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Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

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Abstract

Objectives: This study aimed at testing the significance of mediating and moderating roles of sense of coherence, adaptive coping styles and social support in the relationship between exposure to trauma and psychological symptoms.

Design: Cross-sectional survey design was employed.

Setting: This study was carried out in Tigray region, Mai Aini refugee camp, 1116 Km. North of Addis Ababa, the capital of Ethiopia.

Participants: 562 adult refugees aged 18-74 were randomly selected from eligible Eritrean refugee community living in the camp to screen for depression and PTSD and to look for associated factors.

Results: Pre-migration living difficulties were directly associated with symptoms of PTSD (β=0.09, p <0.05), and indirectly associated with PTSD through paths of duration of stay in camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depression (standardized indirect coefficient = 0.26, p<.01). Pre-migration living difficulties were directly associated with depression (β=0.35, p <0.001). Post-migration living difficulties were directly associated with depression (β=0.23, p < 0.05), and indirectly associated with PTSD through paths of sense of coherence, task-oriented coping and depression (standardized indirect coefficient = 0.13, p<0.01). Sense of coherence and task-oriented coping didn't moderate the effect of pre and post-migration living difficulties on neither PTSD nor depression. Social support moderated the effect of post-migration living difficulties on depression (P<0.05). Emotion-oriented coping moderated the effect of pre-migration threat for abuse on PTSD (β = -0.18, p<0.001) and depression (β = -0.12, p<0.01), while it moderated threat for life on PTSD (β = -0.13, p<0.001).

Conclusions: Sense of coherence and task-oriented coping style partially mediated the association between exposure to trauma and psychological symptoms. Emotion-oriented coping style and social support moderated the effect of pre and post-migration living difficulties, respectively. Fostering social support, task-oriented and emotion-oriented coping styles seem to be beneficial for these refugees.

Key words: Mediation, moderation, PTSD, depression, Eritrean refugees, Ethiopia

Strength and limitations of the Study

- Participants were randomly drawn from refugee community coming from diversified socio-economic background and occupational profile from many places of Eritrea gives advantage to generalize findings to Eritrean refugee population in Ethiopia.
- In calculating indirect (mediated) effect, the mediating roles of multiple factors were taken into account instead of single mediating factor, and this is strength of this study.
- However, the inherent nature of cross-sectional design may make it difficult to draw cause-effect relationship between variables of research interest.
- Outcome measures used in this study were tested only using 50 respondents.

Background

In contemporary mental health research in humanitarian settings, to look into the effect of traumatic events on the mental wellbeing of survivors is becoming a common phenomenon. There is also increasing interest to investigate mediators which can be either precipitating risk factors like exposure to post migration trauma,[1] maladaptive coping method,[2] as well as protective factors such as adaptive coping strategy, sense of coherence and social support. These are among vital factors tested for mediating and moderating mental health problems in humanitarian settings principally because identification of these variables yields vital information for planning intervention. In this regard, there is evidence regarding the mediating roles of sense of coherence,[3-4] use of coping methods,[5] and social support[6] between adverse life events and mental health outcome such as: post-traumatic stress disorder (PTSD), depression

and anxiety in emergency settings. The moderating roles of sense of coherence, [7-9] emotion-oriented coping method, [10] and social support[11-12] were also reported.

A study from Tibetan refugees in India indicated that exposure to trauma is positively and significantly associated with coping style and coping style mediated the association between exposure to trauma and symptoms (i.e., depression and PTSD).[5] In another study which compared the use of different coping strategies among victims of PTSD and controls, it was found that those with PTSD were more likely to use emotion-oriented coping style in dealing with stressful events compared to those without PTSD.[13] The kind of Coping style would moderate (strengthen or weaken) the association between the other resilience variables and PTSD symptoms.[14] In the same study, engagement coping style was hypothesized to strengthen the above associations, while disengagement coping style would weaken them.[14] In addition, the finding in the Democratic Republic of Congo indicated that the interaction between emotion-oriented coping strategy and problem-oriented coping strategy (coping flexibility) were associated with lower psychological distress.[10]

Population-based studies in Eritrea and Iraq showed that sense of coherence was found to be negatively associated with PTSD symptoms.[8-9] Cross-cultural studies aimed at determining the relationship between sense of coherence and coping strategies in Chinese and US participants showed that sense of coherence was predictor of problem solving and avoidance coping strategies.[15] In addition, a study from samples of Pakistan and German indicated the mediation role of sense of coherence between social support and stress.[3]

Structural Equation Modeling (SEM) analysis from among Zimbabwean refugees in South Africa showed that post-migration living difficulties mediated the association between pre-migration living difficulties and PTSD.[1] In the same study, mental distress (where depression is one of indicator variables) significantly and positively predicted PTSD.[1] A study in Ethiopia among internally displaced persons indicated that some sub-scales of coping interact with displacement related traumatic events leading to have significant association with mental distress.[16]

Although there are reports on mediating and moderating roles of sense of coherence, copying styles, and social support in the association between exposure to trauma and psychological symptoms in humanitarian settings, to our knowledge there are no such studies in Eritrean refugees living in Ethiopia. Therefore, the present study aimed at addressing this research gap.

Materials and Methods

Study setting: This study was conducted at Mai-Aini refugee camp which is one of the largest refugee camps in Tigray Region, 1116 km North of Addis Ababa, the capital city of Ethiopia. Mai-Ani is one of the refugee camps used by Eritreans which was established in 2008 through support given by the United Nations Higher Commissioner for Refugees (UNHCR) to the Ethiopian Government.[42] As of 2013, this camp alone hosts about 17,825 Eritrean refugees.[43] The camp has self contained structure with provision of employment opportunities; health and education support to the local Ethiopians as well as the Eritreans, but it does not provide a long stay environment for the new arrivals.[42]

Study design

Data for this particular report were collected using a cross-sectional study design.

Sample size estimation

Sample size determination was done taking into account the average PTSD prevalence of 30.73% among refugees in East African camps[18-20] with 4% precision and 95% confidence interval. Adding 10% for the likely non-response, the final calculated sample size using single population proportion formula[17] was 562 adults.

Sampling

Households were taken as a sampling frame for the survey. According to population census document we were able to obtain from ARRA and UNCHR, there were a total of 10,006 registered refugees living in the camp in December 2015, of which 4,257 were females and 5,749 males. But, this document contained incomplete information about refugees' addresses, especially for the newly arrived. Thus, we conducted numbering and making census of households from December 2015 to January, 2016. A total of 2055 households were registered out of which 100 houses holds were filtered out because they were units for unaccompanied minors (children below the age of 18 living without their parents or guardians). Thus, the remaining 1955 units of households were taken as a sampling frame. Finally, 562 households were selected using simple random sampling method. One participant was selected from each household using a lottery method from among members of the household aged 18 and above. Twenty two of the selected households were replaced because household members were not found upon three visits by data collectors. The replacement was done from neighboring households (i.e. from those that preceded or followed the selected household numbers) Data collection took place from January to March, 2016.

Variables

PTSD and depression were taken as the main outcome variables of the research interest. Pre and post-migration living difficulties were considered to be the exposure and main predictor variables. Sense of coherence, task-oriented coping, emotion-oriented, avoidance-oriented coping styles and social support were conceptualized as mediating as well as moderating variables and assumed to moderate the effect of exposure to traumatic events on psychological symptoms. Variables such as: gender, age, marital statuses, educational background, frequency of using religious coping method, and duration of stay in the refugee camp were regarded as potentially confounders.

Instrument adaptation

All the instruments were adapted following adaptation procedures for instruments for trans-cultural study.[34] Except for Center for Epidemiologic Studies Depression (CES-D) Scale, all instruments described below were translated from the source language (English) into the target language (Tigrigna) by two bilingual experts, and then masked back translated into English by other two independent bilingual translators. The translations as well as the back translations were given to an expert panel whose mother tongue was Tigrigna, the language used for the study. Having the input from the feedbacks obtained from experts, consensus meetings were held to merge the two translated versions by the translators. The translations were then rated using a 4-point rating scale for their content relevance by seven experts to obtain content validity index.[35-36] Besides, cognitive interviews were conducted with six refugees from the target community and hence minor revisions were made based on their feedbacks. All the instruments were pilot tested before they were employed to collect data for the main study.

Measures

An exposure variable of interest, traumatic events, were measured using *Pre and Post Migration Living Difficulties Checklist*.[1] This tool was developed and used to measure traumatic events of

Zimbabwean refugees in South Africa in pre and post-migration periods. It has 14-item checklist with five point response format (i.e. strongly disagree score = 1; disagree = 2; neutral = 3; agree = 4, and strongly agree = 5). In order to differentiate those who had encountered trauma from those who hadn't , the authors re-coded responses 1 to 3 to 0 and 4 & 5 to 1.[21] In the pilot study (n=50), internal consistency alpha values of 0.86 and 0.83 were obtained for pre-migration and post-migration living difficulties, respectively. Besides, the item level Content Validity Index (I-CVI) for the fourteen items in the present study ranged from 0.86 to 1.00 The scale level average content validity index(S-CVI/Ave) was found to be 0.98.

Depression was measured using *Center for Epidemiologic Studies Depression Scale (CES-D)*.[22] The English version of CES-D is a brief 20 item scale with four alternative response options, which ranges from 'None of the time' to be scored 0 to 'Most of the time' to be scored 3, and this instrument is designed to measure depressive symptomatology in the general population.[22] CES-D was translated and validated into Tigrigna for Tigrigna speaking Eritrean refugees in the United States, and the adaptation study found alpha value of 0.86 for internal consistency and 0.91 for test re-test reliability.[23] The internal consistency in the present study demonstrated 0.92 in pilot study (n=50). After allowing unique values to correlate, Confirmatory Factor Analysis (CFA) suggested that the present data best fits with two dimensions of negative affect and positive affect (x^2= 271.65; df=144; CFI=0.975; TLI= 0.967; SRMR= 0.0378; RMSEA=.04) with sufficient loadings of all the 20 items to either of these two dimensions better than other computing factor structures of CES-D in the literature. Thus, composite reliability alpha of the two factors negative Affect (16 Items) has an Alpha value which is 0.93, whereas the positive Affect (4 items) has an alpha value of 0.70. Moreover, the I-CVI values for the 20 items ranged from 0.71 to 1.00 and S-CVI/ Ave for the total scale was found to be 0.92.

PTSD was measured using *Primary Care PTSD Screener (PC-PTSD)*.[24] This is a four item brief screening instrument, having two response options, 'Yes' or 'No'.[24] Test re-test reliability was found to be 0.83.[25] Furthermore, the sensitivity and specificity of PC-PTSD is found to be 0.78 and 0.87, respectively.[24] The scale was extensively used to study PTSD among veterans in United States,[24-25] Afganistan and Iraq,[26] its use for screening PTSD in refugees is also well documented.[27-28]In the present study, the internal consistency alpha value was found to be .68 in the pilot study (n=50). Item-total correlation for the four items ranged from 0.59 to 0.75 in the pilot study. For the four items, Item level Content Validity Index (I-CVI) is 1, which makes the overall Scale level Item Validity Index (S-IVI) to be 1. Moreover, Principal Component Analysis (PCA) shows that the four items loaded on a single factor (ranging from 0.582 to 0.818). Similarly, CFA analysis demonstrated that all the four items, each of which basically represent one factor structure of PTSD, loaded adequately onto a single dimension, ranging from 0.49 (numbing) to 0.73 (re-experiencing).

Coping strategies were measured using a *Coping Style Scale*, [16] which consists 10 items. The items require participants to respond as "this is not like me" or "this is like me".[16] This instrument was cross-culturally validated by Trans-cultural Psychosocial Organization (TPO), and later used to study displaced Ethiopians from Eritrea during secession of Eritrea from Ethiopia.[16, 29] This scale roughly captured three coping strategies, including: task-oriented, avoidance-oriented and emotion-oriented coping strategies.[16] In the present study, the internal consistency alpha value was found to be 0.61 in the pilot study (n=50).

Resilience was measured using Sense *of Coherence Scale* (*SoC-13)*.[30] This is a 13-item semantic differential scale adapted for Eritrean culture in the form of a 5-point Likert scale from the original 7-point scale to reduce complexity[8.] Responses for the items 1, 2, 3, 7, and 10 were coded reversely.[31]The instrument was reported to have proved an adequate measure of resilience in Eritrean population.[8] Despite the conflicting findings regarding the dimensionality of SoC-13,[32] our data in the present study fits well into a single factor structure, except for item-2. Twelve items have demonstrated significant loadings onto a single factor (x^2=57.54; df=34; CMIN/df=1.69; CFI= 0.98; RMSEA= 0.035), which gives a supporting evidence that it measures a uni-dimensional construct as proposed by the original scale developer.[30] From the pilot study (n=52) Crombach's alpha value for internal consistency was 0.67.

Social support was measured using *Oslo Social Support Scale (OSS-3).*[12] This is a scale consisting of three items in which sum scores range from 3-14.[33] In a validation study of OSS-3 in Nigeria, Crombach's alpha value for internal consistency was found to be 0.5.[33] In the present pilot study (N=52), Crombach's alpha value was 0.39. CFA showed that all the items significantly and adequately loaded onto a single factor ranging from 0.49 to 0.68. All the items received I-CVI of 1, which makes S-CVI to be 1 for the total scale.

