BMJ Open

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-006299
Article Type:	Research
Date Submitted by the Author:	04-Aug-2014
Complete List of Authors:	Sipsma, Heather; University of Illinois at Chicago College of Nursing, Falb, Kathryn ; Yale School of Public Health, Department of Chronic Disease Epidemiology Willie, Tiara; Yale School of Public Health, Department of Chronic Disease Epidemiology Bradley, Elizabeth; Yale University, Global Health Leadership Institute Bienkowski, Lauren; American Refugee Committee, Meerdink, Ned; American Refugee Committee, Gupta, Jhumka; Yale School of Public Health, Department of Chronic Disease Epidemiology
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology, Global health, Public health
Keywords:	EPIDEMIOLOGY, International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, STATISTICS & RESEARCH METHODS, PUBLIC HEALTH

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Heather L. Sipsma[1], Kathryn L. Falb[2], Tiara Willie[2], Elizabeth H. Bradley[3], Lauren Bienkowski[4], Ned Meerdink[4], Jhumka Gupta[2]

[1]Department of Women, Children and Family Health Science, University of Illinois at Chicago College of Nursing, Chicago, IL

[2]Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT

[3]Department of Health Policy and Management, Yale School of Public Health, New Haven, CT

[4]American Refugee Committee

Address for Correspondence:

Jhumka Gupta, ScD, MPH

Yale School of Public Health

Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences

60 College Street, Rm 431

New Haven, CT 06520

Word Count: 3,017

Abstract

Objective: To examine patterns of conflict-related violence and intimate partner violence (IPV) and their associations with emotional distress among Congolese refugee women living in Rwanda.

Design: Cross-sectional study.

Setting: Two Congolese refugee camps in Rwanda.

Participants: 548 ever-married Congolese refugee women of reproductive age (15-49 years) residing in Rwanda.

Primary Outcome Measure: Our primary outcome was emotional distress as measured using the Self Report Questionnaire-20 (SRQ-20). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress.

Results: Almost half of women (49%) reported experiencing physical, emotional or sexual violence during the conflict, and less than 10% of women reporting experiences of any type of violence after fleeing the conflict. Lifetime IPV was reported by approximately 22% of women. Latent class analysis derived four distinct classes of violence experiences, including the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict* class. In multivariate regression models, latent class was strongly associated with emotional distress. Compared with women in the *Low All Violence* class, women in the *High Violence During and After Conflict* class and women in the *High Violence During Conflict* had 2.7 times (95% CI 1.11, 6.74) and 2.3 times (95% CI 1.30, 4.07) the odds of experiencing emotional distress in the past 4 weeks, respectively. Furthermore, women in the *High IPV* class had a 4.7 times (95% CI 2.53, 8.59) greater odds of experiencing emotional distress compared with women in the *Low All Violence* class.

Conclusions: Experiences of IPV do not consistently correlate with experiences of conflict-related violence, and women who experience high levels of IPV may have the greatest likelihood for poor mental health in conflict-affected settings.

Article Summary

Strengths and limitations of this study

- This study is one of the first to examine how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health.
- This study included a large, probability-based sample of traditionally underserved refugee women.
- Although time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners.
- The current analysis did not include other potentially important forms of violence against women that may also be high among refugee women populations.
- Women may have underreported experiences of violence due to stigma associated with these experiences; however, all interviews were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting.

Introduction

Violence against women in conflict-affected settings is a serious global public health issue. Conflict-related violence, such as sexual and physical violence by armed perpetrators, has disproportionately affected women in conflict settings, with experiences of violence affecting between 24% and 73% in settings such as East Timor and Cote d'Ivoire (1-5). Women in conflict-affected settings often also experience high levels of male-perpetrated intimate partner violence (IPV), and it is increasingly being recognized that violence against women in such settings does not solely take place in public spheres, but also in more private aspects of a woman's life, such as her home and within intimate relationships (6). Women who experience conflict-related violence have been shown to be significantly more likely to experience IPV compared with women who had not experienced conflict-related violence (7, 8). Approximately 31% of women in the Eastern Democratic Republic of Congo reported experiencing physical and/or sexual IPV (9), and as much as 77% of women in Jordanian refugee camps reported psychological partner violence (10).

Both conflict-related violence and IPV have been shown to be associated with poor mental health (9, 10), but few studies to date have examined the co-occurrence of conflict-related violence and IPV and its relationship to poor mental health. Vinck and Pham et al. (11) found both conflict-related violence and experiences of IPV to be independently associated with depression and PTSD among women in post-conflict Liberia, and Gupta and colleagues (2) found that past-year IPV but not conflict-related violence was associated with probable PTSD. Falb and colleagues suggest that there is a moderation effect where the experience of conflict-related violence increases the odds of suicide ideation among women who have experienced IPV (7). Furthermore, even fewer studies have examined how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health. U.S.-based research using latent class analysis (LCA), in which similar participants are classified into groups or latent classes based on observable indicators, found patterns of violence experienced by women were differentially associated with positive screens for depression (12). To date, LCA has not yet been applied to examine patterns of violence against women

in conflict-affected settings. Additional research therefore is needed to examine the impact of these patterns of violence on mental health.

Accordingly, we sought to examine patterns of conflict-related violence and IPV and their associations with emotional distress, using data from a cross-sectional survey of Congolese refugee women living in Rwanda. Eastern Congo has experienced an ongoing conflict since the early 1990s, and violence against women has been staggering during this protracted conflict.

Methods

Sample Population

The Reproductive Health Assessment Toolkit for Conflict-Affected Women (13) was implemented by the American Refugee Committee (ARC) in 2008 for use with Congolese refugee women residing in two refugee camps where ARC provides health and gender-based violence prevention and response services. The camps, Nyabiheke and Gihembe, were established in 2005 and 1997, respectively. At the time of the survey, 27,088 refugees lived in these two camps. ARC program staff used household lists within the pre-defined catchment area for the sampling frame; male-only households or households without women of reproductive age were excluded. Excel and/or a random numbers table were used to randomly select eligible households and individuals. Trained female program staff visited each selected household, randomly selected one woman of reproductive age (15-49 years of age) within the household, and verbally obtained informed consent. Interview staff were language-matched with participants and scheduled a time for the woman to participate in the survey within a private, centralized location (e.g. NGO offices) (13) All surveys were verbally administered in either French or Kinyarwanda (an official language in Rwanda), and responses were recorded by female interviewers. Surveys collected data on a variety of topics, including but not limited to emotional health, gender-based violence, and sociodemographic characteristics. A total of 810 women participated in the survey from these refugee camps. We restricted our analytic sample to ever-

married women (N=548) since the IPV module of the RHA was only administered to these women, which is consistent with other global demographic surveys (e.g. Demographic Health Survey).

Measures

Outcome. Emotional distress was measured using the Self Report Questionnaire-20 (SRQ-20) (14), which had been developed as a screening tool by the World Health Organization. The SRQ-20 asks respondents to indicate whether or not they have experienced common problems in the past 4 weeks (e.g., "Do you have headaches?" and "Do you feel unhappy?"). Items were summed to indicate the total number of problems experienced by each participant; total scores ranged from 0 to 20. Internal consistency for the SRQ-20 was excellent (Cronbach's alpha=0.91). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress (15). This scale and the cut-off point employed in the current analysis have been previously validated among conflict-affected populations in Rwanda (15).

Exposures. We assessed whether or not women experienced physical, emotional and/or sexual violence by anyone outside their family during the conflict and after the conflict. Consistent with existing studies that have implemented the RHA toolkit to examine violence against refugee women, we considered women to have experienced physical violence if they reported having been physically hurt (such as slapped, hit, choked, beaten, or kicked) and/or shot at or stabbed. We considered women to have experienced emotional violence if they reported having been threatened with a weapon of any kind and/or detained against their will. We considered women to have experienced sexual violence if they reported having been subjected to improper sexual comments, forced to remove or stripped of their clothing, subjected to unwanted kissing or touching on sexual parts of your body, and/or forced or threatened with harm to make you give or receive oral sex or have vaginal or anal sex. Participants were asked to report whether or not they experienced these types of violence 1) during the conflict and 2) after the conflict (with specific dates to indicate violence experienced after fleeing the conflict).

Women were also asked about their experiences with physical, emotional, and sexual violence from any of their partners or ex-partners (i.e., lifetime IPV). We considered women to have experienced physical IPV if they reported that any of their partners had "slapped you, twisted your arm, hit you with a fist or something else, pushed you down or kicked you, or choked you" and/or "threatened to hurt you with a weapon or himself." We considered women to have experienced emotional IPV if they reported that any of their partners had "forbid you from participating in activities in the community such as seeing friends or family, educational opportunities, women's groups, or employment opportunities;" and we considered women to have experienced sexual IPV if they reported that any of their partners had "threatened to hurt you or used force to make you have sex with him when you did not want to." For all violence experiences, we chose to code "no response" as not having experienced that type of violence.

Sociodemographic controls. Sociodemographic characteristics included as covariates in the final model included: age, current relationship status (married and living together; married and not living together; not currently married (i.e., abandoned, divorced, or separated); or widowed), ability to read (not at all, with difficulty, easily), and refugee camp. The secondary data analysis of unidentifiable data was deemed exempt from review by the Yale School of Public Health human subjects committee.

Analysis

We first generated descriptive statistics to describe sample characteristics. We then conducted latent class analysis with maximum likelihood estimation and robust standard errors to classify participants with similar violence experiences into groups or latent classes (16). Our nine indicators of violence experiences were used to empirically derive class membership. We determined the most appropriate number of classes by examining six commonly used criteria, including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the sample-size adjusted BIC (SSABIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT), entropy (a measure of the appropriateness of classification), and the usefulness and interpretability of the latent classes (16). The AIC, BIC, and SSABIC indicate relative goodness of fit; lower values represent better fitting models. A non-significant p-value from the LMR-LRT suggests that the model with one fewer classes is

acceptable, and higher entropy values suggest better classification. The best model was considered the one with the fewest number of distinct classes to offer meaningful results (17). Multivariate logistic regression models were used to determine the effect of latent class on emotional distress, adjusted for other covariates. A complete case analysis was conducted. Analyses were conducted with SAS 9.3 and MPlus Version 4.21.

Results

Participant Characteristics

Participants on average were 32 years old (SD=7.64 years); 16% were 15 to 24 years old and 37% were 35 to 49 years old (**Table 1**). A total of 57% were married and living with their partner, and almost 44% reported they could read easily. The sample was fairly evenly divided between the two refugee camps. The average emotional distress score was 6.9 (SD=5.50), and 28% of the sample had scores greater than 10.

Experiences of Violence

The highest levels of violence were experienced during the conflict (**Table 1**). Approximately 35% of women reported experiencing physical violence, 31% reported experiencing emotional violence, and 18% reported experiencing sexual violence. Almost half of women (49%) reported experiencing any type of violence during the conflict. After fleeing the conflict, experiences of violence were reportedly less common, with less than 10% of women reporting experiences of physical, emotional or sexual violence. Lifetime physical IPV was reported by 17% of the women, lifetime emotional IPV was reported by 8% of the women, and lifetime sexual IPV was reported by 14% of the women. Any lifetime IPV was reported by approximately 22% of women.

