

Sense of Coherence and Its Association With Exposure to Traumatic Events, Posttraumatic Stress Disorder, and Depression in Eastern Democratic Republic of Congo

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The Democratic Republic of Congo is the scene of some of the worst atrocities in recent history. However, in the face of traumatic experience, only a minority of people develops symptoms that impair their functioning. The sense of coherence proposed by Antonovsky (1987) is a theoretical construct reflecting an individual's overall wellbeing and ability to cope with stress. This study explores the relationships between sense of coherence, exposure to traumatic events, symptoms of posttraumatic stress disorder (PTSD), and depression. Results suggest an association between a high sense of coherence and high education levels, high income, and positive social relationships. Furthermore, the study found that sense of coherence is inversely correlated with cumulative exposure to violence and symptoms of PTSD and depression.

Decades of colonialism and oppressive national rule followed by internal and international conflicts have made the Democratic Republic of Congo (DRC) the scene of some of the worst atrocities in recent history. Each military intervention sets off a round of shifting leadership, further violence, and loss of civilian lives.

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Recent research revealed that an estimated 5.4 million “excess deaths” occurred in DRC between August 1998 and April 2007 (Coghlan et al., 2007) and tens of thousands of women and girls have suffered rape and sexual violence at the hands of both rebel groups and the Congolese Army (Human Rights Watch, 2009).

Beyond the direct violence, the mass atrocities in the Congo have dramatic direct and indirect effects on health and wellbeing. The institutions and infrastructure that sustain the society, such as rule of law, health care, and the educational system have been destroyed or are barely operative. At the same time, violence may lead to long-term physical, social, and psychological effects among survivors who may have lost family members, those who no longer have the means to sustain their livelihoods, or who have experienced amputation, disfigurement, displacement, torture, abduction, sexual violence, malnutrition, and disease.

Focusing on the long-term consequences of conflict, an important body of literature has explored the negative psychological effects of mass violence such as posttraumatic stress disorder (PTSD), and depression (de Jong et al., 2001; Lopes Cardozo, Vergara, Agani, & Gotway, 2000; Mollica et al., 1999; Pham, Weinstein,

& Longman, 2004; Vinck, Pham, Stover, & Weinstein, 2007). Studies have also established a relationship between psychological effects of mass violence and attitudes towards peace, justice, and reconciliation (Bayer, Klasen, & Adam, 2007; Pham et al., 2004; Vinck et al., 2007). These studies highlight the importance of public health and psychosocial interventions after violent conflict. However, less is known about how individuals cope and rebuild their lives despite exposure to extraordinary circumstances.

In the face of traumatic experience, only some of the people exposed, in most cases a minority, develop symptoms that impair their functioning. The sense of coherence proposed by Antonovsky is a theoretical construct reflecting an individual's overall wellbeing and ability to cope with stress (Almedom et al., 2007; Antonovsky, 1987; Geyer, 1997). Sense of coherence is defined as "a stable generalized orientation in relation to perceiving and controlling the environment for meaningful and appropriate action" (Kivimäki, Feldt, Vahtera, & Nurmi, 2000, p. 583). It is strongly developed when the individual perceives the environment as comprehensible (i.e., rational, understandable, consistent, and predictable), manageable, and meaningful (i.e., challenging and worthwhile; Antonovsky, 1987; Geyer, 1997).

The sense of coherence is rooted in the theory of salutogenesis, seeking to explain why people stay healthy after being exposed to trauma, rather than falling ill (Almedom et al., 2007; Antonovsky, 1987). Antonovsky proposed that the human response to extreme psychosocial stressors is based on the mobilization of generalized resistance resources. The sense of coherence scale has been shown to be a robust instrument for cross-cultural investigation of the generalized resistance resources (Almedom et al., 2007; Bowman, 1996; Edwards & Besseling, 2001; Ekblad & Wennstroem, 1997). Furthermore, the sense of coherence has been shown to be related to self-efficacy (Bandura, 1977), hardiness (Kobasa, 1979), locus of control (Rotter, 1966), and resiliency (Struempfer, Viviers, & Gouws, 1998). Additional studies have demonstrated a relationship between sense of coherence, overall wellbeing, and health status (Eriksson & Lindstrom, 2005).