Statistical analysis

Associations and direction of associations tested in this study were hypothesized based on existing literature. Path analysis was performed to test the significance and direction of association as well as to identify direct and indirect effect of variables. IBM SPSS Amos, version, 21 was employed to carry out the path analysis. The effect of interaction among some coping sub-scales with sub-scales of pre and post migration living difficulties was calculated by multiplying the respective variables there by interaction terms were created. Then, the effect of each interaction term was tested for its significance of association with PTSD, depression or both using independent path analysis. Item-level Content Validity Index (I-CVI) values of 0.78 or higher are considered to be valid indices for content validity if the instrument is rated by 6 to 10 experts.[35] In the present study the cut-off values for fit indices of accepted model include: values of chi-square to degree of freedom (x^2/df) less than 3; greater than or equal to 0.95 for Comparative Fit Index (CFI); greater than or equal to 0.95 for Tuker Lewis Index (TLI); less than or equal to 0.06 to 0.08 for Root Mean Square Error of Approximation (RMSEA), less than or equal to 0.08 for Standardized Root Mean Square Residual (SRMR).[44]

Result

Characteristics of participants

Of the 652 participants (Table-1), 304(54.1%) were females. Age ranged from 18-74 (with mean age=29.63, SD=10.18); the majority was literate; the average duration of stay in the refugee camp was 3.71 years. High proportion of participants belonged to the Tigrinya ethnic group (92%). Very few participants came from Saho, Bilen, Tigre and Jabelty ethnic groups of Eritrea constituting 8% altogether. Eighty five percent were followers of Coptic Orthodox Christianity. They had diverse profile of occupation before coming to Ethiopia, but students, x-soldiers and farmers constituted 71%.

Table-1: Socio-demographic characteristics of participant

Characteristics		Number (%)
Sex	Male	258(45.9)
	Female	304(54.1)
Age	Mean(SD)	29.6(10.2)
	18-24	205 (36.5)
	25-34	219(39.0)
	35-44	89(15.8)
	45-54	29(5.2)
	55-64	15(2.5)
	65-75	5 (0.9)
Educational Background	Non-literate	67(11.9)
	Elementary school	232(41.3)
	Secondary school	238(42.3)
	College graduate or above	25(4.5)
Marital status	Single	189(33.6)
	Married	327(58.2)
	Divorced	29(5.2)
	Widowed	17(3.0)
Religion	Orthodox	477(84.9)
	Protestant	17(3.0)
	Catholic	23(4.1)
	Muslim	44(7.8)
	Jehovah witness	1(0.2)
Past occupation in Eritrea	Student	201 (35.7)
	Military	111 (19.8)
	Farmer	89 (15.8)
	Home maid	66 (11.75)
	Educator	23 (4.1)
	Daily laborers	15 (2.7)
	Others	57(13.1)

Direct and mediating predictors of PTSD and depression

The path model presented in figure-1 fits to the data well (x^2=39.97; df = 24; x^2/df =1.67; CFI=0.985; TLI= 0.972; SRMR=0.05; RMSEA=0.034 (90% CI=0.013, 0.053); p=0.022). In examining the paths in detail, both pre-migration (β=-0.19, p<0.001) and post-migration (β = -0.15, p<0.001) trauma are significantly associated with sense of coherence. Sense of coherence in turn is significantly and negatively associated with symptoms of PTSD (β = -0.16, p<0.001) and depression (ß= -0.40, p<0.001) (Table-2). Pre-migration living difficulties were directly associated with symptoms of PTSD (β=0.09, p <0.05) and with depression (β= 0.35, p < 0.001). It was also indirectly associated with depression via sense of coherence and post-migration living difficulties. Post-migration living difficulties were directly associated with depression (β= 0.23, p<0.001) and indirectly associated with PTSD via sense of coherence, symptoms of depression, and task-oriented coping style.

Table 2: Path coefficients between predictors and endogenous variables in the path model

Predictors	Endogenous variables	Unstandardized Estimate(95%,CI)	Standard Error	Standardized Path Coefficient	p-values
Pre-migration difficulties	Post-migration	0.21 (0.17, 0.25)	0.021	0.39	p<0.001
Post-migration difficulties	Sense of coherence	-0.21 (-0.32, -0.10)	0.056	-0.15	p<0.001
Pre-migration difficulties	Sense of coherence	-0.14 (-0.20, -0.08)	0.031	-0.19	p<0.001
Social support	Sense of coherence	1.28 (1.01, 1.55)	0.139	0.35	p<0.001
Sense of coherence	Depression	-0.59 (-0.68, -0.50)	0.046	-0.40	p<0.001
Pre-migration difficulties	Depression	0.38 (0.31, 0.45)	0.034	0.35	p<0.001
Post-migration difficulties	Depression	0.46 (0.34, 0.58)	0.062	0.23	p<0.001
Pre-migration difficulties	Duration of stay	0.02 (0.00, 0.04)	0.011	0.09	p<0.05
Social support	Depression	-0.78 (-1.05, -0.51)	0.162	-0.14	p<0.001
Post-migration difficulties	Task-oriented coping	0.03 (0.01, 0.05)	0.008	0.16	p<0.001
Social support	Task-oriented coping	0.13 (0.09, 0.17)	0.022	0.22	p<0.001
Duration of stay	PTSD	0.07 (0.04, 0.10)	0.017	0.14	p<0.001
Sense of coherence	Avoidance-oriented coping	-0.01(-0.02, -0.002)	0.004	-0.14	p<0.001
Sense of coherence	PTSD	-0.03 (-0.04, -0.02)	0.007	-0.16	p<0.001
Pre-migration difficulties	PTSD	0.01 (0.00, 0.02)	0.005	0.09	p<0.05
Depression	PTSD	0.04 (0.03, 0.05)	0.006	0.38	p<0.05
Task-oriented coping	PTSD	-0.07(-0.14, -0.004)	0.038	-0.07	p<0.05
Pre-migration difficulties	Emotion-oriented coping	0.01 (0.004, 0.02)	0.003	0.09	p<0.001
Sense of coherence	Emotion-oriented coping	-0.01(-0.02, -0.002)	0004	-0.14	p<0.01

Duration of stay in the refugee camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depression together seem to mediate the association between pre-migration living difficulties and PTSD symptoms (standardized indirect coefficient = 0.26, p< 0.01). Similarly, task-oriented coping style, sense of coherence and depression combined mediate the association between post-migration living difficulties and PTSD symptoms (standardized indirect coefficient= 0.13, p<0.01) (Table 3).

Table 3: Mediation analysis between exposure to trauma during pre and post- migration period and symptoms (PTSD and depression)

Hypothesized relationship	Standardized Direct Effect	Standardized Indirect Effect	Result
Pre-migration living difficulties → PTSD	0.09*	0.26£	Partially mediated
Post-migration living difficulties → PTSD	-0.05(n.s)	0.13£	Partially mediated
Pre-migration living difficulties → Depression	0.35¥	0.19£	Partially mediated
Post-migration living difficulties →Depression	0.23¥	-0.06£	Partially mediated

* p< 0.05; £ p< 0.01; ¥ p< 0.001; n.s = not significant

Pre-migration and post migration living difficulties were not significantly associated with social support. Hence, social support is not a mediator for the association between exposure to trauma and symptoms in this path model (see figure-1).

Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.

The association between pre-migration living difficulties and depression is strengthened by exposure to post- migration living difficulties (β= 0.23, p< 0.001). Pre-migration living difficulties are significantly and positively associated with emotion-oriented coping style (β= 0.09, p < 0.05) as well as post-migration living difficulties (β=0.39, p < 0.001). On the other hand, post-migration living difficulties are positively associated with task-oriented coping style (β=0.16, p< 0.001). Depression partially mediated and strengthened the association between post-migration trauma and symptoms of PTSD (β= 0.38, p< 0.001).

Moderators

Test for moderation (interaction effect) (Table-4) illustrates that sense of coherence and task-oriented coping style do not seem to moderate the effect of pre- migration living difficulties as well as post-migration living difficulties on neither PTSD nor depression (p > 0.05). However, the interaction between social support and post-migration living difficulties is inversely associated with depression (p < 0.05), and hence social support seems to moderate the effect of post-migration living difficulties on depression.

Table 4: Moderation analysis for sense of coherence, task-oriented coping style and social support

Model	Main and interaction predictors	Standardized path coefficient to PTSD (n=562)	Standardized path coefficient to depression(n=562)
1	Pre-migration living difficulties	0.248¥	0.440¥
	pre-migration living difficulties x Sense of coherence	0.057	0.022
	Sense of coherence	-0.372¥	-0.513¥
2	Post-migration living difficulties	0.103£	0.371¥
	Post-migration living difficulties x Sense of coherence	-0.036	0.053
	Sense of coherence	-0.407¥	-0.536¥
3	Pre-migration living difficulties	0.353¥	0.547¥
	pre-migration living difficulties x Task-oriented coping	0.027	-0.004
	Task-oriented coping	-0.092*	-0.012
4	Post-migration living difficulties	0.221¥	0.466¥
	Post-migration living difficulties x task-oriented coping	-0.019	-0.061
	Task-oriented coping	-0.076	0.000
5	Pre-migration living difficulties	0.327¥	0.536¥
	pre-migration living difficulties x social support	0.037	-0.006
	social support	-0.249¥	-0.295¥
6	Post-migration living difficulties	0.193¥	0.445¥
	Post-migration living difficulties x social support	-0.029	-0.106*
	Social support	-0.253¥	-0.259¥

¥ p < 0.001, £ p<0.01, * p < 0.05

Emotion–oriented coping style seems to have a moderating effect upon PTSD when interacting with threat for life sub-scale of pre-migration for both females (β= -0.120, p< 0.05) (n=304) and

males (β= -0.114, p< 0.05) (n=258) (Table-5). Similarly, it is associated with reduced symptoms of PTSD and depression when interacting with threat for abuse sub-scale of pre-migration living difficulties. More specifically, the interaction between emotion-oriented coping styles with threat for abuse sub-scale of pre-migration trauma is negatively and significantly associated both with PTSD and depression (model-6). Sub-group analysis by gender (Table-5: models 7-12) demonstrated that exposure to post-migration trauma is associated with symptoms of PTSD only in females (p<0.001).

Table-5: The significance of path coefficients regarding main effect and interaction effect of predictors on symptoms of PTSD and depression.

Model	Main and interaction predictors	Standardized path coefficient to PTSD			Standardized path coefficient to Depression		
		Total (n=562)	Female (n=304)	Male (n=258)	Total (n=562)	Female (n=304)	Male (n=258)
1	Threat for life (Pre-migration)	0.362¥	0.052¥	0.421¥	0.483¥	0.720¥	0.484¥
	Threat for life(pre-m) x Task-oriented coping	0.035	0.085	0.026	0.026	0.206	0.057
	Task-oriented coping	-0.089*	-0.055	-0.094	0.009	0.768	-0.044
2	Threat for life (Pre-migration)	0.362¥	0.317¥	0.428¥	0.492¥	0.514¥	0.494¥
	Threat for life(pre-m) x Avoidance-oriented coping	-0.069	-0.048	-0.059	-0.046	-0.021	-0.030
	Avoidance-oriented coping	0.021	0.081	-0.038	0.028	0.115	-0.044
3	Threat for life (Pre-migration)	0.362¥	0.319¥	0.422¥	0.483¥	0.514¥	0.484¥
	Threat for life(pre-m) x Emotion-oriented coping	-0.127£	-0.120*	-0.114*	-0.047	-0.060	-0.015
	Emotion-oriented coping	0.001	0.006	-0.020	0.053	0.067	0.021
	Threat for Abuse (Pre-migration)	0.203¥	0.224¥	0.181£	0.504¥	0.538¥	0.461¥
4	Threat for Abuse(pre-m) x Task-oriented coping	0.010	0.019	-0.002	-0.079*	-0.098	-0.060
	Task-oriented coping	-0.066	-0.069	-0.064	-0.012	0.015	-0.038
	Threat for Abuse (Pre-migration)	0.195¥	0.206¥	0.180£	0.490¥	0.530¥	0.450¥
5	Threat for Abuse(pre-m) x Avoidance-oriented coping	-0.025	-0.006	-0.024	-0.005	0.030	-0.017
	Avoidance-oriented coping	0.034	0.077	-0.002	0.030	0.089	-0.014
	Threat for Abuse (Pre-migration)	0.238¥	0.227¥	0.269¥	0.517¥	0.543¥	0.495¥
6	Threat for Abuse(pre-m) x Emotion-oriented coping	-0.180¥	-0.133*	-0.240¥	-0.116£	-0.093	-0.154£
	Emotion-oriented coping	-0.009	0.011	-0.036	0.006	0.030	-0.024
	Threat for life (Post-migration)	0.190¥	0.293¥	0.078	0.449£	0.502¥	0.400¥
7	Threat for life(post-m) x Task-oriented coping	-0.035	-0.009	-0.034	-0.070*	-0.056	-0.090
	Task-oriented coping	-0.073	-0.072	-0.069	0.002	0.063	-0.061
	Threat for life (Post-migration)	0.182¥	0.281¥	0.067	0.453¥	0.522¥	0.382¥
8	Threat for life(post-m) x Avoidance-oriented coping	-0.019	-0.013	-0.016	0.029	0.045	0.017
	Avoidance-oriented coping	0.037	0.083	-0.002	0.050	0.114*	-0.007
9	Threat for life (Post-migration)	0.182¥	0.281¥	0.063	0.452¥	0.521¥	0.382¥
	Threat for life(post-m) x Emotion-oriented coping	.0004	0.034	-0.040	0.008	0.000	0.012
	Emotion-oriented coping	0.022	0.023	0.020	0.075a	0.061	0.088
	Threat for Abuse (Post-migration)	0.206¥	0.281¥	0.106	0.328¥	0.380¥	0.280¥
10	Threat for Abuse(post-m) x Task-oriented coping	0.004	0.029	-0.034	-0.054	-0.107*	-0.002
	Task-oriented coping	-0.061	-0.072	-0.061	0.038	0.078	-0.006
	Threat for Abuse (Post-migration)	0.199¥	0.276¥	0.093	0.329¥	0.387¥	0.273¥
11	Threat for Abuse(post-m) x Avoidance-oriented coping	0.024	0.025	0.049	0.033	0.040	0.023
	Avoidance-oriented coping	0.052	0.097	0.013	0.069	0.126*	0.014
12	Threat for Abuse (Post-migration)	0.201¥	0.272¥	0.111	0.331¥	0.384¥	0.278¥
	Threat for Abuse(post-m) x Emotion-oriented coping	-0.005	-0.018	0.003	-0.033	-0.014	-0.052
	Emotion-oriented coping	0.040	0.050	0.027	0.109*	0.111*	0.106*
13	Task oriented coping	-0.049	-0.025	-0.072	0.038	0.114*	-0.039
	Task-oriented coping x Emotion –oriented coping	-0.025	0.014	-0.067	-0.125£	-0.115*	-0.148*
	Emotion-oriented coping	0.033	0.043	0.035	0 .098*	0.077	0.125*

