A Scoping Review of the Associations Between Mental Health and Factors Related to HIV Acquisition and Disease Progression in Conflict-Affected Populations

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**Recommended Citation**  
Koegler, Erica; Koegler, Erica; and Kennedy, Caitlin, "A Scoping Review of the Associations Between Mental Health and Factors Related to HIV Acquisition and Disease Progression in Conflict-Affected Populations" (2018). Social Work Faculty Works. 6.  
DOI: [https://doi.org/10.1186/s13031-018-0156-y](https://doi.org/10.1186/s13031-018-0156-y)  
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A scoping review of the associations between mental health and factors related to HIV acquisition and disease progression in conflict-affected populations

Erica Koegler 1,2* and Caitlin E. Kennedy 2

Abstract

The association between poor mental health and factors related to HIV acquisition and disease progression (also referred to as HIV-related factors) may be stronger among conflict-affected populations given elevated rates of mental health disorders. We conducted a scoping review of the literature to identify evidence-based associations between mental health (depression, anxiety, and post-traumatic stress disorder [PTSD]) and factors related to HIV acquisition and progression in conflict-affected populations. Five electronic databases were searched on October 10, 2014 and updated on March 7, 2017 to identify peer-reviewed publications presenting primary data from January 1, 1994 to March 7, 2017. Articles were included if: 1) depression, anxiety, and/or PTSD was assessed using a validated scale, 2) HIV or HIV-related factors were a primary focus, 3) quantitative associations between depression/anxiety/PTSD and HIV or HIV-related factors were assessed, and 4) the study population was conflict-affected and from a conflict-affected setting. Of 714 citations identified, 33 articles covering 110,818 participants were included. Most were from sub-Saharan Africa (n = 25), five were from the USA, and one each was from the Middle East, Europe, and Latin America. There were 23 cross-sectional, 3 time-series, and 7 cohort studies. The search identified that mental health has been quantitatively associated with the following categories of HIV-related factors in conflict-affected populations: markers of HIV risk, HIV-related health status, sexual risk behaviors, and HIV risk exposures (i.e. sexual violence). Further, findings suggest that symptoms of poor mental health are associated with sexual risk behaviors and HIV markers, while HIV risk exposures and health status are associated with symptoms of poor mental health. Results suggest a role for greater integration and referrals across HIV and mental health programs for conflict-affected populations.

Keywords: Mental health, HIV, Conflict settings, Depression, Anxiety, PTSD

Background

The relationship between mental health and HIV acquisition and disease progression (also referred to as HIV-related factors) is bi-directional. Having symptoms of post-traumatic stress disorder (PTSD), depression, and/or anxiety has been linked to HIV risk factors in various populations both prospectively [1] and cross-sectionally [2–6]. Being HIV-positive physiologically, psychologically, and socially increases risk for neuropsychiatric conditions [7]. In this paper we consider a broad range of factors associated with HIV acquisition and disease progression, such as markers of HIV risk, HIV-related health status, sexual risk behaviors, and other potential HIV risk exposures not under individual control (i.e. sexual violence).

As conflict-affected populations often have elevated rates of PTSD, depression, and anxiety [8–12], the association between poor mental health and risk for HIV acquisition and disease progression may be stronger among these populations. Conflict can shape population movements, opportunities for sexual partnering, and mortality patterns in ways that might increase or decrease HIV prevalence [13, 14]. Epidemiological evidence suggests...
elevated HIV prevalence in the five years prior to conflict, but an overall decrease in HIV prevalence during and just after conflict [15, 16]. However, vulnerable populations may remain at elevated risk for HIV acquisition during political and socioeconomic instability [14, 17]. A seminal paper discussing population vulnerability to HIV transmission in conflict-affected settings discusses health factors but does not detail the ways poor mental health can impact population vulnerability to HIV [13]. Poor mental health, conflict, and being HIV positive are independently related to morbidity and mortality. Co-occurrence of these factors can contribute to increased vulnerability to morbidity and mortality.

Other reviews that have examined associations between mental health and HIV risk behaviors or care and treatment programs have focused on migrant populations [18] and populations from developing countries [18, 19]. It is yet unknown how the vulnerabilities of poor mental health and factors related to HIV acquisition and disease progression operate in conflict-affected populations. Understanding how mental health is associated with HIV acquisition and disease progression in conflict-affected populations can inform program and policy work in these settings. The aim of our study was to conduct a scoping review of the literature to identify evidence-based associations between common mental health conditions (depression, anxiety, and PTSD) and factors related to HIV acquisition and disease progression in conflict-affected populations. We sought to understand the bi-directional associations between these mental health conditions and various measures of HIV-related factors, and to examine the strength and directionality of associations to offer suggested directions for future research, policy, and interventions.

Methods
Peer-reviewed publications that presented primary data from January 1, 1994 to March 7, 2017 were included in this review if they met the following inclusion criteria: 1) one or more of three common mental health conditions (depression, anxiety, PTSD) was a primary or substantive focus of the article and was assessed using a validated scale, 2) HIV serostatus or factors related to HIV acquisition and disease progression (defined below) was a primary or substantive focus of the article and was assessed using a validated scale, 3) the quantitative relationship between HIV or HIV-related factors and the mental health condition(s) was discussed, and 4) the study reported that participants were conflict-affected and from a conflict-affected setting. All age groups were included in this review. All study designs were considered as long as the four inclusion criteria were met. Articles were excluded if they measured HIV-related factors on a war events scale but did not present data for the relationship between the HIV-related factor alone and mental health measures. This review was conducted following PRISMA guidelines [20].

Definition of terms
We sought to illuminate the ways a broad range of factors related to HIV acquisition and disease progression have been examined in relationship to mental health. Therefore, we defined factors related to HIV acquisition and disease progression to include factors such as: markers of HIV risk (i.e. sexually transmitted infections (STIs)); HIV-related health status (i.e. HIV seropositive status, CD4 count); sexual risk behaviors (e.g. unprotected sex, multiple sexual partners, exchange sex, etc.); and other potential HIV exposures not under individual control (i.e. sexual assault). A range of factors related to HIV were included in order to provide a comprehensive understanding of how researchers have quantitatively examined the relationships between specific mental health disorders and HIV-related factors.

Conflict-affected settings were defined according to UNESCO as areas with ‘explosive’ (over 200 battle-related deaths in a year) or ‘protracted’ (over 1000 battle-related deaths over ten years) events [21]. Both active conflict and post-conflict settings were included. Since not all populations in conflict-affected countries are directly affected by conflict, the study population had to be affected by conflict and described as such by the article’s authors. All combat-affected populations were considered for inclusion, both combatants and civilians. Conflict-affected populations across the economic spectrum were considered for inclusion to examine the relationship between mental health and HIV-related factors in a variety of economic situations.

Search strategy
Five electronic databases (PubMed, PsycINFO, SCOPUS, CINAHL, and EMBASE) were searched first on October 10, 2014 and updated on March 7, 2017. Search terms included combinations of terms for mental health, HIV risk, and conflict-affected settings (Additional file 1). We also searched reference lists of included articles and hand searched the table of contents of Conflict and Health and Medicine Conflict and Survival. Only articles with an abstract in English were screened.

