk for ART failure and HIV transmission risk behavior. Identifying such patients may allow for a more

effective allocation of scarce clinic and/or community resources. Interventions addressing trauma and/or PTSD have shown promise in reducing risk behaviors and improving mental health among men and women with, or at risk for, HIV [68–70]. For example, one study demonstrated that a 12-session group therapy intervention targeting skills building and self-efficacy among women with co-occurring substance abuse and PTSD led to a significant reduction in unprotected sexual experiences (90). The findings of our study call for an invigorated focus on trauma screening in clinical practice and for new interventions that focus on trauma-prevention and trauma-recovery among women with HIV.

Acknowledgments The authors wish to thank Naomi Azriel, Johanna Breyer, Colleen Buggs and Ginger Ruth for their sensitivity and compassion working with the participants; Brandon Norris for his administrative leadership of the prevention program; Jennifer Cocohoba, Nancy Hessol, Manya Magnus, and Maya Petersen for their helpful advice about research methodology; and Tulia Gonzales-Flores and Juanita Molina for their Spanish translation of the abstract.

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Psychological Trauma and PTSD in HIV-Positive Women: A Meta-Analysis

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Published online: 17 January 2012
© Springer Science+Business Media, LLC 2012

Abstract Women bear an increasing burden of the HIV epidemic and face high rates of morbidity and mortality. Trauma has been increasingly associated with the high prevalence and poor outcomes of HIV in this population. This meta-analysis estimates rates of psychological trauma and posttraumatic stress disorder (PTSD) in HIV-positive women from the United States. We reviewed 9,552 articles, of which 29 met our inclusion criteria, resulting in a sample of 5,930 individuals. The findings demonstrate highly disproportionate rates of trauma exposure and recent PTSD in HIV-positive women compared to the general population of women. For example, the estimated rate of recent PTSD among HIV-positive women is 30.0% (95% CI 18.8–42.7%), which is over five-times the rate of recent PTSD reported in a national sample of women. The estimated rate of intimate partner violence is 55.3% (95% CI 36.1–73.8%), which is more than twice the national rate.

Electronic supplementary material The online version of this article (doi:10.1007/s10461-011-0127-4) contains supplementary material, which is available to authorized users.

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Studies of trauma-prevention and trauma-recovery interventions in this population are greatly needed.

Keywords HIV/AIDS · Women · Trauma · PTSD
Meta-analysis

Resumen Las mujeres enfrentan un incremento en la epidemia de VIH y altos índices de morbilidad y mortalidad. El trauma psicológico ha sido cada vez más asociado con la alta prevalencia y los resultados pobres de VIH en esta población. El presente metaanálisis estima la tasa de trauma y Trastorno por Estrés Postraumático (TPEP) en mujeres estadounidenses. Fueron revisados 9,552 artículos de los cuales 29 cumplieron los criterios, resultando en una muestra total de 5,930 individuos. Los resultados demuestran una tasa desproporcionadamente alta de exposición a trauma y reciente TPEP en mujeres VIH positivas en comparación con la población general de mujeres estadounidenses. La tasa estimada de reciente TPEP entre mujeres VIH positivas es 30.0% (95% IC 18.8–42.7%), lo cual es cinco veces la tasa de reciente TPEP reportada en una muestra nacional de mujeres. La tasa estimada de violencia del compañero íntimo (VCI) es 55.3% (95% IC 36.1–73.8%), lo cual es más del doble de la tasa nacional. Estudios de prevención de trauma e intervenciones de recuperación de trauma en esta población son enormemente necesitados.

Introduction

Women bear a steadily increasing burden of the HIV epidemic. In the United States (US), women account for at least 27% of all new HIV/AIDS diagnoses, up from 8% in 1985 and 14% in 1992 [1–3]. Women of color bear the

lion's share of this burden; Black and Hispanic women now represent more than three-quarters (77%) of women recently diagnosed with HIV/AIDS [3].