Latent class analysis suggests the existence of four distinct classes (**Figure 1**). The 4-class solution was supported by the AIC, SSABIC, LMR-LRT, and the interpretability of the classes. Classes were named based on their most prominent characteristics and included the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict*

class. The largest class (n=322; 59.0%), which we named the *Low All Violence* class, was characterized by infrequent reports of during-conflict violence, after-conflict violence, and IPV. The second-largest class (n=113, 20.7%), which we named the *High Violence During Conflict* class, was characterized by a high prevalence of violence reported during the conflict but low prevalences of after-conflict violence and of IPV. The third class (n=79; 14.5%), which we named the *High IPV* class, was characterized by the highest frequencies of reports of IPV; this class of respondents also experienced moderate frequencies of violence during the conflict but low frequencies of violence after the conflict. The smallest class (n=32; 5.9%), which we named the *High Violence During and After Conflict* class, was characterized by high frequencies of violence during and after the conflict and moderate IPV victimization.

Violence Experiences and Emotional Distress

Multivariable logistic regression models suggested that latent class was strongly associated with emotional distress, even after adjusting for other common risk factors (**Table 2**). Women in the *High Violence During and After Conflict* class compared with *Low All Violence* class had almost 3 times the odds of experiencing emotional distress in the past 4 weeks (95% CI=1.11, 6.74). Additionally, women who were in the *High Violence During Conflict* class compared with the *Low All Violence* class had a 2.3 times greater odds of experiencing emotional distress (95% CI=1.30, 4.07). Women in the *High IPV* class compared with women in the *Low All Violence* class had a 4.7 times greater odds of experiencing emotional distress (95% CI=2.53, 8.59); furthermore, the odds of experiencing emotional distress among women in the *High IPV* class is approximately twice the odds of experiencing emotional distress among women in the *High Violence During Conflict* class (95% CI=1.04, 3.98).

Discussion

This refugee camp-based study found high levels of emotional distress and multiple forms of violence experienced by Congolese refugee women of reproductive age living in Rwanda. One in four women were thought to be experiencing poor mental health, an estimate higher than other reported

estimates of poor mental health, including past-month suicidality (7%) (7), PTSD (12%-14%) (2, 11), and depression (11%) (11) among women in conflict-affected settings. This high prevalence seems likely attributable to the more inclusive nature of our mental health measure. Our findings also suggested that approximately half of Congolese refugee women in Rwanda have experienced some form of violence. Not surprisingly, experiences of violence among these women were concentrated during the conflict with approximately 49% experiencing some form of violence during the conflict and 15% experiencing some form of violence after fleeing the conflict. Nearly one-quarter of women had experienced IPV at some point in their lifetime, consistent with frequencies observed in comparable settings (2, 9, 11). Taken together, these findings affirm the need to address the co-occurrence of both public forms of violence (i.e., conflict-related violence) and more private forms of violence (i.e., IPV) experiences among refugee women.

The data highlighted four distinct latent classes of women reporting similar violence experiences, based on the co-occurrence of conflict-related violence and IPV experiences. The emergence of these distinct classes suggests that experiences of IPV do not consistently correlate with experiences of conflict-related violence. For instance, in the *High IPV* class, women experienced relatively low levels of during and after conflict violence, but experienced high levels of IPV. These patterns suggest the strength in a latent class approach to understand nuance in violence experiences. Our study is the first to use latent class analysis (LCA) to understand patterns of violence against women in conflict-affected settings. Future research may seek to understand risk and protective factors that may be associated with the clustering of violence experiences among women affected by conflict, to help inform prevention and intervention programs.

These classes demonstrated differential associations with emotional distress and corroborate growing research in conflict-affected settings documenting that emotional health is not solely affected by violence perpetrated by armed actors or others outside of the family, but is also a result of private forms of violence, such as IPV (2, 7). Our results suggest that although women who experience elevated levels of violence may suffer from worse mental health compared with women who do not

experience violence or who experience low levels of violence, women who experience high levels of IPV may have the greatest likelihood for poor mental health. These results demonstrate the value of LCA for identifying distinct classes of women to understand potential mental health consequences. Furthermore, our findings have important implications for refugee programs as much of the current humanitarian funding tends to focus on conflict-related violence and excludes IPV. Similarly, specialized violence against women prevention and response programs within refugee camps tend to focus solely on conflict-related violence as well. Policies and programs must consider allocating resources for addressing IPV in addition to conflict-related violence in conflict-affected settings.

Despite several strengths of our study, including a large, probability-based sample of refugee women, findings should be interpreted in light of some limitations. First, although the time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners. This measurement, therefore, considered IPV occurring 20 years ago and 20 days ago as having the same effect. Despite this broad conceptualization of experiences of IPV, our results still indicate the robustness and effects of these experiences. Additionally, the current analysis did not include other important forms of violence against women (e.g., child marriage, transactional sex, denial of resources) that may also be high among refugee women populations. Future LCA research may seek to integrate these additional forms of gender-based violence to further understand associations with health outcomes. Furthermore, women may have underreported experiences of violence due to stigma associated with these experiences. All interviews, however, were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting. All trained female interviewers were able to offer participants ethical referrals for relevant services according to each participant's wishes. Furthermore, the benefits of seeking assistance from qualified service providers were continuously reinforced throughout the refugee camps. New strategies, however, are likely needed to combat low self-efficacy and help-seeking behaviors among women and girls affected

by violent experiences. Last, these results may be generalizable to women residing in similar conflict-affected settings, but the extent to which is unclear.

Our study has several implications for policy, practice, and future research. First, our findings suggest that humanitarian assistance programs should emphasize the importance of employing skilled mental health workers or social workers to respond to multiple forms of violence, paying particular attention to experiences of IPV. Programs serving refugee women and communities should also seek to respond to multiple forms of violence against women, including IPV. Currently, much of the funding and programmatic attention focuses primarily on conflict-related violence (particularly sexual violence), with less emphasis on IPV. Programs aimed to respond to violence against women should thus be equipped to respond to the mental health needs of women with varying levels of exposure to both discrete events of violence that are more common with conflict-related violence as well as chronic, continual exposure to IPV. Health care workers in humanitarian settings should also implement field-tested, safe, and routine IPV and other violence screening for women and adolescent girls accessing healthcare because these experiences have health implications that appear to differ from the experiences of conflict-related violence. Additionally, these health care workers should pay particular attention to women who have experienced IPV from their current or past partner as they may have some of the poorest mental health among women in refugee camps. Acknowledging the patterns of violence women experience in conflict settings may improve mental health response services. Such response services should be combined with other prevention programs, such as community-based programming to improve gender equitable norms and engagement of men to reduce perpetration, in order to reduce violence against women within and outside their homes.

Contributions: HS, KF, EB, and JG conceptualized and designed the study. HS conducted the data analysis and wrote the first draft of the manuscript. All authors critically reviewed and contributed to the manuscript and approve the final manuscript as submitted.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing Interests: None.

Data Sharing Statement: Additional details about the data and its availability can be accessed through the CDC's Division of Reproductive Health at http://www.cdc.gov/reproductivehealth/Global/CrisisSituations.htm.

References

1. Amowitz L, Reis C, Lyons K. Prevalence of war-related sexual violence and other human rights abuses among internally displaced persons in Sierra Leone. JAMA. 2002;287(4):513-21.
2. Gupta J, Falb K, Carliner H, Hossain M, Kpebo D, Annan J. Associations between exposure to intimate partner violence and probable PTSD among women in rural Cote d'Ivoire. PLOS One. 2014;9(5):e96300.
3. Hynes M, Ward J, Robertson K, Crouse C. A determination of the prevalence of gender-based violence among conflict-affected populations in East Timor. Disasters. 2004;28(3):294-321.
4. Kerimova J, Posner S, Brown Y, Hillis S, Meikle S, Duerr A. High prevalence of self-reported forced sexual intercourse among internally displaced women in Azerbaijan. American Journal of Public Health. 2003;93(7):1067-70.
5. Vu A, Adam A, Wirtz A, Pham K, Runenstein L, Glass N, et al. The prevalence of sexual violence among female refugees in complex humanitarian emergencies: a systematic review and meta-analysis. PLOS Currents Disasters. 2014;March 18, 2014.
6. Annan J, Brier M. The risk of return: intimate partner violence in northern Uganda's armed conflict. Social Science & Medicine. 2010;70(1):152-9.
7. Falb K, McCormick M, Hemenway D, Anfinson K, Silverman J. Suicide ideation and victimization among refugee women along the Thai-Burma border. Journal of Traumatic Stress. 2013;26:631-5.
8. Stark L, Ager A. A systematic review of prevalence studies of gender-based violence in complex emergencies. Trauma, Violence, and Abuse. 2011;12(3):127-34.
9. Johnson K, Scott J, Rughita B, Kisielewski M, Asher J, Ong R, et al. Association of sexual violence and human rights violations with physical and mental health in territories of the Eastern Democratic Republic of the Congo. JAMA. 2010;304(5):553-62.
10. Al-Modallal H. Psychological partner violence and women's vulnerability to depression, stress, and anxiety. International Journal of Mental Health Nursing. 2012;21:560-6.

11. Vinck P, Pham P. Association of exposure to intimate-partner violence and potentially traumatic war-related events with mental health in Liberia. Social Science & Medicine. 2013;77:41-9.
12. Cavanaugh C, Messing J, Petras H, Fowler B, La Flair L, Kub J, et al. Patterns of violence against women: a latent class analysis. Psychological Trauma. 2012;4(2):169-76.
13. Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Coordinating Center for Health Promotion, Centers for Disease Control and Prevention, Department of Health and Human Services. Reproductive Health Assessment Toolkit for Conflict-Affected Women.; 2007 Contract No.: Document Number|.
14. Beusenberg M, Orley J. A user's guide to to the Self Reporting Questionniare (SRQ). Geneva: World Health Organization; 1994.
15. Scholte W, Verduin F, van Lammeren A, Rutayisire T, Kamperman A. Psychometric properties and longitudinal validation of the self-reporting questionnaire (SRQ-20) in a Rwandan community setting: a validation study. BMC Medical Research Methodology. 2011;11:116.
16. Muthen B, Muthen L. Integrating person-centered and variable-centered analysis: growth mixture modeling with latent trajectory classes. Alcoholism, Clinical and Experimental Research. 2000;24(6):882-91.