¥ p< 0.001), £ p< 0.01, * p< 0.05

Task-oriented coping style was independently and negatively associated with PTSD (Table 5: model 1), while emotion-oriented coping style showed positive association with depression (Table 5: models 9, 12 and 13) independently. Thus, emotion-oriented coping style seems to be a risk factor when tested for its independent prediction. On the contrary, the interaction between

emotion-oriented and task-oriented coping styles was negatively and significantly associated with depression for females (β= -0.12, p< 0.05) and males (B= -0.15, p< 0.05). Thus, emotion-oriented coping has dual role in that it became a protective factor when interacting with other variables (Table 5: Model- 3, 6 &13), but a risk factor when tested for independent prediction. Avoidance-oriented coping style was a risk factor for females when tested as independent predictor (Table 5: models 8 and 11).

Discussion

In the present study which principally aimed at investigating mediating and moderating roles of theoretically relevant factors, specifically sense of coherence, adaptive coping style and social support between exposure to traumatic events and psychological symptoms, findings supporting previous studies were obtained. Sense of coherence partially mediated but not moderated the effect of exposure to pre and post traumatic events on symptoms of PTSD and depression; task-oriented coping also partially mediated but not moderated the effect of exposure to post-migration traumatic events on PTSD. However, social support moderated the effect of post-migration living difficulties on symptoms of depression, whereas emotion-oriented coping strategy moderated the effect of exposure to pre-migration trauma on symptoms of PTSD and depression.

The present finding that duration of stay in refugee camp which seems to exacerbate symptoms is consistent with previous findings in Australia, [37] which reported that prolonged detention and temporary protection of refugees contribute substantially to the risk of PTSD and depression as well as other mental health-related disabilities. An increase in the magnitude of emotion-oriented and task-oriented coping styles with increased exposure to pre-migration and post-migration living difficulties respectively, is in line with previous findings of Tibetan refugees in India.[5]

Our finding that sense of coherence being associated with reduced symptoms of PTSD and depression is in line with the literature that describes inverse association between sense of coherence and psychological distress in many cultural contexts.[3, 8-9, 30] On the other hand, sense of coherence seems to mediate the association between traumatic events and psychological symptoms in this study which is again in agreement with previous findings.[3-4] However, its moderating role between exposure to trauma and psychological symptoms reported in other studies[7-9] was not found in this study.

Our finding is in line with previous evidence regarding the moderating role of social support;[11-12,40] . However, unlike the recent study which indicated perceived social support has moderated the effect of exposure to trauma on symptoms of PTSD among Eritrean and Sudanese asylum seekers in Israel, [40] the current findings demonstrated that social support has moderated the effect of exposure to post-migration trauma on symptoms of depression.

Task-oriented coping style seems to have mediated the relationship between exposure to post-migration trauma and symptoms of PTSD which signifies the importance of this coping strategy for Eritrean refugees; however, task-oriented coping didn't moderate the effect of exposure to trauma on psychological health reported in previous studies, including report of findings from samples of displaced Ethiopians from Eritrea who were living in temporary shelters in Ethiopia.[10] On the other hand, avoidance-oriented coping style was not found beneficial in this study unlike what was reported in Ethiopia and Congo where avoidance-coping strategy was found beneficial.[10,16] The likely explanation for this is the composition of refugee participants

where most of them were literate, having urban-orientation, and relatively assertive culture of Eritreans, which was also triangulated in Focus Group Discussions (reported elsewhere). Our finding regarding the association between depression and PTSD supported what was reported in the Zimbabwean sample. The beneficial effect of the interaction between emotion-oriented coping style and task-oriented coping style, for depression for both sexes is in line with the report from the Democratic Republic of Congo.[10] Our findings that PTSD symptoms are differentially associated with post-migration trauma in females, not in males, implies the ongoing gender-based vulnerability of female refugees to post migration abuses in the refugee camps, which are also reported in previous studies conducted in Ethiopian refugee camps.[38-39] The association between emotion-oriented coping style and reduced symptoms of PTSD, when it interacts with threat for life sub-scale of pre-migration difficulties may imply that this coping style has potential benefit for those persons who encountered life threatening trauma. This coping strategy may be helpful for release of long held traumatic memories, thereby reducing their PTSD symptoms. The moderating effect of emotion-oriented coping strategy for pre-migration abuse (sexual and physical) in reducing symptoms (PTSD and depression) implies its potential use for refugees who had experienced abuse in Eritrea to deal with symptoms of both conditions. The protective role of this coping style was also reported by previous studies in African humanitarian settings.[10, 16]

Implications of findings for refugees' mental health care

The differential association of PTSD symptoms with post-migration living difficulties for females, not for males, may necessitate the need to focus for intervention for the ongoing effect of post-migration traumatic abuses uniquely for female refugees. The finding that duration of stay in camp which seems to mediate the effect of pre-migration trauma on PTSD calls for accelerated integration of the refugees with the host society. Enhancement of social support for the refugees also seems to be crucial, because this study has shown that it has a fairly strong positive association with increased sense of coherence, which in turn is associated with decreasing symptoms of PTD and depression; it has also modified the effect of post-migration living difficulties on depression. The finding that task-oriented and emotion-focused coping styles seem to have benefited for release of long held negative feelings about the trauma is useful information obtained from the present study. Future studies should focus on prospective cohort as well as longitudinal study designs to fully confirm the present findings from Eritrean samples in humanitarian settings.

Acknowledgments: We would like to thank ARRA for the permission to conduct this study. We would also like to express our sincere appreciation for healthcare staff of ARRA in Shire and Mai Aini for their unreserved support during the entire period of data collection, and all the participants of the study who shared their experiences without reservation.

Funding: This study was financially supported by Addis Ababa University and University of Gondar, Ethiopia

Data availability and sharing: All necessary data to understand in MS is included in tables or text within the MS. The row data in SPSS format will be deposited in the Department of Psychiatry, AAU, and can be accessed in accordance with data sharing policy of Institutional Review Board (IRB) of College of Health Sciences, Addis Ababa University.

Authors' contributions: BG led the generation of the research idea, design and methods of the study, writing the research protocol, validating measures, data collection, analysis, interpretation and writing of the findings. AA has made contribution in revising the research protocol, the research design, validation of measures, analysis and interpretation of data, and critically reviewing the final manuscript. GM made contribution in checking and editing the statistical analysis, critically reviewing of the drafted manuscript, and approved the final version.

Ethical Considerations: This study had ethical clearance from Institutional Ethical Review Board (IRB) of College of Health

Sciences, Addis Ababa University. Participants were provided with information sheet about the study regarding its objective, relevance, beneficence, risk, participant's rights and others. Then a written consent from each participant was obtained before engaging them to participate. Ethical issues as outlined by declaration of Helsinki for human participants in medical research[41] were adhered.

Competing interests: Authors declare that there is no conflict of interest.

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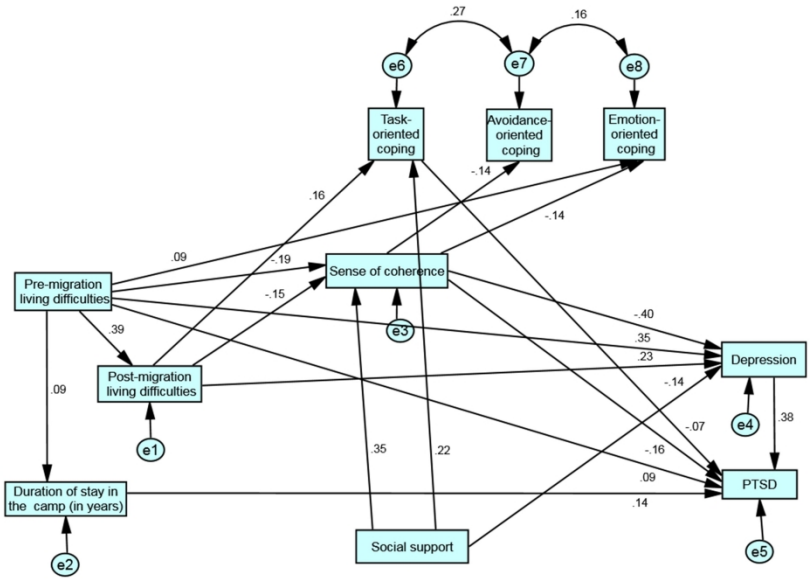
Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.



Legend: All paths are depicting standardized significant coefficients. Rectangles represent observed variables, circles represent disturbance (error) terms; one sided arrows together with coefficient values are equivalent to regression beta weights between the two variables; double headed arrows represent co-variances between error terms.

279x238mm (300 x 300 DPI)

Information Sheet

Study Name-Post Traumatic Stress Disorder and Depression among Eritrean Refugees in Ethiopia: their Contextual Relevance and Implications for Intervention

Principal investigator- Berhanie Getnet

Institution-Addis Ababa University, College of Health Sciences, Department of Psychiatry, Addis Ababa

Aim-Little is known about the experience of trauma, conceptualization of Post Traumatic Stress Disorder and depression and source of coping and healing among Eritrean refugees in Ethiopian camps. Therefore, the present study is principally aimed at understanding the lived experiences about reactions to traumatic experiences sources of coping and cultural healing(ritual as well as spiritual) so that it is possible to make important recommendation for designing culturally appropriate trauma intervention for this target community. Although the study is devoted entirely for academic purpose (PhD thesis), the summary of the outcomes of this study will be shared to important stake holders and service providers thinking that there will be improvement in the service with respect to trauma intervention to the refugee community. Since your genuine responses are highly vital for the success of this study, I would like thank you for your genuine and active participation in anticipation.

Expectation of the participant-We are expecting you to respond anonymously to questions of survey about your personal details, why you come to Ethiopia, your pre-migration, transit and post -migration experiences of trauma, perceived experiences of coping and healing which will take no more than an hour.

Voluntary Participation-Participation in this study is completely voluntary and therefore, you have the right to terminate your participation. You have also the right to skip from giving response to some questions if you felt embarrassed or not willing to share.

Confidentiality-Your formation obtained during data collection will be completely kept confidential at the process of research as well as after completion of the study. Your names will remain anonymous while reporting the results of the study, and hence we would like you ensure that your names will not appear in any publications of research.

Harm - Unless carefully managed, we believe that the side effects (i.e. harm) of collecting data using instruments that asks refugee participants to recollect past and current stressful life events and present feelings of distress will potentially trigger unnecessary discomfort and negative emotional feelings during the process of data collection.

Benefit

Refugees are among a high risk of special population who are more likely prone to multiple emotional, sexual and physical abuses, and hence great care will be taken to safeguard your emotional safety while collecting data. Although this study may provoke some discomfort while remembering and discussing some stressful memories and your current psychological distress, it has an immediate as well as long run benefits. Those few participants who felt overwhelmed by the questionnaire or interview as well as have shown acute symptoms of distress will be given the necessary counseling emotional debriefing, referral to counselors as well as medications, according to the nature and severity of their problem. The outcome of the study will be shared to important governmental as well as humanitarian stakeholders (including UNHCR, IOM and ARRA) for the ultimate benefit of improving the mental health services.