This study explores these relationships further and is, to the best of our knowledge, the first attempt to measure the association between sense of coherence and exposures and responses to traumatic events during conflict. Specifically, we examine whether the cumulative number of exposures to traumatic events is associated with the sense of coherence and whether the sense of coherence is associated with symptoms of PTSD and depression. Eastern DRC was selected for this study because of the extreme and prolonged violence that took place and the authors' research experience there.

The political turmoil that followed the Congolese independence from Belgium colonial domination paved the way, beginning in 1965, for over three decades of autocratic rule under President Mobutu Sese Seko. The gradual decay of all state institutions and Mobutu's loss of support from key Western allies at the end of the Cold War encouraged the emergence of opposition movements (Turner, 2007). In 1997, a rebellion supported by the govern-

ments of Rwanda and Uganda led to the ouster of Mobutu and the accession of Laurent Kabila as President. Rwanda's interests in the Congo were originally directed at pursuing remnants of the army and militia that perpetrated the 1994 genocide against the Tutsi minority and moderate Hutus in Rwanda. In the process, thousands of civilians, mostly Hutu refugees and local Congolese were killed in the cross fire. Uganda became involved as concerns increased that rebel groups would attack its territory from northwestern Congo. (BBC, 2009; Lemarchand, 2009; Weinstein, 2000).

By 1998, president Kabila, tired of kowtowing to his neighbors, sought to diminish the influence of his Rwandan and Ugandan allies. In response, the Rwanda government threw its support behind a new rebellion, while Rwandan and Ugandan troops still present in the eastern part of the country transformed themselves into occupation forces. This mobilization, along with Uganda's security concerns, led to what has been called the "first African world war" (Prunier, 2009; Reyntjens, 2001). Six countries became actively engaged in armed conflict in the DRC—Angola, Namibia, and Zimbabwe supporting Kabila and Uganda, Rwanda, Burundi and their Congolese allies attacking the Presidency. Chad, Libya, and Sudan also played minor roles in supporting the Kinshasa government. In 1999, the Lusaka Peace Accord was signed to end the war and the United Nations (UN) agreed to send in a peacekeeping force to support the ceasefire (Carayannis, 2003). Nevertheless, fighting continued.

In 2001, Laurent Kabila was assassinated by a bodyguard and was succeeded by his son, Joseph Kabila. Prospects for peace improved and peace talks were initiated in 2002 in Sun City, South Africa, ultimately leading to a "Global and All-Inclusive Agreement" to end the war. The peace agreement was followed by a transition period that ended with the 2005 drafting of a new constitution and 2006 presidential elections. Joseph Kabila was elected president.

However, the violence continued in eastern DRC, most notably at the hands of the Democratic Forces for the Liberation of Rwanda, accused of taking part in the 1994 genocide and threatening the security of Tutsi minorities in the Congo and Rwanda, the National Congress for the Defense of the People, claiming to protect the Congolese Tutsi minority, and the Congolese armed forces. Shifting alliances among the Congolese Army, various rebel forces and militias, Uganda, and Rwanda have kept Eastern Congo in turmoil resulting in massive refugee flows, death, and destruction of infrastructure and commerce.

This violence has been fueled by complex and interlinked local disputes and inequities over access to land, natural resources, political positions, and educational and economic opportunity, deepening long-standing conflicts along ethnic lines (Reyntjens, 2001; Vlassenroot & Raeymaekers, 2004, 2009). Complicating an already complex picture, the political economy of these wars that allows national and foreign elites to benefit from the richness of Congo ensures that there is little impetus towards a peaceful

resolution. Reyntjens (1999) notes that by 1999, Rwandan and Ugandan politicians, their families, and military officers were engaged in resource exploitation. Economic incentives have far outweighed any motivation for real resolution of the violence.

Despite the presence of UN peacekeepers, civilians have paid a high toll in these conflicts, and all the groups involved, including government troops, have committed atrocities. Although there has been some movement towards a peaceful solution, and attempts at holding leadership accountable by the International Criminal Court, the end is not yet in sight. In 2009, Rwanda reentered Congo, this time in support of the Kinshasa government. The move, however, reescalated hostilities, with civilians paying the price once again.

METHOD

Participants and Procedure

From September to December 2007, we conducted a cross-sectional survey of 2,635 adult residents of eastern DRC selected by a multistage cluster random sampling procedure. The sample was drawn from the area most affected by the conflicts: the provinces of North Kivu and South Kivu and the district of Ituri in Orientale Province. We received population estimates from the Congolese National Institute of Statistics Census Department. Because the last census was conducted in 1981, we used the recent population projections that were conducted for the 2006 national election. We also verified the estimates with local authorities that were counting the population for administrative purposes.

