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# Association of Combatant Status and Sexual Violence With Health and Mental Health Outcomes in Postconflict Liberia

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**T**HE CONFLICT IN LIBERIA BEGAN in late 1989 when then-rebel leader Charles Taylor launched an incursion from neighboring Cote d'Ivoire. This conflict has been characterized by ethnic killings and massive abuses against the civilian population between 1989 and 1997 and again in 2003 and 2004.<sup>1</sup> Relative peace was established in 2004 and today, a fragile peace is maintained by the 15 000-strong United Nations Mission in Liberia troops<sup>2</sup> and a large international aid agency presence.

The health, mental health, and psychosocial consequences of populations exposed to or forced into combat are well delineated.<sup>3-7</sup> Combatants are both participants in and victims of atrocities. They are forced to perpetrate brutal acts of violence including rape, torture, and murder while they are subjected to the same.<sup>8</sup> Often, female combatants are made to perform as sex and domestic slaves, while males' fate is combat.<sup>9</sup> Although in Liberia there are indications that females were forced into combat as well, and that males may have been used routinely for sexual purposes.<sup>10-13</sup> The use of males for sexual slavery is not well documented in the postconflict literature.

**Context** Liberia's wars since 1989 have cost tens of thousands of lives and left many people mentally and physically traumatized.

**Objectives** To assess the prevalence and impact of war-related psychosocial trauma, including information on participation in the Liberian civil wars, exposure to sexual violence, social functioning, and mental health.

**Design, Setting, and Participants** A cross-sectional, population-based, multi-stage random cluster survey of 1666 adults aged 18 years or older using structured interviews and questionnaires, conducted during a 3-week period in May 2008 in Liberia.

**Main Outcome Measures** Symptoms of major depressive disorder (MDD) and post-traumatic stress disorder (PTSD), social functioning, exposure to sexual violence, and health and mental health needs among Liberian adults who witnessed or participated in the conflicts during the last 2 decades.

**Results** In the Liberian adult household-based population, 40% (95% confidence interval [CI], 36%-45%; n=672/1659) met symptom criteria for MDD, 44% (95% CI, 38%-49%; n=718/1661) met symptom criteria for PTSD, and 8% (95% CI, 5%-10%; n=133/1666) met criteria for social dysfunction. Thirty-three percent of respondents (549/1666) reported having served time with fighting forces, and 33.2% of former combatant respondents (182/549) were female. Former combatants experienced higher rates of exposure to sexual violence than noncombatants: among females, 42.3% (95% CI, 35.4%-49.1%) vs 9.2% (95% CI, 6.7%-11.7%), respectively; among males, 32.6% (95% CI, 27.6%-37.6%) vs 7.4% (95% CI, 4.5%-10.4%). The rates of symptoms of PTSD, MDD, and suicidal ideation were higher among former combatants than noncombatants and among those who experienced sexual violence vs those who did not. The prevalence of PTSD symptoms among female former combatants who experienced sexual violence (74%; 95% CI, 63%-84%) was higher than among those who did not experience sexual violence (44%; 95% CI, 33%-53%). The prevalence of PTSD symptoms among male former combatants who experienced sexual violence was higher (81%; 95% CI, 74%-87%) than among male former combatants who did not experience sexual violence (46%; 95% CI, 39%-52%). Male former combatants who experienced sexual violence also reported higher rates of symptoms of depression and suicidal ideation. Both former combatants and noncombatants experienced inadequate access to health care (33.0% [95% CI, 22.6%-43.4%] and 30.1% [95% CI, 18.7%-41.6%], respectively).

**Conclusions** Former combatants in Liberia were not exclusively male. Both female and male former combatants who experienced sexual violence had worse mental health outcomes than noncombatants and other former combatants who did not experience exposure to sexual violence.

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The Disarmament, Demobilization, and Reintegration educational program of Liberia was meant to deliver health care, education, skills training, family

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tracing and reunification, and response to the particular needs of women and girls, many of whom struggled with the psychological, physical, and social consequences of sexual and other forms of physical abuse, forced "marriage," pregnancy, and childbirth.<sup>12</sup> Many former soldiers were forced to quit the Disarmament, Demobilization, and Reintegration program due to economic necessity and lack of funding, and not all former combatants were admitted to the program. Since 2004, at least hundreds of Liberians have been re-recruited across borders to fight within Cote d'Ivoire, as well as thousands of others in both Guinea and Sierra Leone.<sup>10</sup>

Until now, there has been no national Liberian population-based assessment of health, mental health, and social functioning, with a focus on the interaction of combatant status and sexual violence. These data will help to guide rehabilitation and community-based programs, and inform governments and policy makers while assisting individuals to resume normal lives and eventually live as functional members of society who participate in the rebuilding and stabilization of their war-torn communities.

## METHODS

### Survey Sites and Sample Selection

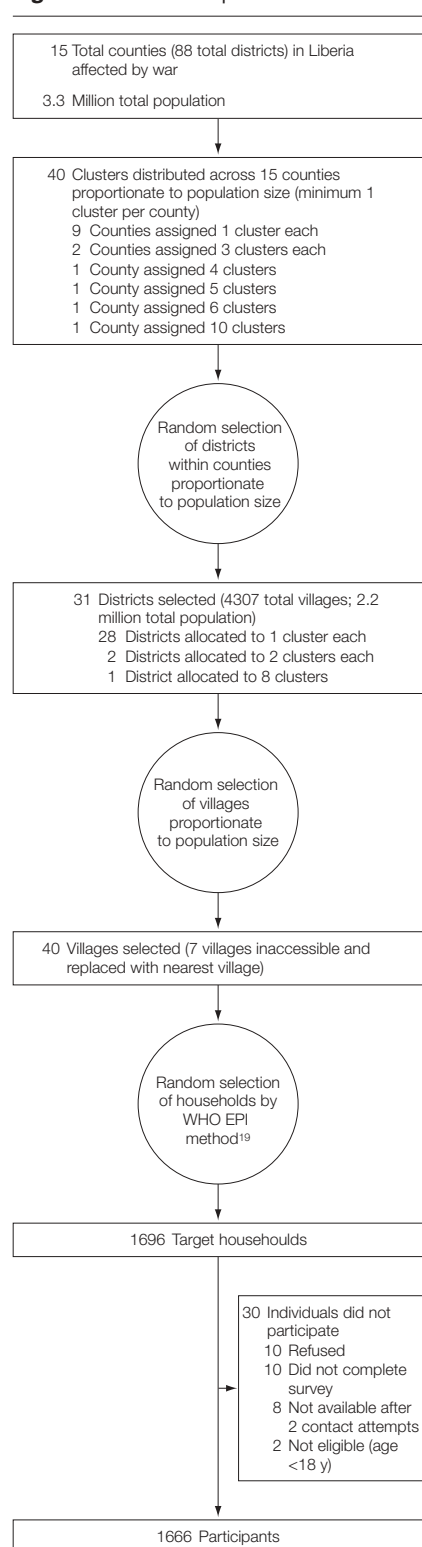
This research is based on a cross-sectional study conducted during a 3-week period in May 2008 in Liberia. Participants were selected via a combination of systematic random sampling and 40 × 40 cluster sampling to generalize to the largest population possible (FIGURE and eFigure [see <http://www.jama.com>]). To determine an appropriate sample size for this study, we assumed a prevalence of major depression of 0.50, similar to that of other postconflict communities.<sup>4,5,7</sup> The sample size required to estimate that prevalence via a simple random sample (to within 0.05 with 95% confidence) is 385 households.<sup>14</sup> However, assuming a design effect of 2 to account for the sample design,<sup>15</sup> a sample size of 770 would be needed. Further, to allow estimation for subgroups as small as one-

fourth of the population and assuming relatively uniform distribution of the subpopulation across clusters, a sample size of 1540 would be required.<sup>16</sup> Therefore to account for refusals, we targeted our total sample size to be 1600 households.

At the time of the study, the results of the national census conducted in March 2008 were not available. Consequently, our study used population information generated by the United Nations Development Program (UNDP) in 2005 and available at the country, county, district, and village levels.<sup>17</sup> In May 2008, the estimated population of Liberia was 3.3 million and composed of 15 major administrative sections (counties) and 88 districts.<sup>17</sup> Two counties, Bong (population of 516 725) and Montserrado (population of 865 575), were largely urbanized and account for 42% of Liberia's population.<sup>17</sup> According to the UN High Commissioner for Refugees, as of August 2006, officially there were no remaining camps for internally displaced persons or refugee camps in the country.<sup>18</sup>

The sampling plan included stratification by county, allocation of clusters to counties proportionally by county population size, and then systematic probability proportional to size sampling of districts within counties. Within each district, village selection relied on detailed county maps provided by the UNDP's Humanitarian Information Center for Liberia.<sup>17</sup> With the exception of the capital (Monrovia), village populations were only available as rough estimations, indicated on UNDP maps as 200, 200 to 2000, 2000 to 10 000, and more than 10 000. Therefore, random selection of villages within districts was systematic (from north to south) and proportional to village size in that villages with a population of less than 2000 were equally likely of selection, and villages and cities with a population greater than 2000 but less than 10 000 were 5 times more likely to be selected. In the 2 cases in which the village had a population size greater than 10 000, the village was equivalent to the district and selected into the sample at

**Figure. Flow of Participants**



EPI indicates Expanded Program of Immunization; WHO, World Health Organization.

the district level. In one of these cases, a more detailed map was available for the Monrovia district/city and 138 neighborhoods were treated as villages and sampled proportionally to population size.