Data extraction and management
Articles were screened and data extracted by one reviewer (EK), with uncertainty resolved through discussion with a second reviewer (CK). A third reviewer verified all data presented in Tables 1 and 2. First, titles and abstracts identified through the search strategy were screened. Full text articles were obtained for all selected abstracts. An eligibility form was completed to determine final study selection. Data were extracted using a standardized data extraction
| Primary author and Year | Country | Study design | Sampling strategy | Sample size and participation rate | Participant characteristics |
|-------------------------|---------|--------------|-------------------|-----------------------------------|-------------------------------|
| Mental health and HIV serostatus/HIV-related outcomes |
| Adedimeji et al., 2015 | Rwanda | Cross-sectional | Baseline data from 2005 RWISA prospective cohort | $N = 928$ 99% of $N = 936$ included | Women over age 15 who experienced the 1994 genocide; 76% HIV+ 205% < 30 years 48% 30–40 years 31.1% 40+ years 100% female |
| Adler et al., 2011 | USA | Time-series | Time 1: 4 months after return from deployment  Time 2: 4 months later | $N = 647$ 39% of $N = 1651$ included who completed both assessments | Active duty USA soldiers in a brigade combat team who had returned from a 15-month deployment in Iraq  Age not reported 96% male 4% female |
| Kinyanda et al., 2012 | Uganda | Cross-sectional | Nested in study on HIV-related psychiatric & psychosocial vulnerabilities in war-affected community | $N = 1560$ 98.5% of $N = 1584$ included who completed the interview | Vulnerable (widows, orphans, single mothers) and non-vulnerable individuals in a war-affected community Aged 15 years and older 56% were aged between 18 and 44 years 43% male 57% female |
| Kinyanda et al., 2016 | Uganda | Cross-sectional | Nested in study addressing HIV-related psychiatric and psychosocial vulnerabilities in the war-affected community | $N = 1110$ 71.2% with complete data included of $N = 1560$ | Vulnerable (widowed, divorced, orphan, suffered torture, mental illness, etc.) and non-vulnerable individuals in a war-affected community Aged 15 years and older 56% were aged between 18 and 44 years 43% male 57% female |
| Malamba et al., 2016 | Uganda | Cross-sectional | Baseline data from a longitudinal cohort study to determine HIV prevalence and risk factors to inform program development | $N = 2388$ 97.5% who had HIV results included of $N = 2449$ consenting individuals | Conflict affected individuals aged 13–49 29.1% 13–19 years 202% 20–24 years 196% 25–29 years 124% 30–34 years 186% 35+ years 40% male 60% female |
| Svetlicky et al., 2010 | Lebanon | Cross-sectional | Collected 6 months post-conflict, collected for 4 months. | $N = 180$ 65.7% of $N = 274$ included who completed questionnaires | Mean age = 29.95 years (SD = 5.82; range = 20 to 54 years) 100% male Most were Israeli-born (82.8%) |
| Talbot et al., 2013 | Rwanda | Time-series | Collected at baseline, 5, 9, and 12 months | $N = 120$ 95% of $N = 120$ completed all 4 assessments; all participants were included in analysis | 94% were orphaned from the genocide Mean age = 18 years (range 15–25) Male 47% Female 53% |
| Primary author and Year | Country | Study design | Sampling strategy | Sample size and participation rate | Participant characteristics |
|-------------------------|---------|--------------|-------------------|-----------------------------------|-----------------------------|
| B.E. Cohen et al., 2012 | USA     | Retrospective cohort | Non random selection | N = 71,504 | Veterans of Operations Enduring and Iraqi Freedom Mean age = 28.5 to 29.5 100% female |
|                         |         | From a roster of all USA veterans from 2 operations | Separated USA veterans who were new users of Department of Veterans Affairs healthcare | | |
|                         |         |                  |                   | | |
| Sexual violence and mental health outcomes |         |                  |                   | | |
| Amone PO’Olak et al., 2013 | Uganda | Cross-sectional | Random selection | N = 539 83% of N = 650 who were invited to the study | Aged between 18 and 25 years 61% male 39% female 86% Acholi ethnic group |
|                         |         | Baseline data nested in a before and after study | War-affected youth who had been abducted and lived in rebel captivity for at least 6 months | | |
|                         |         |                  |                   | | |
| Roberts et al., 2008 | Uganda | Cross-sectional | Random selection | N = 1210 | Adults living in camps for internally displaced persons Mean age = 35.3 years 40% male 60% female 91% Acholi ethnic group |
|                         |         |                  | Multi-stage cluster sampling of camps, administrative zones, and individuals | | |
|                         |         |                  |                   | | |
| Nakimuli-Mpungu et al., 2013 | Uganda | Time series | Non random selection | N = 375 59% of N = 631 included who were present for at least 2 visits | Demographic data reported all patients N = 2868, many of whom were not included in the main analysis Mean age adult men = 34.5 Mean age adult women = 37.3 47% male 53% female |
|                         |         | Collected at baseline, 3, and 6 months | Analysis included only adults with a history of war-related traumatic experiences | | |
|                         |         |                  |                   | | |
| Okello et al., 2007 | Uganda | Case control | Random selection | N = 153 Formerly abducted N = 82 Non-abducted N = 71 | War affected adolescents Boys mean age = 15.5 years Girls mean age = 15.2 years Cases: 64% male; 36% female Controls: 61% male; 39% female 100% of controls in secondary school, 12.2% of cases in secondary school |
|                         |         | Cross-sectional, unmatched | Systematic recruitment, every 3rd name at 2 sites: a children’s support organization (case) and a mixed boarding school (control) | | |
|                         |         | Cases were formerly abducted youth Controls were non abducted youth | | | |
|                         |         |                  |                   | | |
| Betancourt, Agnew-Blais et al., 2010 | Sierra Leone | Prospective cohort | Non random selection | N = 152 60% of N = 260 interviewed at both times | Former child soldiers Mean age = 17.4 years 89% male 11% female |
|                         |         | Collected at baseline and time 2 | Two stage method: 1) master list of youth in care 2) invited youth between ages 10–18 with contact information | | |
|                         |         |                  |                   | | |
| Betancourt et al., 2011 | Sierra Leone | Cross-sectional | Non random selection | N = 273 | Former child soldiers Mean age = 16.53 (SD 2.61) 71% male 29% female |
|                         |         | Partially nested in a longitudinal study | Longitudinal participants from those who participated in one follow up visit, new participants recruited with NGO outreach lists | | |
|                         |         |                  |                   | | |
| Betancourt, Borisova et al., 2010 | Sierra Leone | Prospective cohort | Non random selection | N = 156 60% of N = 260 interviewed at both times | Former child soldiers Mean age = 15.13 years 88% male 12% female |
|                         |         | Collected at baseline and time 2, approximately 2 years later | Two stage method: 1) master list of youth in care 2) Youth aged 10–18 who did not have a severe disability participated | | |
|                         |         |                  |                   | | |
| Betancourt, Borisova et al., 2010 | Sierra Leone | Prospective cohort | Non random selection | N = 260 | Former child soldiers |
| Primary author and Year | Country                        | Study design                      | Sampling strategy                                                                                   | Sample size and participation rate                                                                 | Participant characteristics                                                                 |
|-------------------------|--------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Betancourt, Brennan et al., 2010 | Collected at baseline (2002), time 2 (2004), and time 3 (2008) | Sample from a master list of youth assisted by program. Youth aged 10-17 with contact information invited to participate. | 56.5% (N = 147) assessed at time 2 68.8% (N = 179) assessed at time 3                                     | Mean age at time 1 = 15.13 (SD = 222) 89% male 11% female                                       |
| Johnson et al., 2008    | Liberia                        | Cross-sectional                   | Random selection Population based multi stage random cluster of households                           | N = 1666 98.2% of N = 1696 attempted interviews                                                   | Adults in Liberia; 1/3 were former combatants Mean age = 41 years 47.2% male 52.8% female       |
| Johnson et al., 2010    | Democratic Republic of Congo   | Cross-sectional                   | Non random selection Accessible population based cluster (some originally selected villages were inaccessible due to weather and security concerns) | N = 998 98.9% of N = 1005 households surveyed                                                      | Adults in conflict-affected provinces and districts Mean age = 40.1 years 40.6% male 59.4% female |
| Johnson et al., 2014    | Kenya                          | Cross-sectional                   | Random sampling Systematic sampling of 90 villages and 10 households to assess election-related violence | N = 916 95.8% of N = 956 households samples                                                        | Adults in Kenya Mean age = 37.3 years 40% male 60% female                                      |
| Cardozo et al., 2000    | Kosovo                         | Cross-sectional                   | Random selection Two-stage cluster sampling                                                        | N = 1385 Only women included in relevant analysis, N = 825                                         | Kosovar ethnic Albanians aged 15+ years 45.3% 15–34 34.1% 35–54 10% 55–64 9.7% 65+ 37.7% male 62.3% female |
| Sabin et al., 2003      | Guatemalan refugees living in Mexico | Cross-sectional                   | Non random selection Convenience sample of 5 camps; all households sampled in 4 camps, every 3rd house in 1 camp | N = 170 93% of N = 183 households                                                                 | Adults and children in Mayan refugee camps Mean age = 37.9 years 42% male 58% female           |
| Wolfe et al., 1998      | USA                            | Retrospective cohort Nesting in longitudinal study. Baseline within 5 days of return from deployment, time 2 18–24 months later. | Non random selection Included women who completed the mailed sexual harassment questionnaire          | N = 160 66.7% of N = 240 women assessed at baseline                                               | Returned veterans of the Persian Gulf War Mean age = 28.2 years (SD = 6.8) 100% female         |
| Washington et al., 2013 | USA                            | Cross-sectional Pertinent result presented as case (PTSD) control (no PTSD) | Random selection Population based stratified sample. Included those who completed the PTSD screener | N = 3598 99.6% of N = 3611                                                                      | Veterans who had been called to duty Mean age: females with PTSD = 39.1; without PTSD = 38.1 Males: with PTSD = 40.4; without PTSD = 39.6 81.4% male 18.6% female |
| Kang et al., 2005       | USA                            | Case control Nested data from a population based survey Cases: PTSD Controls did not meet criteria for PTSD | Random selection Stratified sample to include each subgroup of military personnel                    | N = 11,441 76.3% of N = 15,000 sampled                                                           | Gulf War veterans Mean age: females: with PTSD = 39.1; without PTSD = 38.1 Males: with PTSD = 40.4; without PTSD = 39.6 81.4% male 18.6% female |