During the first phase of sampling, 30 counties (collectivities) in North and South Kivu and the district of Ituri were randomly selected using a systematic random procedure proportionate to sample size. Using the same procedure, 25% of the village groupings (groupements) within each of the 30 sampled counties and 10 villages within each of the village groupings were selected. At the village level, interviewers selected every other household in a randomly selected direction. Within each household, one adult that was of the same gender as the interviewer was randomly selected using the first letter of the name of each household member of the same sex as the interviewer. The minimum sample size of 80 households for each of the 30 counties was determined using the proportion estimate formula for an assumed level of precision of 10% with 80% power and was adjusted for assumed design effect of two due to the multistage cluster design and non-response and refusal rate of 20%.

As a result of insecurity, two village groups had to be replaced by others using random selection. Three hundred thirty-four households, or 11% of all sampled households, and 270 individuals, or 9% of all selected individuals, had to be replaced because of refusal to participate, absence of selected respondent, or other reasons.

Three attempts were made to contact selected respondents. It is unknown whether the opinions of replaced individuals differed significantly from those of selected respondents.

A semistructured survey instrument was used for the interviews. Except for questions that employed a scaling format (e.g., Likert scales, yes/no questions), answer options were not provided to the respondents. The questionnaire was also piloted before and during the training. The survey instrument was initially developed in French (the native language of two of the authors) and then translated into the local languages (i.e., Lingala and Swahili). Subsequently, the translated versions were then back-translated into French. Where there were discrepancies, we consulted with our local partners whose expertise in health or law informed an appropriate translation that reflected the concepts under study.

Because of the sensitivity of some of the questions and to increase rapport with the respondents, the interviewers were assigned to same-sex respondents and were selected to be of the same ethnic group as in their geographic area of assignment. One-on-one interviews were conducted anonymously in a confidential setting. We organized a 5-day training session and 2 days of piloting in nonselected sites to familiarize interviewers with the instrument and research protocol and to ensure that interviews were conducted in a consistent manner. Due to logistical problems related to conducting research in conflict and underdeveloped zones (e.g., data collection is limited to daylight due to security concerns), we utilized another method to ensure interrater reliability. During the training, we conducted mock interviews in front of the trainee and requested that each trainee code the responses. We repeated this exercise until we had 100% agreement between the trainees for two consecutive mock interviews.

Due to the high illiteracy rate in the population being surveyed, we obtained oral rather than written consent from persons eligible to participate. The consent form stressed confidentiality and respondents' names were never recorded. Neither monetary nor material incentives were offered for participation. The researchers provided the participants with contact information if they had questions. If a participant requested a referral for emotional distress, they were offered information on local nongovernmental organizations that offered these services. However, none of the participants sought referral. The Human Subject Committees of the University of California, Berkeley, Tulane University, and the School of Public Health, University of Kinshasa, DRC approved the study protocol. In addition, permission from local administrative authorities to conduct work in the selected areas was obtained at the provincial, county, and village levels.

The questionnaire design, training, and consent form were designed to address several possible limitations, including inaccurate recall, the sensitivity of some of the questions, fear of reprisal, and the level of understanding and knowledge of respondents. Respondents were free to interpret the concepts and terms used, and no definitions were provided to them to avoid leading responses.

Measures

The sense of coherence was measured using Antonovsky's (1987) 13-item short form of the Orientation to Life Questionnaire measuring the three aspects of the sense of coherence—meaningfulness, comprehensibility, and manageability. The scores ranged from 13 to 65. The scale has been found to have good psychometric properties (Feldt & Rasku, 1998) and appears to be applicable in non-Western environments (Almedom et al., 2007; Bowman, 1996; Edwards & Besseling, 2001; Ekblad & Wennstroem, 1997). To assess symptoms of PTSD and depression, we used, respectively, the Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C), a scale comprising 17 items (total scores ranging from 17 to 85), and the 15-item depression section of the Johns Hopkins Depression Symptom Checklist (HDSC—total scores ranging from 15 to 65). The PCL-C uses simple language that eases the process of translation and administration by nonclinicians to a population with little formal education, with good internal reliability and high convergent validity in a wide variety of studies (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). In addition, the PCL-C and HDSC had good reliability when used by the investigators for this and prior studies in Rwanda and northern Uganda (Pham et al., 2004; Vinck et al., 2007). Hence, for cross-country comparability and consistency, the authors used the same scales to standardize the methodology where possible. The estimated alphas (a measure of internal reliability) for the three scales in this study were .72 for the sense of coherence, .95 for the PCL-C, and .95 for the HDSC.