Despite the availability of effective antiretroviral therapy (ART), women face surprisingly high rates of HIV-related morbidity and mortality [1, 4, 5]. HIV/AIDS is now the leading cause of death for US Black women aged 25–34 [1]. Numerous calls have been made to identify and respond to factors associated with the high prevalence and poor outcomes of HIV in women [6–8].

Trauma is increasingly recognized as an important factor associated with the rising prevalence and poor outcomes of HIV in women [9–11]. HIV-positive women are affected by high rates of sexual and physical trauma in both childhood and adulthood, as well as by posttraumatic stress disorder (PTSD) [12–40]. Trauma and PTSD are well known to predispose women to becoming infected with HIV [11, 16, 17, 41–43]. Once infected, women exposed to trauma and those who go on to develop PTSD have poorer health outcomes [44–49] and higher transmission risk behaviors [12, 15, 16, 25, 27, 50, 51].

Although prior studies [12–40] have documented high rates of different types of psychologically traumatizing experiences and PTSD in HIV-positive women, the rates reported by individual studies often vary, even for a specific type of trauma. For example, the reported rates of intimate partner violence (IPV) among US HIV-positive women range from 10 to 100% [25, 26] and the reported rates of recent PTSD range from 15 to 53% [23, 37]. Many studies cannot be generalized to the larger HIV-positive female population in the US because of the use of convenience samples or site-specific recruitment methods (e.g., prisons, drug treatment programs).

The purpose of this study is to employ meta-analytic technique to clarify rates of trauma exposure and PTSD in HIV-positive women and, where possible, to compare these rates to those in the general population of US women. To the authors' knowledge, this is the first time that a meta-analysis has addressed this question.

Methods

Search Strategy

Four computerized databases (PubMed, Cochrane Reviews, EMBASE, and PsycINFO) were systematically searched for citations in the date range from March 1, 1990 through December 31, 2009. Search algorithms were customized to the terminology of each database. A wide range of key words was used to reflect the variations in trauma-related terminology over time. Search terminology, algorithms, and counts of articles identified can be found in the

electronic supplementary material (Supplementary material 1).

Inclusion Criteria

Articles were included for the meta-analysis if they met all of the following five criteria: (1) published in English in a peer-reviewed journal; (2) included adult participants from the US, a Western European country, Scandinavia, Australia, or New Zealand; (3) included at least some study participants who were female and diagnosed as HIV-positive; (4) reported data separately for HIV-positive women if the study included men or HIV-negative participants; and (5) examined current or past exposure to at least one type of traumatic stressor that met *Criterion A* of the DSM-IV diagnostic criteria for PTSD [52] or examined PTSD but did not specify the traumatic event. In brief, *Criterion A* is defined by an exposure to an extreme traumatic stressor that is associated with intense fear, helplessness, or horror (e.g., actual or threatened death or serious harm to one's physical integrity or witnessing an event that involves death, injury, or a threat to the physical integrity of another person). We chose to limit our inclusion criteria geographically in an effort to limit the heterogeneity in definitions, measurements, and experiences of trauma exposure and PTSD.

Exclusion Criteria

Articles were excluded for the following reasons: (1) the event was a "non-traumatic" stressor such as losing a job, or having financial, relationship, or health problems; (2) the focus of the study was on the psychological impact of war, genocide, injury, or natural disaster; (3) the article was a case report, letter, review of the literature, or doctoral dissertation; (4) traumatic exposure or PTSD was a criterion for being included in the sample and resulted in 100% prevalence; or (5) the study examined a traumatic event that is clearly a constituent of a broader type of traumatic event (e.g., rape being one of several types of sexual abuse). Because we could not include unlimited categories for every specific type of trauma, the rationale for this last exclusion criterion was to avoid underestimating the broad categories of trauma. Studies were *not excluded* if they imposed regional, socio-economic, or health criteria for participating. However, these differences between studies were abstracted and listed in the table of included studies (Table 1).