Table 1. Participant characteristics (N=548)

	N (%)[1]
Age[2]	
15-24 years	85 (15.9%)
25-34 years	251 (47.0%)
35-49 years	198 (37.1%)
Current relationship status[3]	
Married, living together	309 (56.9%)
Married, not living together	144 (26.5%)
Other	49 (9.0%)
Widowed	41 (7.6%)
Ability to read	
Not at all	184 (33.6%)
With difficulty	125 (22.8%)
Easily	239 (43.6%)
Refugee camp	
Nyabiheke Camp	302 (55.1%)
Gihembe Camp	246 (44.9%)
Emotional distress (SRQ-20)[4]	
≤ 10	374 (72.3%)
> 10	143 (27.7%)
Type of Violence	
During conflict: physical[5]	191 (34.9%)
During conflict: emotional	169 (30.8%)
During conflict: sexual[5]	96 (17.5%)
After conflict: physical	44 (8.0%)
After conflict: emotional	28 (5.1%)
After conflict: sexual	39 (7.1%)
IPV: physical[6]	93 (17.3%)
IPV: emotional[2]	45 (8.4%)
IPV: sexual[2]	74 (13.9%)

[1]Valid percentages

[2]14 participants (2.6%) had missing responses

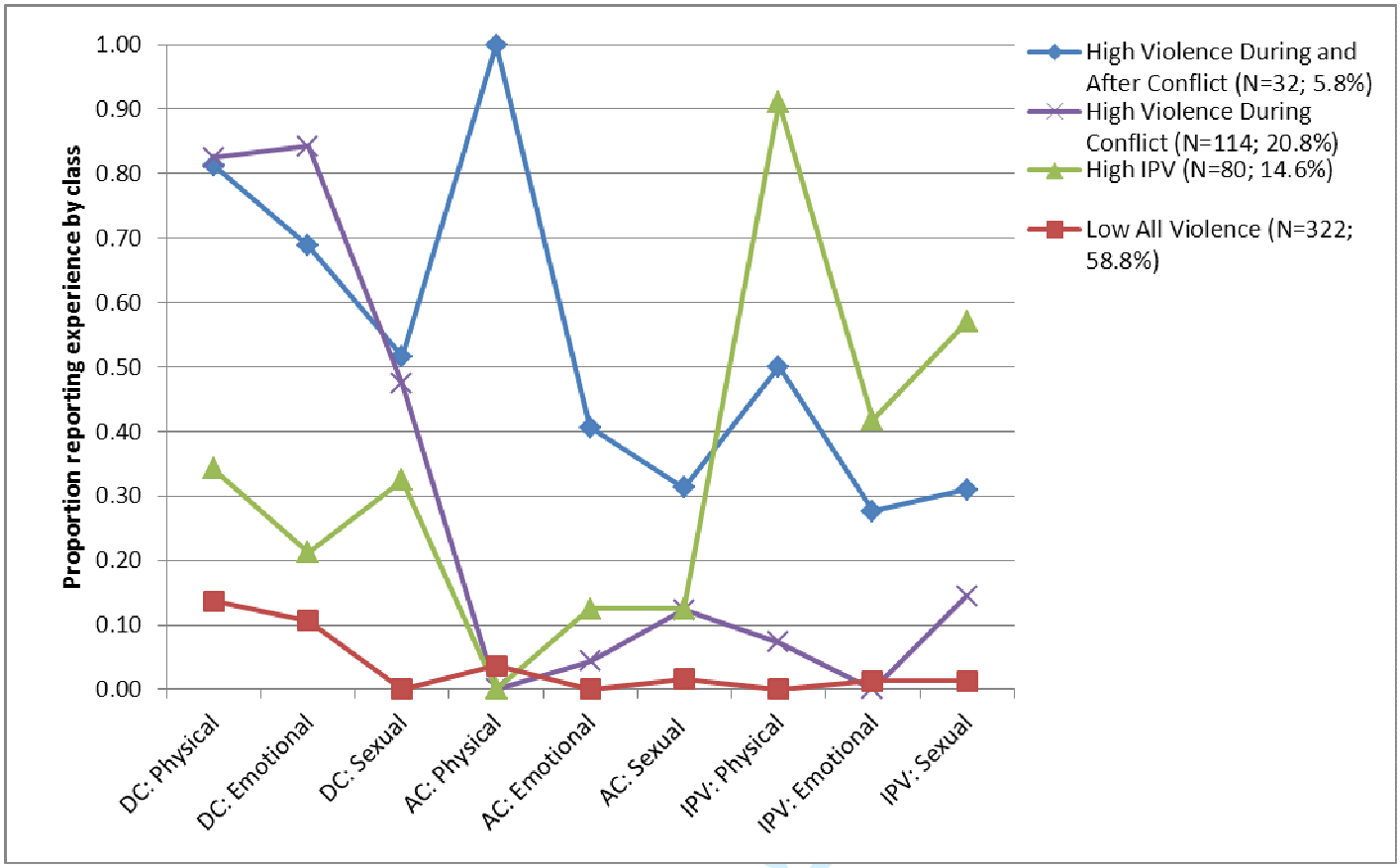
[3]5 participants (0.9%) had missing responses to relationship status

[4]"No response" was coded as missing; 31 participants (5.7%) were missing responses to one or more items in the SRQ-20

[5]1 participant (0.2%) had a missing response

[6]17 participants (3.1%) had missing responses

Figure 1. Exposure to violence during and after the conflict and lifetime exposure to intimate partner violence among ever-married women



Note: DC = during conflict; AC = after conflict; IPV = intimate partner violence (lifetime)

Table 2. Multivariate logistic regression models exploring the associations between emotional distress and classes of violence exposure among ever-married women (N=477; 92.2% of sample with valid emotional distress data)

	OR (95% CI)
Age	
15-24 years	1.00
25-34 years	1.48 (0.76, 2.91)
35-49 years	1.66 (0.80, 3.42)
Current relationship status	
Married, living together	1.00
Married, not living together	1.56 (0.92, 2.63)
Other	2.63 (1.21, 5.70)*
Widowed	4.70 (2.20, 10.04)**
Ability to read	
Not at all	1.76 (1.05, 2.93)*
With difficulty	0.71 (0.39, 1.31)
Easily	1.00
Length of displacement	1.15 (0.90, 1.46)
Nyabiheke Camp	1.72 (0.21, 13.92)
Class[1]	
Low all violence	1.00
High violence during conflict	2.30 (1.30, 4.07)**
High IPV	4.67 (2.53, 8.59)**
High violence during and after conflict	2.74 (1.11, 6.74)*

*P-value < 0.05; **P-value < 0.01

[1]*High IPV* class is significantly different from *High violence during conflict* class (*High IPV* vs *High violence during conflict*: OR = 2.03; 95%CI = 1.04, 3.98; P-value = 0.039) in its effect on emotional distress

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	16-17
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA, 7,9
		(*b*) Report category boundaries when continuous variables were categorized	16, 18
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-006299.R1
Article Type:	Research
Date Submitted by the Author:	27-Jan-2015
Complete List of Authors:	Sipsma, Heather; University of Illinois at Chicago College of Nursing, Falb, Kathryn ; Yale School of Public Health, Department of Chronic Disease Epidemiology Willie, Tiara; Yale School of Public Health, Department of Chronic Disease Epidemiology Bradley, Elizabeth; Yale University, Global Health Leadership Institute Bienkowski, Lauren; American Refugee Committee, Meerdink, Ned; American Refugee Committee, Gupta, Jhumka; Yale School of Public Health, Department of Chronic Disease Epidemiology
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology, Global health, Public health
Keywords:	EPIDEMIOLOGY, International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, STATISTICS & RESEARCH METHODS, PUBLIC HEALTH

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Heather L. Sipsma[1], Kathryn L. Falb[2], Tiara Willie[2], Elizabeth H. Bradley[3], Lauren Bienkowski[4], Ned Meerdink[4], Jhumka Gupta[2]

[1]Department of Women, Children and Family Health Science, University of Illinois at Chicago College of Nursing, Chicago, IL

[2]Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT

[3]Department of Health Policy and Management, Yale School of Public Health, New Haven, CT

[4]American Refugee Committee

Address for Correspondence:

Jhumka Gupta, ScD, MPH

Yale School of Public Health

Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences

60 College Street, Rm 431

New Haven, CT 06520

Word Count: 3,017

Abstract

Objective: To examine patterns of conflict-related violence and intimate partner violence (IPV) and their associations with emotional distress among Congolese refugee women living in Rwanda.

Design: Cross-sectional study.

Setting: Two Congolese refugee camps in Rwanda.

Participants: 548 ever-married Congolese refugee women of reproductive age (15-49 years) residing in Rwanda.

Primary Outcome Measure: Our primary outcome was emotional distress as measured using the Self Report Questionnaire-20 (SRQ-20). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress.

Results: Almost half of women (49%) reported experiencing physical, emotional or sexual violence during the conflict, and less than 10% of women reporting experiences of any type of violence after fleeing the conflict. Lifetime IPV was reported by approximately 22% of women. Latent class analysis derived four distinct classes of violence experiences, including the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict* class. In multivariate regression models, latent class was strongly associated with emotional distress. Compared with women in the *Low All Violence* class, women in the *High Violence During and After Conflict* class and women in the *High Violence During Conflict* had 2.7 times (95% CI 1.11, 6.74) and 2.3 times (95% CI 1.30, 4.07) the odds of experiencing emotional distress in the past 4 weeks, respectively. Furthermore, women in the *High IPV* class had a 4.7 times (95% CI 2.53, 8.59) greater odds of experiencing emotional distress compared with women in the *Low All Violence* class.

Conclusions: Experiences of IPV do not consistently correlate with experiences of conflict-related violence, and women who experience high levels of IPV may have the greatest likelihood for poor mental health in conflict-affected settings.

Article Summary

Strengths and limitations of this study

- This study is one of the first to examine how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health.
- This study included a large, probability-based sample of traditionally underserved refugee women.
- Although time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners.
- The current analysis did not include other potentially important forms of violence against women that may also be high among refugee women populations.
- Women may have underreported experiences of violence due to stigma associated with these experiences; however, all interviews were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting.

Introduction

Violence against women in conflict-affected settings is a serious global public health issue. Conflict-related violence, such as sexual and physical violence by armed perpetrators, has disproportionately affected women in conflict settings, with experiences of violence affecting between 24% and 73% in settings such as East Timor, Cote d'Ivoire, and the Democratic Republic of Congo (1-11). Women in conflict-affected settings often also experience high levels of male-perpetrated intimate partner violence (IPV) (7, 12), and it is increasingly being recognized that violence against women in such settings does not solely take place in public spheres, but also in more private aspects of a woman's life, such as her home and within intimate relationships (7, 10, 13). Women who experience conflict-related violence have been shown to be significantly more likely to experience IPV compared with women who had not experienced conflict-related violence (14, 15). Approximately 31% of women in the Eastern Democratic Republic of Congo reported experiencing physical and/or sexual IPV (4), and as much as 77% of women in Jordanian refugee camps reported psychological partner violence (16).

Both conflict-related violence and IPV have been shown to be associated with poor mental health (4, 16), but few studies to date have examined the co-occurrence of conflict-related violence and IPV and its relationship to poor mental health. Vinck and Pham et al. (17) found both conflict-related violence and experiences of IPV to be independently associated with depression and PTSD among women in post-conflict Liberia, and Gupta and colleagues (2) found that past-year IPV but not conflict-related violence was associated with probable PTSD. Falb and colleagues suggest that there is a moderation effect where the experience of conflict-related violence increases the odds of suicide ideation among women who have experienced IPV (14). Furthermore, even fewer studies have examined how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health. U.S.-based research using latent class analysis (LCA), in which similar participants are classified into groups or latent classes based on observable indicators, found patterns of violence experienced by women were differentially associated with positive screens for depression (18). To date, LCA has not yet been applied to examine patterns of violence against women

in conflict-affected settings. Additional research therefore is needed to examine the impact of these patterns of violence on mental health.

Accordingly, we sought to examine patterns of conflict-related violence and IPV and their associations with emotional distress, using data from a cross-sectional survey of Congolese refugee women living in Rwanda. Eastern Congo has experienced an ongoing conflict since the early 1990s, and violence against women has been staggering during this protracted conflict (19, 20).