HIV acquisition/disease progression and mental health outcomes
### Table 1 Description of included studies (Continued)

| Primary author and Year | Country | Study design | Sampling strategy | Sample size and participation rate | Participant characteristics |
|-------------------------|---------|--------------|-------------------|------------------------------------|----------------------------|
| Epino et al., 2012      | Rwanda  | Cross-sectional | Non random selection | N = 610  |
|                         |         | From a prospective cohort | Patients from clinics |  |
|                         |         |                  |                  | HIV-positive adults who initiated lifelong ART |
|                         |         |                  |                  | Mean age = 38 (SD = 10) |
|                         |         |                  |                  | 38% male |
|                         |         |                  |                  | 62% female |
|                         |         |                  |                  | Mean CD4 count = 214 (SD = 92) |
| Mugisha, Muyinda, Wandiembe et al., 2015 | Uganda | Cross-sectional | Random selection | N = 2361  |
|                         |         | Baseline data from a project delivering a kinship intervention for post-conflict mental health | Two-stage cluster sample stratified at the sub-county | 98% with complete data of N = 2406 |
|                         |         |                  |                  | Adult residents of 3 of the most war affected districts |
|                         |         |                  |                  | 23.5% 18–24 years |
|                         |         |                  |                  | 27.3% 25–34 years |
|                         |         |                  |                  | 20.8% 35–44 years |
|                         |         |                  |                  | 28.5% 45–54 years |
|                         |         |                  |                  | 37.5% male |
|                         |         |                  |                  | 62.5% female |
| Mugisha, Muyinda, Malamba et al., 2015 | Uganda | Cross-sectional | Random selection | N = 2361  |
|                         |         | Nested in project delivering a kinship intervention for post-conflict mental health | Multistage sampling for a representative sample from 3 districts | 98% who had complete data included of N = 2406 |
|                         |         |                  |                  | Adult residents of 3 of the most war affected districts |
|                         |         |                  |                  | 23.8% 18–24 years |
|                         |         |                  |                  | 27.1% 25–34 years |
|                         |         |                  |                  | 20.7% 35–44 years |
|                         |         |                  |                  | 28.4% 45+ years |
|                         |         |                  |                  | 37.5% male |
|                         |         |                  |                  | 62.5% female |
| Muldoon et al., 2014 | Uganda | Cross-sectional | Non random selection | N = 129  |
|                         |         | From a larger community-based study of sex workers | Recruited through peer/sex worker led outreach in bars and hotels, and community-led outreach to former IDP camps |  |
|                         |         |                  |                  | Formerly abducted by the Lords Resistance Army |
|                         |         |                  |                  | Median age = 22 years (IQR,20–26) |
|                         |         |                  |                  | 100% female |
|                         |         |                  |                  | 96.1% from Acholi tribe |
| M.H. Cohen et al., 2009 | Rwanda | Cross-sectional | Non random selection | N = 850  |
|                         |         | Baseline data from a prospective cohort study | Mainly recruited by Rwandan women's associations | 91% of N = 936 with available mental health data |
|                         |         |                  |                  | HIV-positive and HIV-negative women |
|                         |         |                  |                  | About half of each group experienced genocidal rape |
|                         |         |                  |                  | Mean age = 36.4 |
|                         |         |                  |                  | 100% female |
| M.H. Cohen et al., 2011 | Rwanda | Prospective cohort | Non random selection | N = 698  |
|                         |         | Baseline, 6, 12, and 18 months later | Recruited from Rwandan women's associations and HIV clinics in Kigali | 74.6% of N = 936 who completed baseline HTQ and at least 1 post-baseline HTQ |
|                         |         |                  |                  | HIV-positive and HIV-negative women |
|                         |         |                  |                  | 50% of each group experienced genocidal rape |
|                         |         |                  |                  | Mean age = 36.7 (SD = 8.3) |
|                         |         |                  |                  | 100% female |
| Gard et al., 2013 | Rwanda | Cross-sectional | Non random selection | N = 922  |
|                         |         | Baseline data nested in a prospective cohort study | Recruited Rwandan women's associations and clinical sites for HIV patients | 98.5% of N = 936 women who completed the Health-Related Quality of Life measure |
|                         |         |                  |                  | HIV-positive and HIV-negative women |
|                         |         |                  |                  | 50% of each group experienced genocidal rape |
|                         |         |                  |                  | 20.8% under 30 years |
|                         |         |                  |                  | 48.4% aged 30–40 years |
|                         |         |                  |                  | 30.8% over 40 years |
|                         |         |                  |                  | 100% female |
|                         |         |                  |                  | Conflict-affected adult women |
| Primary author and Year | Country                      | Study design                      | Sampling strategy                                           | Sample size and participation rate | Participant characteristics |
|-------------------------|------------------------------|-----------------------------------|------------------------------------------------------------|-----------------------------------|-----------------------------|
| Kohli et al., 2014      | Democratic Republic of Congo | Baseline data from a randomized community trial | Included if provided family rejection information and had experienced at least 1 traumatic event in the past 10 years | 1.9% 16–19 years 14.6% 20–24 years 28.25% 25–34 years 22.54% 35–44 years 29.52% 45–60 years 3.17% over 60 years 100% female |
| Sinayobye et al., 2015  | Rwanda                       | Cross-sectional                    | Non random selection                                       | N = 710 HIV+ women over age 15, ART naïve | Mean age = 34.9 ± 7.0 100% female |

*ART* Antiretroviral therapy, *HIV* Human Immunodeficiency Virus, *HTQ* Harvard trauma questionnaire, *IDP* Internally displaced person, *PTSD* Post traumatic stress disorder, *USA* United States of America
| First author & Year | Mental health | Mental health scales | HIV risk measures | Results |
|---------------------|---------------|----------------------|-------------------|---------|
| **Mental health and HIV serostatus/HIV-related outcomes** |
| Adedimeji et al., 2015 Rwanda | Depression | Center for Epidemiologic Studies Depression Scale (CES-D) | HIV serostatus | Had sex last 6 months Depression (p < 0.001) but not PTSD (p = 0.06) was related to HIV serostatus |
| Adler et al., 2011 USA | PTSD | PTSD Checklist (PCL) | Risked STD by having unprotected sex | PTSD at time 1 predicted sex without a condom four months later (OR = 1.57, CI 1.20, 2.04) |
| Kinyanda et al., 2012 Uganda | Depression | Hopkins Symptom Checklist (HSCL-15) | High risk sexual behaviors: | High-risk sexual behavior was marginally related to MDD amongst males in univariate analysis (OR = 1.61, 95% CI 0.99–2.62, p = 0.06) but not females (OR = 1.17, 95% CI 0.68–2.01, p = 0.57). |
| | | | sex outside marriage; sex in exchange for gifts; sex in exchange for money; sex in exchange for protection; sex with an older person; sex with someone known for less than a day; sex with uniformed personnel; sex with more than one partner | |
| Kinyanda et al., 2016 Uganda | Depression | HSCL-25 | Sexual intimate partner violence (IPV) (force you to have sex when you don’t want to) | Females who experienced sexual IPV had greater odds of probable MDD (AOR = 4.20, CI 1.54, 11.46) |
| Malamba et al., 2016 Uganda | Depression | HSCL-25 | HIV serostatus | Those with MDD symptoms had greater odds of testing positive for HIV (UOR = 2.70, CI 1.95, 3.75; AOR = 1.89, CI 1.28, 2.80) |
| | PTSD | HTQ | | |
| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Svetlicky et al., 2010 Lebanon | PTSD | PTSD Inventory | Risky sexual activities (3 items including sex without protection against sexually transmitted diseases) | Those with PTSD symptoms had greater odds of testing positive for HIV (UOR = 1.90, CI 1.30, 2.78; AOR = 1.44, CI 1.06, 1.96) |
| Talbot et al., 2013 Rwanda | PTSD | PCL | Laboratory STI testing; HIV risk taking behavior: Exchanging sex for drugs, money, or favors; Having sex with an HIV-infected or status unknown partner; Having two or more sexual partners within the past 3 months | No relationship was found between PTSD and risky sexual activitiesa |
| Koegler and Kennedy (2018) | | | | |
| B.E. Cohen et al., 2012 USA | Depression PTSD Comorbid depression and PTSD | ICD-9-CM diagnostic codes | Sexually transmitted infections: cervical dysplasia; genital herpes; genital warts; chlamydia; gonorrhea; trichomonas; and other STIs | All STIs except chlamydia were associated with PTSD. Cervical dysplasia AOR = 1.86 (CI 1.61–2.16), Genital herpes AOR = 1.69 (CI 1.36–2.08), Genital warts AOR = 1.83 (CI 1.45–2.31), Chlamydia AOR = 1.66 (CI 0.93–2.96), Gonorrhea AOR = 3.12 (CI 1.51–6.44), Trichomonas AOR = 1.60 (CI 1.08–2.39), Other STIs AOR = 1.83 (CI 1.52–2.21) All STIs were associated with depression. Cervical dysplasia AOR = 2.35 (CI 2.12–2.59), Genital herpes AOR = 2.51 (CI 2.20–2.87), Genital warts AOR = 2.44 (CI 2.09–2.86), Chlamydia AOR = 2.21 (CI 1.49–3.27), Gonorrhea AOR = 3.99 (CI 2.38–6.71), Trichomonas AOR = 2.38 (CI 1.85–3.06), Other STIs AOR = 2.21 (CI 1.95–2.53) All STIs were most strongly associated with comorbid PTSD and depression. Cervical dysplasia AOR = 2.65 (CI 2.41–2.91), Genital herpes AOR = 2.55 (CI 2.24–2.91), Genital warts AOR = 2.97 (CI 2.56–3.43), Chlamydia AOR = 2.38 (CI 1.80–3.70), Gonorrhea AOR = 4.74 (CI 2.91–7.71), Trichomonas AOR = 3.75 (CI 3.01–4.66), Other STIs AOR = 2.92 (CI 2.59–3.28) |