Exposure to 39 violent events representing common human rights violations, war crimes, and crimes against humanity was assessed for the duration of the conflicts. The violent events were grouped into eight categories: displacement, loss of assets, sustaining injuries, witnessing violence (fighting, killing, sexual violence), abduction of at least 1 week, force/coercion into committing violence (beating, looting, killing), and the killing of a household member. A summative scale on the eight categories was used to measure cumulative exposure to violence (total scores ranging from 0 to 8).

We developed a measure of social relationships based on three questions which asked respondents to rank their relationship with their friends and neighbors, community, and other ethnic groups on a 5-point Likert scale. Principal component analysis was used to analyze the three items and resulted in one factor explaining 72% of the original variance. We therefore used a summative scale based on the original items as a measure of social relationships, with a total score ranging from 3 to 15 ($\alpha = .79$). Using the same procedure, we constructed a sense of insecurity scale comprising 11 items, which asked how secure they felt in various settings (e.g., walking at night within their village); the variance explained is 56%, $\alpha = .92$, and the total scores ranged from 11 to 55.

Data Analysis

We analyzed the interview data using Statistical Package for Social Science (SPSS) version 18.0. No weighting factors were used during the analysis because selection of the primary sampling unit was proportional to the population size. Three separate stepwise linear regression analyses were conducted with the sense of coherence, symptoms of PTSD (PCL-C total score), and symptoms of depression (HDSC total score) as dependent variables. We explored the following independent variables: age, sex, monthly income, educational level, sense of insecurity, and level of exposure to violence. We also included the sense of coherence as an independent variable in the two analyses with symptoms of PTSD and depression as the outcome variables.

RESULTS

Sample Characteristics

The sample characteristics are presented in Table 1. The sample includes approximately equal numbers of men and women as we assigned equal numbers of male and female interviewers to same-sex respondents. The age of the respondents averaged 37 years ($SD = 14$), with 54% aged below 35 years of age. A majority of the respondents were in a marital or partnership relationship. Reflecting the complex ethnic make-up of eastern DRC, the sample comprised more than 80 ethnic groups, with 6 groups (Nande, Shi, Hunde, Lega, Alur, and Hutu) accounting for 56% of the sample. Over half (53%) earned no income or less than US\$10 per month.

Table 1. Sociodemographic Characteristics of the Respondents, Eastern Democratic Republic of Congo

		%
Gender ($N = 2,635$)	Male	50.2
	Female	49.8
Marital status ($n = 2,607$) ^a	Married/partner	71.7
	Single	28.2
Education ($n = 2,622$) ^a	No school	22.4
	Some primary school	18.7
	Completed primary school	43.8
Monthly income ($n = 2,623$) ^a	Higher than primary school	15.1
	No income	22.0
	≤US\$ 10	31.4
	US\$ 11–20	19.2
	US\$ 21–30	12.2
	US\$ 31–60	8.0
	> US\$ 60	7.1

^aDue to item missing responses, the n varied.

Table 2. Exposure to Traumatic Events ($N = 2,635$), Eastern Democratic Republic of Congo

	Yes (n)	%	SOC total (13 items)		SOI total (11-Items)		PCL-C total (17 Items)		HDSC total (15 items)	
			M	DIFF	M	DIFF	M	DIFF	M	DIFF
All respondents ($N = 2,635$)	–	–	42.8	–	31.7	–	42.0	–	32.8	–
Destroyed assets (yes)	2,390	95.3	42.6	–4.8***	31.8	2.2**	42.8	16.1***	33.3	11.3***
Displaced (yes)	2,139	85.5	42.5	–2.2***	31.9	1.0*	43.2	8.1***	33.7	6.2***
Witness violence (yes)	2,131	84.0	42.1	–4.5***	32.0	1.9***	44.0	12.9***	34.3	9.9***
Family member killed (yes)	1,606	64.2	42.0	–2.4***	32.4	1.8***	44.7	7.4***	35.1	6.5***
Abducted at least 1 week (yes)	913	36.5	40.6	–3.5***	32.8	1.7***	48.5	10.2***	39.2	10.0***
Injured/wounded (yes)	865	34.5	40.4	–3.6***	32.9	1.8***	48.7	10.1***	38.9	9.3***
Forced to commit violence (yes)	412	16.5	41.5	–1.6***	33.7	2.3***	46.3	5.0***	37.8	6.0***
Sexually violated (yes)	396	15.8	41.0	–2.2***	34.0	2.7***	47.5	6.5***	39.8	8.3***