Methods

Sample Population

The Reproductive Health Assessment Toolkit for Conflict-Affected Women (Toolkit) (21) was implemented by the American Refugee Committee (ARC) in 2008 for use with Congolese refugee women residing in two refugee camps where ARC provides health and gender-based violence prevention and response services. The camps, Nyabiheke and Gihembe, were established in 2005 and 1997, respectively. In July and August 2008, 27,088 refugees lived in these two camps. ARC program staff used household lists, compiled through home visits and updated monthly, within the pre-defined catchment area for the sampling frame; male-only households or households without women of reproductive age were excluded. Excel and/or a random numbers table were used to randomly select eligible households and individuals using simple random sampling. Trained female interviewers, selected mainly from community health workers and peer educators and trained using guidelines outlined in the Toolkit (21), visited each selected household and randomly selected one woman of reproductive age (15-49 years of age) within the household. The sampling strategy to select women of reproductive age was implemented per technical assistance from the CDC and their guidelines in the Toolkit (21). First, the program staff asked the adult who answered the door how many women between the ages 15 and 49 lived in the household. If more than one eligible woman lived in the household, the interview staff listed all eligible women and their ages from oldest to youngest and looked up the random number in the selection table to indicate which woman to be interviewed. Additional details

about this process and associated forms can be found elsewhere (21). After randomly selecting the participant, the interview staff then verbally obtained informed consent. Interview staff were language-matched with participants and scheduled a time for the woman to participate in the survey within a private, centralized location (e.g. NGO offices) (21) All surveys were verbally administered in either French or Kinyarwanda (an official language in Rwanda), and responses were recorded by female interviewers. Surveys collected data on a variety of topics, including but not limited to emotional health, gender-based violence, and sociodemographic characteristics. Participants who may have needed counseling were referred to the ARC office in each of the camps, where women were linked with appropriate resources. The ARC followed the World Health Organization's guidelines for conducting violence surveys (22). A total of 810 women participated in the survey from these refugee camps. We used all available data and restricted our analytic sample to ever-married women (N=548) since the IPV module of the RHA was only administered to these women, which is consistent with other global demographic surveys (e.g. Demographic Health Survey). This secondary data analysis of unidentifiable data was deemed exempt from review by the Yale School of Public Health human subjects committee and the Internal Review Board at the University of Illinois at Chicago.

Measures

Outcome. Emotional distress was measured using the Self Report Questionnaire-20 (SRQ-20) (23), which had been developed as a screening tool by the World Health Organization. The SRQ-20 asks respondents to indicate whether or not they have experienced common problems in the past 4 weeks (e.g., "Do you have headaches?" and "Do you feel unhappy?"). Items were summed to indicate the total number of problems experienced by each participant; total scores ranged from 0 to 20. Internal consistency for the SRQ-20 was excellent (Cronbach's alpha=0.91). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress (24). This scale and the cut-off point employed in the current analysis have been previously validated among conflict-affected populations in Rwanda (24).

Exposures. We assessed whether or not women experienced physical, emotional and/or sexual violence by anyone outside their family during the conflict and after the conflict. Consistent with existing studies that have implemented the RHA toolkit to examine violence against refugee women, we considered women to have experienced physical violence if they reported having been physically hurt (such as slapped, hit, choked, beaten, or kicked) and/or shot at or stabbed. We considered women to have experienced emotional violence if they reported having been threatened with a weapon of any kind and/or detained against their will. We considered women to have experienced sexual violence if they reported having been subjected to improper sexual comments, forced to remove or stripped of their clothing, subjected to unwanted kissing or touching on sexual parts of your body, and/or forced or threatened with harm to make you give or receive oral sex or have vaginal or anal sex. Participants were asked to report whether or not they experienced these types of violence 1) during the conflict (October 1996 – March 2003) and 2) after the conflict (after March 2003).

Women were also asked about their experiences with physical, emotional, and sexual violence from any of their partners or ex-partners (i.e., lifetime IPV). We considered women to have experienced physical IPV if they reported that any of their partners had "slapped you, twisted your arm, hit you with a fist or something else, pushed you down or kicked you, or choked you" and/or "threatened to hurt you with a weapon or himself." We considered women to have experienced emotional IPV if they reported that any of their partners had "forbid you from participating in activities in the community such as seeing friends or family, educational opportunities, women's groups, or employment opportunities;" and we considered women to have experienced sexual IPV if they reported that any of their partners had "threatened to hurt you or used force to make you have sex with him when you did not want to." For all violence experiences, we chose to code "no response" as not having experienced that type of violence.

Sociodemographic controls. Sociodemographic characteristics included as covariates in the final model included: age, current relationship status (married and living together; married and not living together; not currently married (i.e., abandoned, divorced, or separated); or widowed), ability to read (not at all, with difficulty, easily), and refugee camp. The secondary data analysis of unidentifiable data

was deemed exempt from review by the Yale School of Public Health human subjects committee.

Analysis

We first generated descriptive statistics to describe sample characteristics. We then conducted latent class analysis with maximum likelihood estimation and robust standard errors to classify participants with similar violence experiences into groups or latent classes (25). Our nine indicators of violence experiences were used to empirically derive class membership. We determined the most appropriate number of classes by examining six commonly used criteria, including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the sample-size adjusted BIC (SSABIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT), entropy (a measure of the appropriateness of classification), and the usefulness and interpretability of the latent classes (25). The AIC, BIC, and SSABIC indicate relative goodness of fit; lower values represent better fitting models. A non-significant p-value from the LMR-LRT suggests that the model with one fewer classes is acceptable, and higher entropy values suggest better classification. The best model was considered the one with the fewest number of distinct classes to offer meaningful results (25). Multivariate logistic regression models were used to determine the effect of latent class on emotional distress, adjusted for other covariates. A complete case analysis was conducted. Analyses were conducted with SAS 9.3 and MPlus Version 4.21.

Results

Participant Characteristics

Participants on average were 32 years old (SD=7.64 years); 16% were 15 to 24 years old and 37% were 35 to 49 years old (**Table 1**). A total of 57% were married and living with their partner, and almost 44% reported they could read easily. The sample was fairly evenly divided between the two refugee camps. The average emotional distress score was 6.9 (SD=5.50), and 28% of the sample had scores greater than 10.

Experiences of Violence

The highest levels of violence were experienced during the conflict (**Table 1**). Approximately 35% of women reported experiencing physical violence, 31% reported experiencing emotional violence, and 18% reported experiencing sexual violence. Almost half of women (49%) reported experiencing any type of violence during the conflict. After fleeing the conflict, experiences of violence were reportedly less common, with less than 10% of women reporting experiences of physical, emotional or sexual violence. Lifetime physical IPV was reported by 17% of the women, lifetime emotional IPV was reported by 8% of the women, and lifetime sexual IPV was reported by 14% of the women. Any lifetime IPV was reported by approximately 22% of women.

Latent class analysis suggests the existence of four distinct classes (**Figure 1**). The 4-class solution was supported by the AIC, SSABIC, LMR-LRT, and the interpretability of the classes. Classes were named based on their most prominent characteristics and included the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict* class. The largest class (n=322; 59.0%), which we named the *Low All Violence* class, was characterized by infrequent reports of during-conflict violence, after-conflict violence, and IPV. The second-largest class (n=113, 20.7%), which we named the *High Violence During Conflict* class, was characterized by a high prevalence of violence reported during the conflict but low prevalences of after-conflict violence and of IPV. The third class (n=79; 14.5%), which we named the *High IPV* class, was characterized by the highest frequencies of reports of IPV; this class of respondents also experienced moderate frequencies of violence during the conflict but low frequencies of violence after the conflict. The smallest class (n=32; 5.9%), which we named the *High Violence During and After Conflict* class, was characterized by high frequencies of violence during and after the conflict and moderate IPV victimization.

Violence Experiences and Emotional Distress

Multivariable logistic regression models suggested that latent class was strongly associated with emotional distress, even after adjusting for other common risk factors (**Table 2**). Women in the *High*

Violence During and After Conflict class compared with *Low All Violence* class had almost 3 times the odds of experiencing emotional distress in the past 4 weeks (95% CI=1.11, 6.74). Additionally, women who were in the *High Violence During Conflict* class compared with the *Low All Violence* class had a 2.3 times greater odds of experiencing emotional distress (95% CI=1.30, 4.07). Women in the *High IPV* class compared with women in the *Low All Violence* class had a 4.7 times greater odds of experiencing emotional distress (95% CI=2.53, 8.59); furthermore, the odds of experiencing emotional distress among women in the *High IPV* class is approximately twice the odds of experiencing emotional distress among women in the *High Violence During Conflict* class (95% CI=1.04, 3.98).

Discussion

This refugee camp-based study found high levels of emotional distress and multiple forms of violence experienced by Congolese refugee women of reproductive age living in Rwanda. One in four women were thought to be experiencing poor mental health, an estimate higher than other reported estimates of poor mental health, including past-month suicidality (7%) (14), PTSD (12%-14%) (2, 17), and depression (11%) (17) among women in conflict-affected settings. This higher prevalence seems likely attributable to the more inclusive nature of our mental health measure. This prevalence, however, is lower than the estimate of depression (54%) found among refugees living in Uganda, who were primarily from the Democratic Republic of Congo (26). This discrepancy could be explained by differences in the respondents; the Congolese refugees living in Rwanda had been residing in the camps longer on average than the Congolese refugees in Uganda.

Our findings also suggested that approximately half of Congolese refugee women in Rwanda have experienced some form of violence. Not surprisingly, experiences of violence among these women were concentrated during the conflict with approximately 49% experiencing some form of violence during the conflict and 15% experiencing some form of violence after fleeing the conflict. Estimates of conflict-related sexual violence among this sample were comparable to other general population samples from the DRC (4, 8, 27). Nearly one-quarter of women had experienced IPV at

some point in their lifetime, consistent with frequencies observed in comparable settings (2, 4, 17). Taken together, these findings affirm the need to address the co-occurrence of both public forms of violence (i.e., conflict-related violence) and more private forms of violence (i.e., IPV) experiences among refugee women.

The data highlighted four distinct latent classes of women reporting similar violence experiences, based on the co-occurrence of conflict-related violence and IPV experiences. The emergence of these distinct classes suggests that experiences of IPV do not consistently correlate with experiences of conflict-related violence. For instance, in the *High IPV* class, women experienced relatively low levels of during and after conflict violence, but experienced high levels of IPV. These patterns suggest the strength in a latent class approach to understand nuance in violence experiences. Our study is the first to use latent class analysis (LCA) to understand patterns of violence against women in conflict-affected settings. Future research may seek to understand risk and protective factors that may be associated with the clustering of violence experiences among women affected by conflict, to help inform prevention and intervention programs.

These classes demonstrated differential associations with emotional distress and corroborate growing research in conflict-affected settings documenting that emotional health is not solely affected by violence perpetrated by armed actors or others outside of the family, but is also a result of private forms of violence, such as IPV (2, 14). Our results suggest that although women who experience elevated levels of violence may suffer from worse mental health compared with women who do not experience violence or who experience low levels of violence, women who experience high levels of IPV may have the greatest likelihood for poor mental health. These results demonstrate the value of LCA for identifying distinct classes of women to understand potential mental health consequences. Furthermore, our findings have important implications for refugee programs as much of the current humanitarian funding tends to focus on conflict-related violence and excludes IPV. Similarly, specialized violence against women prevention and response programs within refugee camps tend to

focus solely on conflict-related violence as well. Policies and programs must consider allocating resources for addressing IPV in addition to conflict-related violence in conflict-affected settings.