Districts within the counties were randomly chosen. The starting district of the sample was determined by numbering the districts in the list and having a computer program (Randomness 1.5.2) generate a random number in that range. The district matching the chosen number was designated the start of the sampling interval and was allocated the first cluster. After the first cluster was allocated, the district's population was compared with the sampling interval. If the sampling interval was smaller than the district's population, the district was allocated another cluster. The sampling interval was then doubled. If the doubled sampling interval was still smaller than the district's population, the district received a third cluster and the interval was tripled. This continued with each successive interval until the district's population no longer contained the multiplied sampling interval. If the sampling interval was larger than the district's population (ie, the sampling interval fell outside the population range), the district's population was added to the population of the next district on the list. If the sampling interval was smaller than this combined population, the second district was allocated the next cluster. If the sampling interval was larger than the combined population, the second district was skipped. The third district's population was then added to the combined population, and so on. This continued until all the county's clusters had been allocated to districts.

Households within villages were sampled according to the World Health Organization's Expanded Program of Immunization method.<sup>19</sup> That is, data collectors began in the geographic center of the village and used a randomization device to pick a direction and the number of houses to pass in order to reach the first sampling unit. Each

subsequent survey was conducted in the household whose door was nearest to the door of the previous household. This continued until all 40 surveys within the cluster were completed, with records kept of refusals, ineligible households, and lack of availability after 2 attempts.

Substitution for initial sampled villages occurred for 7 of the 40 clusters (17.5%) due to inaccessible roads during the rainy season. Additionally, in one case, the selected village had less than 40 households, so the next closest household was selected from within the neighboring village and household selection continued within that village.<sup>19</sup>

### Participants

A Liberian data collector interviewed 1 adult ( $\geq 18$  years) per household in the sample. At each house, the surveyor requested to speak with an adult household member either male or female who could give accurate information about the household. If this person was unavailable, then the next adult in the household was approached. An assertive attempt was made to ensure that women were not excluded as respondents. Data collectors were asked to alternate male or female interviews for each household approached. If only 1 adult or 1 sex was present at the time a household was visited, that person was interviewed regardless of sex.

One-to-one interviews were conducted anonymously in a setting that offered privacy and confidentiality, typically inside the housing unit. Oral rather than written consent was obtained because of the high illiteracy rate. All participants were informed about the purpose of the survey, ensured that their name would not be recorded, and told that there would be no benefits or penalties for refusing or agreeing to participate. Respondents were provided with a referral to local nongovernmental organizations and health centers that offered mental health programs if they requested help for emotional distress, appeared to be in severe distress as observed by trained interviewers, or an-

swered "yes" to any red flag questions in the survey.

### Instrument

The survey contained 128 questions on respondent demographics, combatant status, basic needs, education, physical and mental health and health care access, mortality of household members in a 3-month and 1-year time frame including deaths of children younger than 5 years, morbidity (head trauma exposure, perceptions of general health before, during, and after the war), reproductive health, gender-based violence, substance abuse, and opinions concerning rehabilitation of former combatants and conflict-related trauma. Although a 10-year recall of events is generally considered reliable,<sup>20</sup> we asked about events since 1989 because the first civil war at that time was a major traumatic event in Liberian history and can therefore be reliably recalled.<sup>21</sup>

Mental health was assessed using social functioning, posttraumatic stress disorder (PTSD), and major depressive disorder (MDD) scales. Social functioning was measured via a 5-point scale rating difficulty in completing each of 10 common sex-specific tasks (eg, collecting wood and child care for women and farming for men), with a score of 4 (scale of 0-4) indicating complete inability to engage in the task. The total social functioning score was the sum of the 10 individual task scores. The social functioning scales were adapted for Liberia, according to a template provided by Bolton and Tang,<sup>22</sup> by Liberian community health workers who conducted separate women's and men's focus groups to determine the lists of tasks that are important to the daily functioning of Liberians. The wording used is what they suggested and follows culturally accepted terms. Pilot testing of the adapted scale was completed in Liberian communities by community health workers among 10 or more Liberian household members before incorporation into the survey. To assess symptoms of PTSD, we used the 17-item PTSD Symptom Scale Interview, which has an 86% sensitivity and 78%

specificity to a PTSD diagnosis.<sup>23</sup> However, we changed the 2-week symptom recall period to a 1-month recall period similar to other PTSD instruments adapted for surveys to assess current as opposed to lifetime PTSD.<sup>23</sup> Symptoms of MDD were assessed using the Patient Health Questionnaire 9, a well-validated, highly sensitive instrument for identifying individuals with current and past depression.<sup>24</sup> Although not validated, the PTSD scale and social functioning template have been used reliably among postconflict communities in Uganda<sup>4,7</sup> and Rwanda,<sup>25</sup> the MDD scale in Darfur<sup>26</sup>; all postconflict communities in Africa. Questions about suicidal ideation<sup>27</sup> and suicide attempts<sup>28</sup> among respondents were reported as yes or no responses.

The survey was written in English. The Liberian data collectors and researchers collaborated on a verbal translation of the survey from English to Liberian English (lingua franca) to account for culturally sensitive wording while holding true to the survey intent. The data collectors learned to verbally administer the survey in Liberian English in which they were all fluent. These translations were checked for accuracy by the 4 members of the research team, including 1 Liberian English speaker.

### Interviewers

To standardize the survey and in keeping with our commitment to capacity building, researchers trained Liberian interviewers to conduct the survey.<sup>29</sup> The 20 data collectors comprised an equal number of men and women who were selected among graduate students from the Cuttington School of Public Health in Monrovia and community health workers from Tiyatein Health, a Liberian nongovernmental organization in Grand Gedeh. They were primarily from the 2 main ethnic groups, Kpelle and Bassa, but data collectors from other ethnic groups were used to survey areas in which their ethnic group was prominent. However, we did not specifically match ethnicity of interviewers to respondents. Training

involved 2 days of a combination of classroom teaching and experimental role-play, followed by several days of field observation.<sup>29</sup> The classroom sessions included instruction on survey administration, sampling frame, the need for confidentiality and privacy, and referral to services.

Survey answers were coded as numbers, which the data collectors circled on the form. Some questions required that the data collectors enter a number (eg, age of respondent). Interviewers were not assigned to same-sex respondents. Each survey interview took approximately 25 to 45 minutes and was conducted in Liberian English. All surveys were reviewed for completeness and for correctness of recording by the researchers at the end of each day. Researchers worked closely with data collectors on a daily basis to answer questions and give feedback about each survey completed, and completed an average of 10 surveys per day and worked between 8 and 14 days.

Teams arrived in the village to be surveyed early in the morning before participants would leave for work or for the fields. Upon arrival to the village and per local custom and protocol, the team located the village chief to request permission to conduct the survey. A small token of appreciation was extended to the village chief and in return the chief requested that the villagers remain in the village and be accessible to the interviewers.

### Human Subject Protections

Ethical approval was obtained from the institutional review board of the Uniformed Services University of the Health Sciences and the ethical review board of the Liberian Ministry of Health. Verbal informed consent was obtained from all participants. The research was conducted in accord with the Declaration of Helsinki as revised in 2000.<sup>30</sup> Every effort was made to ensure protection and confidentiality and to reduce any potential adverse consequence to the participants. Data were kept anonymous at all times. Participants did not receive any material compensation and

were informed of this during the consenting process. They were informed that participation or lack thereof will not affect their access to or the quality of the care they receive, and were explicitly given the right to refuse participation. Referrals to appropriate local psychosocial services were given if requested by the participant or if the participant was perceived as a threat to himself or herself.

### Statistical Analysis

Data analysis was performed using the survey module within the statistical software package R, an open-source version of S-plus.<sup>31</sup> Analysis involved the estimation of weighted population and subpopulation means and percentages, as well as the development of logistic regression models for the calculation of weighted odds ratios (ORs). The 95% confidence intervals (CIs) were calculated using jackknife variance estimation to account for the complex sample design, and *P* values for bivariate comparisons were calculated using the adjusted Wald test of association (a test that is robust to multistage clustered sampling). *P* values less than .05 are considered significant.

Weighting of the data was necessary due to differences in the probabilities of selection of individual villages. Data were weighted to account for both the sampling scheme and response rates. Village-level weights were developed by taking the inverse of the village selection probability. To develop individual-level weights, the village-level weights were multiplied by the average village size for the district (calculated by dividing the district population size by the number of villages in the district) and divided by 40 (the sample size within the village). Using average village size was necessary because exact population counts were not available at the village level. The weights were then adjusted for varying levels of response. The resulting weights varied in size by a factor of 3.75 (ie, the largest weight was 3.75 times larger than the smallest weight) due to the selection probability differences.