Sexual violence and mental health outcomes

| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Amone-Polak et al., 2013 Uganda | Depression and anxiety | Acholi Psychosocial Assessment Instrument (APAI) | Sexual abuse measured by one item in the War Trauma Screening scale | Sexual abuse (β = 0.32, SE = 0.16, p < 0.001) predicted symptoms of depression and anxiety for female but not male youths in multivariate analysis. Those who reported rape or sexual abuse had greater odds of PTSD symptoms (AOR = 1.76, CI 1.01, 2.75) but not depression symptoms (NR) |
| Roberts et al., 2008 Uganda | PTSD | HTQ | Rape or sexual abuse | |
| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Nakimuli-Mpungu et al., 2013 Uganda | Depression and PTSD | Self-reporting questionnaire (SRQ-20) HTQ | Experiencing sexual violence | Experienced sexual violence was significantly related to PTSD symptom scores ($\beta = 3.75$, SE = 1.01, $p < 0.05$) but not depression symptom scores ($\beta = 0.54$, SE = 0.45). Being HIV-positive was not significantly related to depression ($\beta = 0.51$, SE = 0.43) or PTSD ($\beta = -1.41$, SE = 0.94) scores. |
| Okello et al., 2007 Uganda | Depression and Anxiety PTSD | MINI-KID Sexual torture (undefined) Being forced to marry | | Quantitative results not presented in a table, but the stated that no trauma event (including sexual torture and being forced to marry) showed any significant relationship with any diagnosis of PTSD, major depression and generalized anxiety disorder. |
| Betancourt, Agnew-Blais, et al., 2010 Sierra Leone | Depression and anxiety | A measure developed by the Oxford Refugee Studies Program for use among former child soldiers includes a subscale for anxiety, depression, and hostility | Rape as part of Child War Trauma Questionnaire | Surviving rape predicted an increase in depression over time ($b = 2.58$, $p = 0.01$) after controlling for demographic and war-related experiences. When perceived discrimination was included, the strength of the relationship between rape and depression is reduced, ($b = 1.65$, $p = 0.08$). When protective factors were added, there was no longer a relationship between rape and depression. Surviving rape was significantly associated with higher levels of anxiety ($b = 5.33$, $p < 0.001$) even after perceived discrimination and protective factors were controlled for. |
| Betancourt et al., 2011 Sierra Leone | Depression and Anxiety | HSCL-25 Rape as part of Child War Trauma Questionnaire | | No significant relationship between rape and depression after controlling for multiple variables $b = 2.42$ (CI : -0.99, 5.84). Rape was significantly related to anxiety $b = 2.85$ (CI : 0.45, 5.26, $p = 0.05$). A smaller percentage of boys experienced rape (5%) compared to girls (44%), but the effect of rape on anxiety was significant among male child soldiers and not for females ($b = -6.42$, $p = 0.05$). |
| Betancourt, Borisova, et al., 2010 Sierra Leone | Depression and anxiety | Oxford Refugee Studies Program measure for use among former child soldiers | Rape as part of Child War Trauma Questionnaire | Rape was correlated to depression symptoms ($\gamma = 0.24$, $p \leq 0.01$) and anxiety symptoms ($\gamma = 0.38$, $p \leq 0.001$). Rape was not predictive of depression at T2, adjusting for all covariates ($b = 1.74$, CI : -0.33, 4.00). Rape was the strongest predictor of anxiety at T2 controlling for anxiety levels at T1 ($b = 4.06$, CI : 1.49, 6.62, $p < 0.05$) and adjusting for all other covariates. |
| Betancourt, Brennan et al., 2010 Sierra Leone | Depression and anxiety | Oxford Refugee Studies Program measure for use among former child soldiers | Rape as part of Child War Trauma Questionnaire | Rape was associated with higher baseline levels of internalizing problems (depression/anxiety) ($b = 4.60$, $p < 0.005$). After adjusting for all hardship and protective factors, among time-invariant predictors, only being raped remained significantly related to depression/anxiety ($b = 4.34$, $p = 0.039$). |
| Johnson et al., 2008 Liberia | Depression and PTSD | Patient Health Questionnaire 9 PTSD Symptom Scale Interview (1 month recall) | Sexual violence defined as any violence, physical or psychological, carried out through sexual means or by targeting sexuality and included rape and attempted rape, molestation, sexual slavery, being forced to undress or |
| | | | | Adults who experienced sexual violence were more likely to meet criteria for PTSD (69% vs. 38%, $p < 0.0001$) and MDD (57% vs. 37%, $p = 0.0002$) compared to adults who did not experience sexual violence. |
Table 2 Study outcomes for association between mental health and HIV risk (Continued)

| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|----------------------|------------------|---------|
|                     |                         |                      |                  |         |
| Johnson et al., 2010| Depression | Patient Health Questionnaire-9 | Sexual violence – defined above | The weighted prevalence of PTSD (81% vs. 46%, \(p < 0.001\)) and MDD (64% vs. 42%, \(p = 0.003\)) was higher among male former combatants who had experienced sexual violence compared to those who had not. The weighted prevalence of PTSD (74% vs. 44%, \(p = 0.005\)) was higher but not MDD (63% vs. 55%, \(p = 0.051\)) among female former combatants who experienced sexual violence compared to those who had not. Noncombatant sexual violence was not related to MDD (32% vs. 29%, \(p = 0.73\)) nor PTSD (39% vs. 36%, \(p = 0.74\)) for men nor MDD (48% vs. 36%, \(p = 0.15\)) nor PTSD (56% vs. 36%, \(p = 0.09\)) for women. Those who experienced lifetime sexual violence had 1.39 (\(p = 0.04\)) the odds of MDD and 2.67 (\(p < 0.001\)) the odds of PTSD compared to those who did not experience sexual violence. |
|                     | PTSD | PTSD Symptom Scale Interview (PSS-I) |                  |         |
| Johnson et al., 2014| Kenya | Depression | Patient Health Questionnaire-9 | The prevalence of MDD was significantly higher for those who experienced sexual violence (60.4%) compared to those who did not experience sexual violence (30.7%, \(p < 0.001\)). The prevalence of PTSD was significantly higher for those who experienced sexual violence (70.2%) than those who did not experience sexual violence (40.3%, \(p < 0.001\)). The prevalence of MDD for females who experienced conflict-related sexual violence was significantly higher (67.7%) than for those who did not experience conflict-related sexual violence (30.3, \(p < 0.001\)). The prevalence of PTSD for females who experienced conflict-related sexual violence was significantly higher (75.9%) than for those who did not experience conflict-related sexual violence (44.4%, \(p < 0.001\)). There were no differences in the prevalence of MDD (47.5% vs. 36.3%, \(p = 0.18\)) or PTSD (56% vs. 41.7%, \(p = 0.17\)) for men who did and did not experience conflict-related sexual violence. There were no differences in the prevalence of MDD (50.7% vs. 38.4%, \(p = 0.38\)) or PTSD (61.9% vs. 44.1%, \(p = 0.34\)) for men nor of MDD (72.9% vs. 40.1%, \(p = 0.07\)) or PTSD (83.6% vs. 52.4%, \(p = 0.06\)) for women who experienced community based sexual violence. |
|                     | PTSD | PSS-I |                  |         |