Despite several strengths of our study, including a large, probability-based sample of refugee women, findings should be interpreted in light of some limitations. First, although the time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners. This measurement, therefore, considered IPV occurring 20 years ago and 20 days ago as having the same effect. Additionally, the experience of IPV may be ongoing, whereas violence experienced during the conflict is relatively distant and the violence experienced after the conflict may be less distant but still in the past. These possible discrepancies in the timing of violence occurrence could help explain the impact of IPV on emotional distress within this sample. Furthermore, this analysis lacks the ability to make conclusions about the effects of chronic IPV. Additional research is needed to overcome these limitations in order to better understand the timing of such events. Second, the current analysis did not include other important forms of violence against women (e.g., child marriage, transactional sex, denial of resources) that may also be high among refugee women populations. Future LCA research may seek to integrate these additional forms of gender-based violence to further understand associations with health outcomes. We also did not include socioeconomic status, as status prior to displacement was unavailable; socioeconomic status has been associated with mental health in previous research and is an important factor to consider for future work (28). Third, recall bias could have affected the reporting of both IPV as well as conflict-related violence, given that the conflict arose in the early 1990s, and could have caused underreporting of less severe forms of violence. Women may have also misinterpreted questions; however, survey items were based on the WHO's domestic violence surveys, which have been field-tested in several vulnerable populations (22, 29). Further, women may have underreported experiences of violence due to stigma associated with these experiences. All interviews, however, were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting. Interviewer bias is also a possibility; however, all interviewers

were trained according to WHO guidelines for conducting domestic violence surveys (22, 29). All interviewers were able to offer participants ethical referrals for relevant services according to each participant's wishes, and the benefits of seeking assistance from qualified service providers were continuously reinforced throughout the refugee camps. New strategies, however, are likely needed to combat low self-efficacy and help-seeking behaviors among women and girls affected by violent experiences. Last, sampling was not proportional to the size of the refugee camps and the survey's participation rate is unknown. These results may be generalizable to women residing in similar conflict-affected settings, but the extent to which is unclear.

Our study has several implications for policy, practice, and future research. First, our findings suggest that humanitarian assistance programs should emphasize the importance of employing skilled mental health workers or social workers to respond to multiple forms of violence, paying particular attention to experiences of IPV. Programs serving refugee women and communities should also seek to respond to multiple forms of violence against women, including IPV. Currently, much of the funding and programmatic attention focuses primarily on conflict-related violence (particularly sexual violence), with less emphasis on IPV. Programs aimed to respond to violence against women should thus be equipped to respond to the mental health needs of women with varying levels of exposure to both discrete events of violence that are more common with conflict-related violence as well as chronic, continual exposure to IPV as many women in conflict-affected settings experience ongoing IPV (30). Studies also suggest that the prevalence of IPV may be higher in conflict-affected settings and that exposure to conflict may increase a woman's vulnerability to experiencing IPV. As such, prevention and intervention programs are needed to reduce the prevalence of IPV and mitigate its health consequences. To date, little data exist regarding promising interventions in such conflict-affected settings, but at least two randomized trials within Cote d'Ivoire demonstrate the potential to reduce IPV in conflict-affected settings (2, 12). More research is needed in this area. Health care workers in humanitarian settings should also implement field-tested, safe, and routine IPV and other violence screening for women and adolescent girls accessing healthcare because these experiences have

health implications that appear to differ from the experiences of conflict-related violence. Additionally, these health care workers should pay particular attention to women who have experienced IPV from their current or past partner as they may have some of the poorest mental health among women in refugee camps. Acknowledging the patterns of violence women experience in conflict settings may improve mental health response services. Such response services should be combined with other prevention programs, such as community-based programming to improve gender equitable norms and engagement of men to reduce perpetration, in order to reduce violence against women within and outside their homes.

Contributions: HS, KF, EB, and JG conceptualized and designed the study. HS conducted the data analysis and wrote the first draft of the manuscript. All authors critically reviewed and contributed to the manuscript and approve the final manuscript as submitted.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing Interests: None.

Data Sharing Statement: Additional details about the data and its availability can be accessed through the CDC's Division of Reproductive Health at http://www.cdc.gov/reproductivehealth/Global/CrisisSituations.htm.

References

1. Amowitz L, Reis C, Lyons K. Prevalence of war-related sexual violence and other human rights abuses among internally displaced persons in Sierra Leone. JAMA. 2002;287(4):513-21.
2. Gupta J, Falb K, Carliner H, Hossain M, Kpebo D, Annan J. Associations between exposure to intimate partner violence and probable PTSD among women in rural Cote d'Ivoire. PLOS One. 2014;9(5):e96300.
3. Hynes M, Ward J, Robertson K, Crouse C. A determination of the prevalence of gender-based violence among conflict-affected populations in East Timor. Disasters. 2004;28(3):294-321.
4. Johnson K, Scott J, Rughita B, Kisielewski M, Asher J, Ong R, et al. Association of sexual violence and human rights violations with physical and mental health in territories of the Eastern Democratic Republic of the Congo. JAMA. 2010;304(5):553-62.
5. Kelly J, Betancourt T, Lipton R, VanRooyen M. Experiences of female survivors of sexual violence in eastern Democratic Republic of the Congo: a mixed-methods study. Conflict and Health. 2011;5(25):1-8.
6. Kerimova J, Posner S, Brown Y, Hillis S, Meikle S, Duerr A. High prevalence of self-reported forced sexual intercourse among internally displaced women in Azerbaijan. American Journal of Public Health. 2003;93(7):1067-70.
7. Peterman A, Palermo T, Bredenkamp C. Estimates and determinants of sexual violence against womenin the Democratic Republic of Congo. American Journal of Public Health. 2011;101(6):1060-7.
8. Pham P, Vinck P, Weinstein H. Human rights, transitional justice, public health and social reconstruction. Social Science & Medicine. 2010;70(1):98-105.
9. Pratt M, Werchick L. Sexual terrorism: rape as a weapon of war in Easter Democratic Republic of Congo; 2004 Contract No.: Document Number|.
10. Tlapek S. Women's status and intimate partner violence in the Democratic Republic of Congo. Journal of Interpersonal Violence. 2014;epub before print:1-15.

11. Vu A, Adam A, Wirtz A, Pham K, Runenstein L, Glass N, et al. The prevalence of sexual violence among female refugees in complex humanitarian emergencies: a systematic review and meta-analysis. PLOS Currents Disasters. 2014;March 18, 2014.
12. Hossain M, Zimmerman C, Kiss L, Kone D, Bakayoko-Topolska M, Manan D, et al. Men's and women's experiences of violence and traumatic events in rural Cote d'Ivoire before, during and after a period of armed conflict. BMJ Open. 2014;4:e003644.
13. Annan J, Brier M. The risk of return: intimate partner violence in northern Uganda's armed conflict. Social Science & Medicine. 2010;70(1):152-9.
14. Falb K, McCormick M, Hemenway D, Anfinson K, Silverman J. Suicide ideation and victimization among refugee women along the Thai-Burma border. Journal of Traumatic Stress. 2013;26:631-5.
15. Stark L, Ager A. A systematic review of prevalence studies of gender-based violence in complex emergencies. Trauma, Violence, and Abuse. 2011;12(3):127-34.
16. Al-Modallal H. Psychological partner violence and women's vulnerability to depression, stress, and anxiety. International Journal of Mental Health Nursing. 2012;21:560-6.
17. Vinck P, Pham P. Association of exposure to intimate-partner violence and potentially traumatic war-related events with mental health in Liberia. Social Science & Medicine. 2013;77:41-9.
18. Cavanaugh C, Messing J, Petras H, Fowler B, La Flair L, Kub J, et al. Patterns of violence against women: a latent class analysis. Psychological Trauma. 2012;4(2):169-76.
19. Hanlon H. Implications for health care practice and improved policies for victims of sexual violence in the Democratic Republic of Congo. Journal of International Women's Studies. 2008;10(2):64-72.
20. Human Rights Watch. Soldiers Who Rape, Commanders Who Condone: Sexual Violence and Military Reform in the Democratic Republic of Congo. New York, NY; 2009 Contract No.: Document Number|.

21. Reproductive Health Assessment Toolkit for Conflict-Affected Women.: Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Coordinating Center for Health Promotion, Centers for Disease Control and Prevention, Department of Health and Human Services; 2007 Contract No.: Document Number|.

22. Sethi D, Habibula S, McGee K, Peden M, Bennett S, Hyder A, et al., editors. Guidelines for Conducting Community Surveys on Injuries and Violence. Geneva: World Health Organization; 2004.

23. Beusenberg M, Orley J. A user's guide to to the Self Reporting Questionniare (SRQ). Geneva: World Health Organization; 1994.

24. Scholte W, Verduin F, van Lammeren A, Rutayisire T, Kamperman A. Psychometric properties and longitudinal validation of the self-reporting questionnaire (SRQ-20) in a Rwandan community setting: a validation study. BMC Medical Research Methodology. 2011;11:116.

25. Muthen B, Muthen L. Integrating person-centered and variable-centered analysis: growth mixture modeling with latent trajectory classes. Alcoholism, Clinical and Experimental Research. 2000;24(6):882-91.

26. Morof D, Sami S, Mangeni M, Blanton C, Cardozo B, Tomczyk B. A cross-sectional survey on gender-based violence and mental health among female urban refugees and asylum seekers in Kampala, Uganda. International Journal of Gynecology and Obstetrics. 2014;127:138-43.

27. Ministry of Planning, Democratic Republic of Congo. Demographic and Health Survey 2007. Calverton, MD; 2008 Contract No.: Document Number|.

28. Acevedo-Garcia D, Sanchez-Vaznaugh E, Viruell-Fuentes E, Almeida J. Integrating social epidemiology into immigrant health research: A cross-national framework. Social Science & Medicine. 2012;75(12):2060-8.

29. WHO. WHO Multi-country Study on Women's Health and Domestic Violence against Women. Geneva, Contract No.: Document Number|.

30. International Rescue Committee. Let Me Not Die Before My Time. New York, NY; 2012 Contract No.: Document Number|.

Table 1. Participant characteristics (N=548)

	N (%)[1]
Age[2]	
15-24 years	85 (15.9%)
25-34 years	251 (47.0%)
35-49 years	198 (37.1%)
Current relationship status[3]	
Married, living together	309 (56.9%)
Married, not living together	144 (26.5%)
Other	49 (9.0%)
Widowed	41 (7.6%)
Ability to read	
Not at all	184 (33.6%)
With difficulty	125 (22.8%)
Easily	239 (43.6%)
Refugee camp	
Nyabiheke Camp	302 (55.1%)
Gihembe Camp	246 (44.9%)
Emotional distress (SRQ-20)[4]	
≤ 10	374 (72.3%)
> 10	143 (27.7%)
Type of Violence	
During conflict: physical[5]	191 (34.9%)
During conflict: emotional	169 (30.8%)
During conflict: sexual[5]	96 (17.5%)
After conflict: physical	44 (8.0%)
After conflict: emotional	28 (5.1%)
After conflict: sexual	39 (7.1%)
IPV: physical[6]	93 (17.3%)
IPV: emotional[2]	45 (8.4%)
IPV: sexual[2]	74 (13.9%)

[1]Valid percentages

[2]14 participants (2.6%) had missing responses

[3]5 participants (0.9%) had missing responses to relationship status

[4]"No response" was coded as missing; 31 participants (5.7%) were missing responses to one or more items in the SRQ-20

[5]1 participant (0.2%) had a missing response

[6]17 participants (3.1%) had missing responses

Figure 1. Exposure to violence during and after the conflict and lifetime exposure to intimate partner violence among ever-married women

Note: DC = during conflict; AC = after conflict; IPV = intimate partner violence (lifetime)

Table 2. Multivariate logistic regression models exploring the associations between emotional distress and classes of violence exposure among ever-married women (N=477; 92.2% of sample with valid emotional distress data)

	OR (95% CI)
Age	
15-24 years	1.00
25-34 years	1.48 (0.76, 2.91)
35-49 years	1.66 (0.80, 3.42)
Current relationship status	
Married, living together	1.00
Married, not living together	1.56 (0.92, 2.63)
Other	2.63 (1.21, 5.70)*
Widowed	4.70 (2.20, 10.04)**
Ability to read	
Not at all	1.76 (1.05, 2.93)*
With difficulty	0.71 (0.39, 1.31)
Easily	1.00
Length of displacement	1.15 (0.90, 1.46)
Nyabiheke Camp	1.72 (0.21, 13.92)
Class[1]	
Low all violence	1.00
High violence during conflict	2.30 (1.30, 4.07)**
High IPV	4.67 (2.53, 8.59)**
High violence during and after conflict	2.74 (1.11, 6.74)*