Articles were reviewed closely to ensure that the same data published in more than one article would be included only once. In the situation of multiple reports of the same data set, data was included from the study with the earliest published date.

Table 1 Included studies

Primary author	Year	HIV+ women (N)	Measures	Key characteristics	Prevalence	
					(n)	(%)
Recent PTSD						
Martinez [30]	2002	41	PCL-C	County HIV outpatient clinics	17	42
Katz [23]	2005	102	PCL-C, THQ	New York City	15	15
Murphy [31]	1999	40	DIS-IV	Midwestern children's hospital; mothers	9	22
Pence [33]	2007	191	PCL	ID clinics in southeastern states	35	18
Smith [37]	2002	58	PCL-C	New York City; patients with chronic pain	31	53
Kimerling [24]	1999	67	IES-Revised, LSC	New Orleans; African American	24	35
Lifetime PTSD						
Lewis [27]	2005	81	SCID-P, SCID II, CAPS	Niantic, CT; incarcerated	60	74
Intimate partner violence						
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	120	62
Lang [25]	2007	304	UNPUB-INT, 2 dichotomous items	Georgia and Alabama; sexually active within 6 months	31	10
Cohen [16]	2000	1288	UNPUB-INT, 7 dichotomous items	WIHS study; 6 urban clinical cohorts	850	66
Gielen [19]	2002	188	CTS2	Baltimore, Maryland; in intimate relationship	79	42
Leenerts [26]	1999	12	UNPUB-interviews, observation, notes, etc.	Large western city; Caucasian	12	100
Liebschutz [28]	2000	50	UNPUB-INT, 2 dichotomous items; medical record review	Boston, Mass and Providence, Rhode Island	34	68
Sareen [34]	2009	30	Abbreviated CTS	National survey; romantic relationship within year	8	27
Simoni [35]	2000	220	UNPUB-INT, 4 items on 1–7 scale	New York City	150	68
Adult sexual abuse						
Bedimo [12]	1997	238	UNPUB-INT, 1 dichotomous item	Outpatient clinic in New Orleans; childbearing age	76	32
Gielen [18]	2000	257	Adapted CTS2, 5 dichotomous items	Baltimore, Maryland	69	27
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	89	46
Kalichman [22]	2002	115	Adapted SES, 3 dichotomous items	None specified	59	51
Lang [25]	2007	304	UNPUB-INT, 2 dichotomous items	Georgia and Alabama; sexually active within 6 months	4	1
Myers [32]	2006	147	UNPUB-INT, 2 dichotomous items	Los Angeles	73	49
Simoni [35]	2000	220	UNPUB-SR	New York City	101	46
Vlahov [39]	1998	763	UNPUB-INT	Maryland, New York, Rhode Island, Michigan	350	46
Adult physical abuse						
Burke [14]	2005	310	UNPUB-INT, 2 dichotomous items	Baltimore; low income	191	62
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	142	74
Lang [25]	2007	304	UNPUB-INT, 2 dichotomous items	Georgia and Alabama; sexually active within 6 months	30	10
Simoni [35]	2000	220	UNPUB-SR	New York City	139	63
Vlahov [39]	1998	764	UNPUB-INT	Maryland, New York, Rhode Island, Michigan	508	66
Adult abuse (unspecified)						
Gielen [18]	2000	257	Adapted CTS2, 5 dichotomous items	Baltimore, Maryland	159	62
Sowell [38]	2002	275	UNPUB-INT, 6 items	Georgia, North Carolina, South Carolina	187	68