being stripped of clothing, forced marriage, and insertion of foreign objects into the genital opening or anus, forcing 2 individuals to perform sexual acts on one another or harm one another in a sexual manner, or mutilating a person’s genitals. The prevalence of MDD was significantly higher for those who experienced sexual violence (60.4%) compared to those who did not experience sexual violence (30.7%, \(p < 0.001\)). The prevalence of PTSD was significantly higher for those who experienced sexual violence (70.2%) than those who did not experience sexual violence (40.3%, \(p < 0.001\)). The prevalence of MDD for females who experienced conflict-related sexual violence was significantly higher (67.7%) than for those who did not experience conflict-related sexual violence (30.3, \(p < 0.001\)). The prevalence of PTSD for females who experienced conflict-related sexual violence was significantly higher (75.9%) than for those who did not experience conflict-related sexual violence (44.4%, \(p < 0.001\)). There were no differences in the prevalence of MDD (47.5% vs. 36.3%, \(p = 0.18\)) or PTSD (56% vs. 41.7%, \(p = 0.17\)) for men who did and did not experience conflict-related sexual violence. There were no differences in the prevalence of MDD (50.7% vs. 38.4%, \(p = 0.38\)) or PTSD (61.9% vs. 44.1%, \(p = 0.34\)) for men nor of MDD (72.9% vs. 40.1%, \(p = 0.07\)) or PTSD (83.6% vs. 52.4%, \(p = 0.06\)) for women who experienced community based sexual violence. 31% of those who experienced sexual violence had anxiety and depression before the 2007 election, 45% who experienced sexual violence had anxiety and depression during the election, and 33.7% who experienced sexual violence had anxiety and depression after the 2007 election. The weighted prevalence of MDD (41.0%, CI 27, 55 vs. 35.0%, CI 29.2, 40.8) and PTSD (40.1%, CI 28.6, 51.6 vs. 36.0%, CI 25.0, 48.3) were higher among men who experienced sexual violence compared to those who did not experience sexual violence.
### Table 2: Study outcomes for association between mental health and HIV risk (Continued)

| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Cardozo et al., 2000 Kosovo | PTSD | HTQ | Rape | 30.9% (CI 25, 36.8) were not significantly different between those who reported sexual violence and those who did not report sexual violence. |
| Sabin et al., 2003 Guatemalan refugees living in Mexico | Depression Anxiety PTSD | HSCL-25 HTQ | Sexual abuse or rape reported as traumatic event | Rape was not related to PTSD symptoms. 21.6% of women who reported rape had symptoms of PTSD vs. 15.92% of women who did not report rape, $p = 0.049$; AOR = 1.68, CI 0.69, 4.08 |
| Wolfe et al., 1998 USA | PTSD | Mississippi Scale for Combat-related PTSD | Sexual assault defined as a sexual experience that was unwanted and involved the use or threat of force (attempted or completed rape) either by strangers or people you knew | Sexual abuse or rape was independently associated with anxiety ($p = 0.02$) but sexual abuse did not remain significant in the full model. All rape survivors ($N = 6$, 100%) experienced anxiety. Sexual abuse or rape was not related to PTSD or depression. |
| Washington et al., 2013 USA | PTSD | 7-item screen for DSM IV PTSD | History of military sexual assault | Women who were sexually assaulted experienced a significant 18.9 point increase in PTSD scores ($M = 91.83$, SD = 22.69) compared to women with no sexual harassment ($M = 71.36$, SD = 17.53). |
| Kang et al., 2005 USA | PTSD | PCL | Sexual assault | Women who were sexually assaulted had increased risk for PTSD compared to women who were only physically (12.5 point difference) or verbally (15.9 point difference) harassed. |

**HIV acquisition/disease progression and mental health outcomes**

| First author & Year | Mental health disorders | Mental health scales | HIV status | Results |
|---------------------|-------------------------|---------------------|------------|---------|
| Epino et al., 2012 Rwanda | Depression | HSCL-15 | CD4 count | There was not a significant difference in depression for those with $<=200$ CD4 cell count (25.5) and $>200$ CD4 count (26) ($p = 0.58$). |
| Mugisha, Muyinda, Wandembe et al., 2013 Uganda | PTSD | Mini-International Neuropsychiatric Interview (MINI) | HIV status | Those reporting HIV+ status had greater odds of having PTSD (UOR = 2.09, CI 1.48, 2.95) |
| Mugisha, Muyinda | Depression | MINI | HIV status | Those who experienced 1–2 sexual trauma events had greater odds of having PTSD in the unadjusted (UOR = 26, CI = 1.63, 4.15) but not the adjusted (AOR = 1.23, CI 0.73, 2.07) model. |
| | | | High risk sexual behaviors | Those who experienced 3+ sexual trauma events had greater odds of having PTSD (UOR = 5.65, CI 3.33, 9.61; AOR = 2.02, CI 1.08, 3.76) |
| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Malamba et al., 2015 Uganda | Depression | CES-D | Receiving HIV treatment | HIV+ status was related to MDD (UOR = 2.85, CI 2.04, 3.96), after adjusting for sex and age (AOR = 2.63, CI 1.87, 3.70), and in the multivariate model (OR = 1.83, CI 1.22, 2.74). High risk sexual behavior was not related to MDD in the unadjusted (UOR = 1.13, CI 0.77, 1.67) or adjusted model (AOR = 1.37, CI 0.91, 2.09). Receiving HIV treatment was related to MDD in the adjusted model (AOR = 3.22, CI 1.08, 9.57) but not the unadjusted model (UOR = 2.03, CI 0.85, 4.85). |
| Muldoon et al., 2014 Uganda | Depression and anxiety | APAI | All participants had exchanged sex for money or resources in the previous 30 days | For all participants the mean score for the depression sub-scale was 12.84 (SD = 4.79) and the mean score for the anxiety sub-scale was 8.76 (SD = 5.14). No cut off score is defined for symptomatic for either subscale. |
| M.H. Cohen et al., 2009 Rwanda | Depression | CES-D | About 50% of participants in each group of HIV-positive and HIV-negative experienced genocidal rape | CD4 cell counts | Women with HIV infection were more likely than HIV-negative women to have clinically significant depression (81% vs. 65%, p < 0.0001) and MDD (31% vs. 23%, p < 0.047). Women with more advanced HIV, indicated by CD4 cell counts < 200 = mL (OR 4.97, CI 2.93, 8.45) were the most likely to have depressive symptoms. Women who had experienced genocidal rape were more likely to have PTSD in unadjusted analyses (OR = 1.63, CI 1.23, 2.15). Depressive symptoms were higher in women who had a history of genocidal rape (OR = 1.56, CI 1.12, 2.16). |
| M.H. Cohen et al., 2011 Rwanda | Depression | CES-D | About 50% of participants in each group of HIV-positive and HIV-negative experienced genocidal rape | PTSD | HIV-positive status was related to increased symptoms of depression (81.5% vs. 63.8%, p < 0.0001), marginally related to symptoms of PTSD (59.6 vs. 67.5%, p = 0.081), and not related to MDD (29.2% vs. 22.7%, p = 0.11) compared to HIV-negative status at baseline. There was a continued reduction in PTSD at each follow-up visit for both HIV-positive and HIV-negative groups (6 month change = −0.78, p < 0.0001; 12 month change = −0.9, p < 0.0001; 18 month change = −0.84, p < 0.0001). HIV-positive status (b = 0.03, p = 0.38) was not related to PTSD improvement from baseline to 18-month follow up. All participants had fewer depressive symptoms at 18 months follow up compared to baseline (77% vs. 57%). In changes from baseline to visit 4, experiencing genocidal rape was significantly associated with reduced PTSD. |
| Gard et al., 2013 Rwanda | Depression | CES-D | About 50% of participants in each group of HIV-positive and HIV-negative experienced genocidal rape | PTSD | |

Other associations between mental health and HIV acquisition and disease progression