Note. SOC = sense of coherence; SOI = sense of insecurity; PCL-C = Posttraumatic Stress Disorder Checklist-Civilian Version; HDSC = Hopkins Depression Symptom Checklist; DIFF = difference in score between those who experienced the event and those who did not. Independent t -tests were performed to test difference in means.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Exposure to Violence and Sense of Insecurity

The results on exposure to violence presented in Table 2, confirm the devastating consequences of the conflicts in eastern DRC on the resident population (Coghlan et al., 2007). A majority experienced a loss of assets, displacement, witnessed violence, and lost a family member. Many respondents also experienced direct violence including abduction for at least a week, often to serve as load carriers; or were physically wounded or injured as a result of direct violence. Using independent t -tests, there were statistically significant differences in mean sense of coherence, sense of insecurity, PCL-C, and HDSC total scores between those who were exposed to the eight listed traumatic events in Table 2 and those who were not. For example, compared to those who were never displaced, respondents who were displaced during the conflict had a significantly lower mean sense of coherence score, and higher sense of insecurity, PCL-C and HDSC mean scores.

Exposure to Trauma, Sense of Coherence, and Mental Health

Among study participants who responded to all items on the sense of coherence scale ($n = 2,511$, 95% of all respondents), the average

score was 43. Exposure to each category of violent events resulted in a significantly lower sense of coherence scores. Among study participants who responded to all items on the PCL-C scale, the mean was 42. Among study participants who responded to all items on the depression section of the Hopkins Symptoms Checklist (HSCL), the mean score was 33. Using respective cutoffs of 44 for the PCL-C scale and 40 for the HSCL (Pham et al., 2004; Sonis et al., 2009; Vinck et al., 2007), 42% of the respondents met the criteria for symptoms of PTSD, and 27% of the respondents met the criteria for symptoms of depression. Exposure to each category of violent events resulted in significantly higher average scores on the PCL-C scale and HSCL.

As shown in Table 3, the sense of coherence is inversely associated with cumulative exposure to violence, PCL-C total score, and HSCL total score. Increase in the number of exposures to traumatic events is correlated with a lower sense of coherence score. An increase in PCL-C and HSCL total score were both strongly associated with lower SOC total score.

Multivariate linear regression shows that the sense of coherence score was associated with exposure to traumatic events, sense of insecurity, education level, social relationships, monthly income, and gender (Table 4). Each additional type of violent exposure experienced by the respondents resulted in a significantly lower sense of

Table 3. Spearman Correlation Coefficients of Dependent Variables ($n = 2,466$), Eastern Democratic Republic of Congo

	SOC (13 items)	Exposure to violence (8 items)	PCL-C total (17 Items)	HDSC total (15 items)
SOC (13 items)	–	–	–	–
Exposure to violence (8 items)	–.30**	–	–	–
PCL-C Total (17 Items)	–.66**	.39**	–	–
HDSC Total (15 items)	–.69**	.39**	.90**	–

Note. SOC = sense of coherence; PCL-C = Posttraumatic Stress Disorder Checklist-Civilian Version; HDSC = Hopkins Depression Symptom Checklist.