Questions about Research-If you would like to ask any further information about this research, or would like to obtain further clarification about its purpose, methods and procedures, questionnaire items, you may contact to the principal investigator, Berhanie Getnet via email as well as mobile telephone. My email is berhanie.getnet.bg@gmail.com and mobile telephone is (+251)911-33-62-95. In case you need more information about this study you can also directly contact the Institute of Review Board (IRB) in Addis Ababa University, College of health sciences with an address of office telephone +251118961396.

Consent Form

Study Name-Post Traumatic Stress Disorder and Depression among Eritrean Refugees in Ethiopia: their Contextual Relevance and Implications for Intervention

Principal Investigator- Berhanie Getnet

I read the information sheet and understand the purpose of this research and I hereby give my consent to participate in this study having in mind that I agree on the following points:

Please, check in the boxes

1. For my questions and doubts which I need further clarity, I was given sufficient clarifications. ☐
2. I fully understand that participation is completely voluntary and I am free to terminate my participation and demand to cancel the Information I gave in case I feel it put my health as well as legal rights at risk. ☐
3. I understand that information regarding my name and personal details will be kept confidential in security key and only accessed by the investigators. ☐
4. I agree that the researchers can use the information I will give anonymously when making scientific report. ☐
5. I give my consent to be audio taped, photographed or video recorded while I will provide the interview ☐
6. I am volunteer to take part in this study and express my consent by my Signature below ☐

Name_____Signature_____ Date_____

Name and signature of a person asking the consent (other than investigator)

Name_____ Signature_____ Date_____

Name and Signature of investigator

Name_____ Signature_____ Date_____

	Addis Ababa University College of Health Science Institutional Review Board **'itle:** **3.2. Use of Study Assessment Form**	**SOP# AAUMF 008** **Version 2.0** **Effective date:** **1 Feb. 2009** **Page 13 of 13**

ANNEX 3

Form AAUMF 03-008

IRB's Decision

Meeting No:001/15 Date: January, 2015

Protocol number: 052/14/Psy Assigned No……

Protocol Title: Post-traumatic stress disorder & depression among Eritrean refugees in an Ethiopian camp. Their contextual relevance and implication for intervention	
Principal Investigators:	Berhanie Getnet
Institute:	CHS-AAU
Elements Reviewed (AAUMF 01-008)	☑ Attached ☐ Not attached
Review of Revised Application ☐ Yes ☐ No	Date of Previous review:
Decision of the meeting:	☑ **Approved** ☐ Approved with Recommendation ☐ Resubmission ☐ Disapproved

I.Elements approved-
1. Protocol Version No. ……
2. Protocol Version Date……
3. Informed consent Version No. ……
4. Informed Consent Version Date ……

II. Obligations of the PI-
1. Should comply with the standard international & national scientific and ethical guidelines
2. All amendments and changes made in protocol and consent form needs IRB approval
3. The PI should report SAE within 10 days of the event
4. End of the study, including manuscripts and thesis works should be reported to the IRB

III. **TO ESTM** ☐

Institution Review Board (IRB) Approval: Period from **02/02/2015 to 01/02/2016**

Follow up report expected in

3 Months ___ 6 months ___ 9 months_____ one year____

Chairperson, IRB
Dr. Yimtubezinash Woldeamanuel
Signature _____
Date: 02/02/2015

Associate Dean for Postgraduate and Research
Signature _____
Date _____

Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

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

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

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	4
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	NA
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	4,6-7
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	NA
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	2
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	2
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

NA-Not Applicable

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

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

BMJ Open

Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-021142.R1
Article Type:	Research
Date Submitted by the Author:	25-May-2018
Complete List of Authors:	Getnet, Berhanie; Addis Ababa University School of Medicine, Psychiatry Medhin, Girmay; Addis Ababa University, Aklilu Lemma Institute of Pathobiology Alem, Atalay; Addis Ababa University School of Medicine, Psychiatry
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology
Keywords:	Mediation, Moderation, Post Traumatic Stress Disorder, Depression, Eritrean refugees

Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

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Abstract

Objective: This study aimed at testing the significance of mediating and moderating roles of sense of coherence, adaptive coping styles and social support in the relationship between exposure to trauma and psychological symptoms.

Methods: A cross-sectional survey design was employed to collect data. The study was carried out in Mai Aini refugee camp, Ethiopia. 562 adult refugees aged 18-74 were randomly selected from eligible Eritrean refugee community living in the camp to screen for depression and PTSD and to look for associated factors. Data were collected using Pre and post-migration living difficulties checklist, Center for Epidemiologic Studies Depression Scale (CES-D), Primary Care PTSD Screener (PC-PTSD), Coping style scale, Sense of Coherence scale (SoC-13), and Oslo Social Support scale (OSS-3). Path modeling was used to test the mediation and moderation effects of pre-specified factors.

Results: Pre-migration living difficulties were directly associated with symptoms of PTSD (β=0.09, $p < 0.05$), and indirectly associated with PTSD through paths of duration of stay in camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depression ($\beta = 0.26$, $p<.01$). Pre and post-migration living difficulties were directly associated with depression with standardized estimate of (β=0.35, $p < 0.001$) and (β=0.23, $p < 0.05$), respectively. Post-migration living difficulties were indirectly associated with PTSD through paths of sense of coherence, task-oriented coping style and depression ($\beta = 0.13$, $p<0.01$). Social support moderated the effect of post-migration living difficulties on depression ($P<0.05$). Emotion-oriented coping style moderated the effect of pre-migration threat for abuse on PTSD ($\beta = -0.18$, $p<0.001$) and depression ($\beta = -0.12$, $p<0.01$). It also moderated threat for life on PTSD ($\beta = -0.13$, $p<0.001$).

Conclusions: Sense of coherence and task-oriented coping style partially mediated the association between exposure to trauma and symptoms of depression and PTSD. Emotion-oriented coping style and social support moderated the effect of pre and post-migration living difficulties, respectively. Fostering social support, task-oriented and emotion-oriented coping styles seem to be beneficial for these refugees.

Key words: Mediation, moderation, PTSD, depression, Eritrean refugees, Ethiopia

Strengths and Limitations of this Study

- The strength of this study is that it has examined the moderating and mediating roles of multiple factors, which will give the readers a chance to see the dynamic interplay of personal and environmental factors as determinants of refugees' mental wellbeing. This will give a direction for considering multiple factors in the intervention plan.
- Using tools/measures after rigorously adapting them to the local context may also be viewed as the strength of the present study.
- However, this study has inherent limitations; the cross-sectional design employed in the study will limit to show cause-effect relationship between variables of research interest.
- Since there were no gold standard measures in Tigrigna version normed in the target community to identify cases of PTSD and depression, as well as determine cut-off points for self reported measures employed in the present study, the outcomes in the present study as measured by PC-PTSD and CES-D were described as dimensional constructs using their respective symptoms as outcomes. Thus, one needs to be cautious in the interpretation of the findings.
- Since there is vulnerability of refugees for potential abuses in the host society, the likelihood of response bias on the part of respondents for items asking experiences of post-migration living difficulties cannot be ruled out.

Background

In the contemporary mental health research in humanitarian settings, to look into the effect of traumatic events on the mental wellbeing of survivors is becoming a common phenomenon. There is also increasing interest to investigate mediators which can be either precipitating risk factors like exposure to post migration trauma,[1] maladaptive coping methods,[2] and protective factors such as sense of coherence[3-4]and adaptive coping strategy.[5]Antonvsky(1987, p.19) defined sense of coherence as: "a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feelings of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured and predictable and explicable;(2) the resources are available to one to meet the demands posed by the stimuli; and (3) these demands are challenges worthy of investment and engagement".[6]The moderating roles of sense of coherence, [7] emotion-oriented coping method,[8] inverse association of social support with depression,[9] and moderating role of social support[10]were also reported. Social support has moderated the effect of exposure to trauma on symptoms of PTSD among Eritrean and Sudanese asylum seekers in Israel.[10]

A study from Tibetan refugees in India indicated that exposure to trauma is positively and significantly associated with coping style and coping style mediated the association between exposure to trauma and symptoms of depression and PTSD.[5] Coping in this regard refers to the psychological process that individuals respond to stressors and life hassles, which plays the mediating role between stress and psychological wellbeing.[11]In another study which compared the use of different coping strategies among victims of PTSD and a control group, it was found that those with PTSD were more likely to use emotion-oriented coping style in dealing with stressful events compared to those without PTSD.[12] The kind of coping style would moderate (strengthen or weaken) the association between the other resilience variables and PTSD symptoms.[13] In the same study, engagement coping style was hypothesized to strengthen the above associations, while disengagement coping style would weaken them.[13]A similar study from sample of the Democratic Republic of Congo indicated that the interaction between emotion-oriented coping strategy and problem-oriented coping strategy (coping flexibility) were associated with lower psychological distress.[8]

Population-based studies in Eritrea and Iraq showed that sense of coherence was found to be negatively associated with PTSD symptoms.[14-15] Cross-cultural studies aimed at determining the relationship between sense of coherence and coping strategies in Chinese and United States participants showed that sense of coherence was predictor of problem solving and avoidance coping strategies.[16] A study from samples of Pakistan and German indicated the mediating role of sense of coherence between social support and stress.[3]Sense of coherence also partially mediated the impact of trauma on both anxiety and social dysfunction in samples of Palestinian emergency health workers.[4]

Findings from analysis of Structural Equation Modeling (SEM) from among Zimbabwean refugees in South Africa showed that post-migration living difficulties mediated the association between pre-migration living difficulties and PTSD.[1]A recent study that focused on the importance of post-migration stressors in ecological model of refugees' mental health reported that post-migration stressors have consistently been found to predict levels of distress as

powerfully as exposure to pre-migration trauma, like exposure to violence.[17]A study in Ethiopia among internally displaced persons indicated that some sub-scales of coping interact with displacement related traumatic events leading to have significant association with mental distress.[18]

Continuous migration of Eritrean youth to refugee camps of Ethiopia is owing to different reasons, which include: economic hardship, political reasons and family reunification.[19] As of 2013, there were 53,035 refugees in four camps (i.e.Mai Aini, Shimelba, Adi harush and Hitsats).[20]Of these, 37,562 (70.8%) were males. Mai Aini, where this study was conducted, is the second largest camp where 17,825 refugees resided at the time of the study of whom 11,892(66.7%) were males.[20]The majority were students, and most of them were unemployed before coming to Ethiopia.[20]A recent update by United Nations Higher Commissioner for Refugees (UNHCR) indicates that about 11,718 Eritrean refugees were living in Mai Aini camp, of which 4,826(41%) were females.[21]

Although there are reports on mediating and moderating roles of sense of coherence, copying styles, and social support in the association between exposure to trauma and psychological symptoms in humanitarian settings, to our knowledge there are no such studies in Eritrean refugees living in Ethiopia. Therefore, the present study aimed at addressing this knowledge gap.

Hypotheses

After reviewing the literature, our alternative hypotheses for this study were: (a) sense of coherence and task-oriented coping together mediate the relationship between exposure to pre and post-migration living difficulties and psychological symptoms (PTSD and depression); (b) Social support moderates the effect of exposure to traumatic events on symptoms of PTSD and depression; (c) the interaction between emotion-orientated and task-oriented coping styles are associated with reduced symptoms of PTSD and depression.

Materials and Methods

Study setting: This study was conducted at Mai-Aini refugee camp, 1116 km North of Addis Ababa, the capital city of Ethiopia. Mai-Ani is one of the refugee camps hosting Eritreans which was established in 2008 through the support given by the UNHCR to the Ethiopian Government.[19]

Study design

Data for this particular report were collected using a cross-sectional study design.

Sample size estimation

Sample size determination was done taking into account the average PTSD prevalence of 30.73% among refugees in East African camps[22-24] with 4% precision and 95% confidence interval. Adding 10% for the likely non-response, the final calculated sample size using single population proportion formula was 562 participants.

Sampling

Households were taken as a sampling frame for the survey. According to population census document we were able to obtain from Administration of Refugees and Returnees Affairs (ARRA) and UNCHR, there were a total of 10,006 registered refugees living in the camp in December 2015, of whom 4,257 were females and 5,749 males. But, this document contained

incomplete information about refugees' addresses, especially for the newly arrived. Thus, we conducted numbering and making census of households from December 2015 to January, 2016. A total of 2055 households were registered out of which 100 households were excluded because they were units for unaccompanied minors (children below the age of 18) Thus, the remaining 1955 households were taken as a sampling frame. Then 562 households were selected using simple random sampling method. One participant was selected from each household using a lottery method from among members of the household aged 18 and above. Twenty two of the selected households were replaced because household members were not found upon three visits by data collectors. The replacement was done from neighboring households (i.e. from those that preceded or followed the selected households). Data collection took place from January to March, 2016.Since the principal investigator (BG) was supervising and monitoring the data collection on daily basis, missed data were obtained by sending the data collectors back to the respondents' homes to bring information for those skipped question items.

Variables

Symptoms of PTSD and depression were the main outcome variables in this study. Pre and post-migration living difficulties were considered to be the exposure and main predictor variables. Sense of coherence, task-oriented coping, emotion-oriented, avoidance-oriented coping styles and social support were assumed to moderate the effect of exposure to traumatic events on symptoms of depression and PTSD. Variables such as: Genders, age, marital status, and educational background, frequency of using religious coping, and duration of stay in the refugee camp were regarded as potential confounders.