Table 1 continued

Primary author	Year	HIV+ women (N)	Measures	Key characteristics	Prevalence	
					(n)	(%)
Childhood sexual abuse						
Chuang [15]	2006	73	UNPUB-INT, 2 dichotomous items	Boston; history of alcohol abuse	28	39
Cohen [16]	2000	1288	UNPUB-INT, 7 dichotomous items	WIHS study: 6 urban clinical cohorts	399	31
Gielen [20]	2001	287	UNPUB-INT, 1 dichotomous item	Baltimore	118	41
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	100	52
Pence [33]	2007	191	UNPUB-INT	ID clinics in southeastern states	66	35
Simoni [35]	2000	220	UNPUB-SR	New York City	84	38
Vlahov [39]	1998	761	UNPUB-INT	Maryland, New York, Rhode Island, Michigan	314	41
Childhood physical abuse						
Brady [13]	2002	100	UNPUB-CHART REVIEW, progress notes	Urban area in Northeast; HMO	66	66
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	110	57
Kalichman [22]	2002	115	Adapted SES, 3 dichotomous items	None specified	38	34
Pence [33]	2007	191	UNPUB-INT	ID clinics in southeastern states	36	19
Simoni [35]	2000	220	UNPUB-SR	New York City	95	43
Vlahov [39]	1998	763	UNPUB-INT	Maryland, New York, Rhode Island, Michigan	316	41
Childhood abuse (unspecified)						
Simoni [35]	2000	220	UNPUB-SR	New York City	110	50
Leenerts [26]	1999	12	UNPUB-INT, observation, notes, etc.	Large western city; Caucasian	9	75
Lifetime sexual abuse						
Brady [13]	2002	100	UNPUB-CHART REVIEW, progress notes	Urban area in Northeast; HMO	95	95
Chuang [15]	2006	73	UNPUB-INT, 2 dichotomous items	Boston; history of alcohol abuse	53	73
El-Bassel [17]	2001	15	UNPUB-INT, 2 dichotomous items, 2 items on 0–7 scale	New York; sex workers	3	18
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	127	66
Kalichman [22]	2002	115	Adapted SES, 3 dichotomous items	None specified	78	68
Sowell [38]	2002	275	UNPUB-INT, 6 items	Georgia, North Carolina, South Carolina	143	52
Simoni [36]	2002	222	UNPUB-INT, 4 items on 1–7 scale	New York City	129	58
Whetten [40]	2006	189	UNPUB-INT	ID clinics in southeastern states	72	38
Lifetime physical abuse						
Brady [13]	2002	100	UNPUB-CHART REVIEW, progress notes	Urban area in Northeast; HMO	83	83
Chuang [15]	2006	73	UNPUB-INT, 2 dichotomous items	Boston; history of alcohol abuse	64	88
El-Bassel [17]	2001	15	UNPUB-INT, 2 dichotomous items, 2 items on 0–7 scale	New York; sex workers	5	32
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	156	81
Sowell [38]	2002	275	UNPUB-INT, 6 items	Georgia, North Carolina, South Carolina	162	59
Simoni [36]	2002	222	UNPUB-INT, 4 items on 1–7 scale	New York City	155	70
Lifetime abuse (unspecified)						
El-Bassel [17]	2001	15	UNPUB-INT, 2 dichotomous items, 2 items on 0–7 scale	New York; sex workers	4	27
Gielen [20]	2001	287	UNPUB-INT, 4 dichotomous items	Baltimore City	180	63
Henny [21]	2007	193	UNPUB-INT, 8 dichotomous items, 1 per type of trauma	Baltimore, Chicago, L.A.; homeless or near-homeless	166	87
Liebschutz [29]	2005	73	UNPUB-INT, 3 dichotomous items	Boston; history of alcohol abuse	64	88

Table 1 continued

Primary author	Year	HIV+ women (N)	Measures	Key characteristics	Prevalence	
					(n)	(%)
Sowell [38]	2002	275	UNPUB-INT, 6 items	Georgia, North Carolina, South Carolina	187	68
Simoni [36]	2002	222	UNPUB-INT, 4 items on 1–7 scale	New York City	167	75