Koegler and Kennedy. Conflict and Health, 2018:120
| First author & Year | Mental health disorders | Mental health scales | HIV risk measures | Results |
|---------------------|-------------------------|---------------------|------------------|---------|
| Kohli et al., 2014 Democratic Republic of Congo | Depression PTSD | HSCL-15 HTQ | Rape | HIV-positive women had higher depression scores than HIV-negative participants (23.67, SD = 9.19 vs. 20.79, SD = 9.60, p < 0.001). More HIV-positive women met criteria for depression than HIV-negative women (81.46% vs. 64.58%, p < 0.001). There was no difference in PTSD scores between HIV-positive and HIV-negative women (2.31, SD = 0.69 vs. 2.4 SD = 0.67, p = 0.09). A greater percentage of HIV-negative compared to HIV-positive women experienced elevated PTSD scores (65.63% vs. 57.8%, p = 0.05). |
| Sinayobye et al., 2015 Rwanda | Depression PTSD | CES-D HTQ | CD4 count | Rape or sexual assault in the past 10 years was related to increased symptoms of PTSD ($\beta = 0.35$, p < 0.001) and depression ($\beta = 0.29$, p < 0.001) in multivariate regression. Depression scores were associated with CD4 count ($p < 0.001$) with: CD4 counts > 350 having a mean depression score of 22.4 ± 9.3 CD4 count 200–350 having a mean depression score of 23.0 ± 8.2 CD4 count < 200 having a mean depression score of 25.8 ± 9.1 PTSD scores were not associated with CD4 count ($p = 0.60$) with: CD4 counts > 350 having a median (IQR) PTSD score of 2.1 (1.7–2.7) CD4 count 200–350 having a median (IQR) PTSD score of 2.1 (1.8–2.8) CD4 count < 200 having a median (IQR) PTSD score of 2.2 (1.8–2.8) |

AOR adjusted odds ratio, ART Antiretroviral therapy, CI confidence interval, MDD major depressive disorder, NR not reported, OR odds ratio, SE Standard Error, SD standard deviation

*Effect size data are reported where available; textual descriptions of results are reported when that was all that the authors present*
spreadsheet. For each included study the following information was extracted where applicable: citation; location, setting and target group; study design; sample size; age range; gender; random or non-random selection of participants; length of follow up; outcome measures; comparison groups; effect sizes; confidence intervals; significance levels; measures of HIV risk, mental health conditions and measures; funding source; and study limitations. To assess study quality, we extracted data on study design, sampling strategy, sample size, and participant characteristics, presented in Table 1. These factors were then considered in relation to study quality as presented in the results and discussion. We did not conduct meta-analysis due to the diversity of populations, study designs, and measured outcomes.

Results
Of 714 citations identified through the search strategy, 33 publications were included in this review (Tables 1 and 2). Figure 1 presents a flowchart of the search and screening process. Eighteen articles were identified via database searching, thirteen through reference searching, and two through searching journal table of contents.

Table 1 provides information on location, study design, sampling strategy, study size, and participant characteristics for each included article. Although most studies were cross-sectional, many articles presented the expected directionality of the relationship based on which variable was considered the exposure and which was considered the outcome. Results are organized by the outcome variable reported by the authors (using the authors’ expected directionality of the association) as follows: mental health and HIV serostatus/HIV-related outcomes; sexual violence and mental health outcomes; HIV acquisition/disease progression and mental health outcomes; and other associations. Under other associations, we include studies that met the inclusion criteria but that did not specify the expected directionality of the associations. Twenty-five studies were from sub-Saharan Africa, five were from the United States of America (USA), and one each was from the Middle East, Europe, and Latin America. Most studies were cross-sectional, though three time-series studies and seven cohort studies reported longitudinal data. Most studies had non-random sampling of participants, though 14 studies utilized a form of random sampling. Overall, 110,818 participants were included across articles. However, there was overlap in participants across four papers discussing child soldiers in Sierra Leone [22–25], in five papers discussing HIV-positive and negative women, half of whom survived rape during the genocide in Rwanda [26–30], in two papers from Uganda [31, 32], and in two papers from the Wayo-Nero Study in Uganda [33, 34]. The smallest study included 120 participants and the largest study included 71,504 participants.

Table 2 presents each of the included studies by author and year, country, mental health disorders and measurement scales, HIV risk measures, and the relationship...
found between mental health and HIV-related outcomes. Most studies reported mental health outcomes either in relation to sexual violence or other factors related to HIV acquisition and disease progression. Eight studies reported HIV serostatus or HIV risk outcomes. Three studies reported other outcomes but included analyses of the association between mental health and HIV acquisition and disease progression. In several studies, the relationship between HIV-related factors with mental health was not the main objective, but rather one of many results reported.

Mental health and HIV serostatus/HIV-related outcomes
Of the eight studies that reported HIV serostatus or HIV-related outcomes, five included HIV sexual risk behaviors, two reported HIV serostatus, two reported other STIs, and one reported intimate partner sexual violence.

Four HIV sexual risk behavior studies found some relationship between mental health and HIV risk behaviors. A study from Uganda found a relationship between depression and at least one of eight sexual risk behaviors amongst males in multivariate analysis in a war-affected community (odds ratio \( \text{OR} = 1.70, p = 0.05 \)) [32]. In one Rwandan study, increased symptoms of PTSD were correlated with at least one of three HIV risk-taking behaviors \( (r = 0.24, p = 0.0006) \) [35]. In another Rwandan study, women who had exchanged sex had greater odds of depression \( (\text{OR} = 1.74, \text{confidence interval (CI)} 1.10, 2.76) \) and PTSD \( (\text{OR} = 1.68, \text{CI} 1.19, 2.36) \) [30]. Women who used condoms at least 50% of the time had decreased odds of PTSD \( (\text{OR} = 0.60, \text{CI} 0.42, 0.86) \), but increased odds of elevated depression scores \( (\text{OR} = 1.84, \text{CI} 1.20, 2.82) \) [30]. Women who had sex in the last six months had decreased odds of depression \( (\text{OR} = 0.57, \text{CI} 0.04, 0.81) \) [30]. A longitudinal study from the USA showed that PTSD predicted unprotected sex four months later \( (\text{OR} = 1.57, \text{CI} 1.20, 2.04) \) [36]. In Lebanon, no relationship was found between PTSD and risky sexual activities [37].

Two studies focused on HIV serostatus as an outcome. Depression \( (p < 0.001) \) but not PTSD \( (p = 0.06) \) was related to HIV positive serostatus amongst female survivors of the Rwandan genocide in a cross-sectional, non-randomly selected cohort [30]. In a randomly selected cross-sectional study in Uganda, men and women with depression (adjusted odds ratio \( \text{AOR} = 1.89, \text{CI} 1.28, 2.80 \)) and PTSD \( \text{AOR} = 1.44, \text{CI} 1.06, 1.96 \) had greater odds of testing positive for HIV [38].

Two studies reported STIs other than HIV as an outcome. Female survivors of the Rwandan genocide who had a non-HIV STI had greater odds of elevated depression scores \( (\text{AOR} = 1.64, \text{CI} 1.01, 2.65) \), but not PTSD \( \text{OR} = 1.07, \text{CI} 0.77, 1.50 \) [30]. Female USA veterans of conflict in Iraq and Afghanistan who had PTSD were significantly more likely to have six of seven different STIs compared to veterans without any mental health diagnosis; female veterans with depression were more likely to have all seven STIs compared to those without any mental health diagnosis [39]. Those with comorbid depression and PTSD were even more likely to have all seven STIs compared to those without any mental health diagnosis with adjusted OR between 2.55 and 4.74. This study had the largest population amongst the included articles (\( N = 71,504 \)) and represented the entire population of female veterans who met inclusion criteria.

Finally, one study from Uganda reported intimate partner sexual violence as an outcome. In this a cross-sectional study, females who experienced sexual violence from an intimate partner had greater odds of probable depression \( (\text{AOR} = 4.20, \text{CI} 1.54, 11.46) \) [31].

Overall, studies reported strong associations between depression and PTSD and HIV serostatus/HIV-related outcomes in African and American conflict-affected populations.

Sexual violence and mental health outcomes
Twenty-two studies reported mental health outcomes: two reported depression only; six PTSD only; six depression and anxiety; six depression and PTSD; and two depression, anxiety, and PTSD. A large number of studies in this review \( (n = 16) \) were conducted in sub-Saharan Africa and reported the relationship between mental health and sexual violence, rape, or sexual abuse (as an HIV-related measure out of the victims’ control). The remaining studies in this category were conducted in the USA \( (n = 3) \), with Kosovar ethnic Albanians \( (n = 1) \), and with Guatemalan refugees in Mexico \( (n = 1) \).