Three multivariate logistic regression models were developed to examine the relationships among exposure to violent or traumatic events and indicators of mental health. Each model used all data (both combatants and noncombatants). For each model, the dependent variable was a binary indicator of 1 of the following: PTSD symptoms, MDD symptoms, or suicide attempt. The PTSD symptoms variable was set to 1 if the respondent met the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) (DSM-IV) criteria based on his/her answers to the PTSD Symptom Scale Interview portion of the interview.<sup>25,26</sup> The MDD symptom variable was set to 1 if the respondent met the DSM-IV criteria based on his/her answers to the Patient Health Questionnaire 9 portion of the interview.<sup>27</sup>

Independent variables included in each of the models to control for confounders were sex, household size, meals eaten per day (as an indicator of basic needs attainment), primary education, and counseling obtained after the war. In each of the 3 models, additional independent variables were selected via backward elimination until all remaining variables were significant at the .05 level. Those independent variables were then combined to create a common final model for all 3 mental health outcomes. The resulting independent predictors were current age in years; number of years residing in current village; number of deaths in household within the past 3 months; previous head injury; being a scout, spy, decoy, courier, guide, or guard as a former combatant; being a porter, cook, or domestic laborer as a former combatant; and a sexual violence indicator. Most model variables were binary, resulting in prevalence ORs. The 5 exceptions—household size, meals eaten per day, current age in years, number of years residing in current village, and number of deaths in household within the past 3 months—yield ORs that are interpreted as follows: each unit increase in the variable is associated with the given increase or decrease in likelihood of the mental health outcome. To maintain interpretability of the ORs de-

veloped from the models, interaction terms were not included in the modeling procedure.

The ORs were calculated from the coefficients in the logistic regression models, and both standard errors for the coefficients and also *P* values for 2-sided tests of significance of the coefficients relied on variance estimation via linearization. The 95% CIs for the ORs were formed from the model coefficients and their standard errors.<sup>32</sup>

### Definitions

A household was defined as the group of people eating from the same pot or sleeping under the same roof. Social dysfunction was defined as a score of 19 or higher, indicating a moderate degree of interference in functioning.<sup>22</sup> Substance abuse was noted if the participant reported using drugs or alcohol on a regular basis (>2 times per week or in excess each time).<sup>33</sup> Untreated water source was defined as any water source other than a communal tap, home tap, or protected well. Inadequate shelter was defined as housing other than a brick or cement dwelling, or housing that either lacks a roof or has a paper roof. Inadequate general health care was defined as a lack of hospital or clinic within a 4-hour walking distance. Self-reported morbidity and mortality predictors were developed by asking the respondent directly if he/she had enough of a given resource (eg, enough cooking fuel).

A combatant was defined, using the United Nations' definition, as any person who reported being part of any kind of regular or irregular armed force in any capacity, including but not limited to participation in combat, laying mines or explosives, serving as a cook or domestic laborer, decoy, courier, guide, guard, porter, or spy, trained or drilled as a combatant, or serving as a sexual servant or slave.<sup>3</sup> With regard to sexual servitude, respondents were asked if in their lifetime they were forced to be a sexual servant or sexual slave to a government or nongovernment military or militia group and asked who the perpetrator may have been if

known. Lifetime sexual violence was assessed by asking a respondent if they had experienced sexual violence to include molestation, forced undressing, forced intercourse, or other sexual acts. Perpetrator information followed. Respondents also were asked if he/she were subjected to beatings by a spouse or partner to identify intimate partner violence, resulting in a binary variable measuring intimate partner violence. Sexual violence was determined as any violence, physical or psychological, carried out through sexual means or by targeting sexuality and included rape and attempted rape, molestation, sexual slavery, being forced to undress or being stripped of clothing, forced marriage, and insertion of foreign objects into the genital opening or anus, forcing 2 individuals to perform sexual acts on one another or harm one another in a sexual manner, or mutilating a person's genitals.<sup>9,34</sup> A perpetrator was defined as any person who directly inflicted violence or a reported abuse.<sup>35</sup> Knowledge of human immunodeficiency virus was assessed by asking the respondent to rate their knowledge as "a great deal," "a little bit," or "none."

## RESULTS

### Demographics

Demographic estimates for the Liberian adult household-based population are given in TABLE 1. The sample (n=1666) is composed of nearly equal numbers of men (786; 47.2%) and women (880; 52.8%). Of 1696 interviews attempted, 1666 were completed, yielding an overall response rate of 98.2%. Of the 30 nonrespondents (1.8%), 10 refused to participate, 2 were ineligible due to age (<18 years), 8 were not available after 2 contact attempts, and 10 were interrupted and could not complete the interview.

The mean years living in the current home village for the adult household-based population is 26 years (95% CI, 24.3-28.5 years), and the mean age for the population is 41 years (95% CI, 40-42 years). Average Liberian household size is 6.8 members (95% CI, 6.7-7.0), with an average of 3.2 children

(95% CI, 3.14-3.53). The majority of the population is either married or in a partnership, but 2% of spouses are still missing from the war. The main ethnic groups are Kpelle (29%; 95% CI, 19.6%-38.2%; n=463/1661) and Bassa (19.6%; 95% CI, 13.1%-26.1%; n=289/1661) and the majority of the adult population is Christian (89.6%; 95% CI, 85.0%-94.1%; n=1462/1650). Nearly half own their land (46.6%; 95% CI, 42.5%-50.6%; n=728/1563), and the most prevalent occupation is farming (47.5%; 95% CI, 27.9%-67.0%; n=772/1659). Only 4.7% of Liberian adults (95% CI, 2.8%-6.6%; n=78/1659) are unemployed. About half of the adult population has no formal education (52.1%; 95% CI, 42.4%-62.0%; n=832/1601) and only 43% (95% CI, 33.2%-52.9%; n=716/1652) read and write with little or no difficulty.

### Combatant Status

A third of all respondents (549/1666; 33.0%) reported serving time with fighting forces (TABLE 2). A third of respondents who are former combatants are also female (182/549; 33.2%).

Among the adult household-based population, most former combatants served as porters, cooks, or domestic laborers within their fighting groups (males, 76.1% [95% CI, 70.6%-81.6%], n=278/367; females, 85.4% [95% CI, 79.7%-91.2%], n=155/182). Many male combatants also participated in combat (52% [95% CI, 45.5%-58.6%]; n=184/365), acted as a scout, spy, decoy, courier, guide, or guard (41.8% [95% CI, 35.3%-48.4%]; n=145/359), or trained or drilled as a soldier (41.7% [95% CI, 34.6%-48.8%]; n=142/356). Compared with male combatants, female combatants were forced to be sexual servants more often (female combatants: 35.3% [95% CI, 27.5%-43.2%], n=66/180 vs male combatants: 16.5% [95% CI, 12.4%-20.7%], n=57/360). A quarter of former female combatants participated in combat (25.0% [95% CI, 16.6%-33.3%]; n=43/182). Male combatants were more likely to lay mines or explosives than female combatants (males, 26.8% [95% CI, 20.4%-33.2%],

**Table 1.** Weighted Population Characteristics for 1666 Respondents<sup>a</sup>

Characteristic	No. With Characteristic	Total No. of Respondents to Question <sup>b</sup>	Weighted % (95% CI)
<b>Sex</b>			
Male	786	1666	47.0 (42.0-51.9)
Female	880	1666	53.0 (48.1-58.0)
Age, mean, y	1647	1647	41.3 (40.2-42.4)
Time residing in home village, mean, y	1571	1571	26.4 (24.3-28.5)
Household size, mean	1660	1660	6.8 (6.7-7.0)
No. of household members <18 y, mean	1589	1589	3.2 (3.1-3.5)
Literacy <sup>c</sup>	716	1652	43.0 (33.2-52.9)
<b>Marital status</b>			
Never married	148	1648	8.5 (3.1-14.0)
Unmarried with partner	365	1648	22.4 (19.3-25.6)
Married	897	1648	54.6 (46.3-62.9)
Spouse missing	31	1648	1.8 (1.1-2.4)
Divorced or separated	68	1648	4.2 (3.3-5.1)
Widowed	139	1648	8.4 (7.0-9.9)
<b>Ethnic group</b>			
Kpelle	463	1661	29.0 (19.6-38.2)
Bassa	289	1661	19.6 (13.1-26.1)
Grebo	138	1661	9.2 (1.5-16.8)
Kru	125	1661	7.6 (1.1-14.0)
Gio	119	1661	6.9 (2.3-11.4)
Mano	121	1661	5.0 (0.4-9.6)
Kissi	71	1661	4.1 (0-8.8)
Gola	68	1661	3.8 (0.6-7.0)
Krahn	60	1661	3.4 (0-8.0)
Gbandi	51	1661	3.0 (0-7.6)
Vai	44	1661	2.3 (0-4.6)
Mandingo	35	1661	1.9 (0.09-3.7)
Loma	29	1661	1.7 (0.2-3.1)
Mende	27	1661	1.4 (0.7-2.2)
Other <sup>d</sup>	21	1661	1.3 (0.4-2.1)
<b>Religion</b>			
Christian	1462	1650	89.6 (85.0-94.1)
Muslim	167	1650	9.1 (4.8-13.4)
Other <sup>e</sup>	21	1650	1.3 (0.4-2.2)
Household owns land	728	1563	46.6 (42.5-50.6)
<b>Occupation</b>			
Farmer or herder	772	1659	47.5 (27.9-67.0)
Small business	345	1659	20.1 (10.9-29.3)
Housewife	135	1659	8.3 (5.0-11.6)
Professional	85	1659	5.1 (3.7-6.4)
Retired	33	1659	1.8 (1.0-2.7)
Unemployed	78	1659	4.7 (2.8-6.6)
Student	94	1659	5.5 (2.8-8.1)
Other	117	1659	7.1 (4.6-9.6)
<b>Highest level of education</b>			
None	832	1601	52.1 (42.4-62.0)
Some primary	224	1601	14.6 (11.9-17.4)
Finished primary	105	1601	6.5 (5.2-7.8)
Some high school	228	1601	13.9 (11.7-16.1)
Finished high school	156	1601	9.3 (4.5-14.2)
Some university	46	1601	2.8 (0-5.6)
Finished university	10	1601	0.6 (0-1.7)