PCL-C Posttraumatic Stress Disorder Checklist-Civilian Version, *THQ* Trauma History Questionnaire, *DIS-IV* Diagnostic Interview Schedule for DSM-IV diagnoses, *PCL* Posttraumatic Stress Disorder Checklist, *IES-Revised* Impact of Event Scale-Revised, *LSC* Life Stressor Checklist, *SCID-P* Structured Clinical Interview for Diagnosis for DSM-IV, *SCID II* Structured Clinical Interview for Diagnosis for DSM-IV-TR Personality Disorders, *CAPS* Clinician Administered Post-traumatic Stress Scale, *CTS2* Revised Conflict Tactics Scales, *CTS* Conflict Tactics Scales, *SES* Sexual Experiences Survey, *UNPUB-INT* Unpublished interview

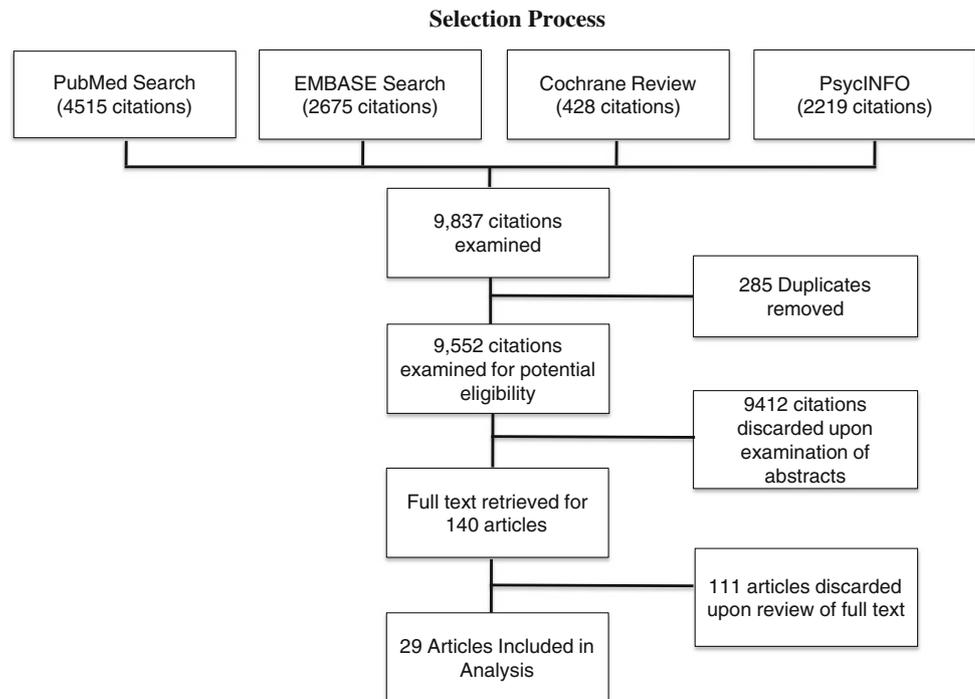
Fig. 1 Selection process

Figure 1 depicts the article selection process. The primary search of the literature was designed to maximize sensitivity to identify all potentially eligible articles. The primary search of four databases returned 9,837 citations; 285 duplicates were removed. In the secondary screen, the titles, abstracts, and keywords of the remaining 9,552 articles were evaluated against the inclusion and exclusion criteria. This secondary screen excluded the vast majority of the articles and left 140 remaining. In the tertiary screen, the full text of each remaining article was reviewed against criteria, and 111 of the 140 articles did not qualify. Table 2 describes the reasons for exclusion in the tertiary screen. The remaining 29 articles were included in the analysis [12–40] resulting in a sample of 5,930 individuals.

Data Abstraction

The 29 articles included in the final analysis were coded for date of publication, sample size, method of measurement,

other key study characteristics (e.g., study location, patient demographics), type of trauma exposure, time-frame of trauma exposure, rate of exposure, and for those with PTSD as the outcome, the time-frame and rate of PTSD identified. To reduce the possibility of error, the data were abstracted by one author (TW) and subsequently confirmed in detail by a research assistant.