Instrument adaptation

All of the instruments used in this study were adapted following standard adaptation procedures for trans-cultural study.[25] Except for Center for Epidemiologic Studies Depression (CES-D) Scale, all instruments described below were translated from the source language (English) into the target language (Tigrigna) by two bilingual experts, and then masked back translated into English by other two independent bilingual translators. The translations as well as the back translations were given to an expert panel whose mother tongue was Tigrigna, the language used for the study. Having the input from the feedbacks obtained from experts, consensus meetings were held to merge the two translated versions by the translators. The translations were then rated using a 4-point rating scale for their content relevance by seven experts to obtain content validity index.[26-27]Following that, cognitive interviews were conducted with six refugees from the target community, and hence minor revisions were made based on their feedbacks. All instruments were pilot tested before they were employed in the main study.

Patient and public involvement

Since this study involved special vulnerable people, refugees, who were potentially at risk of mental health problems and violation of their rights, the necessary care was taken when recruiting participants of the study. The research question and adaptation of outcome measures were informed by literature review and priorities, preferences as well as experiences of refugees based on situational analysis study done in the same community one year prior to the current study (unpublished to date). That study involved interviews with key informants of the refugees and Focus Group Discussion (FGD) with refugee counselors and Eritrean lay counselors trained in psychosocial intervention. The participants were ensured about legal protection for their security that permission letters have been obtained from concerned higher authority, ARRA in Addis Ababa and its site offices, before they gave us their informed consent. Higher scorers of PTSD symptoms were encouraged to visit refugee counselors or obtain psychiatric service via

local healthcare staff as part of connecting refugees who are at risk to a referral pathway for mental health care. Findings of this study will be disseminated to participants through workshops and briefing sessions.

Measures

An exposure variable of interest, traumatic events, were measured using *Pre and Post Migration Living Difficulties Checklist*.[1] This tool was developed and used to measure traumatic events of Zimbabwean refugees in South Africa in pre and post-migration periods. It has 14-item checklist with five point response format (i.e. strongly disagree score = 1; disagree = 2; neutral = 3; agree = 4, and strongly agree = 5). Examples of items include: "I was beaten and harassed; I was sexually harassed". In order to differentiate those who had encountered trauma from those who hadn't , the authors re-coded responses 1 to 3 to 0 and 4 & 5 to 1.[28] In the pilot study (n=50), internal consistency alpha values of 0.86 and 0.83 were obtained for pre-migration and post-migration living difficulties, respectively. CFA analysis of the main study (n=562) has demonstrated that the two factor structure of pre-migration living difficulties has shown acceptable fit to the present data: chi-square (x^2)=172.444; chi-square to degree of freedom (x^2/df)= 2.874; Comparative Fit Index (CFI) =0.971; Tucker Lewis Index (TLI) =0.951; Root Mean Square Error of Approximation(RMSEA)=0.058(90%CI=0.048, 0.068); Standardized Root Mean Residual (SRMR) = 0.0402. In this model the first factor, threat for life (9-items), and the second factor, threat for abuse (5-items), had good internal consistency (Cronbach's alpha 0.88 and 0.82, respectively). Two factor structures of post-migration living difficulties have demonstrated acceptable fit to the present data: x^2=202.576; x^2/df =3.554; CFI=0.950; TLI=0.919; RMSEA= 0.067(90%CI= 0.058, 0.078). The first factor, threat for life (9-iems) and the second factor, threat for abuse (5-items) are internally consistent (Cronbach's alpha values 0.68 and 0.72 respectively). Besides, the item level Content Validity Index (I-CVI) for the fourteen items in the present study ranged from 0.86 to 1.00. The scale level average content validity index(S-CVI/Ave) was found to be 0.98.

Depression was measured using *Center for Epidemiologic Studies Depression Scale (CES-D)*.[29] The English version of CES-D is a 20 item scale with four alternative response options; specifically, 'None of the time' to be scored 0 "A little of the time' to be scored 1, 'Moderate amount of time" to be scored 2, and 'Most of the time' to be scored 3.[29] One example item reads: "I was bothered by things that usually do not bother me". This instrument is designed to measure depressive symptomatology in the general population.[29] CES-D was translated and validated into Tigrigna for Tigrigna speaking Eritrean refugees in the United States, and the adaptation study found alpha value of 0.86 for internal consistency and 0.91 for test re-test reliability.[30] The internal consistency in the present study demonstrated 0.92 in pilot study (n=50) and 0.91 in the main study (n=562). After allowing unique values to correlate, Confirmatory Factor Analysis (CFA) suggested that the present data best fitted best with two dimensions of negative affect and positive affect with second order single factor model (x^2= 271.65; df=144; CFI=0.975; TLI= 0.967; SRMR= 0.0378; RMSEA=.04). All the 20 items loaded sufficiently to either of these two dimensions better than other computing factor structures of CES-D in the literature. Thus, composite reliability alpha of the two factors negative Affect (16 Items) has an Alpha value which is 0.93, whereas the positive Affect (4 items) has an alpha value of 0.70 (n=562). Moreover, the I-CVI values for the 20 items ranged from 0.71 to 1.00 and S-CVI/ Ave for the total scale was found to be 0.92.

PTSD was measured using *Primary Care PTSD Screener (PC-PTSD)*.[31] This is a four item brief screening instrument, having two response options, 'Yes' or 'No'.[31] This scale has one common instruction for all items , "In your life, have you ever had any experience that was so frightening, horrible, or upsetting that, in the past month…". One example from among items following this instruction is: "Have had nightmares about it or thought about it when you did not want to?"[31] Test re-test reliability was found to be 0.83.[32] Furthermore, the sensitivity and specificity of PC-PTSD was 0.78 and 0.87, respectively.[31] The scale was extensively used to study PTSD among veterans in United States,[31-32] Afghanistan and Iraq,[33] its use for screening PTSD in refugees is also well documented.[34-35]In the present study, the internal consistency alpha value was found to be 0.68 in the pilot study (n=50) and 0.64 in the main study (n=562). Item-total correlation for the four items ranged from 0.59 to 0.75 in the pilot study. For the four items, Item level Content Validity Index (I-CVI) is 1, which makes the overall Scale level Item Validity Index (S-IVI) to be 1. Moreover, Principal Component Analysis (PCA) showed that the four items loaded on a single factor (ranging from 0.582 to 0.818). Similarly, CFA analysis demonstrated that all the four items, each of which basically represents one factor structure of PTSD, loaded adequately onto a single dimension, ranging from 0.43 (numbing) to 0.78 (re-experiencing). The present data demonstrated closer fit with a single factor structure of PTSD with fit indices of x^2=17.275; x^2/df= 8.622, CFI=0.963; TLI=0.888; RMSEA=0.117 (90%CI=0.070, 0.17), SRMR=0.0355.

Coping strategies were measured using a *Coping Style Scale*,[18] which consists 10 items. The items require participants to respond as "this is not like me" or "this is like me".[18]The first set of 4-items follow one scenario "Imagine, someone is spreading a damaging gossip about you". One example of item that following this reads: "Some people would try to find the person who began the gossip and discuss it with him/her".[18] The second set of 6-items follow imaginative scenario "Imagine that some property of your, money, food or object of value is lost or stolen", one example of item following this is "some people would avoid thinking about the lost or theft".[18]This instrument was cross-culturally validated by Trans-cultural Psychosocial Organization (TPO), and later used to study displaced Ethiopians from Eritrea during secession of Eritrea from Ethiopia.[18,36]This scale roughly captured three coping strategies, including: task-oriented, avoidance-oriented and emotion-oriented coping strategies. [18]In the present study, the internal consistency alpha value was found to be 0.61 in the pilot study (n=50) and 0.48 in the main study (n=562). The three factors of coping have demonstrated reasonable fit to the present data with exclusion of item-8 (β =0.014, p>0.05). The remaining 9-items also have shown close fit to the data: x^2=54.549; x^2/df=2.273; CFI=0.901; TLI= 0.851; RMSEA=0.048(90%CI=0.031, 0.064).

Resilience was measured using Sense *of Coherence Scale* (*SoC-13)*.[37]This is a 13-item semantic differential scale adapted for Eritrean culture in the form of a 5-point Likert scale from the original 7-point scale to reduce complexity.[14]For example, item-1 asks: "Do you have feeling that you don't really care about what goes on around you? Response options range from "very seldom or never' to be scored as 1 and 'very often' to be scored as 5.[14] Responses for the items 1, 2, 3, 7, and 10 were reverse coded as indicated in previous literature.[38]The instrument was reported to have proved an adequate measure of resilience in Eritrean population.[14] Despite the conflicting findings regarding the dimensionality of SoC-13,[39]our data in the present study fits well into a single factor structure, except for item-2. Twelve items have demonstrated significant

loadings onto a single factor (x^2=57.54; df=34; x^2/df=1.69; CFI= 0.98; RMSEA= 0.035), which gives a supporting evidence that it measures a one dimensional construct as proposed by the original scale developer.[37] Cronbach's alpha value for internal consistency for pilot study (n=52) and main study (n=562) were 0.67 and 0.74, respectively.

Social support was measured using *Oslo Social Support Scale (OSS-3).*[9] This is a scale consisting of three items in which sum scores range from 3-14.[40]In a validation study of OSS-3 in Nigeria, Cronbach's alpha value for internal consistency was found to be 0.5.[40] In our pilot study (N=52), Cronbach's alpha value was 0.39 and the alpha value for the main study was 0.58 (n=562). CFA showed that all the items significantly and adequately loaded onto a single factor ranging from 0.49 to 0.68, with fit indices of x^2=4.233, x^2/df=4.233, CFI=0.978,TLI=0.934, RMSEA=0.076(90%CI=0.014,0.156). All the items received I-CVI of 1, which makes S-CVI to be 1 for the total scale.

Statistical analysis

Associations and direction of associations tested in this study were hypothesized based on existing literature. Path analysis was performed to test the significance and direction of association as well as to identify direct and indirect effect of variables. IBM SPSS Amos, version, 21 was employed to carry out the path analysis. The effect of interaction among some coping sub-scales with sub-scales of pre and post-migration living difficulties was calculated by multiplying the respective variables there by interaction terms were created. Then, the effect of each interaction term was tested for its significance of association with PTSD, depression or both using independent path analysis. Item-level Content Validity Index (I-CVI) values of 0.78 or higher are considered to be valid indices for content validity if the instrument is rated by 6 to 10 experts.[26]In the present study the cut-off values for fit indices of accepted model include: values of x^2/df less than 3; greater than or equal to 0.95 for CFI; greater than or equal to 0.95 for TLI; less than or equal to 0.06 to 0.08 for RMSEA, and less than or equal to 0.08 for SRMR.[41]

Results

Characteristics of participants

Of the 562 participants (Table-1), 304(54.1%) were females. Age ranged from 18-74 (with mean age=29.63, SD=10.18); the majority was literate; the average duration of stay in the refugee camp was 3.71 years. High proportion of participants belonged to the Tigrinya ethnic group (92%). Very few participants came from Saho, Bilen, Tigre and Jabelty ethnic groups of Eritrea constituting 8% altogether. Eighty five percent were followers of Coptic Orthodox Christianity. They had diverse profile of occupation before coming to Ethiopia, but students, x-soldiers and farmers constituted 71%.

Table-1: The demographic characteristics of participants

Characteristics		Number (%)
Sex	Male	258(45.9)
	Female	304(54.1)
Age	Mean(SD)	29.6(10.2)
	18-24	205 (36.5)
	25-34	219(39.0)
	35-44	89(15.8)
	45-54	29(5.2)
	55-64	15(2.5)
	65-75	5 (0.9)
Educational Background	Non-literate	67(11.9)
	Elementary school	232(41.3)
	Secondary school	238(42.3)
	College graduate or above	25(4.5)
Marital status	Single	189(33.6)
	Married	327(58.2)
	Divorced	29(5.2)
	Widowed	17(3.0)
Religion	Orthodox	477(84.9)
	Protestant	17(3.0)
	Catholic	23(4.1)
	Muslim	44(7.8)
	Jehovah witness	1(0.2)
Past occupation in Eritrea	Student	201 (35.8)
	Military	111 (19.8)
	Farmer	89 (15.8)
	Home maid	66 (11.7)
	Educator	23 (4.1)
	Daily laborers	15 (2.7)
	Others	57(10.1)

Direct and mediating predictors of PTSD and depression

The path model presented in figure-1 fits to the data well (x^2=39.97; df = 24; x^2/df =1.67; CFI=0.985; TLI= 0.972; SRMR=0.05; RMSEA=0.034 (90% CI=0.013, 0.053); p=0.022). In examining the paths in detail, both pre-migration (β=-0.19, p<0.001) and post-migration (β = -0.15, p<0.001) trauma are significantly associated with sense of coherence. Sense of coherence in turn is significantly and negatively associated with symptoms of PTSD (β = -0.16, p<0.001) and depression (ß= -0.40, p<0.001) (Table-2). Pre-migration living difficulties were directly associated with symptoms of PTSD (β=0.09, p <0.05) and with depression (β= 0.35, p < 0.001). It was also indirectly associated with depression via sense of coherence and post-migration living difficulties. Post-migration living difficulties were directly associated with depression (β= 0.23, p<0.001) and indirectly associated with PTSD via sense of coherence, symptoms of depression, and task-oriented coping style.