*P-value < 0.05; **P-value < 0.01

[1]*High IPV* class is significantly different from *High violence during conflict* class (*High IPV* vs *High violence during conflict*: OR = 2.03; 95%CI = 1.04, 3.98; P-value = 0.039) in its effect on emotional distress

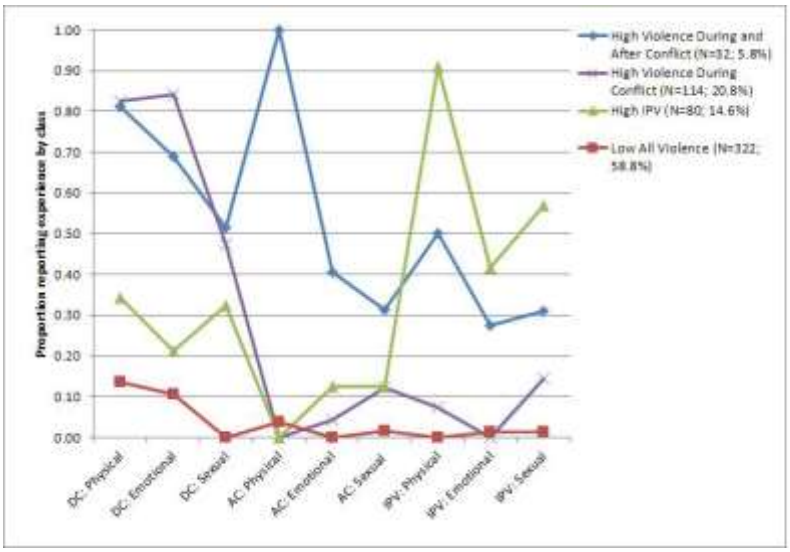


Figure 1. Exposure to violence during and after the conflict and lifetime exposure to intimate partner violence among ever-married women

Note: DC = during conflict; AC = after conflict; IPV = intimate partner violence (lifetime)
238x129mm (96 x 96 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	16-17
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA, 7,9
		(*b*) Report category boundaries when continuous variables were categorized	16, 18
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-006299.R2
Article Type:	Research
Date Submitted by the Author:	11-Mar-2015
Complete List of Authors:	Sipsma, Heather; University of Illinois at Chicago College of Nursing, Falb, Kathryn ; Yale School of Public Health, Department of Chronic Disease Epidemiology Willie, Tiara; Yale School of Public Health, Department of Chronic Disease Epidemiology Bradley, Elizabeth; Yale University, Global Health Leadership Institute Bienkowski, Lauren; American Refugee Committee, Meerdink, Ned; American Refugee Committee, Gupta, Jhumka; Yale School of Public Health, Department of Chronic Disease Epidemiology
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology, Global health, Public health
Keywords:	EPIDEMIOLOGY, International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, STATISTICS & RESEARCH METHODS, PUBLIC HEALTH

Violence against Congolese Refugee Women in Rwanda and Mental Health: A Cross-Sectional Study using Latent Class Analysis

Heather L. Sipsma[1], Kathryn L. Falb[2], Tiara Willie[2], Elizabeth H. Bradley[3], Lauren Bienkowski[4], Ned Meerdink[4], Jhumka Gupta[2]

[1]Department of Women, Children and Family Health Science, University of Illinois at Chicago College of Nursing, Chicago, IL

[2]Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT

[3]Department of Health Policy and Management, Yale School of Public Health, New Haven, CT

[4]American Refugee Committee

Address for Correspondence:

Jhumka Gupta, ScD, MPH

Yale School of Public Health

Department of Chronic Disease Epidemiology and Division of Social and Behavioral Sciences

60 College Street, Rm 431

New Haven, CT 06520

Word Count: 3,578

Abstract

Objective: To examine patterns of conflict-related violence and intimate partner violence (IPV) and their associations with emotional distress among Congolese refugee women living in Rwanda.

Design: Cross-sectional study.

Setting: Two Congolese refugee camps in Rwanda.

Participants: 548 ever-married Congolese refugee women of reproductive age (15-49 years) residing in Rwanda.

Primary Outcome Measure: Our primary outcome was emotional distress as measured using the Self Report Questionnaire-20 (SRQ-20). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress.

Results: Almost half of women (49%) reported experiencing physical, emotional or sexual violence during the conflict, and less than 10% of women reporting experiences of any type of violence after fleeing the conflict. Lifetime IPV was reported by approximately 22% of women. Latent class analysis derived four distinct classes of violence experiences, including the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict* class. In multivariate regression models, latent class was strongly associated with emotional distress. Compared with women in the *Low All Violence* class, women in the *High Violence During and After Conflict* class and women in the *High Violence During Conflict* had 2.7 times (95% CI 1.11, 6.74) and 2.3 times (95% CI 1.30, 4.07) the odds of experiencing emotional distress in the past 4 weeks, respectively. Furthermore, women in the *High IPV* class had a 4.7 times (95% CI 2.53, 8.59) greater odds of experiencing emotional distress compared with women in the *Low All Violence* class.

Conclusions: Experiences of IPV do not consistently correlate with experiences of conflict-related violence, and women who experience high levels of IPV may have the greatest likelihood for poor mental health in conflict-affected settings.

Article Summary

Strengths and limitations of this study

- This study is one of the first to examine how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health.
- This study included a large, probability-based sample of traditionally underserved refugee women.
- Although time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners.
- The current analysis did not include other potentially important forms of violence against women that may also be high among refugee women populations.
- Women may have underreported experiences of violence due to stigma associated with these experiences; however, all interviews were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting.

Introduction

Violence against women in conflict-affected settings is a serious global public health issue. Conflict-related violence, such as sexual and physical violence by armed perpetrators, has disproportionately affected women in conflict settings, with experiences of violence affecting between 24% and 73% in settings such as East Timor, Cote d'Ivoire, and the Democratic Republic of Congo (1-11). Women in conflict-affected settings often also experience high levels of male-perpetrated intimate partner violence (IPV) (7, 12), and it is increasingly being recognized that violence against women in such settings does not solely take place in public spheres, but also in more private aspects of a woman's life, such as her home and within intimate relationships (7, 10, 13). Women who experience conflict-related violence have been shown to be significantly more likely to experience IPV compared with women who had not experienced conflict-related violence (14, 15). Approximately 31% of women in the Eastern Democratic Republic of Congo reported experiencing physical and/or sexual IPV (4), and as much as 77% of women in Jordanian refugee camps reported psychological partner violence (16).

Both conflict-related violence and IPV have been shown to be associated with poor mental health (4, 16), but few studies to date have examined the co-occurrence of conflict-related violence and IPV and its relationship to poor mental health. Vinck and Pham et al. (17) found both conflict-related violence and experiences of IPV to be independently associated with depression and PTSD among women in post-conflict Liberia, and Gupta and colleagues (2) found that past-year IPV but not conflict-related violence was associated with probable PTSD. Falb and colleagues suggest that there is a moderation effect where the experience of conflict-related violence increases the odds of suicide ideation among women who have experienced IPV (14). Furthermore, even fewer studies have examined how combinations of experiences of conflict-related violence and IPV may result in differential effects on mental health. U.S.-based research using latent class analysis (LCA), in which similar participants are classified into groups or latent classes based on observable indicators, found patterns of violence experienced by women were differentially associated with positive screens for depression (18). To date, LCA has not yet been applied to examine patterns of violence against women

in conflict-affected settings. Additional research therefore is needed to examine the impact of these patterns of violence on mental health.

Accordingly, we sought to examine patterns of conflict-related violence and IPV and their associations with emotional distress, using data from a cross-sectional survey of Congolese refugee women living in Rwanda. Eastern Congo has experienced an ongoing conflict since the early 1990s, and violence against women has been staggering during this protracted conflict (19, 20).

Methods

Sample Population

The Reproductive Health Assessment Toolkit for Conflict-Affected Women (Toolkit) (21) was implemented by the American Refugee Committee (ARC) in 2008 for use with Congolese refugee women residing in two refugee camps where ARC provides health and gender-based violence prevention and response services. The camps, Nyabiheke and Gihembe, were established in 2005 and 1997, respectively. In July and August 2008, 27,088 refugees lived in these two camps. ARC program staff used household lists, compiled through home visits and updated monthly, within the pre-defined catchment area for the sampling frame; male-only households or households without women of reproductive age were excluded. Excel and/or a random numbers table were used to randomly select eligible households and individuals using simple random sampling. Trained female interviewers, selected mainly from community health workers and peer educators and trained using guidelines outlined in the Toolkit (21), visited each selected household and randomly selected one woman of reproductive age (15-49 years of age) within the household. The sampling strategy to select women of reproductive age used the KISH method (22) and was implemented per technical assistance from the CDC and their guidelines in the Toolkit (21).. Additional details about this process and associated forms can be found elsewhere (21). After randomly selecting the participant, the interview staff then verbally obtained informed consent. Interview staff were language-matched with participants and scheduled a time for the woman to participate in the survey within a private, centralized location (e.g. NGO offices)

(21) All surveys were verbally administered in either French or Kinyarwanda (an official language in Rwanda), and responses were recorded by female interviewers. Surveys were translated and back-translated to ensure accuracy and collected data on a variety of topics, including but not limited to emotional health, gender-based violence, and sociodemographic characteristics. Participants who may have needed counseling were referred to the ARC office in each of the camps, where women were linked with appropriate resources. The ARC followed the World Health Organization's guidelines for conducting violence surveys (23). A total of 810 women participated in the survey from these refugee camps. We used all available data and restricted our analytic sample to ever-married women (N=548) since the IPV module of the RHA was only administered to these women, which is consistent with other global demographic surveys (e.g. Demographic Health Survey). This secondary data analysis of unidentifiable data was deemed exempt from review by the Yale School of Public Health human subjects committee and the Internal Review Board at the University of Illinois at Chicago.

Measures

Outcome. Emotional distress was measured using the Self Report Questionnaire-20 (SRQ-20) (24), which had been developed as a mental health screening tool by the World Health Organization. The SRQ-20 asks respondents to indicate whether or not they have experienced common problems in the past 4 weeks (e.g., "Do you have headaches?" and "Do you feel unhappy?"). Items were summed to indicate the total number of problems experienced by each participant; total scores ranged from 0 to 20. Internal consistency for the SRQ-20 was excellent (Cronbach's alpha=0.91). For analysis, we considered participants with scores greater than 10 to be experiencing emotional distress and participants with scores of 10 or less not to be experiencing emotional distress (25). This scale and the cut-off point employed in the current analysis have been previously validated among conflict-affected populations in Rwanda (25).

Exposures. We assessed whether or not women experienced physical, emotional and/or sexual violence by anyone outside their family during the conflict and after the conflict. Consistent with existing studies that have implemented the RHA toolkit to examine violence against refugee women, we

considered women to have experienced physical violence if they reported having been physically hurt (such as slapped, hit, choked, beaten, or kicked) and/or shot at or stabbed. We considered women to have experienced emotional violence if they reported having been threatened with a weapon of any kind and/or detained against their will. We considered women to have experienced sexual violence if they reported having been subjected to improper sexual comments, forced to remove or stripped of their clothing, subjected to unwanted kissing or touching on sexual parts of your body, and/or forced or threatened with harm to make you give or receive oral sex or have vaginal or anal sex. Participants were asked to report whether or not they experienced these types of violence 1) during the conflict and 2) after the conflict. Specific dates were not provided.