Categorization

We utilized categories of trauma exposure and PTSD that most specifically captured the categories used by the included studies. For trauma exposure, two variables were used for categorization. The first was stage of life at which trauma exposure occurred: (a) childhood, (b) adulthood, and (c) unspecified. The second variable was type of trauma exposure. Combining the first and second variables resulted in 10 categories: IPV, childhood sexual abuse (CSA), childhood physical abuse (CPA), childhood abuse

Table 2 Exclusion of articles in tertiary screen

Reason for exclusion	Number of studies
Data for HIV-positive women not reported separately from HIV-positive men	32
Article did not fulfill criteria for types of included studies (e.g., not peer-reviewed, literature review, case report, letter to editor)	29
Study measured non-traumatic event (e.g., stress)	17
Data for HIV-positive women not reported separately from HIV-negative women	12
Data from study was not amenable to pooling (e.g., qualitative data)	12
Inclusion criteria for participation in study required history of trauma or PTSD	4
Sample included adolescents	3
Data reported previously and already included in analysis	1
Location of study	1
Total number of studies excluded	111

(unspecified), adult sexual abuse, adult physical abuse, adult abuse (unspecified), lifetime sexual abuse, lifetime physical abuse, lifetime abuse (unspecified). We used the term “unspecified” when studies reported abuse (childhood, adulthood, or lifetime) but: (1) did not describe the specific type of abuse (physical or sexual) or, (2) included types of abuse that did not fit into sexual or physical abuse (e.g., neglect). For PTSD, we utilized two categories: recent (within 1 year) and lifetime. Studies which reported data as intimate partner violence, domestic violence, or gender-based violence were included in the IPV category because of significant overlap in the interpretation of the meanings of these terms in the included studies. We included all studies of IPV among HIV-positive women in a single category despite the wide variability of time frames used by individual studies. There was also considerable heterogeneity among the included studies in the age used to differentiate childhood versus adulthood abuses. Because rates were reported in aggregate and not reported separately for each specific age, we were unable to establish a uniform definition of childhood and adulthood and instead relied on the definition used by each of the studies.

Statistical Methods

To calculate pooled prevalence rates for each category of trauma and PTSD, we initially explored using a fixed-effects model with inverse variance weighting. However, substantial heterogeneity among the studies was found, as indicated by a large Cochran Q statistic. Following accepted evidence-based protocols for meta-analytic technique involving studies with substantial heterogeneity [53], we employed a random-effects model (Dersimonian–Laird) to calculate pooled prevalence rates [54]. Studies were not given additional or diminished statistical weight based on their methodologies or other perceived qualities. The

random-effects analysis (DerSimonian–Laird) was conducted in StatsDirect v2.7.8.

For PTSD, only data for recent PTSD was amenable to meta-analytic technique because we found only a single study reporting rates of lifetime PTSD in HIV-positive women that met our inclusion criteria. National prevalence rates in the general population of US women were included for comparison, if such rates were available.

To assess for publication bias, all categories of trauma exposure and PTSD were analyzed using Begg and Mazumdar’s test [55].

Results

The results of the meta-analysis are presented in Table 3. The estimated rate of recent PTSD in HIV-positive women is 30.0% (95% confidence interval [CI] 18.8–42.7%). This estimate is over five times the rate of recent PTSD reported in a national prevalence sample of women [56, 57]. The rate of lifetime PTSD in one study is reported to be 74%. While this rate is much higher than 9.7% reported in a national sample of women [57, 58], a single study is not amenable to meta-analytic technique. The estimated rate of IPV among HIV-positive women is 55.3% (95% CI 36.1–73.8%). This estimate is more than twice the national prevalence rate of IPV in women [59].

Estimated rates of adult sexual abuse and adult physical abuse are 35.2% (95% CI 20.1–51.4%) and 53.9% (95% CI 30.2–76.8%), respectively. The estimated rate of adult abuse (unspecified type) is 65.0% (95% CI 58.9–70.8%). National prevalence rates in the general population of women for these three types of abuse are not available for comparison.