Table 2: Path coefficients between predictors and endogenous variables in the path model

Predictors	Endogenous variables	Unstandardized Estimate(95%,CI)	Standard Error	Standardized Path Coefficient	p-values
Pre-migration difficulties	Post-migration	0.21 (0.17, 0.25)	0.021	0.39	p<0.001
Post-migration difficulties	Sense of coherence	-0.21 (-0.32, -0.10)	0.056	-0.15	p<0.001
Pre-migration difficulties	Sense of coherence	-0.14 (-0.20, -0.08)	0.031	-0.19	p<0.001
Social support	Sense of coherence	1.28 (1.01, 1.55)	0.139	0.35	p<0.001
Sense of coherence	Depression	-0.59 (-0.68, -0.50)	0.046	-0.40	p<0.001
Pre-migration difficulties	Depression	0.38 (0.31, 0.45)	0.034	0.35	p<0.001
Post-migration difficulties	Depression	0.46 (0.34, 0.58)	0.062	0.23	p<0.001
Pre-migration difficulties	Duration of stay	0.02 (0.00, 0.04)	0.011	0.09	p<0.05
Social support	Depression	-0.78 (-1.05, -0.51)	0.162	-0.14	p<0.001
Post-migration difficulties	Task-oriented coping	0.03 (0.01, 0.05)	0.008	0.16	p<0.001
Social support	Task-oriented coping	0.13 (0.09, 0.17)	0.022	0.22	p<0.001
Duration of stay	PTSD	0.07 (0.04, 0.10)	0.017	0.14	p<0.001
Sense of coherence	Avoidance-oriented coping	-0.01(-0.02, -0.002)	0.004	-0.14	p<0.001
Sense of coherence	PTSD	-0.03 (-0.04, -0.02)	0.007	-0.16	p<0.001
Pre-migration difficulties	PTSD	0.01 (0.00, 0.02)	0.005	0.09	p<0.05
Depression	PTSD	0.04 (0.03, 0.05)	0.006	0.38	p<0.05
Task-oriented coping	PTSD	-0.07(-0.14, -0.004)	0.038	-0.07	p<0.05
Pre-migration difficulties	Emotion-oriented coping	0.01 (0.004, 0.02)	0.003	0.09	p<0.001
Sense of coherence	Emotion-oriented coping	-0.01(-0.02, -0.002)	0004	-0.14	p<0.01

Duration of stay in the refugee camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depression together seem to mediate the association between pre-migration living difficulties and PTSD symptoms (standardized indirect coefficient = 0.26, p< 0.01). Similarly, task-oriented coping style, sense of coherence and depression combined mediate the association between post-migration living difficulties and PTSD symptoms (standardized indirect coefficient= 0.13, p<0.01) (Table 3).

Table 3: Mediation analysis between exposure to trauma during pre and post- migration period and symptoms (PTSD and depression)

Hypothesized relationship	Mediating variables	Standardized Direct Effect	Standardized Indirect Effect	Result
1. Pre-migration living difficulties → PTSD	Duration of stay in the camp, sense of coherence, post-migration living difficulties, task-oriented coping, depression	0.09*	0.26£	Partially mediated
Post-migration living difficulties → PTSD	Task-oriented coping, sense of coherence and depression	-0.05(n.s)	0.13£	Partially mediated
Pre-migration living difficulties → Depression	Sense of coherence and post-migration living difficulties	0.35¥	0.19£	Partially mediated
Post-migration living difficulties →Depression	Sense of coherence	0.23¥	-0.06£	Partially mediated

* p< 0.05; £ p< 0.01; ¥ p< 0.001; n.s = not significant

Pre-migration and post migration living difficulties were not significantly associated with social support. Hence, social support is not a mediator for the association between exposure to trauma and symptoms in this path model (see figure-1).

Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.

The association between pre-migration living difficulties and depression is strengthened by exposure to post- migration living difficulties (β= 0.23, p< 0.001). Pre-migration living difficulties are significantly and positively associated with emotion-oriented coping style (β= 0.09, p < 0.05) as well as post-migration living difficulties (β=0.39, p < 0.001). On the other hand, post-migration living difficulties are positively associated with task-oriented coping style (β=0.16, p< 0.001). Depression partially mediated and strengthened the association between post-migration trauma and symptoms of PTSD (β= 0.38, p< 0.001).

Moderators

Test for moderation (interaction effect) (Table-4) illustrates that sense of coherence and task-oriented coping style do not seem to moderate the effect of pre- migration living difficulties as well as post-migration living difficulties on neither PTSD nor depression (p > 0.05). However, the interaction between social support and post-migration living difficulties is inversely associated with depression (p < 0.05), and hence social support seems to moderate the effect of post-migration living difficulties on depression.

Table 4: Moderation analysis for sense of coherence, task-oriented coping style and social support

Model	Main and interaction predictors	Standardized path coefficient to PTSD (n=562)	Standardized path coefficient to depression(n=562)
1	Pre-migration living difficulties	0.248¥	0.440¥
	pre-migration living difficulties x Sense of coherence	0.057	0.022
	Sense of coherence	-0.372¥	-0.513¥
2	Post-migration living difficulties	0.103£	0.371¥
	Post-migration living difficulties x Sense of coherence	-0.036	0.053
	Sense of coherence	-0.407¥	-0.536¥
3	Pre-migration living difficulties	0.353¥	0.547¥
	pre-migration living difficulties x Task-oriented coping	0.027	-0.004
	Task-oriented coping	-0.092*	-0.012
4	Post-migration living difficulties	0.221¥	0.466¥
	Post-migration living difficulties x task-oriented coping	-0.019	-0.061
	Task-oriented coping	-0.076	0.000
5	Pre-migration living difficulties	0.327¥	0.536¥
	pre-migration living difficulties x social support	0.037	-0.006
	social support	-0.249¥	-0.295¥
6	Post-migration living difficulties	0.193¥	0.445¥
	Post-migration living difficulties x social support	-0.029	-0.106*
	Social support	-0.253¥	-0.259¥

¥ p < 0.001, £ p<0.01, * p < 0.05

Emotion–oriented coping style seems to have a moderating effect upon PTSD when interacting with threat for life sub-scale of pre-migration for both females (β= -0.120, p< 0.05) (n=304) and males (β= -0.114, p< 0.05) (n=258) (Table-5). Similarly, it is associated with reduced symptoms of PTSD and depression when interacting with threat for abuse sub-scale of pre-migration living difficulties. More specifically, the interaction between emotion-oriented coping styles with threat for abuse sub-scale of pre-migration trauma is negatively and significantly associated both with PTSD and depression (model-6). Sub-group analysis by gender (Table-5: models 7-12) demonstrated that exposure to post-migration trauma is associated with symptoms of PTSD only in females (p<0.001).

Table-5: The significance of path coefficients regarding main effect and interaction effect of predictors on symptoms of PTSD and depression.

Model	Main and interaction predictors	Standardized path coefficient to PTSD			Standardized path coefficient to Depression		
		Total (n=562)	Female (n=304)	Male (n=258)	Total (n=562)	Female (n=304)	Male (n=258)
1	Threat for life (Pre-migration)	0.362¥	0.052¥	0.421¥	0.483¥	0.720¥	0.484¥
	Threat for life(pre-m) x Task-oriented coping	0.035	0.085	0.026	0.026	0.206	0.057
	Task-oriented coping	-0.089*	-0.055	-0.094	0.009	0.768	-0.044
2	Threat for life (Pre-migration)	0.362¥	0.317¥	0.428¥	0.492¥	0.514¥	0.494¥
	Threat for life(pre-m) x Avoidance-oriented coping	-0.069	-0.048	-0.059	-0.046	-0.021	-0.030
	Avoidance-oriented coping	0.021	0.081	-0.038	0.028	0.115	-0.044
3	Threat for life (Pre-migration)	0.362¥	0.319¥	0.422¥	0.483¥	0.514¥	0.484¥
	Threat for life(pre-m) x Emotion-oriented coping	-0.127£	-0.120*	-0.114*	-0.047	-0.060	-0.015
	Emotion-oriented coping	0.001	0.006	-0.020	0.053	0.067	0.021
	Threat for Abuse (Pre-migration)	0.203¥	0.224¥	0.181£	0.504¥	0.538¥	0.461¥
4	Threat for Abuse(pre-m) x Task-oriented coping	0.010	0.019	-0.002	-0.079*	-0.098	-0.060
	Task-oriented coping	-0.066	-0.069	-0.064	-0.012	0.015	-0.038
	Threat for Abuse (Pre-migration)	0.195¥	0.206¥	0.180£	0.490¥	0.530¥	0.450¥
5	Threat for Abuse(pre-m) x Avoidance-oriented coping	-0.025	-0.006	-0.024	-0.005	0.030	-0.017
	Avoidance-oriented coping	0.034	0.077	-0.002	0.030	0.089	-0.014
	Threat for Abuse (Pre-migration)	0.238¥	0.227¥	0.269¥	0.517¥	0.543¥	0.495¥
6	Threat for Abuse(pre-m) x Emotion-oriented coping	-0.180¥	-0.133*	-0.240¥	-0.116£	-0.093	-0.154£
	Emotion-oriented coping	-0.009	0.011	-0.036	0.006	0.030	-0.024
	Threat for life (Post-migration)	0.190¥	0.293¥	0.078	0.449£	0.502¥	0.400¥
7	Threat for life(post-m) x Task-oriented coping	-0.035	-0.009	-0.034	-0.070*	-0.056	-0.090
	Task-oriented coping	-0.073	-0.072	-0.069	0.002	0.063	-0.061
	Threat for life (Post-migration)	0.182¥	0.281¥	0.067	0.453¥	0.522¥	0.382¥
8	Threat for life(post-m) x Avoidance-oriented coping	-0.019	-0.013	-0.016	0.029	0.045	0.017
	Avoidance-oriented coping	0.037	0.083	-0.002	0.050	0.114*	-0.007
9	Threat for life (Post-migration)	0.182¥	0.281¥	0.063	0.452¥	0.521¥	0.382¥
	Threat for life(post-m) x Emotion-oriented coping	.0004	0.034	-0.040	0.008	0.000	0.012
	Emotion-oriented coping	0.022	0.023	0.020	0.075a	0.061	0.088
	Threat for Abuse (Post-migration)	0.206¥	0.281¥	0.106	0.328¥	0.380¥	0.280¥
10	Threat for Abuse(post-m) x Task-oriented coping	0.004	0.029	-0.034	-0.054	-0.107*	-0.002
	Task-oriented coping	-0.061	-0.072	-0.061	0.038	0.078	-0.006
	Threat for Abuse (Post-migration)	0.199¥	0.276¥	0.093	0.329¥	0.387¥	0.273¥
11	Threat for Abuse(post-m) x Avoidance-oriented coping	0.024	0.025	0.049	0.033	0.040	0.023
	Avoidance-oriented coping	0.052	0.097	0.013	0.069	0.126*	0.014
12	Threat for Abuse (Post-migration)	0.201¥	0.272¥	0.111	0.331¥	0.384¥	0.278¥
	Threat for Abuse(post-m) x Emotion-oriented coping	-0.005	-0.018	0.003	-0.033	-0.014	-0.052
	Emotion-oriented coping	0.040	0.050	0.027	0.109*	0.111*	0.106*
13	Task oriented coping	-0.049	-0.025	-0.072	0.038	0.114*	-0.039
	Task-oriented coping x Emotion –oriented coping	-0.025	0.014	-0.067	-0.125£	-0.115*	-0.148*
	Emotion-oriented coping	0.033	0.043	0.035	0 .098*	0.077	0.125*

¥ p< 0.001, £ p< 0.01, * p< 0.05

Task-oriented coping style was independently and negatively associated with PTSD (Table 5: model-1), while emotion-oriented coping style showed positive association with depression (Table 5: models 9, 12 and 13) independently. On the contrary, the interaction between emotion-oriented and task-oriented coping styles was negatively and significantly associated with depression for females (β= -0.12, p< 0.05) and males (B= -0.15, p< 0.05). Emotion-oriented coping has shown inverse association with symptoms when interacting with other variables (Table 5: Model-3, 6 &13), but it demonstrated a positive association with psychological symptoms when tested for independent prediction. Avoidance-oriented coping style was positively associated with symptoms of depression for females when tested as independent predictor (Table 5: models-8 &11).

Discussion

In the present study which principally aimed at investigating mediating and moderating roles of theoretically relevant factors, specifically sense of coherence, adaptive coping style and social support between exposure to traumatic events and psychological symptoms, findings supporting our hypotheses, which we formulated based on previous studies were obtained. Sense of coherence partially mediated but not moderated the effect of exposure to pre and post traumatic events on symptoms of PTSD and depression; task-oriented coping also partially mediated but not moderated the effect of exposure to post-migration traumatic events on PTSD. However, social support moderated the effect of post-migration living difficulties on symptoms of depression, whereas emotion-oriented coping strategy moderated the effect of exposure to pre-migration trauma on symptoms of PTSD and depression.