Women were also asked about their experiences with physical, emotional, and sexual violence from any of their partners or ex-partners (i.e., lifetime IPV). We considered women to have experienced physical IPV if they reported that any of their partners had "slapped you, twisted your arm, hit you with a fist or something else, pushed you down or kicked you, or choked you" and/or "threatened to hurt you with a weapon or himself." We considered women to have experienced emotional IPV if they reported that any of their partners had "forbid you from participating in activities in the community such as seeing friends or family, educational opportunities, women's groups, or employment opportunities;" and we considered women to have experienced sexual IPV if they reported that any of their partners had "threatened to hurt you or used force to make you have sex with him when you did not want to." For all violence experiences, we chose to code "no response" as not having experienced that type of violence.

Sociodemographic controls. Sociodemographic characteristics included as covariates in the final model included: age, current relationship status (married and living together; married and not living together; not currently married (i.e., abandoned, divorced, or separated); or widowed), ability to read (not at all, with difficulty, easily), and refugee camp. The secondary data analysis of unidentifiable data was deemed exempt from review by the Yale School of Public Health human subjects committee.

Analysis

We first generated descriptive statistics to describe sample characteristics. We then conducted latent class analysis with maximum likelihood estimation and robust standard errors to classify participants with similar violence experiences into groups or latent classes (26). Our nine indicators of violence experiences were used to empirically derive class membership. We determined the most appropriate number of classes by examining six commonly used criteria, including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the sample-size adjusted BIC (SSABIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT), entropy (a measure of the appropriateness of classification), and the usefulness and interpretability of the latent classes (26). The AIC, BIC, and SSABIC indicate relative goodness of fit; lower values represent better fitting models. A non-significant p-value from the LMR-LRT suggests that the model with one fewer classes is acceptable, and higher entropy values suggest better classification. The best model was considered the one with the fewest number of distinct classes to offer meaningful results (26). Multivariate logistic regression models were used to determine the effect of latent class on emotional distress, adjusted for other covariates. A complete case analysis was conducted. Analyses were conducted with SAS 9.3 and MPlus Version 4.21.

Results

Participant Characteristics

Participants on average were 32 years old (SD=7.64 years); 16% were 15 to 24 years old and 37% were 35 to 49 years old (**Table 1**). A total of 57% were married and living with their partner, and almost 44% reported they could read easily. The sample was fairly evenly divided between the two refugee camps. The average emotional distress score was 6.9 (SD=5.50), and 28% of the sample had scores greater than 10.

Experiences of Violence

The highest levels of violence were experienced during the conflict (**Table 1**). Approximately 35% of women reported experiencing physical violence, 31% reported experiencing emotional violence, and 18% reported experiencing sexual violence. Almost half of women (49%) reported experiencing any type of violence during the conflict. After fleeing the conflict, experiences of violence were reportedly less common, with less than 10% of women reporting experiences of physical, emotional or sexual violence. Lifetime physical IPV was reported by 17% of the women, lifetime emotional IPV was reported by 8% of the women, and lifetime sexual IPV was reported by 14% of the women. Any lifetime IPV was reported by approximately 22% of women.

Latent class analysis suggests the existence of four distinct classes (**Figure 1**). The 4-class solution was supported by the AIC, SSABIC, LMR-LRT, and the interpretability of the classes. Classes were named based on their most prominent characteristics and included the *Low All Violence* class, the *High Violence During Conflict* class, the *High IPV* class, and the *High Violence During and After Conflict* class. The largest class (n=322; 59.0%), which we named the *Low All Violence* class, was characterized by infrequent reports of during-conflict violence, after-conflict violence, and IPV. The second-largest class (n=113, 20.7%), which we named the *High Violence During Conflict* class, was characterized by a high prevalence of violence reported during the conflict but low prevalences of after-conflict violence and of IPV. The third class (n=79; 14.5%), which we named the *High IPV* class, was characterized by the highest frequencies of reports of IPV; this class of respondents also experienced moderate frequencies of violence during the conflict but low frequencies of violence after the conflict. The smallest class (n=32; 5.9%), which we named the *High Violence During and After Conflict* class, was characterized by high frequencies of violence during and after the conflict and moderate IPV victimization.

Violence Experiences and Emotional Distress

Multivariable logistic regression models suggested that latent class was strongly associated with emotional distress, even after adjusting for other common risk factors (**Table 2**). Women in the *High Violence During and After Conflict* class compared with *Low All Violence* class had almost 3 times the

odds of experiencing emotional distress in the past 4 weeks (95% CI=1.11, 6.74). Additionally, women who were in the *High Violence During Conflict* class compared with the *Low All Violence* class had a 2.3 times greater odds of experiencing emotional distress (95% CI=1.30, 4.07). Women in the *High IPV* class compared with women in the *Low All Violence* class had a 4.7 times greater odds of experiencing emotional distress (95% CI=2.53, 8.59); furthermore, the odds of experiencing emotional distress among women in the *High IPV* class is approximately twice the odds of experiencing emotional distress among women in the *High Violence During Conflict* class (95% CI=1.04, 3.98).

Discussion

This refugee camp-based study found high levels of emotional distress and multiple forms of violence experienced by Congolese refugee women of reproductive age living in Rwanda. One in four women were thought to be experiencing poor mental health, an estimate higher than other reported estimates of poor mental health, including past-month suicidality (7%) (14), PTSD (12%-14%) (2, 17), and depression (11%) (17) among women in conflict-affected settings. This higher prevalence seems likely attributable to the more inclusive nature of our mental health measure, which assesses general emotional distress as opposed to specific diagnoses. This prevalence, however, is lower than the estimate of depression (54%) found among refugees living in Uganda, who were primarily from the Democratic Republic of Congo (27). This discrepancy could be explained by differences in the respondents; the Congolese refugees living in Rwanda had been residing in the camps longer on average than the Congolese refugees in Uganda.

Our findings also suggested that approximately half of Congolese refugee women in Rwanda have experienced some form of violence. Not surprisingly, experiences of violence among these women were concentrated during the conflict with approximately 49% experiencing some form of violence during the conflict and 15% experiencing some form of violence after fleeing the conflict. Estimates of conflict-related sexual violence among this sample were comparable to other general population samples from the DRC (4, 8, 28). Nearly one-quarter of women had experienced IPV at

some point in their lifetime, consistent with frequencies observed in comparable settings (2, 4, 17). Taken together, these findings affirm the need to address the co-occurrence of both public forms of violence (i.e., conflict-related violence) and more private forms of violence (i.e., IPV) experiences among refugee women.

The data highlighted four distinct latent classes of women reporting similar violence experiences, based on the co-occurrence of conflict-related violence and IPV experiences. The emergence of these distinct classes suggests that experiences of IPV do not consistently correlate with experiences of conflict-related violence. For instance, in the *High IPV* class, women experienced relatively low levels of during and after conflict violence, but experienced high levels of IPV. These patterns suggest the strength in a latent class approach to understand nuance in violence experiences. Our study is the first to use latent class analysis (LCA) to understand patterns of violence against women in conflict-affected settings. Future research may seek to understand risk and protective factors that may be associated with the clustering of violence experiences among women affected by conflict, to help inform prevention and intervention programs.

These classes demonstrated differential associations with emotional distress and corroborate growing research in conflict-affected settings documenting that emotional health is not solely affected by violence perpetrated by armed actors or others outside of the family, but is also a result of private forms of violence, such as IPV (2, 14). Our results suggest that although women who experience elevated levels of violence may suffer from worse mental health compared with women who do not experience violence or who experience low levels of violence, women who experience high levels of IPV may have the greatest likelihood for poor mental health. These results demonstrate the value of LCA for identifying distinct classes of women to understand potential mental health consequences. Furthermore, our findings have important implications for refugee programs as much of the current humanitarian funding tends to focus on conflict-related violence and excludes IPV. Similarly, specialized violence against women prevention and response programs within refugee camps tend to

focus solely on conflict-related violence as well. Policies and programs must consider allocating resources for addressing IPV in addition to conflict-related violence in conflict-affected settings.

Despite several strengths of our study, including a large, probability-based sample of refugee women, findings should be interpreted in light of some limitations. First, although the time periods for experiences of violence during the conflict and after fleeing the conflict were well-defined and relatively recent, experiences of IPV were those that could have occurred by one's current or former partners. This measurement, therefore, considered IPV occurring 20 years ago and 20 days ago as having the same effect. Additionally, the experience of IPV may be ongoing, whereas violence experienced during the conflict is relatively distant and the violence experienced after the conflict may be less distant but still in the past. These possible discrepancies in the timing of violence occurrence could help explain the impact of IPV on emotional distress within this sample. Furthermore, this analysis lacks the ability to make conclusions about the effects of chronic IPV. Additional research is needed to overcome these limitations in order to better understand the timing of such events. Second, the current analysis did not include other important forms of violence against women (e.g., child marriage, transactional sex, denial of resources) that may also be high among refugee women populations. Future LCA research may seek to integrate these additional forms of gender-based violence to further understand associations with health outcomes. We also did not include socioeconomic status, as status prior to displacement was unavailable; socioeconomic status has been associated with mental health in previous research and is an important factor to consider for future work (29). Third, recall bias could have affected the reporting of both IPV as well as conflict-related violence, given that the conflict arose in the early 1990s, and could have caused underreporting of less severe forms of violence. Women may have also misinterpreted questions; however, survey items were based on the WHO's domestic violence surveys, which have been field-tested in several vulnerable populations (23, 30). Further, women may have underreported experiences of violence due to stigma associated with these experiences. All interviews, however, were conducted in private, safe spaces, and confidentiality was reinforced throughout the survey to encourage unbiased reporting. Interviewer bias is also a possibility; however, all interviewers

were trained according to WHO guidelines for conducting domestic violence surveys (23, 30). All interviewers were able to offer participants ethical referrals for relevant services according to each participant's wishes, and the benefits of seeking assistance from qualified service providers were continuously reinforced throughout the refugee camps. New strategies, however, are likely needed to combat low self-efficacy and help-seeking behaviors among women and girls affected by violent experiences. Last, sampling was not proportional to the size of the refugee camps and the survey's participation rate is unknown. These results may be generalizable to women residing in similar conflict-affected settings, but the extent to which is unclear.

Our study has several implications for policy, practice, and future research. First, our findings suggest that humanitarian assistance programs should emphasize the importance of employing skilled mental health workers or social workers to respond to multiple forms of violence, paying particular attention to experiences of IPV. Programs serving refugee women and communities should also seek to respond to multiple forms of violence against women, including IPV. Currently, much of the funding and programmatic attention focuses primarily on conflict-related violence (particularly sexual violence), with less emphasis on IPV. Programs aimed to respond to violence against women should thus be equipped to respond to the mental health needs of women with varying levels of exposure to both discrete events of violence that are more common with conflict-related violence as well as chronic, continual exposure to IPV as many women in conflict-affected settings experience ongoing IPV (31). Studies also suggest that the prevalence of IPV may be higher in conflict-affected settings and that exposure to conflict may increase a woman's vulnerability to experiencing IPV. As such, prevention and intervention programs are needed to reduce the prevalence of IPV and mitigate its health consequences. To date, little data exist regarding promising interventions in such conflict-affected settings, but at least two randomized trials within Cote d'Ivoire demonstrate the potential to reduce IPV in conflict-affected settings (2, 12). More research is needed in this area. Health care workers in humanitarian settings should also implement field-tested, safe, and routine IPV and other violence screening for women and adolescent girls accessing healthcare because these experiences have

health implications that appear to differ from the experiences of conflict-related violence. Additionally, these health care workers should pay particular attention to women who have experienced IPV from their current or past partner as they may have some of the poorest mental health among women in refugee camps. Acknowledging the patterns of violence women experience in conflict settings may improve mental health response services. Such response services should be combined with other prevention programs, such as community-based programming to improve gender equitable norms and engagement of men to reduce perpetration, in order to reduce violence against women within and outside their homes.