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008.

<sup>b</sup>Indicates sum of the survey weights for the respondents with the characteristic.

<sup>c</sup>Defined as self-reported reading and writing with some or no difficulty.

<sup>d</sup>There were 6 Bella, 3 Congo, 5 Fula, 2 Dei, 1 Sako, 1 Sherpo, 1 Shefula, and 2 not given.

<sup>e</sup>There were 15 traditional, 2 atheist, 1 Bahai, and 3 not given.

n=94/364; females, 6.3% [95% CI, 2.0%-10.6%], n=11/178;  $P<.001$ ). Former combatants were most commonly recruited into the fighting forces by abduction or kidnapping.

In regard to substance abuse, almost half of male combatants used

drugs during the war (44.9% [95% CI, 38.4%-51.3%], n=162/363), a higher percentage than female combatants (12.3% [95% CI, 7.6%-16.9%], n=20/180) ( $P<.001$ ). Male former combatants also are more likely to have increased their drug usage since the war

ended (males, 12.1% [95% CI, 8.2%-15.9%], n=44/367; females, 1.2% [95% CI, 0%-2.9%], n=2/180;  $P=.001$ ).

A difference between education attainment of male and female former combatants also was observed. Most female former combatants have never

**Table 2.** Weighted Prevalence by Sex for 549 Former Combatant Respondents<sup>a</sup>

Characteristic	Male Former Combatants <sup>b</sup>		Female Former Combatants <sup>c</sup>		P Value <sup>d</sup>
	Respondents With Characteristic/ Total Respondents to Question	Weighted % (95% CI)	Respondents With Characteristic/ Total Respondents to Question	Weighted % (95% CI)	
By role					
Train or drill as soldier	142/356	41.7 (34.6-48.8)	20/177	10.9 (1.1-20.6)	<.001
Participate in combat	184/365	52.0 (45.5-58.6)	43/182	25.0 (16.6-33.3)	<.001
Lay mines or explosives	94/364	26.8 (20.4-33.2)	11/178	6.3 (2.0-10.6)	<.001
Scout, spy, decoy, courier, guide, or guard	145/359	41.8 (35.3-48.4)	22/180	12.3 (4.8-19.7)	<.001
Porter, cook, or domestic laborer	278/367	76.1 (70.6-81.6)	155/182	85.4 (79.7-91.2)	.03
Forced to be sexual servant or slave	57/360	16.5 (12.4-20.7)	66/180	35.3 (27.5-43.2)	.002
By recruitment strategy					
Wanted to enlist	22/346	6.9 (3.8-10.0)	2/159	1.1 (0-2.7)	.007
Needed employment	13/346	3.3 (0.9-5.7)	4/159	2.4 (0.05-4.8)	.54
Needed shelter	14/346	4.5 (1.5-7.6)	8/159	4.9 (1.3-8.5)	.88
Needed food	27/346	8.8 (5.9-11.8)	23/159	15.0 (5.5-24.4)	.18
Pressured by friends	6/346	1.7 (0-3.7)	0/159	0	NA
Promised money, drugs, or other incentives	1/346	0.3 (0-0.8)	0/159	0	NA
Abducted or kidnapped	131/346	36.7 (29.5-43.9)	65/159	39.7 (30.3-49.2)	.45
Given by family	2/346	0.5 (0-1.2)	2/159	1.3 (0-3.2)	.40
Forced to kill family or friends	27/346	7.8 (3.6-12.1)	9/159	5.1 (1.4-8.8)	.22
Family threatened with violence	64/346	17.5 (11.6-23.4)	14/159	8.9 (4.4-13.5)	.03
Personal security threatened	79/346	22.4 (16.5-28.3)	28/159	16.4 (9.7-23.1)	.21
By substance abuse					
Took drugs during war	162/363	44.9 (38.4-51.3)	20/180	12.3 (7.6-16.9)	<.001
Intake increased since war	44/367	12.1 (8.2-15.9)	2/180	1.2 (0-2.9)	.001
Intake stable since war	13/367	3.3 (1.4-5.2)	8/180	4.8 (1.4-8.1)	.40
Intake decreased since war	102/367	29.1 (22.3-35.9)	19/180	10.3 (5.8-14.8)	.003
Current substance abuser	66/365	18.0 (12.8-23.2)	7/182	4.0 (1.0-7.0)	.003
Self-reported current substance use result of war	101/367	27.1 (21.2-33.0)	13/182	7.3 (3.7-10.9)	<.001
By education level					
None	118/356	33.3 (25.4-41.2)	120/171	69.8 (57.5-82.1)	<.001
Some primary	71/356	20.7 (16.6-24.7)	20/171	12.3 (6.4-18.3)	.006
Finished primary	38/356	10.1 (6.8-13.4)	9/171	5.5 (2.2-8.8)	.01
Some high school	72/356	20.3 (16.8-23.9)	13/171	7.2 (2.6-11.9)	<.001
Finished high school	50/356	13.9 (8.3-19.5)	7/171	3.8 (1.4-6.3)	.01
Some university	7/356	1.7 (0-3.9)	2/171	1.3 (0-3.4)	.41
Other					
Participated in DDR	131/352	40.4 (34.4-46.3)	46/162	29.4 (20.2-38.7)	.05
Combatant for <2 wk	65/308	20.9 (14.8-27.0)	30/151	19.3 (10.6-28.0)	.74

Abbreviations: CI, confidence interval; DDR, Disarmament, Demobilization, and Reintegration program; NA, not able to calculate.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008. Denominators are the sum of the survey weights for the respondents in the subpopulation (ie, male or female former combatants).

<sup>b</sup>The number of male respondents classified as combatants is 367 of 786 male respondents total.

<sup>c</sup>The number of female respondents classified as combatants is 182 of 880 female respondents total.

<sup>d</sup>Adjusted Wald test of association was used.

been to school (69.8% [95% CI, 57.5%-82.1%], n=120/171) while only a third of male former combatants have no education (33.3% [95% CI, 25.4%-41.2%], n=118/356) ( $P<.001$ ). Post-conflict Disarmament, Demobilization, and Reintegration programs were attended by only a minority of both male and female former combatants.

### Patterns of Sexual Violence

TABLE 3 describes the prevalence of sexual violence experienced the adult household-based population. Among adult female former combatants, 42.3% (95% CI, 35.4%-49.1%; n=80/182) experienced sexual violence at some point in their lifetime compared with only 9.2% (95% CI, 6.7%-11.7%; n=63/698) of females who had not been combatants ( $P<.001$ ). Being a former combatant or having experienced sexual violence was not associated with the mean age at first pregnancy (approximately 20 years) or the mean number of pregnancies (approximately 6). Combatant status does not appear to be correlated with intimate partner violence because rates for female former combatants and female former noncombatants are nearly the same within sexual violence subcategory (eg, combatants experiencing sexual violence: 50.1% [95% CI, 35.2%-65.0%], n=34/72; noncombatants experiencing sexual violence: 49.1% [95% CI, 38.6%-59.5%], n=29/61). However, women who are former combatants more commonly reported the perpetrators of sexual violence to have been soldiers or rebels than did women who were not combatants (combatants, 87.1% [95% CI, 79.3%-94.9%], n=69/79; noncombatants, 46.0% [95% CI, 35.8%-56.2%], n=25/56;  $P=.001$ ).