The estimated prevalence of CSA and CPA are 39.3% (95% CI 33.9–44.8%) and 42.7% (95% CI 31.5–54.4%),

Table 3 Meta-analytic prevalence rates of traumatic events and PTSD in HIV-positive women

Categories	Number of studies	Pooled <i>n</i>	Prevalence ^a (%)	95% confidence interval	Reference prevalence ^b (%)
Recent PTSD	6	499	30.0	18.8–42.7	5.2
Intimate partner violence	8	2285	55.3	36.1–73.8	24.8
Adult sexual abuse	8	2237	35.2	20.1–51.4	– ^c
Adult physical abuse	5	1791	53.9	30.2–76.8	– ^c
Adult abuse unspecified	2	532	65.0	58.9–70.8	– ^c
Childhood sexual abuse	7	3013	39.3	33.9–44.8	16.2
Childhood physical abuse	6	1582	42.7	31.5–54.4	22.9
Childhood abuse unspecified	2	232	58.2	36.0–78.8	31.9
Lifetime sexual abuse	8	1182	61.1	47.7–73.8	12.0
Lifetime physical abuse	6	878	72.1	60.1–82.1	– ^c
Lifetime abuse unspecified	6	1065	71.6	61.0–81.1	39.0

^a Pooled prevalence from random-effects model (DerSimonian-Laird)

^b National samples of US women (citations in text)

^c Data from a national sample not available or national samples report conflicting rates

respectively. Both of these estimates are approximately twice those documented in a national prevalence sample of women [60]. The estimated rate of childhood abuse (unspecified type) among HIV-positive women is 58.2% (95% CI 36.0–78.8%), compared to 31.9% prevalence in a national sample [60].

The estimated rate of lifetime sexual abuse is 61.1% (95% CI 47.7–73.8%); this estimate is five times the national prevalence in women [61]. The estimated rate of lifetime physical abuse is 72.1% (95% CI 60.1–82.1%). The estimated rate of lifetime abuse (unspecified type) is 71.6% (95% CI 61.0–81.1%), compared to 39% in a national sample [61].

No category of PTSD or trauma exposure yielded significance for publication bias using Begg and Mazumdar's test. Of note, two categories (unspecified adult abuse and unspecified childhood abuse) contained too few studies to conduct the Begg and Mazumdar's test for publication bias. Forest plots of estimated prevalence rates of trauma exposure and recent PTSD can be found in electronic supplemental material (Supplementary material 2).

Discussion

Using meta-analytic technique to estimate rates of exposure to traumatic events and recent PTSD in HIV-positive women, we observed very high rates of all categories of trauma exposure and PTSD. Where data exist that allow comparison to nationally representative samples of US women, the estimated rates of the various categories of trauma exposure and recent PTSD in HIV-positive women are mostly between two and five-fold higher.

The implications of these findings are highly significant. HIV/AIDS has increasingly become a health crisis for women, especially among women of color. These results estimating disproportionately high rates of trauma and PTSD support and inform longtime calls for studies of trauma-prevention and trauma-recovery interventions to reduce the high incidence and poor outcomes of HIV among women [9, 10, 24, 35, 62, 63]. Relatively few such interventions have been reported in the literature among HIV-positive women [64], or women at high risk for HIV [65, 66] and more are urgently needed.