Contributions: HS, KF, EB, and JG conceptualized and designed the study. HS conducted the data analysis and wrote the first draft of the manuscript. All authors critically reviewed and contributed to the manuscript and approve the final manuscript as submitted.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing Interests: None.

Data Sharing Statement: Additional details about the data and its availability can be accessed through the CDC's Division of Reproductive Health at http://www.cdc.gov/reproductivehealth/Global/CrisisSituations.htm.

References

1. Amowitz L, Reis C, Lyons K. Prevalence of war-related sexual violence and other human rights abuses among internally displaced persons in Sierra Leone. JAMA. 2002;287(4):513-21.
2. Gupta J, Falb K, Carliner H, Hossain M, Kpebo D, Annan J. Associations between exposure to intimate partner violence and probable PTSD among women in rural Cote d'Ivoire. PLOS One. 2014;9(5):e96300.
3. Hynes M, Ward J, Robertson K, Crouse C. A determination of the prevalence of gender-based violence among conflict-affected populations in East Timor. Disasters. 2004;28(3):294-321.
4. Johnson K, Scott J, Rughita B, Kisielewski M, Asher J, Ong R, et al. Association of sexual violence and human rights violations with physical and mental health in territories of the Eastern Democratic Republic of the Congo. JAMA. 2010;304(5):553-62.
5. Kelly J, Betancourt T, Lipton R, VanRooyen M. Experiences of female survivors of sexual violence in eastern Democratic Republic of the Congo: a mixed-methods study. Conflict and Health. 2011;5(25):1-8.
6. Kerimova J, Posner S, Brown Y, Hillis S, Meikle S, Duerr A. High prevalence of self-reported forced sexual intercourse among internally displaced women in Azerbaijan. American Journal of Public Health. 2003;93(7):1067-70.
7. Peterman A, Palermo T, Bredenkamp C. Estimates and determinants of sexual violence against womenin the Democratic Republic of Congo. American Journal of Public Health. 2011;101(6):1060-7.
8. Pham P, Vinck P, Weinstein H. Human rights, transitional justice, public health and social reconstruction. Social Science & Medicine. 2010;70(1):98-105.
9. Pratt M, Werchick L. Sexual terrorism: rape as a weapon of war in Easter Democratic Republic of Congo; 2004 Contract No.: Document Number|.
10. Tlapek S. Women's status and intimate partner violence in the Democratic Republic of Congo. Journal of Interpersonal Violence. 2014;epub before print:1-15.

11. Vu A, Adam A, Wirtz A, Pham K, Runenstein L, Glass N, et al. The prevalence of sexual violence among female refugees in complex humanitarian emergencies: a systematic review and meta-analysis. PLOS Currents Disasters. 2014;March 18, 2014.
12. Hossain M, Zimmerman C, Kiss L, Kone D, Bakayoko-Topolska M, Manan D, et al. Men's and women's experiences of violence and traumatic events in rural Cote d'Ivoire before, during and after a period of armed conflict. BMJ Open. 2014;4:e003644.
13. Annan J, Brier M. The risk of return: intimate partner violence in northern Uganda's armed conflict. Social Science & Medicine. 2010;70(1):152-9.
14. Falb K, McCormick M, Hemenway D, Anfinson K, Silverman J. Suicide ideation and victimization among refugee women along the Thai-Burma border. Journal of Traumatic Stress. 2013;26:631-5.
15. Stark L, Ager A. A systematic review of prevalence studies of gender-based violence in complex emergencies. Trauma, Violence, and Abuse. 2011;12(3):127-34.
16. Al-Modallal H. Psychological partner violence and women's vulnerability to depression, stress, and anxiety. International Journal of Mental Health Nursing. 2012;21:560-6.
17. Vinck P, Pham P. Association of exposure to intimate-partner violence and potentially traumatic war-related events with mental health in Liberia. Social Science & Medicine. 2013;77:41-9.
18. Cavanaugh C, Messing J, Petras H, Fowler B, La Flair L, Kub J, et al. Patterns of violence against women: a latent class analysis. Psychological Trauma. 2012;4(2):169-76.
19. Hanlon H. Implications for health care practice and improved policies for victims of sexual violence in the Democratic Republic of Congo. Journal of International Women's Studies. 2008;10(2):64-72.
20. Human Rights Watch. Soldiers Who Rape, Commanders Who Condone: Sexual Violence and Military Reform in the Democratic Republic of Congo. New York, NY; 2009 Contract No.: Document Number|.

21. Reproductive Health Assessment Toolkit for Conflict-Affected Women.: Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Coordinating Center for Health Promotion, Centers for Disease Control and Prevention, Department of Health and Human Services; 2007 Contract No.: Document Number|.

22. Kish L. A procedure for objective respondent selection within the household. Journal of the American Statistical Association. 1949;44:380-7.

23. Sethi D, Habibula S, McGee K, Peden M, Bennett S, Hyder A, et al., editors. Guidelines for Conducting Community Surveys on Injuries and Violence. Geneva: World Health Organization; 2004.

24. Beusenberg M, Orley J. A user's guide to to the Self Reporting Questionniare (SRQ). Geneva: World Health Organization; 1994.

25. Scholte W, Verduin F, van Lammeren A, Rutayisire T, Kamperman A. Psychometric properties and longitudinal validation of the self-reporting questionnaire (SRQ-20) in a Rwandan community setting: a validation study. BMC Medical Research Methodology. 2011;11:116.

26. Muthen B, Muthen L. Integrating person-centered and variable-centered analysis: growth mixture modeling with latent trajectory classes. Alcoholism, Clinical and Experimental Research. 2000;24(6):882-91.

27. Morof D, Sami S, Mangeni M, Blanton C, Cardozo B, Tomczyk B. A cross-sectional survey on gender-based violence and mental health among female urban refugees and asylum seekers in Kampala, Uganda. International Journal of Gynecology and Obstetrics. 2014;127:138-43.

28. Ministry of Planning, Democratic Republic of Congo. Demographic and Health Survey 2007. Calverton, MD; 2008 Contract No.: Document Number|.

29. Acevedo-Garcia D, Sanchez-Vaznaugh E, Viruell-Fuentes E, Almeida J. Integrating social epidemiology into immigrant health research: A cross-national framework. Social Science & Medicine. 2012;75(12):2060-8.

30. WHO. WHO Multi-country Study on Women's Health and Domestic Violence against Women. Geneva, Contract No.: Document Number|.

31. International Rescue Committee. Let Me Not Die Before My Time. New York, NY; 2012 Contract No.: Document Number|.

Table 1. Participant characteristics (N=548)

	N (%)[1]
Age[2]	
15-24 years	85 (15.9%)
25-34 years	251 (47.0%)
35-49 years	198 (37.1%)
Current relationship status[3]	
Married, living together	309 (56.9%)
Married, not living together	144 (26.5%)
Other	49 (9.0%)
Widowed	41 (7.6%)
Ability to read	
Not at all	184 (33.6%)
With difficulty	125 (22.8%)
Easily	239 (43.6%)
Refugee camp	
Nyabiheke Camp	302 (55.1%)
Gihembe Camp	246 (44.9%)
Emotional distress (SRQ-20)[4]	
≤ 10	374 (72.3%)
> 10	143 (27.7%)
Type of Violence	
During conflict: physical[5]	191 (34.9%)
During conflict: emotional	169 (30.8%)
During conflict: sexual[5]	96 (17.5%)
After conflict: physical	44 (8.0%)
After conflict: emotional	28 (5.1%)
After conflict: sexual	39 (7.1%)
IPV: physical[6]	93 (17.3%)
IPV: emotional[2]	45 (8.4%)
IPV: sexual[2]	74 (13.9%)

[1]Valid percentages

[2]14 participants (2.6%) had missing responses

[3]5 participants (0.9%) had missing responses to relationship status

[4]"No response" was coded as missing; 31 participants (5.7%) were missing responses to one or more items in the SRQ-20

[5]1 participant (0.2%) had a missing response

[6]17 participants (3.1%) had missing responses

Figure 1. Exposure to violence during and after the conflict and lifetime exposure to intimate partner violence among ever-married women

Note: DC = during conflict; AC = after conflict; IPV = intimate partner violence (lifetime)

Table 2. Multivariate logistic regression models exploring the associations between emotional distress and classes of violence exposure among ever-married women (N=477; 92.2% of sample with valid emotional distress data)

	OR (95% CI)
Age	
15-24 years	1.00
25-34 years	1.48 (0.76, 2.91)
35-49 years	1.66 (0.80, 3.42)
Current relationship status	
Married, living together	1.00
Married, not living together	1.56 (0.92, 2.63)
Other	2.63 (1.21, 5.70)*
Widowed	4.70 (2.20, 10.04)**
Ability to read	
Not at all	1.76 (1.05, 2.93)*
With difficulty	0.71 (0.39, 1.31)
Easily	1.00
Length of displacement	1.15 (0.90, 1.46)
Nyabiheke Camp	1.72 (0.21, 13.92)
Class[1]	
Low all violence	1.00
High violence during conflict	2.30 (1.30, 4.07)**
High IPV	4.67 (2.53, 8.59)**
High violence during and after conflict	2.74 (1.11, 6.74)*

*P-value < 0.05; **P-value < 0.01

[1]*High IPV* class is significantly different from *High violence during conflict* class (*High IPV* vs *High violence during conflict*: OR = 2.03; 95%CI = 1.04, 3.98; P-value = 0.039) in its effect on emotional distress

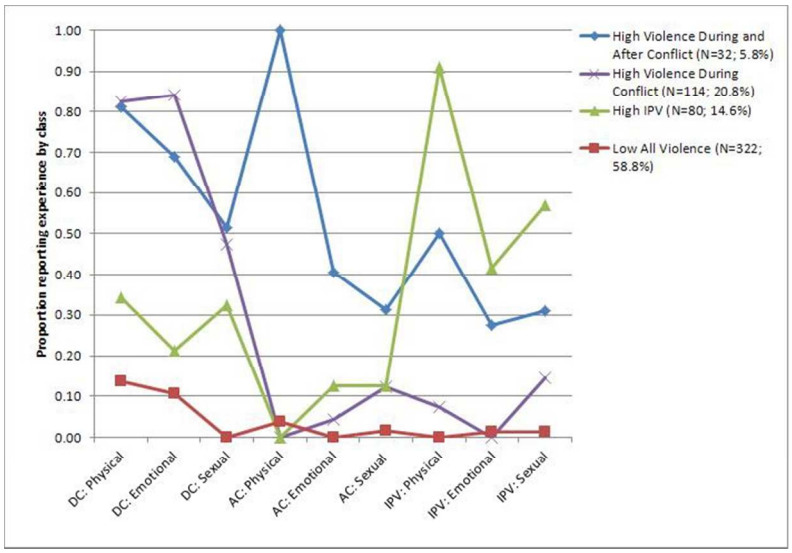


Figure 1. Exposure to violence during and after the conflict and lifetime exposure to intimate partner violence among ever-married women

Note: DC = during conflict; AC = after conflict; IPV = intimate partner violence (lifetime)
238x129mm (96 x 96 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	16-17
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA, 7,9
		(*b*) Report category boundaries when continuous variables were categorized	16, 18
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.