Approximately one-third of adult male former combatants have experienced sexual violence compared with only about 7% of men who were not involved in combat (combatants, 32.6% [95% CI, 27.6%-37.6%], n=118/367; noncombatants, 7.4% [95% CI, 4.5%-10.4%], n=33/419;  $P<.001$ ). Soldiers or rebels were reported to be responsible for the majority of sexual vio-

lence that was committed against Liberian males (combatants and non-combatants).

### Physical Health Outcomes

While factors associated with mortality (eg, rates of untreated water source) are similar across former combatants and noncombatants, morbidity patterns differ between the groups (TABLE 4 and TABLE 5). Former combatants have higher rates of serious head trauma than noncombatants (combatants, 27.6% [95% CI, 23.0-32.3], n=146/548; noncombatants, 16.9% [95% CI, 14.4%-19.4%], n=197/1111;  $P=.006$ ). Use of drugs or alcohol during the war was also more frequent among former combatants than noncombatants ( $P<.001$ ). By self-report, a higher proportion of former combatants than noncombatants were traumatized by the war ( $P<.001$ ).

Access to health care is similarly poor for former combatants and noncombatants with 33.0% (95% CI, 22.6%-43.4%; n=179/542) and 30.1% (95% CI, 18.7%-41.6%; n=325/1109), respectively, experiencing a lack of availability of clinic-based or hospital-based health care within a 4-hour walking distance. The most frequent barrier to health care for both groups is lack of payment ability, followed by health care being too far away. The majority of former combatants and noncombatants also indicate mental health care is unavailable. A higher proportion of former combatants have received mental health counseling since the war compared with noncombatants ( $P=.01$ ), yet a larger proportion of former combatants also have a current need for mental health services ( $P=.009$ ).

### Mental Health Outcomes

Among the adult household-based population, the estimated weighted prevalence of PTSD symptoms is approximately 44% (95% CI, 38%-49%; n=718/1661), with a higher prevalence of PTSD symptoms among former combatants than former non-

combatants (TABLE 6). Among the adult Liberian population who has experienced sexual violence, 69% (95% CI, 62%-76%; n=200/293) meet symptom criteria for PTSD compared with 38% of the adult population who has not experienced sexual violence (95% CI, 33%-44%, n=518/1368;  $P<.001$ ). The weighted prevalence of PTSD symptoms among male former combatants who also have experienced sexual violence (81% [95% CI, 74%-87%]; n=94/118) is higher than the prevalence for male former combatants who have not experienced sexual violence (46% [95% CI, 39%-52%], n=112/249;  $P<.001$ ); it also is higher than the weighted prevalence of PTSD symptoms for male former noncombatants who have experienced sexual violence (39% [95% CI, 18%-60%]; n=12/33) and for those who have not (36% [95% CI, 26%-45%]; n=137/385). Similarly, the weighted prevalence of PTSD symptoms for female former combatants who also have experienced sexual violence (74% [95% CI, 63%-84%]; n=57/80) is higher than that for female combatants who have not experienced sexual violence (44% [95% CI, 35%-53%], n=43/102;  $P=.005$ ). For both male and female former combatants who have experienced sexual violence, the weighted prevalence of PTSD symptoms is higher than the prevalence for combatants as a general category (57% [95% CI, 52%-62%]; n=306/549) and for noncombatants (37% [95% CI, 32%-43%]; n=412/1112).

Similar trends are seen with depressive symptom experiences (Table 6). Approximately 40% (95% CI, 36%-45%; n=672/1659) of the adult household-based population experiences symptoms of MDD, approximately 11% (95% CI, 9%-14%; n=176/1608) experience suicidal ideation, and approximately 6% (95% CI, 4%-8%; n=91/1564) experience at least 1 unsuccessful suicidal attempt. The weighted prevalence of symptoms of MDD is higher for those who have experienced sexual violence (57% [95% CI, 51%-62%]; n=165/294) than for those who have

**Table 3.** Weighted Reproductive Health and Sexual Violence Means and Rates by Combatant Status for 1666 Respondents<sup>a</sup>

Characteristic	Weighted % (95% CI)				P Value <sup>b</sup>
	Combatant		Noncombatant		
	Sexual Violence	No Sexual Violence	Sexual Violence	No Sexual Violence	
	(n = 80)	Female <sup>c</sup> (n = 102)	(n = 63)	(n = 635)	
Age at first pregnancy, mean	(n = 69) 19.6 (18.6-20.6)	(n = 92) 19.3 (18.2-20.4)	(n = 56) 20.0 (18.4-21.5)	(n = 589) 19.6 (19.2-19.9)	
No. of pregnancies, mean	(n = 73) 5.80 (4.84-6.75)	(n = 95) 6.58 (5.77-7.40)	(n = 60) 5.93 (4.86-6.99)	(n = 601) 6.16 (5.68-6.64)	
No. of miscarriages, mean	(n = 72) 1.60 (1.14-2.05)	(n = 90) 1.26 (0.98-1.54)	(n = 59) 1.44 (1.06-1.81)	(n = 567) 1.39 (1.19-1.60)	
No. of live births, mean	(n = 72) 3.61 (3.04-4.17)	(n = 89) 5.03 (4.10-5.97)	(n = 59) 4.11 (3.50-4.73)	(n = 580) 4.45 (4.11-4.78)	
Knowledge of HIV	(n = 15/76) 19.4 (8.5-30.3)	(n = 12/100) 12.4 (4.3-20.6)	(n = 16/61) 21.7 (3.4-40.1)	(n = 134/621) 21.6 (14.5-28.7)	
Intimate partner violence <sup>d</sup>	(n = 34/72) 50.1 (35.2-65.0)	(n = 35/95) 37.1 (26.1-48.2)	(n = 29/61) 49.1 (38.6-59.5)	(n = 178/586) 31.5 (26.9-36.0)	
Sexual violence by perpetrator					
Partner or spouse	(n = 5/79) 6.3 (0.9-11.8)		(n = 12/56) 22.9 (11.4-34.4)		.002
Family member	(n = 3/79) 4.1 (0-8.2)		(n = 4/56) 7.8 (0.7-14.9)		.40
Community member	(n = 1/79) 1.5 (0-4.7)		(n = 4/56) 7.7 (2.0-13.3)		.08
Soldier or rebel	(n = 69/79) 87.1 (79.3-94.9)		(n = 25/56) 46.0 (35.8-56.2)		.001
Friend	(n = 1/79) 0.9 (0-2.4)		(n = 5/56) 7.0 (1.6-12.5)		.08
Unknown	(n = 0/79) NA		(n = 6/56) 8.6 (0-17.2)		NA
	(n = 118)	Male <sup>e</sup> (n = 249)	(n = 33)	(n = 386)	
Age when first child born, mean	(n = 110) 23.2 (22.1-24.3)	(n = 237) 23.8 (23.0-24.6)	(n = 33) 24.4 (23.0-25.7)	(n = 354) 25.1 (24.2-26.1)	
Self-reported knowledge of HIV	(n = 34/115) 30.7 (18.7-42.6)	(n = 55/244) 23.6 (16.4-30.8)	(n = 6/33) 18.2 (0-39.0)	(n = 100/380) 25.7 (15.3-36.0)	
Intimate partner violence <sup>d</sup>	(n = 26/105) 21.4 (12.8-30.0)	(n = 45/239) 19.7 (13.6-25.8)	(n = 6/31) 18.8 (1.2-36.4)	(n = 42/366) 10.8 (8.0-13.6)	
Sexual violence by perpetrator					
Partner or spouse	(n = 8/115) 6.9 (0.3-13.5)		(n = 1/29) 2.7 (0-8.4)		.27
Family member	(n = 1/115) 0.8 (0-2.4)		(n = 1/29) 2.9 (0-8.0)		.49
Community member	(n = 1/115) 0.7 (0-2.1)		(n = 0/29) NA		NA
Soldier or rebel	(n = 98/115) 85.6 (77.2-94.0)		(n = 24/29) 86.6 (75.8-97.4)		.86
Friend	(n = 1/115) 0.8 (0-2.2)		(n = 1/29) 3.3 (0-9.0)		.31
Unknown	(n = 5/115) 4.6 (1.3-7.8)		(n = 2/29) 4.5 (0-9.9)		.99
Other (unspecified)	(n = 1/115) 0.6 (0-2.0)		(n = 0/29) NA		NA

Abbreviations: CI, confidence interval; HIV, human immunodeficiency virus; NA, not able to calculate.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008. The population numbers in parentheses are total respondents to the question or respondents with the characteristic/total respondents to the question. Denominators are the sum of the survey weights for the respondents in the subpopulation (ie, former combatants or noncombatants reporting sexual violence or not reporting sexual violence).

<sup>b</sup>Adjusted Wald test of association was used.

<sup>c</sup>Prevalence of sexual violence for combatants (n = 80/182; 42.3% [95% CI, 35.4%-49.1%]) and noncombatants (n = 63/698; 9.2% [95% CI, 6.7%-11.7%]) (P < .001 with adjusted Wald test of association).

<sup>d</sup>Defined as beatings by a spouse or partner.