** $p < .01$.

Table 4. Linear Regression Model of SOC, Symptoms of PTSD (PCL-C), and Symptoms of Depression (HDSC), Eastern Democratic Republic of Congo

Dependent = SOC	Unstandardized coefficients		
	<i>B</i>	<i>SE B</i>	β
(Constant)	48.7***	0.73	–
Exposure to violence	–0.96***	0.07	–.26
SOI	–0.15***	0.02	–.18
Education level	0.79***	0.14	.12
Monthly income	0.31**	0.09	.07
Social relationship (higher positive)	0.16*	0.06	.04
Sex (male = 1)	0.54*	0.27	.04
$F(6, 2425) = 66.8, p < .001; R^2 = .146$			
Dependent = PCL-C total score	<i>B</i>	<i>SE B</i>	β
(Constant)	73.22***	2.21	–
SOC score	–1.27***	0.04	–.55
SOI	0.45***	0.03	.23
Exposure to violence	1.55***	0.13	.18
Age	0.06***	0.02	.05
$F(4, 2337) = 630.8, p < .001; R^2 = .52$			
Dependent = HDSC total score	<i>B</i>	<i>SE B</i>	β
(Constant)	63.20***	1.91	–
SOC score	–1.20***	0.03	–.57
SOI	0.44***	0.03	.25
Exposure to violence	1.36***	0.11	.18
Age	0.06***	0.02	.05
Education level	–0.57**	0.20	–.04
$F(5, 2300) = 613.9, p < .001; R^2 = .57$			

Note. SOC = sense of coherence; SOI = sense of insecurity; PTSD = posttraumatic stress disorder; PCL-C = Posttraumatic Stress Disorder Checklist-Civilian Version; HDSC = Hopkins Depression Symptom Checklist.
* $p < .05$. ** $p < .01$. *** $p < .001$.

coherence score. Similarly, a higher sense of insecurity resulted in a significantly lower sense of coherence. However, higher educational achievements, higher income, being male, and reported good social relationships with family, neighbors and community were all associated with a higher sense of coherence score.

Multivariate analyses indicated that PCL-C total score were associated with lower sense of coherence score, sense of insecurity, level of exposure to violence, and age. The same variables were found to be associated with symptoms of depression, except level of education. The sense of coherence explained almost two fifths (change in $R^2 = .43$) of the variance in PCL-C total score and almost one half in the HDSC total score (change in $R^2 = .48$). Increased HDSC total score was associated with a lower level of education. Increased PCL-C and HDSC total scores were associated with a lower sense of coherence score. An increase in PCL-C and HDSC total scores were associated with an increased sense

of insecurity, an increase in number of exposures to violence, and older age.

DISCUSSION

The high rates of exposure to violence and the great sense of insecurity reported among the 2,635 adults surveyed in eastern DRC likely reflect the 15 years of conflict, the targeting of civilians, and the failure of national and international forces to protect them. Although we do not have baseline data on the psychological well-being among the population of eastern DRC before the conflicts and did not explore all possible psychological effects, our results suggest that the atrocities committed in eastern DRC have affected the psychological well being of many civilians as measured by the selected scales. Our results lie within the broad range of prevalence of symptoms of PTSD and depression observed in other

war-affected populations (Bayer et al., 2007; de Jong et al., 2001; Lopes Cardozo et al., 2000; Mollica et al., 1999; Pham et al., 2004; Vinck et al., 2007).

Despite the grim statistics, our results suggest that some factors may mitigate the psychological impact of stressful events among the population. The sense of coherence may be a useful construct to explore such factors. It is a multidimensional concept that incorporates both a worldview of security and builds on innate and environmental factors that may lessen the effects of trauma (Almedom & Glandon, 2007; Eriksson & Lindstrom, 2005). Although it does not measure directly coping strategies or resilience within individuals, it is a globalized construct that allows us to see how individuals within a population respond to trauma. Studies have shown important correlations with other salutogenic ideas such as coping, efficacy, and resiliency (Ekblad & Wennstroem, 1997; Struempfer et al., 1998). Other research suggests that the sense of coherence is relatively stable and a partially independent general measure of a person's perception and assessment of reality (Feldt & Rasku, 1998; Kivimäki et al., 2000; Schnyder, Büchi, Sensky, & Klaghofer, 2000).

Results from the multivariate linear regression suggest an association between high sense of coherence and high education levels, high income, and positive social relationships. This is consistent with the literature and suggests that the sense of coherence is associated with higher socio-economic status and stronger social cohesion (Cohen, 1997; Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003). It is also consistent with research relating stronger social relationships with social capital and health (Schaefer, Coyne, & Lazarus, 1991; Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

Our findings further indicate that the sense of coherence is inversely correlated with cumulative exposure to violence, symptoms of PTSD (total score), and symptoms of depression (total score). Studies by other researchers show a relationship to health outcomes such as mortality, PTSD, and physiologic dysregulation as measured by validated scales (Hasson, Von Thiele Schwarz, & Lindfors, 2009; Surtees, Wainwright, Luben, Khaw, & Day, 2002; Tham, Christensoon, & Ryding, 2007). Because this is a cross-sectional study, the direction of relationships cannot be established (e.g., higher sense of coherence decreases the odds of having symptoms of PTSD and depression, or having symptoms of PTSD and depression lowers the sense of coherence).