Most studies found a positive association between sexual violence and poor mental health; three studies found no association. Sexual abuse predicted depression and anxiety for female Ugandan youth \( (\beta = 0.32, p < 0.001) \) [40]. Experiencing sexual violence was related to PTSD in a study among Ugandan adults \( (\beta = 3.75, p < 0.05) \) [41]. Similarly, in another study of Ugandan adults, those who experienced three or more sexual trauma events had greater odds of PTSD \( (\text{AOR} = 2.02, \text{CI} 1.08, 3.67) \) [34]. For Ugandan adults living in camps for internally displaced people, those who reported rape had greater odds of PTSD \( (\text{AOR} = 1.76, \text{CI} 1.01, 2.75) \), but not depression [42]. Amongst adult and adolescent Guatemalan refugees in Mexico, sexual abuse was independently associated with anxiety, but did not remain significant after controlling for other variables [43]. Among Kosovar ethnic Albanian women, rape was not related to PTSD \( \text{AOR} = 1.68, \text{CI} 0.69, 4.08 \) [44]. It is notable that in
this study, rape was only identified in 4.4% of women (N = 60) [44].

Three studies by the same study team examined the relationship of sexual violence with depression and PTSD in different countries. The studies utilized different methodologies and had different outcomes. Sexual violence was related to PTSD and depression in Liberian adults, with prevalence of PTSD higher for male (81% vs. 46%, \( p < 0.001 \)) and female (74% vs. 44%, \( p = 0.005 \)) former combatants who experienced sexual violence; depression was higher for male former combatants who experienced sexual violence compared to those who did not (64% vs. 42%, \( p = 0.003 \)) [45]. In the Democratic Republic of Congo, prevalence of PTSD (70.2% vs. 40.3%, \( p < 0.001 \)) and depression (60.4% vs. 30.7%, \( p < 0.001 \)) were higher for participants who experienced sexual violence compared to those who did not; prevalence of PTSD and depression were higher for females who experienced conflict-related sexual violence compared to females who did not, respectively (75.9% vs. 44.4%, \( p < 0.001 \) and 67.7% vs. 30.3%, \( p < 0.001 \)) [46]. During the 2007 election violence in Kenya, the prevalence of sexual violence was not significantly related to major depressive disorder or PTSD [47].

The Liberian study had the strongest methodological quality (utilizing a population based multistage random household cluster survey) and the study in the Democratic Republic of Congo had the weakest quality of the three (non random accessible population cluster). Although sexual violence in Kenya was not significantly related to major depressive disorder and PTSD, sexual violence was significantly related to suicidal ideation and suicide attempt [47].

Sexual torture and being forced to marry were not related to depression, anxiety, and PTSD amongst formerly war abducted adolescents in Uganda [48]. However, the study may not have had the statistical power to detect significance for such analysis as the primary objective was to compare newly abducted and non-abducted adolescents. No trauma event had a significant relationship with mental health outcomes in this randomly selected population.

Four studies reported data from a non-randomly selected prospective cohort of child soldiers in Sierra Leone. In two studies with overlapping samples (one cross-sectional with 273 participants and one longitudinal with 156 participants), rape was significantly related to anxiety (\( b = 2.85, p = 0.05 \); \( b = 4.06, p < 0.05 \)), especially in males, but not depression after controlling for other variables [23, 24]. In a slightly different sample, rape was associated with increased anxiety after controlling for discrimination and protective factors (\( b = 5.35, p < 0.001 \)); rape significantly predicted an increase in depression over time, but this relationship lessened when perceived discrimination was added and was no longer significant when protective factors were added [22]. Rape was the only time-invariant predictor found to be related to depression/anxiety (considered together) after adjusting for hardship and protective factors (\( b = 4.34, p = 0.04 \)) [25]. Combined, these studies demonstrate that rape (as a more extreme war event) is a strong predictor of anxiety over time amongst war-affected adolescents.

Three publications examined sexual assault and mental health in conflict-affected American military populations. Female veterans who returned from deployment in the Persian Gulf were more likely to experience PTSD if they had been sexually assaulted during their service compared to women who did not experience harassment, who only experienced verbal harassment, and who experienced physical harassment that was not sexual assault [49]. In cross-sectional analyses, female veterans with PTSD compared to those without PTSD were more likely to have experienced sexual assault while in the military (43% vs. 5.1%, \( p < 0.001 \)) [50]. Sexual assault reports were significantly associated with PTSD for men (\( OR = 6.21, CI 2.26, 17.04 \)) and women (\( OR = 5.41, CI 3.19, 9.17 \)) after controlling for other variables [51]. Findings from these studies supported a relationship between sexual assault and poor mental health.

Overall, studies reported strong associations between sexual violence and all three mental health outcomes. Sexual violence was most strongly associated with PTSD [41, 42, 45, 46, 49–51], then depression [22, 24, 25, 40, 45, 46], and then anxiety mainly amongst male survivors [22–25, 40, 43].

**HIV acquisition/disease progression and mental health outcomes**

Factors related to HIV acquisition and disease progression were associated with mental health outcomes in two studies that reported HIV sexual risk behavior, one that reported CD4 count, one that reported receiving HIV treatment, two that reported HIV status, and two that compared HIV-positive and HIV-negative participants and rape during genocide.

In Uganda, formerly conflict-abducted young women who recently exchanged sex for money or resources were assessed for mental health with a locally developed measure; mean depression and anxiety scores were 12.84 and 8.76, respectively [52]. Cut off scores defining symptomatic versus asymptomatic depression and anxiety were not provided in this study so no conclusion can be made regarding the association between HIV sexual risk with depression and anxiety. In another study in Uganda, adults with high risk sexual behavior did not have higher odds of depression (\( AOR = 1.37, CI 0.91, 2.09 \)) [33].

Lower CD4 count indicates more advanced HIV disease progression and potentially increases transmissibility. In one non-randomly selected population in Rwanda, there
was no difference in depression scores for adults with CD4 counts at or below 200 compared to adults with CD4 counts over 200 [53]. Receiving HIV treatment was associated with depression (AOR = 3.22, CI 1.08, 9.57) among a random selection of adults in Uganda [33]. Reporting an HIV-positive status was associated with both PTSD (OR = 2.09, CI 1.48, 2.95) [34] and depression (OR = 1.83, CI 1.22, 2.74) [33] among Ugandan adults.

In two publications from another non-randomly selected cohort in Rwanda, depression and PTSD in HIV-positive and negative women were examined both cross-sectionally and longitudinally. At baseline, HIV-positive women were more likely than HIV-negative women to have depression symptoms (81% vs. 65%, p < 0.0001) and HIV-positive women with CD4 counts below 200 were the most likely to have depression symptoms (OR = 4.97, CI 2.93, 8.45) [26]. Women who experienced rape during the genocide were more likely to have PTSD (OR = 1.63, CI 1.23, 2.15) and depression (OR = 1.56, CI 1.12, 2.16) in unadjusted analysis [26]. Over three follow-up visits at six, twelve, and eighteen months, HIV-positive and HIV-negative women had reduced PTSD scores; this improvement was not related to antiretroviral therapy (ART) use, but was related to HIV-positive status at follow-up three, and was related to rape during the genocide at follow-ups two and three [27]. Overall, studies examining mental health outcomes and factors related to HIV acquisition and disease progression reported both positive and null associations.

**Other associations between mental health and HIV acquisition and disease progression**

Three studies used other outcomes for their primary analyses but provided data assessing the cross-sectional association between mental health and HIV acquisition and disease progression, making less clear the authors’ expected directionality of the relationship. One study in Rwanda (with some study population overlap) examined quality of life amongst trauma-affected women with and without HIV. About half of the women in each group had experienced rape during the genocide. HIV-positive women experienced increased depression symptom scores compared to HIV-negative women (p < 0.001), but a greater percentage of HIV-negative women experienced elevated symptoms of PTSD [28]. In another study in Rwanda among HIV positive women (with study population overlap) depression (p < 0.001), but not PTSD (p = 0.60), was associated with CD4 count [29]. In the Democratic Republic of Congo, family rejection amongst survivors of sexual assault was more strongly related to depression, but increased PTSD was more strongly related to sexual assault [54]. Rape or sexual assault in the past ten years was associated with both increased PTSD (β = 0.35, p < 0.001) and depression (β = 0.29, p < 0.001).

Overall, studies in this category demonstrated inconsistent associations between mental health and HIV acquisition and disease progression.