<sup>e</sup>Prevalence of sexual violence for combatants (n = 118/367; 32.6% [95% CI, 27.6%-37.6%]) and noncombatants (n = 33/419; 7.4% [95% CI, 4.5%-10.4%]) (P < .001 with adjusted Wald test of association).

not (37% [95% CI, 32%-42%], n=507/1365;  $P=.002$ ). Approximately 22% (95% CI, 17%-27%; n=59/281) of those who have experienced sexual violence also experience suicidal ideation and approximately 13% (95% CI, 7%-19%; n=32/271) experience at least 1 unsuccessful suicidal attempt.

The weighted prevalence rate of symptoms of MDD among adult former combatants is 52% (95% CI, 46%-59%; n=283/549). Specifically, among male former combatants who have experienced sexual violence, 64% (95% CI, 57%-71%; n=75/118) experience

symptoms of MDD and 25% (95% CI, 18%-31%; n=25/108) experience suicidal ideation. These rates are higher than those for male former combatants who have not experienced sexual violence (42% [95% CI, 33%-51%], n=104/249 experience symptoms of MDD,  $P=.003$ ; and 12% [95% CI, 6%-18%], n=27/239 experience suicidal ideation,  $P=.005$ ).

In the adult household-based population, the weighted prevalence of substance abuse is approximately 7% (95% CI, 5%-9%; n=100/1645), with a significant difference between males (12%

[95% CI, 8%-15%]; n=83/778) and females (2% [95% CI, 1%-3%]; n=17/867) ( $P<.001$ ; Table 6). We estimate the rate of substance abuse among former combatants is 14% (95% CI, 11%-18%, n=73/547); whereas 3% (95% CI, 1%-4%; n=27/1098) of former noncombatants are current substance abusers.

The ORs for PTSD symptoms, developed via logistic regression and controlled for demographic characteristics including sex, highlight the relationship between particular combat roles and sexual violence and PTSD (TABLE 7).

**Table 4.** Weighted Health Means and Rates by Combatant Status for 1666 Respondents<sup>a</sup>

Characteristic	Former Combatants		Former Noncombatants		P Value <sup>c</sup>
	No. of Respondents (n = 549) <sup>b</sup>	Weighted % (95% CI)	No. of Respondents (n = 1117) <sup>b</sup>	Weighted % (95% CI)	
<b>Mortality</b>					
No. of household member deaths in last 3 mo, mean	535	0.36 (0.28-0.45)	1067	0.33 (0.25-0.41)	NA
<5 Household member deaths in last 3 mo, mean	528	0.08 (0.05-0.10)	1051	0.09 (0.06-0.12)	NA
Projected crude mortality per 100 000 population/d	535	59 (43-75)	1067	54 (40-67)	NA
<b>Factors associated with morbidity</b>					
Serious head trauma	146/548	27.6 (23.0-32.3)	197/1111	16.9 (14.4-19.4)	.006
Used drugs or alcohol during war	182/546	33.9 (29.5-38.2)	87/1107	7.5 (5.0-9.9)	<.001
Great effect of war on general health	267/538	49.0 (44.1-54.1)	415/1097	38.0 (33.2-42.8)	<.001
<b>Factors associated with morbidity and mortality</b>					
Mean No. of self-reported meals/d	544	1.64 (1.50-1.59)	1101	1.59 (1.56-1.71)	NA
Untreated water source <sup>d</sup>	222/548	41.0 (26.2-55.7)	323/1112	30.7 (13.8-47.5)	.13
Do not boil water and have untreated water source	212/543	39.5 (25.8-53.3)	305/1108	29.0 (12.7-45.2)	.11
Self-reported inadequate cooking fuel	167/547	30.4 (20.3-40.6)	460/1108	40.7 (31.3-50.2)	.008
Inadequate shelter <sup>e</sup>	317/544	59.0 (47.3-70.6)	551/1109	51.3 (29.8-72.8)	.35
Self-reported inadequate blankets	508/546	92.8 (90.2-95.4)	1007/1088	92.7 (88.7-96.8)	.95
Self-reported lack of mosquito nets	342/540	63.7 (56.4-71.0)	739/1077	67.7 (61.6-73.9)	.13
Inadequate general health care <sup>f</sup>	179/542	33.0 (22.6-43.4)	325/1109	30.1 (18.7-41.6)	.53
Self-reported inadequate educational resources	433/529	81.2 (74.3-88.0)	794/1099	71.6 (63.4-79.9)	.01
<b>Educational attainment</b>					
No schooling completed	238/527	45.2 (37.0-53.4)	594/1074	55.6 (42.9-68.4)	.02
Finished at least primary school	198/527	36.8 (30.8-42.9)	347/1074	31.4 (17.8-45.0)	.22
Finished at least high school	66/527	12.2 (6.7-17.6)	146/1074	13.1 (2.7-23.4)	.79
<b>Mental health (self-reported)</b>					
Traumatized by war	450/533	85.6 (81.3-89.9)	669/1104	61.5 (58.0-65.0)	<.001
Great effect of war on mental health	263/543	48.4 (43.1-53.8)	409/1103	36.9 (31.4-42.4)	.003
Feeling unsafe within current home village	85/531	15.1 (9.2-20.9)	172/1097	14.0 (7.0-21.1)	.60

Abbreviations: CI, confidence interval; NA, not able to calculate.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008.

<sup>b</sup>Single numbers are the respondents with the characteristic and 2 numbers are the respondents with the characteristic/total respondents to the question. Denominators are the sum of the survey weights for the respondents in the subpopulation (ie, former combatants or noncombatants).

<sup>c</sup>Adjusted Wald test of association was used.

<sup>d</sup>Defined as any water source other than a communal tap, home tap, or protected well.

<sup>e</sup>Defined as housing other than a brick or cement dwelling, or housing that either lacks a roof or has a paper roof.

<sup>f</sup>Defined as a lack of hospital or clinic within a 4-hour walking distance.

**Table 5.** Weighted Health Care Access by Combatant Status for 1666 Respondents<sup>a</sup>

Characteristic	Former Combatants		Former Noncombatants		P Value <sup>c</sup>
	No. of Respondents (n = 549) <sup>b</sup>	Weighted % (95% CI)	No. of Respondents (n = 1117) <sup>b</sup>	Weighted % (95% CI)	
Available general health care	(n = 548)		(n = 1112)		
None	89	15.5 (8.6-22.3)	142	13.4 (7.3-19.5)	.35
Amateur druggist	11	2.1 (0.4-3.7)	13	1.2 (0-2.6)	.17
Traditional healer	14	2.9 (0.8-4.9)	75	7.0 (2.2-11.8)	.06
Midwife	31	5.6 (1.2-10.2)	144	13.1 (5.0-21.2)	.007
Feeding center	6	1.0 (0-2.5)	14	1.2 (0-2.5)	.51
Pharmacy	42	7.5 (3.7-11.2)	104	9.0 (5.0-12.9)	.20
Clinic	310	56.8 (46.8-66.8)	640	56.4 (49.4-63.5)	.90
Community health worker	13	2.4 (0.5-4.4)	44	4.5 (2.0-6.9)	.02
Hospital	72	13.2 (3.2-23.3)	194	18.3 (7.4-29.1)	.21
Other (not specified)	1	0.1 (0-0.4)	0	NA	NA
Available mental health care	(n = 546)		(n = 1109)		
None	335	62.4 (55.0-69.8)	578	53.5 (47.4-59.6)	.02
Group counseling	47	8.5 (4.0-12.9)	182	16.1 (8.9-23.3)	.008
Individual counseling	45	7.8 (3.0-12.6)	136	11.7 (5.4-18.1)	.08
Clinic	34	6.2 (3.0-9.5)	77	7.4 (4.8-10.1)	.49
Religious support	25	4.1 (1.4-6.8)	80	6.2 (1.7-8.8)	.20
Hospital	30	5.5 (2.3-8.7)	52	5.0 (1.4-8.6)	.76
Do not know	25	4.8 (2.5-7.1)	52	4.6 (1.8-7.5)	.88
Community health worker	20	3.2 (1.3-5.2)	53	4.9 (2.7-7.1)	.12
Traditional healer	5	1.0 (0-2.0)	30	3.2 (0.7-5.7)	.04
Rehabilitation center	0	NA	8	0.8 (0.4-1.2)	NA
Mental health care access					
Received mental health counseling since war	71/465	14.9 (10.6-19.2)	60/952	6.4 (4.5-8.4)	.01
Self-reported sufficient local mental health programs	13/535	2.4 (1.2-3.5)	94/1100	7.8 (2.9-12.8)	.10
Barriers to health care	(n = 545)		(n = 1107)		
None	11	2.5 (0.3-4.7)	31	3.3 (0.4-6.3)	.18
Lack of payment ability	310	57.2 (50.6-63.7)	648	58.9 (51.8-65.9)	.62
Health care too far away	121	21.1 (13.2-28.9)	177	16.4 (9.6-23.2)	.07
Lack of transit to health care	35	6.5 (2.4-10.5)	113	9.2 (6.2-12.2)	.21
Health care not available	30	5.7 (3.1-8.3)	59	5.5 (2.8-8.2)	.88
Poor quality of care or lack of medicine at facility	22	4.2 (1.3-7.0)	45	3.9 (1.6-6.2)	.70
Ignorance of health care options	7	1.3 (0.2-2.4)	16	1.4 (0.5-2.4)	.75
Facility overcrowded	5	0.8 (0-1.7)	8	0.6 (0.08-1.1)	.37
Other (not specified)	4	0.9 (0.003-1.7)	11	0.9 (0.2-1.7)	.87
Self-reported most needed services	(n = 528)		(n = 1055)		
Medical care	196	37.3 (28.4-46.3)	389	38.2 (24.5-52.0)	.74
Education	100	17.8 (12.3-23.1)	212	19.2 (14.8-23.5)	.98
Vocational or skills training	96	18.7 (12.6-24.9)	151	14.8 (8.8-20.8)	.10
Support groups	37	6.9 (4.0-9.8)	119	10.5 (7.7-13.2)	.12
Income generation projects	37	6.9 (4.1-9.7)	110	10.5 (7.7-13.3)	.17
Mental health services	44	9.1 (5.5-12.8)	30	3.2 (1.4-5.1)	.009
Rehabilitation centers	13	2.5 (1.0-3.9)	35	3.0 (1.8-4.2)	.78
Other <sup>d</sup>	7	1.1 (0.3-1.9)	22	1.8 (0.8-2.8)	.29