The present finding that duration of stay in refugee camp which seems to exacerbate symptoms is consistent with previous findings in Australia,[42] which reported that prolonged detention and temporary protection of refugees contribute substantially to the risk of PTSD and depression as well as other mental health-related disabilities. The likely explanation for exacerbating effect of increased duration of stay for worsening symptoms of depression and PTSD in the present study is that the more refugees stay in the refugee camp, the greater chance they are exposed to post-migration stressors and traumatic abuses. Meager support, limited employment opportunities and resources and being in this situation for a prolonged period are also other stressors that could lead them to experience some form of psychological symptoms.

An increase in the magnitude of emotion-oriented and task-oriented coping styles with increased exposure to pre-migration and post-migration living difficulties respectively, is in line with previous findings of Tibetan refugees in India.[5] The indirect (mediated) effect of pre-migration living difficulties on depression and PTSD via the path of post-migration living difficulties has theoretical support in the literature.[1,17]The association between pre-migration living difficulties and PTSD was mediated by post-migration living difficulties among Zimbabwean refugees in South Africa.[1] A recent study has also reported that post-migration stressors have accounted for greater variance in levels of depression and anxiety compared to experiences of trauma and loss,[17] which implies that being exposed to pre-migration alone is not a sole factor accountable for current status of refugees mental wellbeing, and hence post-migration stressors likely play an intervening (mediating) role. The mediating role of post-migration living difficulties in the present study can be best explained by continues exposure of

Eritrean refugees to stressful conditions of the camp life in Ethiopia, like poverty and economic dependency, limited employment opportunity, poor and overcrowded housing, which likely worsen the effect of exposure to traumatic events, which Eritreans had confronted in their home country before migration.

The association between sense of coherence and reduced symptoms of PTSD and depression in this study is in line with the literature that describes inverse association between sense of coherence and psychological distress in many cultural contexts.[3, 14-15,37] On the other hand, sense of coherence seems to mediate the association between traumatic events and psychological symptoms in this study which is again in agreement with previous findings.[3-4] However, its moderating role between exposure to trauma and psychological symptoms reported in other studies[7] was not found in this study.

The moderating role of social support in this study is in line with evidences of previous studies.[10] However, unlike the recent study which indicated perceived social support to have a moderating effect of exposure to trauma on symptoms of PTSD among Eritrean and Sudanese asylum seekers in Israel,[10] the current findings showed that social support has moderated the effect of exposure to post-migration trauma on symptoms of depression. The absence of mediating role of social support between exposure to trauma and symptoms of PTSD and depression is in agreement with findings of a study conducted in African Americans aged between 18 and 54 from the National Co-morbidity Study, which reported that social support did not mediate the effects of financial strain or traumatic events on psychological symptoms.[43]

Task-oriented coping style seems to have mediated the relationship between exposure to post-migration trauma and symptoms of PTSD in this study, which signifies the importance of this coping strategy for Eritrean refugees. This finding is also consistent with findings in Tibetian refugees in India.[5] However, task-oriented coping style didn't have a moderating effect of exposure to trauma on psychological health indicated in previous studies, including the findings from displaced Ethiopians from Eritrea who were living in temporary shelters in Ethiopia.[18] On the other hand, avoidance-oriented coping style was not found beneficial in this study unlike what was reported in previous studies from Ethiopian[18] and Congolese sample,[8] where avoidance-coping strategy was found beneficial. The likely explanation for this is the composition of refugee participants where most of them were literate, having urban-orientation, and relatively assertive culture of Eritreans.

Our finding regarding the association between depression and PTSD supported what was reported in the Zimbabwean sample.[1] However, since our finding was based on a cross-sectional survey, it is noteworthy to think the possibility that elevated symptoms of depression might have been driven by heightened symptoms of PTSD for reasons of reverse causality, and hence caution should be taken in the interpretation of this finding. The inverse association between the interaction variable (i.e. emotion-oriented coping style and task-oriented coping style) and symptoms of depression for both sexes has supported one of our hypotheses, and this finding is in line with the report from the Democratic Republic of Congo.[8] Our findings that PTSD symptoms are differentially associated with post-migration trauma in females, not in males, implies the ongoing gender-based vulnerability of female refugees to post migration abuses in the refugee camps, which are also reported in previous studies conducted in refugee camps in Ethiopia.[44-45] Specifically, gender based physical violence was documented in previous study from Eritrean sample living in Shimelba, one of the biggest refugee camps for Eritreans in

Northern Ethiopia.[44] Another study from among Somali female refugees reported that they were vulnerable to rape during transit and abduction in the refugee camp in South Eastern Ethiopia.[45] The pre/post-migration living difficulties should be understood with caution in the context of the present study with Eritrean refugees who traveled short distance to cross the border to a neighboring country (Ethiopia), characterized by a relatively similar culture. The essence of pre/post migration living difficulties described in the literature may denote something different for refugees who had traveled long distances and those who had entirely different culture in comparison with the culture of the host country.

The association between emotion-oriented coping style and reduced symptoms of PTSD, when it interacts with threat for life sub-scale of pre-migration difficulties may imply that this coping style has potential benefit for those persons who encountered life threatening trauma. This coping strategy may be helpful for release of long held traumatic memories, thereby reducing their PTSD symptoms. The moderating effect of emotion-oriented coping strategy for pre-migration abuse (sexual and physical) in reducing symptoms (PTSD and depression) implies its potential use for refugees who had experienced abuse in Eritrea to deal with symptoms of both conditions. The protective role of this coping style was also reported by previous studies in other African humanitarian settings.[8,18]

Implications of the findings

The differential association between PTSD symptoms and post-migration living difficulties for females, unlike males, may necessitate on the pressing need of intervention on ongoing post-migration traumatic abuses uniquely for female refugees. This finding also informs national and international policy makers for special protection of women refugees from violation of their rights which is so rampant in a male dominated society such as Eastern Africa.

The finding that duration of stay in camp which seems to mediate the effect of pre-migration trauma on PTSD calls for accelerated integration of refugees with the host society. Enhancement of social support for the refugees also seems to be crucial, because this study has shown that it has a fairly strong positive association with increased sense of coherence, which in turn is associated with decreasing symptoms of PTD and depression; it has also moderated the effect of post-migration living difficulties on depression. Future studies should focus on prospective cohort as well as longitudinal study designs to replicate the present findings from Eritrean samples in humanitarian settings.

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Data availability and sharing: All necessary data to understand in manuscript (MS) is included in tables or text within the MS. The row data in SPSS format will be deposited in the Department of Psychiatry, Addis Ababa University (AAU), and can be accessed in accordance with data sharing policy of Institutional Review Board (IRB) of College of Health Sciences, AAU.

Authors' contributions: BG is the Principal Investigator (PI) of this study. He led in generating the research idea, design and methods of the study, writing the research protocol, validating measures, data collection, analysis, interpretation and writing of the findings. AA has made contribution in revising the research protocol, the research design, validation of measures, analysis

and interpretation of data, and critically reviewing the final manuscript. GM made contribution in checking and editing the statistical analysis, critically reviewing of the drafted manuscript, and approved the final version.

Ethical Considerations: This study had ethical clearance from Institutional Ethical Review Board (IRB) of College of Health Sciences, Addis Ababa University. Participants were provided with information sheet about the study regarding its objective, relevance, beneficence, risk, participant's rights and others. Then a written consent from each participant was obtained before engaging them to participate. Ethical issues as outlined by declaration of Helsinki for human participants in medical research were adhered.

Competing interests: Authors declare that there is no conflict of interest.

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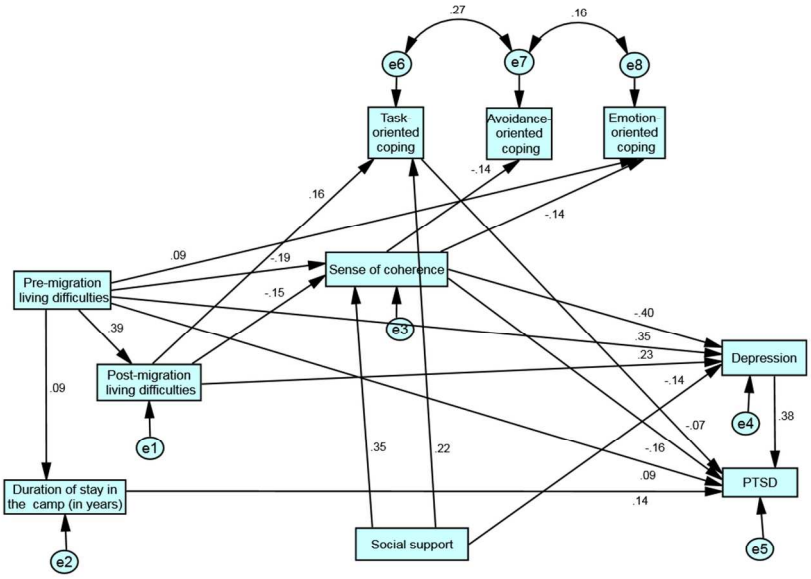
Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.



Legend: All paths are depicting standardized significant coefficients. Rectangles represent observed variables, circles represent disturbance (error) terms; one sided arrows together with coefficient values are equivalent to regression beta weights between the two variables; double headed arrows represent co-variances between error terms.

279x238mm (300 x 300 DPI)

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Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

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Abstract

Objective: This study aimed at testing the significance of mediating and moderating roles of sense of coherence, adaptive coping styles and social support in the relationship between exposure to trauma and psychological symptoms in a refugee population in sub-Saharan Africa.

Methods: A cross-sectional survey design was employed to collect data. The study was carried out in Mai Aini refugee camp in Ethiopia. A total of 562 adult Eritrean refugees aged 18-74 years were selected randomly to screen for depression and post-traumatic stress disorder (PTSD) symptoms and to examine associated factors. Data were collected using the pre- and post-migration living difficulties checklist, Center for Epidemiologic Studies Depression Scale (CES-D), Primary Care PTSD Screener (PC-PTSD), coping style scale, Sense of Coherence scale (SoC-13), and Oslo Social Support scale (OSS-3). Path modeling was used to test the mediation and moderation effects of pre-specified factors.

Results: Pre-migration living difficulties were associated directly with symptoms of PTSD (β=0.09, $p < 0.05$), and associated indirectly with PTSD symptoms in paths through duration of stay in the camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depressive symptoms ($\beta = 0.26$, $p<0.01$). Pre- and post-migration living difficulties were associated directly with depressive symptoms with standardized estimate of β=0.35($p<0.001$) and β=0.23($p<0.05$), respectively. Post-migration living difficulties were associated indirectly with PTSD through paths of sense of coherence, task-oriented coping style and depressive symptoms (β=0.13; $p<0.01$). Social support moderated the effect of post-migration living difficulties on depressive symptoms ($p<0.05$). Emotion-oriented coping style moderated the

effect of pre-migration threat for abuse on PTSD (β = -0.18, p<0.001) and depressive (β = -0.12, p<0.01) symptoms, as well as moderating threat to life on PTSD symptoms (β = -0.13, p<0.001).

Conclusions: Sense of coherence and task-oriented coping style showed a partial mediating effect on the association between exposure to trauma and symptoms of depression and PTSD. An emotion-oriented coping style and social support moderated the effect of pre and post-migration living difficulties, respectively. Fostering social support, task-oriented and emotion-oriented coping styles may be beneficial for these refugees.

Key words: Mediation, moderation, PTSD, depression, Eritrean refugees, Ethiopia

Strengths and Limitations of this Study

- The use of path modeling to examine multiple moderating and mediating factors on the effect of exposure to outcome variables is strength of this study.
- Rigorous adaptation of tools to the local context increased validity of the findings.
- The inherent nature of cross-sectional design employed in the current study means that a cause-effect relationship cannot be inferred.
- It is possible that study participants had reservations about reporting violations of rights and other adverse experiences in Ethiopia for fear of negative consequences.