**Discussion**

Overall, the thirty-three studies included in this review suggest that symptoms of poor mental health are associated with increased sexual risk behaviors and HIV markers, and HIV exposures and HIV-related health status are associated with poor mental health symptoms in conflict-affected populations. Only five studies found no association between mental health and factors related to HIV acquisition and disease progression. Associations were strongest for mental health and HIV serostatus/ HIV-related outcomes and sexual violence and mental health outcomes. Associations between HIV acquisition/disease progression and mental health outcomes and outcomes that examined other associations were more inconsistent. This could be partially attributed to the greater variety in the types of associations measured in these categories. For example, studies that examined sexual violence and mental health outcomes only included associations between sexual violence and mental health, given the large number of studies in this category. However, studies that examined HIV acquisition/disease progression and mental health outcomes looked at a variety of HIV-related correlates with mental health outcomes (e.g. CD4 count, sexual risk behaviors, HIV positive serostatus).

There were slight inconsistencies across studies in associations. For articles that found an association between one or more mental health disorders and factors related to HIV acquisition and disease progression, there were other articles, or findings within the same article, that failed to identify a relationship with one or more other disorders. These inconsistencies may represent real differences in various associations or populations. Inconsistencies in the findings may also be attributed to less rigor among some studies that did not find associations: non-random selection and small sample size [37], small numbers of relevant participants within the sample [43, 48], and low rates of the HIV-related variable [35]. Some studies that did not find associations had trends towards an association [47] or a marginal association [31]. Studies with strong rigor (large sample sizes of randomly selected participants or the entire population) found strong positive associations both in conflict-affected USA [39, 50, 51] and African populations [31, 38].

Our findings are similar to a review of HIV risk behaviors and trauma amongst migrants from low and middle-income countries [18]. Our study differs from the review by Michalopoulos et al. by including associations between
mental health and factors related to HIV acquisition and disease progression in conflict-affected populations from high-income countries, focusing on measurable mental health disorders, and exclusively presenting quantitative relationships.

We only included mental health symptoms documented by validated scales to ensure that included studies met a minimal level of measurement rigor and to increase comparability of findings across studies. Most included articles meet the criteria for ‘protracted’ or ‘post-conflict’ [21, 47]. However, one study stands out as it specified reporting election-related violence rather than war or conflict; with 1133 deaths over 59 days, the setting met criteria for an ‘explosive’ event [21, 47]. This demonstrates the range of included conflict-affected settings. Because HIV disproportionally affects sub-Saharan Africa, much of the literature discussing conflict and HIV focuses on this geographic area. Similarly, a wide range of conflict-affected populations were included in this review, from soldiers fighting in their own country to returned American combat veterans, from orphans to child soldiers, from abducted civilians to those living in internally displaced persons camps. Unfortunately, there were not enough studies examining the same factors in the range of conflict-affected regions or populations to draw strong conclusions as to how these relationships might differ by region or population.

We used findings from this review along with existing literature to develop a framework (Fig. 2). Mock et al. described how HIV prevalence could increase (via increased military and civilian interaction, increased commercial and casual sex, etc.) or decrease (via increased isolation, mortality of high-risk populations, etc.) in conflict-affected settings [13]. It is well established in the

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**Fig. 2** Relationship Between Mental Health & HIV in Conflict Settings. This figure illustrates a framework of the relationship between mental health and HIV serostatus and HIV-related outcomes among conflict-affected populations, based on this review and existing literature. The outside blue panel presents existing knowledge of factors in conflict-affected settings. HIV prevalence could increase or decrease in conflict-settings through various mechanisms [13]. Multiple factors contribute to increased risk for poor mental health in conflict-affected settings. Additional factors adversely affect conflict-affected populations. The inside box presents the relationship between mental health and HIV-related outcomes. HIV can physiologically, psychologically, and socially increase risk for mental health disorders. Health status (being HIV-positive and lower CD4 count) is associated with poor mental health. Poor mental health can influence HIV risk exposures (sexual risk behaviors and STIs). Surviving sexual assault is associated with poor mental health and HIV-related outcomes. Demographic factors can influence each relationship.
literature that conflict-affected populations are at risk for poor mental health [8, 12, 55], and often lack access to mental health services [56, 57]. Physiological, psychological, and social pathways can influence the relationship between HIV-related outcomes and mental health disorders [7]. What is lacking in the literature, to the best of our knowledge, is a framework that incorporates the relationship between mental health and factors associated with HIV acquisition and progression in conflict-affected populations.

Our findings provide evidence for this framework. Specifically, we identified studies that demonstrate health status (HIV-positive serostatus, lower CD4 count) is associated with increased depression [26–30, 38], that mental health disorders may influence HIV risk exposures (sexual risk behaviors [30, 32, 36] and STIs [30, 39]), and that surviving sexual assault may be associated with poor mental health [22–25, 40, 41, 43, 45, 46, 49–51].

There were several limitations to this review. First, only one reviewer identified, screened, and extracted data from included studies. Methodological rigor would be strengthened if two reviewers had independently completed each step and resolved any discrepancies. Although it was not possible to have two reviewers conduct all steps in the review process, a second, experienced reviewer was consulted when specific questions arose during the process and a third reviewer verified the extracted data. Second, the search terms for ‘conflict’ focused only on conflict and war. By excluding terms such as refugee, displaced persons, and asylum seekers we may have missed articles relevant to this review.

We examined only three mental health disorders, selected because they are common and frequently measured in conflict-affected populations. However, other disorders may be relevant in conflict-affected populations, specifically substance use, which has been shown to be common, harmful, and related to HIV transmission and risk in conflict-affected populations [58–60]. Finally, 23 of the 33 studies were cross-sectional, so the temporality of these relationships cannot be determined. No studies were identified in this review that examined the association between viral suppression and mental health; future studies should examine these associations. Longitudinal studies should also be conducted examining associations between mental health and factors related to HIV acquisition and disease progression. Future reviews could examine the associations between HIV acquisition or risk behaviors and substance use or other mental health disorders in conflict-affected populations.

There are several implications from this review. Considering the associations discussed in this paper, programs delivering HIV or other reproductive health services for conflict-affected populations should consider screening individuals who have HIV or STIs for mental health disorders using appropriate cross-culturally validated tools. Referrals could then be made, assuming availability of evidence-based interventions. Similarly, programs delivering mental health services should consider screening for HIV serostatus and associated risk factors. Since health infrastructure is often limited in conflict-affected settings, combining screening and services offers the potential to more systematically and holistically treat vulnerable individuals. An example where this has occurred is in Uganda, where an organization that provided mental health interventions for conflict survivors included HIV screening, referrals, and services to meet the unique mental health needs of people living with HIV [61].

At the policy level, by recognizing the relationships between mental health and factors related to HIV acquisition and disease progression in conflict settings, infrastructure can be integrated to offer mental health and HIV-related services simultaneously. Policy could also require monitoring of results to recognize any differences in separate treatment compared to integrated treatment of mental health and HIV-related services. Future research should employ stronger methods where possible – specifically, random selection of participants to decrease bias and longitudinal studies to better determine directionality of the measured associations. Research should also examine the associations of mental health with HIV acquisition and disease progression with a wider range of conflict-affected populations, as the relationship may vary depending on the population and the possibilities for risk exposure.

**Conclusions**

Existing literature demonstrates that depression, anxiety, and PTSD have been quantifiably associated with four factors related to HIV acquisition and disease progression in conflict-affected populations: markers of HIV risk (i.e. STIs), HIV-related health status (e.g. CD4 count), sexual risk behaviors, and HIV risk exposures (i.e. sexual violence). Specifically, poor mental health has been associated with two outcomes, HIV markers and sexual risk behaviors, while HIV risk exposures and health status have been associated with the outcome of poor mental health. Additional research utilizing random selection and longitudinal design can further establish the strength of these associations and determine if HIV and mental health services need to be integrated for conflict-affected populations.

**Additional file**

Additional file 1: Scoping review search terms for PubMed. (DOCX 14 kb)

**Abbreviations**

AOR: Adjusted Odds Ratio; ART: Antiretroviral Therapy; CI: Confidence Interval; HIV: Human Immunodeficiency Virus; HTQ: Harvard Trauma
The authors declare that they have no competing interests.

Ethics approval and consent to participate

The authors thank Peggy Gross for assistance with generating the search terms. We also thank David Celentano for his extensive feedback on an earlier draft and Jessica Haslag for verifying the extracted data.

Funding

This research was supported by NIMH NRSF F31MH095678.

Availability of data and materials

The data extracted from each included article is available upon request.

Authors’ contributions

EK extracted the data, coded included articles, analyzed the data, and was the primary writer of the manuscript. CK provided substantial contributions to the design of the study, analysis and interpretation of the data, and provided critical revisions throughout several drafts of the manuscript. Both authors read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

Publisher’s Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Received: 24 October 2016 Accepted: 25 March 2018

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