The sense of coherence explained the majority of the variance in the PCL-C and HDSC total score. Colinearity may explain why other factors that are commonly found to be associated with PTSD and depression such as social relationships and gender were not included in the final regression models. When we did not include the sense of coherence score in the regression models with PCL-C and HDSC as the dependent variables, social relationships and gender were both statistically significant; however, the total variance explained by the model dropped below 30%. Further research will be needed to examine how the sense of coherence may mediate symptoms of PTSD and depression and how it in-

teracts with other factors associated with symptoms of PTSD and depression.

Antonovsky's theory suggests that the sense of coherence is a protective factor that influences an individual's mental health and more general wellbeing and health. In turn, this suggests that if we find ways to build on mechanisms that support the sense of coherence, the incidence of psychopathology might be reduced. If we consider the three dimensions of the sense of coherence construct—an environment that is comprehensible, manageable, and meaningful, then interventions that offer individuals some sense of control over food, clothing shelter, and security may be helpful. This has implications for how refugee camps operate and the role of humanitarian agencies. Realistically, however, the most important contributor to a sense of coherence in individuals exposed to ongoing mass violence will be the cessation of the violence and the onset of peace and stability. This idea is reflected in the earlier work of the authors in northern Uganda (another region that has experienced prolonged conflict), Cambodia, and the DRC where restoration of a normal life (education, health, jobs, and peace) represented the highest priority for the future (Pham, Vinck, Balthazard, Hean, & Stover, 2009; Vinck & Pham, 2008; Vinck et al., 2007).

There are limitations to this research. As noted, this is a cross-sectional design and the direction of the relationship between the sense of coherence and other variables cannot be determined. The survey took place during renewed fighting between government forces and rebel groups, and hence fear and social desirability may have affected the results. However, the consent form and interviewing technique were designed to reduce this risk. Cross-cultural validity of concepts and scales used such as the sense of coherence, symptoms of PTSD, and symptoms of depression must be explored further. In addition, because of the sensitivity of some of questions the interviewers were limited to randomly select a respondent that was of their same gender. According to the official population census, the male to female population ratio for the population between the age of 15 and 64 in DRC is .99; in our sample it is 1.01 with slightly more men than women. However, we controlled for the effect of gender during multivariate analyses. In addition, this study focuses on the impact of violent conflict on the individual and does not have community-level information. It is possible that confounding factors such as community influences or responses may explain the relationships found in the study. Although community support systems may affect the outcomes of the study our inability to collect such data as well as the paucity of rigorous experimental methods to make those determinations in conflict areas suggest another area for further study.

Nevertheless, the findings have a number of practical implications for public health interventions. In societies beset by mass violence, we still know little about how to mitigate its effect and facilitate recovery. Much that is known is anecdotal or derived from psychotherapeutic approaches or psychosocial interventions that have not been rigorously evaluated. This study offers preliminary

empirical data to enhance our understanding of how violent conflict may influence health outcomes.

In addition, most psychosocial interventions have focused on the pathology of trauma and thus require specialized training and treatment (Bolton et al., 2007; Staub & Pearlman, 2001). Yet, we still do not understand why many of those exposed do not develop PTSD, major depression, or other psychopathology. The salutogenic concept of Antonovsky (1987) is an attempt to address this gap. The sense of coherence may give us some idea of how individuals respond to atrocities and draw upon their own strengths. Further work should explore how traditions, culture, social supports, and societal mechanisms could strengthen the sense of coherence and promote health. As we have suggested, strengthening the self-efficacy of people to make decisions and participate actively in programs designed to serve them may foster their perception of the environment as manageable. Programs that seek to build and understand the origins of violence may contribute to making the environment more comprehensible and meaningful. Health workers have a role in examining the health value of such programs and in investigating how interventions can create the conditions for individuals to thrive despite the most adverse environments (Pham, Vinck, & Weinstein, 2010).

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