The study conclusions have a number of limitations primarily based on the nature of the literature we utilized. First, we found considerable variation in the methods used to measure trauma exposure and PTSD in the set of 29 studies. Methods to assess trauma exposure ranged from asking study participants a single non-validated dichotomous question to employing validated inventories in the setting of diagnostic interviews conducted by trained and calibrated clinicians. The majority of included studies, however, utilized unpublished, non-validated, methods to measure trauma exposure. The methods for diagnosing PTSD in the included studies were similarly variable. One study used the gold standard in the field, the Clinician Administered Post-traumatic Stress Scale for DSM-IV (CAPS), which is a comprehensive structured interview conducted by experienced clinicians that assesses the frequency and intensity of core and associated symptoms of PTSD [67]. Others used self-report instruments that all measure symptom level but vary with respect to their ability to map to the DSM diagnostic criteria. For example, the Impact of Event Scale Revised (IES-R) was designed not to be a proxy for a PTSD diagnosis, but instead to

measure the amount of distress from PTSD symptoms over the previous week [68]. The PTSD Checklist-Civilian Version (PCL-C) is a 17-item self-report of PTSD-related symptoms [69] that does map to the 17 DSM symptoms. The PCL-C was the most common method for indexing a diagnosis of PTSD in the included studies, but it too is not formally diagnostic. In the included studies that utilized this measure, a variety of cut-off scores were utilized because there is no single validated cut-off value. The use of symptom-based assessments in the included studies has the potential to overestimate rates of PTSD. The variability in measurement of both trauma exposure and PTSD is a limitation inherent in the current literature and is not limited to this set of studies.

Second, there is a degree of heterogeneity among the rates of trauma and PTSD found in the included studies that may be partially attributed to each study's unique characteristics. These characteristics included geographic location, race, substance abuse, sexual activity, homelessness, incarceration, motherhood, and participation in a study cohort. Because many of these characteristics may be correlated with trauma exposure and/or PTSD [70, 71], our analysis may overestimate rates of trauma exposure and PTSD among HIV-positive women. However, the possibility or degree of this overestimation is limited because these same characteristics are well-known to be associated with HIV in women. While these characteristics were abstracted and noted in Table 1, we did not formally analyze them as moderating variables. Doing so calls for a different study in which the design acknowledges that many of these characteristics are correlated and whose purpose is to tease out the complex mechanisms by which trauma and PTSD are associated with HIV. Nonetheless, the lack of consistent inclusion criteria across the included studies, or inclusion criteria that ensure a representative sample of HIV-positive women, may affect the generalizability of our results to all sub-populations of HIV-positive women.

Third, there was heterogeneity in the definitions for specific categories of psychological trauma among the included studies. To accommodate these multiple definitions, we included 10 categories of trauma and only included data if it clearly fit into one of these categories. This heterogeneity is an acknowledged limitation of the comparisons made between rates found in this study to those documented in national samples of US women.

Fourth, the time frame for IPV varied among the included studies, ranging from “in the previous three-months” to “ever”. However, the great majority of included participants in this category reported IPV “as an adult” or “ever”. The data we cite for comparison rates of IPV in the general population of women used “ever” for the timeframe of IPV. As such, if bias exists due to the variability of time frames for IPV in the included studies, our estimate of the rate of

IPV among HIV-positive women would likely be an underestimation when compared to the rates among the general population of women.

Lastly, our data could be affected by publication bias. Specifically, concern exists for the “file drawer effect” in which studies that identify trauma rates in the range of, or lower than, the prevalence in the general population of women are not published. In our study, however, no category of PTSD or trauma exposure yielded significance for publication bias using the Begg and Mazumdar's test, implying that it is unlikely that such bias substantially affects our results.

Conclusion

Effectively addressing trauma and PTSD may be an opportunity to make a transformational impact on the HIV epidemic. Given the high rates and known consequences of trauma and PTSD in HIV-positive women, screening and referrals for recent and past trauma and PTSD should be considered a core component of HIV treatment in this population, along with medication adherence, CD4 counts, and viral loads. Additional studies of trauma-prevention and trauma-recovery interventions in HIV-positive and at-risk women are greatly needed.

Acknowledgements The authors extend special thanks to the following colleagues who contributed meaningfully to this manuscript: Alan Bostrom, Ph.D., Jennifer Cocohoba, Pharm.D, Susannah Empson, Tulia Gonzales-Flores, Starr Hilliard, Michael Kohn, MD, Vanessa Pascoe, and Gloria Won.

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