Abbreviations: CI, confidence interval; NA, not able to calculate.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008.<sup>b</sup>Single numbers are the respondents with the characteristic and 2 numbers are the respondents with the characteristic/total respondents to the question. Denominators are the sum of the survey weights for the respondents in the subpopulation (ie, former combatants or noncombatants).<sup>c</sup>Adjusted Wald test of association was used.<sup>d</sup>Included 6 "religious counseling/support," 1 "nothing would be helpful," and 0 "toilets" for combatants; 13, 7, and 2, respectively, for noncombatants.

**Table 6.** Weighted Mental Health and Social Functioning Prevalences for 1666 Respondents<sup>a</sup>

Characteristic	Weighted % (95% CI)					
	Substance Abuse	MDD	PTSD	Social Dysfunction <sup>b</sup>	Suicidal Ideation	Suicidal Attempt
Adult household-based population	(n = 100/1645) 7 (5-9)	(n = 672/1659) 40 (36-45)	(n = 718/1661) 44 (38-49)	(n = 133/1666) 8 (5-10)	(n = 176/1608) 11 (9-14)	(n = 91/1564) 6 (4-8)
Males	(n = 83/778) 12 (8-15)	(n = 304/780) 39 (32-45)	(n = 355/785) 46 (38-54)	(n = 80/786) 10 (6-13)	(n = 80/754) 11 (7-15)	(n = 38/736) 5 (3-8)
Females	(n = 17/867) 2 (1-3)	(n = 368/879) 42 (37-46)	(n = 363/876) 42 (38-46)	(n = 53/880) 6 (3-8)	(n = 96/854) 11 (8-14)	(n = 53/828) 7 (5-8)
<i>P</i> value <sup>c</sup>	<.001	.35	.17	.04	.95	.33
Sexual violence reported						
Yes	(n = 35/292) 13 (9-17)	(n = 165/294) 57 (51-62)	(n = 200/293) 69 (62-76)	(n = 39/294) 13 (6-19)	(n = 59/281) 22 (17-27)	(n = 32/271) 13 (7-19)
No	(n = 65/1353) 5 (3-7)	(n = 507/1365) 37 (32-42)	(n = 518/1368) 38 (33-44)	(n = 94/1372) 6 (4-9)	(n = 117/1327) 9 (7-11)	(n = 59/1293) 5 (3-6)
<i>P</i> value <sup>c</sup>	.01	.002	<.001	.07	<.001	.03
Combatants	(n = 73/547) 14 (11-18)	(n = 283/549) 52 (46-59)	(n = 306/549) 57 (52-62)	(n = 27/549) 5 (2-7)	(n = 82/525) 16 (12-20)	(n = 44/517) 9 (5-13)
Noncombatants	(n = 27/1098) 3 (1-4)	(n = 389/1110) 34 (30-38)	(n = 412/1112) 37 (32-43)	(n = 106/1117) 9 (6-12)	(n = 94/1083) 9 (7-11)	(n = 47/1047) 5 (4-6)
<i>P</i> value <sup>c</sup>	<.001	<.001	<.001	.002	.004	.06
Males (n = 786)						
Combatant sexual violence reported						
Yes	(n = 29/117) 27 (19-35)	(n = 75/118) 64 (57-71)	(n = 94/118) 81 (74-87)	(n = 14/118) 11 (2-20)	(n = 25/108) 25 (18-31)	(n = 13/107) 14 (6-21)
No	(n = 37/248) 16 (9-23)	(n = 104/249) 42 (33-51)	(n = 112/249) 46 (39-52)	(n = 7/249) 3 (0.7-5)	(n = 27/239) 12 (6-18)	(n = 15/238) 6 (2-10)
<i>P</i> value <sup>c</sup>	.07	.003	<.001	.08	.005	.13
Noncombatant sexual violence reported						
Yes	(n = 1/33) 2 (0-5)	(n = 11/33) 32 (18-46)	(n = 12/33) 39 (18-60)	(n = 13/33) 40 (15-65)	(n = 5/33) 13 (5-22)	(n = 1/29) 4 (0-11)
No	(n = 16/380) 5 (2-7)	(n = 114/380) 29 (20-37)	(n = 137/385) 36 (26-45)	(n = 46/386) 12 (8-16)	(n = 23/374) 6 (4-9)	(n = 9/362) 2 (1-4)
<i>P</i> value <sup>c</sup>	.18	.73	.74	.11	.20	.77
Females (n = 880)						
Combatant sexual violence reported						
Yes	(n = 3/80) 4 (0-9)	(n = 48/80) 63 (48-78)	(n = 57/80) 74 (63-84)	(n = 4/80) 4 (0-8)	(n = 18/78) 24 (12-35)	(n = 12/75) 17 (5-29)
No	(n = 4/102) 4 (0.2-9)	(n = 56/102) 55 (43-67)	(n = 43/102) 44 (35-53)	(n = 2/102) 2 (0-4)	(n = 12/100) 11 (5-18)	(n = 4/97) 4 (1-8)
<i>P</i> value <sup>c</sup>	.96	.51	.005	.33	.08	.11
Noncombatant sexual violence reported						
Yes	(n = 2/62) 3 (0-6)	(n = 31/63) 48 (34-62)	(n = 37/62) 56 (42-70)	(n = 8/63) 13 (0.2-27)	(n = 11/62) 19 (9-30)	(n = 6/60) 9 (1-18)
No	(n = 8/623) 1 (0.3-2)	(n = 233/634) 36 (32-40)	(n = 226/632) 36 (31-41)	(n = 39/635) 6 (3-8)	(n = 55/614) 9 (7-11)	(n = 31/596) 5 (4-7)
<i>P</i> value <sup>c</sup>	.49	.15	.09	.22	.11	.37
All combatants (n = 549) <sup>d</sup>						
Disarmament, Demobilization, and Reintegration program						
Yes	(n = 29/175) 16 (12-33)	(n = 88/177) 52 (40-64)	(n = 112/177) 64 (54-74)	(n = 9/177) 5 (1-10)	(n = 29/170) 18 (10-26)	(n = 22/162) 14 (8-20)
No	(n = 39/337) 13 (27-39)	(n = 180/337) 53 (45-61)	(n = 178/337) 54 (49-59)	(n = 16/337) 4 (2-6)	(n = 48/321) 15 (11-19)	(n = 18/324) 6 (2-9)
<i>P</i> value <sup>c</sup>	.50	.84	.06	.59	.49	.004

Abbreviations: CI, confidence interval; MDD, major depressive disorder; PTSD, posttraumatic stress disorder.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008. The population numbers in parentheses are respondents with the characteristic/total respondents to the question. Denominators are the sum of the survey weights for the respondents with the characteristic.

<sup>b</sup>Defined as moderate to extreme inability to perform common tasks.

<sup>c</sup>Adjusted Wald test of association was used.

<sup>d</sup>Only 514 combatant respondents answered the question "yes" or "no." The remaining combatant respondents were unsure of whether they had participated in the Demobilization, Disarmament, and Reintegration program, or refused to respond.

Specifically, the OR for PTSD symptoms and having participated in combat as a scout, spy, decoy, courier, guide, or guard is 2.04 (95% CI, 1.21-3.43), while the OR for PTSD symptoms and experiencing sexual violence is 2.67 (95% CI, 1.88-3.79). Significant ORs for symptoms of MDD include the OR for having participated in combat as a porter, cook, or domestic laborer (2.44; 95% CI, 1.70-3.49) and the OR for experiencing sexual violence (1.39; 95% CI, 1.06-1.84), while significant ORs for suicidal attempt include the OR for having participated in combat as a scout, spy, decoy, courier, guide, or guard (4.21; 95% CI, 2.03-8.76).

## COMMENT

With more than a quarter of Liberian female former combatants engaged in active combat, this study confirms that active combat participants in Liberia were not exclusively male and challenges the notion that combat is a male-specific activity.<sup>9</sup> Perhaps more importantly, the study shows that male combatants, like female combatants, also experienced sexual violence and may have been forced into sexual ser-

vitute. This finding is important for 2 reasons. First, it challenges the traditional convention that sexual servitude among combatants is confined to females. Second, although causality cannot be determined, this population of male former combatants exhibits higher rates of symptoms of MDD and PTSD, social dysfunction, and suicidal ideation than their combatant peers who did not experience sexual violence.

A previous study of sexual violence against Liberian women noted that being forced to cook for a combatant group was correlated with sexual violence against women.<sup>36</sup> The association between forced domestic labor and poor mental health outcome evident in our study may reflect underreporting of sexual violence due to social stigma or shame. Our data also suggest an association between serving as a scout or spy (predominately reported by males and not females) and poor mental health outcomes that may be due to unreported sexual violence against males, again due to social stigma and shame. If so, the association between sexual violence against males and poor mental health outcomes may be underesti-

mated in this study; further research on the relationship between forced combat and sexual violence against males is required to test this theory.

Exposure to sexual violence in Liberia was not only prevalent among former combatants but also among those who had not served as combatants. During Liberia's conflicts, women and girls were subjected to specific forms of violence and abuse, whether they remained in the communities or fled as internally displaced persons or refugees.<sup>37</sup> This study confirms that sexual violence is an important problem in Liberia—not only in women but also in men. Among noncombatants, 9.2% of women and 7.4% of men reported sexual violence in their lifetime. These rates are similar to other postconflict communities,<sup>34</sup> but less than estimates obtained in other studies in Liberia in which reported sexual violence rates among women ranged from 49% to 77% during the previous conflicts.<sup>13,37</sup> The other studies, however, relied on samples drawn from a subset of the Liberian population ( $\leq 2$  counties) and therefore yielded estimates that are less representative of the

**Table 7.** Weighted Mental Health Outcomes Among 1666 Adult Survey Respondents<sup>a</sup>

	No. of Respondents (n = 1217)	MDD		PTSD		Suicidal Attempt	
		Weighted OR (95% CI) <sup>b</sup>	P Value	Weighted OR (95% CI) <sup>b</sup>	P Value	Weighted OR (95% CI) <sup>b</sup>	P Value
Head injury indicator	241	2.03 (1.54-2.69)	<.001	1.47 (1.00-2.17)	.08	2.21 (1.17-4.17)	.04
Scout, spy, decoy, courier, guide, or guard for combat group during war	111	1.51 (0.86-2.66)	.19	2.04 (1.21-3.43)	.03	4.21 (2.03-8.76)	.004
Porter, cook, or domestic laborer for combatant group during war	329	2.44 (1.70-3.49)	<.001	1.67 (1.12-2.49)	.03	1.18 (0.55-2.54)	.68
Lifetime sexual violence (including sexual slavery during war)	212	1.39 (1.06-1.84)	.04	2.67 (1.88-3.79)	<.001	1.55 (0.79-3.05)	.24
Deaths within household in past 3 mo	1217	1.05 (0.88-1.24)	.61	1.36 (1.07-1.73)	.03	0.96 (0.65-1.40)	.82
No. of years living in current village	1217	0.99 (0.98-1.01)	.35	0.98 (0.97-1.00)	.02	0.99 (0.97-1.01)	.51
Current age	1217	1.01 (1.00-1.02)	.24	1.02 (1.01-1.03)	.002	1.01 (0.99-1.03)	.29
Male sex	589	0.56 (0.39-0.80)	.01	0.85 (0.60-1.19)	.37	0.67 (0.33-1.37)	.30
Household size	1217	1.05 (1.01-1.08)	.12	1.03 (0.99-1.07)	.19	0.97 (0.88-1.07)	.55
Meals/d	1217	0.83 (0.61-1.13)	.27	1.28 (0.93-1.77)	.17	0.93 (0.60-1.45)	.76
At least primary school completed	435	0.78 (0.61-1.00)	.08	0.97 (0.79-1.19)	.78	0.85 (0.37-1.95)	.71
No counseling after war	1082	0.67 (0.42-1.06)	.12	0.86 (0.57-1.28)	.47	0.57 (0.21-1.55)	.30

Abbreviations: CI, confidence interval; MDD, major depressive disorder; OR, odds ratio; PTSD, posttraumatic stress disorder.

<sup>a</sup>Survey results are representative of the adult household-based population of Liberia in May 2008.

<sup>b</sup>The ORs are calculated via separate multivariate logistic regressions for each mental health outcome and are controlled for sex, household size, basic needs attainment (via number of meals per day), primary education attainment, and counseling received after the war. Control variables are listed in the bottom half of the table. Most model variables yield prevalence ORs. The 5 exceptions—household size, meals eaten per day, current age in years, number of years residing in current village, and number of deaths in household within the past 3 months—yield ORs that are interpreted as follows: each unit increase in the variable is associated with the given increase or decrease in likelihood of the mental health outcome. Analysis completed via the `svyglm` function in the survey package of R, which uses a design-based method for complex survey samples, in that sample weights are incorporated into the modeling procedure and a linearization variance estimation procedure is used to calculate standard errors for model coefficients.

Liberian population as a whole. To date there has been no quantitative information on the prevalence of sexual violence among Liberian men.

Sexual violence can have serious physical, social, and psychological consequences on the well-being of survivors, families, and communities.<sup>37</sup> Physical injuries, especially in women, and the psychological consequences of sexual violence are well researched and documented, although the focus is on women not men.<sup>38,39</sup> Furthermore, today in the context of war, rape and other forms of sexual violence have been recognized as instruments of genocide, crimes against humanity, means of torture, and crimes of war and can be prosecuted as such.<sup>9,11,34,40</sup>

Like other studies assessing postconflict mental health, we found similar elevated rates of symptoms of MDD and PTSD.<sup>5-7</sup> However, we found increased rates of symptoms of PTSD and MDD and suicidal ideation among respondents with a history of sexual violence and especially among male combatants who reported sexual violence. Based on Liberia's current population estimates, it can be extrapolated that approximately 800 000 adults meet criteria for PTSD, 750 000 adults meet criteria for MDD, 205 000 adults have suicidal ideation, and approximately 112 000 adults have attempted suicide. These data suggest a high burden of psychiatric disease in the general adult population who may need focused treatment addressing posttraumatic stress, depression, substance abuse,<sup>41,42</sup> and sexual violence as necessary components of the recovery and rehabilitation for the Liberian population.

Finally, while former combatants and noncombatants express a need for mental health care, the majority find such services inaccessible. A successful mental health care delivery strategy also will need to address men who have experienced sexual violence, a new paradigm for gender-based programs that over the years have primarily focused rehabilitation on violence against women.<sup>43,44</sup>

### Limitations

The findings of the study represent the adult household-based population of Liberia. The results cannot be generalized to the entire population that includes children. Although interviewers were careful to explain that there would be no material or other gain by participation in the study, respondents may have exaggerated or underestimated responses if they believed it would be in their interest to do so. Furthermore, it is possible that ethnicity, sex, and unfamiliarity of the data collectors as well as other unidentified characteristics may have limited truthfulness of respondents to sensitive questions such as sexual violence and thus we may have underestimated sexual violence. However, our rates support previous findings in postconflict settings.<sup>13,29,45</sup>

Limited funding, the short data collection period, and inaccessible roads due to the rainy season required the occasional use of nearest neighbor substitution using villages that were accessible. Call backs to sampled households who were not at home were limited to one, and interrupted interviews could not be completed. Despite these difficulties, it is unlikely the replaced villages or respondents would have yielded different results than were obtained. However, potential bias introduced by substitution for inaccessible villages and nonrespondents cannot be measured at this time.

Finally, the nature of this study (a multistage, clustered, random sample survey) allows for the determination of association of population characteristics, but not causality. Although rare, clustered characteristics in a population may be severely overreported or underreported due to a clustered sample design; however, none of the population characteristics discussed here are sufficiently rare to cause concern.

### CONCLUSION

Like their female counterparts, male former combatants who experienced sexual violence have worse mental health outcomes than both the gen-

eral population and also other former combatants. Rehabilitation programs that do not address this specific population risk failing a critically vulnerable group. This unexpected finding suggests that standard postconflict rehabilitation programs and gender-based programs will need to adjust current programming to take into account males who have experienced sexual violence, especially former combatants.<sup>43</sup> By providing not only mental health services but also services that meet basic physical needs (food, water, shelter, and health care), a more complete and integrated program will have a direct effect on the mental health and psychosocial functioning of this postconflict population.<sup>46</sup>

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