Background

In contemporary mental health research in humanitarian settings it is important to consider the effects of traumatic events on the mental wellbeing of survivors. There is also increasing interest to investigate mediators of the effects of trauma on mental health, including the role of

precipitating risk factors such as exposure to post migration trauma,[1] maladaptive coping methods,[2]and protective factors, such as a sense of coherence [3-4]and adaptive coping strategies.[5]

Antonvsky(1987, p.19) defined sense of coherence as: "a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feelings of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured and predictable and explicable;(2) the resources are available to meet the demands posed by the stimuli; and (3) these demands are challenges worthy of investment and engagement".[6] Sense of coherence[7] and emotion-oriented coping strategies [8] have been reported to moderate the effect of traumatic events. Social support is reported to be inversely associated with depression.[9] Similarly, social support has also been reported to have a moderating effect when there has been exposure to trauma on the symptoms of PTSD among Eritrean and Sudanese asylum seekers in Israel.[10]

In a study of Tibetan refugees in India, subsequent development of depressive or PTSD symptoms was mediated by use of coping strategies.[5] Coping in this regard refers to the psychological process with which individuals respond to stressors and life hassles, which acts as a mediator between stress and psychological wellbeing.[11] In another study where the use of different coping strategies was compared between people with PTSD and a control group, it was found that those with PTSD were more likely to use an emotion-oriented coping style in dealing with stressful events compared to those without PTSD.[12] The kind of coping style could moderate (strengthen or weaken) the association between other resilience variables and PTSD symptoms.[13] In the same study, an engagement coping style was hypothesized to strengthen the

above associations, while a disengagement coping style weakened them.[13]A similar study from the Democratic Republic of Congo indicated that the interaction between emotion-oriented coping strategies and problem-oriented coping strategies (coping flexibility) was associated with lower psychological distress.[8]

In population-based studies conducted in Eritrea and Iraq, sense of coherence was found to be negatively associated with PTSD symptoms[14] and exposure to trauma.[15] In cross-cultural studies aimed at determining the relationship between sense of coherence and coping strategies in Chinese and United States study participants, sense of coherence was found to be a predictor of problem solving and avoidance coping strategies.[16] In another study from Pakistan and Germany, sense of coherence played a mediating role between social support and stress.[3] In a study of Palestinian emergency health workers, sense of coherence was shown to be a partial mediator on the impact of trauma for both anxiety and social dysfunction.[4]

In a Structural Equation Modeling (SEM) study conducted among Zimbabwean refugees in South Africa, post-migration living difficulties mediated the association between pre-migration living difficulties and PTSD.[1] Similarly, in a recent study that focused on the importance of post-migration stressors in an ecological model of refugees' mental health, post-migration stressors were found to consistently predict levels of distress as powerfully as exposure to pre-migration trauma such as exposure to violence.[17] In a study in Ethiopia among internally displaced persons, some sub-scales of coping interacted with displacement-related traumatic events leading to a significant association with mental distress.[18]

Continuous migration of Eritrean youth to refugee camps of Ethiopia is occurring in large numbers for a variety of reasons including: limited employment opportunities and economic need, desire for family reunification, social pressure, and perceived threat of conscription. [19] As of 2013, there were 53,035 refugees in four camps (namely Mai Aini, Shimelba, Adi harush and Hitsats).[20] Of these, 37,562 (70.8%) were males. Mai Aini, where this study was conducted, is the second largest camp, where 17,825 refugees resided at the time of the study. Of these, 11,892(66.7%) were males.[20] The majority were students, and most of them were unemployed before coming to Ethiopia.[20]A recent update by the United Nations High Commissioner for Refugees (UNHCR) indicated that about 11,718 Eritrean refugees were living in Mai Aini camp, of which 4,826(41%) were female.[21]

Although there are reports on mediating and moderating roles of sense of coherence, coping styles, and social support in the relationship between exposure to trauma and psychological symptoms in humanitarian settings, to our knowledge there are no such studies in Eritrean refugees living in Ethiopia. Specifically, we wanted to investigate whether: (a) a sense of coherence and task-oriented coping together mediated the relationship between exposure to pre and post-migration living difficulties and psychological symptoms (PTSD and depression); (b) social support moderated the effect of exposure to traumatic events on symptoms of PTSD and depression; (c) the interaction between emotion-orientated and task-oriented coping styles would be associated with reduced symptoms of PTSD and depression.

Materials and Methods

Study setting: As stated earlier, this study was conducted at Mai-Aini refugee camp, 1116 km North of Addis Ababa, the capital city of Ethiopia. Mai-Ani is one of the refugee camps hosting

Eritreans which was established in 2008 through the support given to the Ethiopian Government by the UNHCR.[19]

Study design

Data for this report were collected using a cross-sectional study design.

Sample size estimation

Sample size determination was carried out considering the average prevalence of PTSD to be 30.7% among refugees in East African camps[22-24] with 4% precision and a 95% confidence interval. Adding 10% for the likely non-response, and using a single population proportion formula, the required sample size was 562.

Sampling

According to a population census document from the Administration of Refugees and Returnees Affairs (ARRA) and UNCHR, there were a total of 10,006 registered refugees living in the camp in December 2015, of whom 5,749 were males. However, there was incomplete information about refugees' addresses, especially for the newly arrived. Thus, we allocated a house number to each household and conducted a household census from December 2015 to January, 2016. The census showed that a total of 2055 households were registered in the camp, out of which 100 households were excluded because household members were minors (children below the age of 18).The remaining 1955 households were taken as a sampling frame. From this sampling frame, 562 households were selected using the simple random sampling method and one participant was interviewed by a trained data collector from each household. In a household where there were more than one eligible persons (18 years old and above and having Eritrean nationality before migrating to Ethiopia), one participant was selected using the lottery method. Twenty-two of the selected households were replaced because household members were not found after three visits

by data collectors. The replacement was done using neighboring households (i.e. from those that preceded or followed the selected households' numbers). Data collection took place from January to March 2016. As the principal investigator (BG) was supervising and monitoring the data collection on daily basis, incomplete data were collected by sending the data collectors back to the respondents' homes.

Variables

Symptoms of PTSD and depression were the main outcome variables in this study. Pre and post-migration living difficulties were the exposures and main predictor variables. Sense of coherence, task-oriented coping, emotion-oriented, avoidance-oriented coping styles and social support were assumed to moderate the effect of exposure to traumatic events on symptoms of depression and PTSD. Variables such as gender, age, and marital status, level of education, frequency of prayer and duration of stay in the refugee camp were regarded as potential confounders.

Instrument adaptation

All instruments used in this study were adapted following standard adaptation procedures for trans-cultural study.[25] Except for the Center for Epidemiologic Studies Depression (CES-D) Scale, all instruments were translated from the source language (English) into the target language (Tigrigna) by two bilingual experts, followed by masked back translated into English by two other independent bilingual translators. The translations and the back translations were given to an expert panel whose mother tongue was Tigrigna, the language used for the study. Taking comments from the experts as an input, consensus meetings were held to merge the two translated versions by the translators. The translations were then rated using a 4-point rating scale for their content relevance by seven experts to obtain a content validity index.[26-27]

Following that, cognitive interviews were conducted with six refugees not included in the study to ensure the understandability, as well acceptability, of items for the target Eritrean refugee community. Minor revisions were made based on their feedback. All instruments were pilot tested before they were employed in the main study.

Patient and public involvement

Since this study involved members of vulnerable population, who were at risk of violation of their rights and susceptible to various health problems including mental health problems, the necessary precautions were taken when recruiting participants for the study. The research question and adaptation of outcome measures were informed by literature review. The preferences and experiences of refugees were understood based on a situational analysis study (unpublished data) carried out in the same community one year prior to the current study (B. Getnet, personal communication, May 14, 2015). The situational analysis study involved interviews with key informants amongst the refugees and Focus Group Discussion (FGD) with refugee counselors and Eritrean lay counselors trained in psychosocial interventions. The participants were assured about legal protection for their security. Permission letters were also obtained from concerned higher authorities, ARRA in Addis Ababa and its site offices, before participants gave us their informed consent. High scorers on PTSD and depression symptom scales were encouraged to visit refugee counselors or to obtain psychiatric care from local healthcare staff. Findings of this study will be disseminated to the research participants through workshops and briefing sessions.

Measures

Traumatic events were measured using the Pre and Post Migration Living Difficulties Checklist.[1] This tool was developed and used to measure traumatic events of Zimbabwean refugees in South Africa in pre and post-migration periods. It has a 14-item checklist with five point response format (i.e. strongly disagree score = 1; disagree = 2; neutral = 3; agree = 4, and strongly agree = 5). Examples of items include: "I was beaten and harassed; I was sexually harassed". In order to differentiate those who had encountered trauma from those who had not, the authors re-coded responses 1 to 3 as 0 and 4 to 5 as 1.[28] In the pilot study (n=50), internal consistency alpha values of 0.86 and 0.83 were obtained for pre-migration and post-migration living difficulties, respectively. Confirmatory Factor Analysis (CFA) in the main study sample (n=562) indicated that the two factors structure of pre-migration living difficulties had an acceptable fit to the present data: chi-square (x^2)=172.444; chi-square to degree of freedom (x^2/df)= 2.874; Comparative Fit Index (CFI) =0.971; Tucker Lewis Index (TLI) =0.951; Root Mean Square Error of Approximation(RMSEA)=0.058 (90%CI = 0.048, 0.068); Standardized Root Mean Residual (SRMR) = 0.0402. In this model the first factor, threat for life (9-items), and the second factor, threat for abuse (5-items), had good internal consistency (Cronbach's alpha 0.88 and 0.82, respectively). Two factor structures of post-migration living difficulties have demonstrated acceptable fit to the present data: χ^2=202.576; χ^2/df =3.554; CFI=0.950; TLI=0.919; RMSEA= 0.067(90%CI 0.058, 0.078). The first factor, threat for life (9-items) and the second factor, threat for abuse (5-items) are internally consistent (Cronbach's alpha values 0.68 and 0.72 respectively). Besides, the item level Content Validity Index (I-CVI) for the fourteen items in the present study ranged from 0.86 to 1.00. The scale level average content validity index (S-CVI/Ave) was found to be 0.98.

Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D).[29] The English version of CES-D is a 20 item scale with four alternative response options: none of the time, a little of the time, a moderate amount of the time and most of the time, to be scored 0 to 3.[29] One example of an item reads: "I was bothered by things that usually do not bother me". This instrument is designed to measure depressive symptomatology in the general population.[29] The CES-D was translated into Tigrigna and validated for Tigrigna speaking Eritrean refugees in the United States, and the adaptation study found an alpha value of 0.86 for internal consistency and 0.91 for test re-test reliability.[30] The internal consistency in our pilot study was 0.92(n=50) and 0.91 in the main study (n=562). After allowing unique values to correlate, Confirmatory Factor Analysis (CFA) suggested that the present data best fitted with two dimensions of negative affect and positive affect with a second order single factor model (χ^2= 271.65; df=144; CFI=0.975; TLI= 0.967; SRMR= 0.0378; RMSEA=.04). All the 20 items loaded sufficiently onto either of these two dimensions better than other computing factor structures of CES-D in the literature. Thus, composite reliability alpha of the two factors negative affect (16 Items) had an alpha value of 0.93, whereas the positive affect (4 items) had an alpha value of 0.70 (n=562). The I-CVI values for the 20 items ranged from 0.71 to 1.00 and S-CVI/ Ave for the total scale was found to be 0.92.

PTSD was measured using the Primary Care PTSD Screener (PC-PTSD).[31] This is a four item brief screening instrument, having two response options, 'Yes' or 'No'.[31] This scale has one common instruction for all items , "In your life, have you ever had any experience that was so frightening, horrible or upsetting that, in the past month…". One example item is: "Have

had nightmares about it or thought about it when you did not want to?"[31] Test re-test reliability was found to be 0.83.[32] Sensitivity and specificity of PC-PTSD was 0.78 and 0.87, respectively.[31] The scale has been extensively used to study PTSD in veterans in United States,[31-32] Afghanistan and Iraq; [33] its use for screening PTSD in refugees is also documented.[34-35] In the present study, the internal consistency alpha value was found to be 0.68 in the pilot study (n=50) and 0.64 in the main study (n=562). Item-total correlation for the four items ranged from 0.59 to 0.75 in the pilot study. For the four items, Item level Content Validity Index (I-CVI) was 1, which makes the overall Scale level Item Validity Index (S-IVI) to be 1. Principal Component Analysis (PCA) showed that the four items loaded on a single factor (ranging from 0.58 to 0.82). Similarly, CFA showed that all the four items, each of which basically represents one factor structure of PTSD, loaded adequately onto a single dimension, ranging from 0.43 (numbing) to 0.78 (re-experiencing). The present data showed closer fit with a single factor structure of PTSD with fit indices of χ^2=17.275; χ^2/df = 8.622, CFI=0.963; TLI=0.888; RMSEA=0.117(90%CI=0.070, 0.17), SRMR=0.0355.

Coping strategies were measured using a Coping Style Scale,[18] which consists of 10 items. The items require participants to respond "this is not like me" or "this is like me".[18] The first set of 4-items follow one scenario: "Imagine, someone is spreading damaging gossip about you". One example of the item that follows this reads: "Some people would try to find the person who began the gossip and discuss it with him/her".[18] The second set of 6-items follow an imagined scenario "Imagine that some property of yours, money, food or object of value is lost or stolen", one example of items following this is "some people would avoid thinking about the loss or theft".[18] This instrument was cross-culturally validated by Trans-cultural Psychosocial

Organization (TPO), and later used to study coping strategies from among displaced Ethiopians from Eritrea during the secession of Eritrea from Ethiopia.[18,36] This scale roughly captured three coping strategies, which include: task-oriented, avoidance-oriented and emotion-oriented coping strategies.[18] In the present study, the internal consistency alpha value was found to be 0.61 in the pilot study (n=50) and 0.48 in the main study (n=562). The three factors of coping have demonstrated reasonable fit to the present data with exclusion of item8 (β =0.014, p>0.05). The remaining 9-items had a close fit to the data: χ^2=54.549; χ^2/df =2.273; CFI=0.901; TLI= 0.851; RMSEA=0.048(90%CI=0.031, 0.064).

Resilience was measured using the Sense of Coherence Scale (SoC-13).[37] This is a 13-item semantic differential scale adapted for Eritrean culture in the form of a 5-point Likert scale from the original 7-point scale to reduce complexity.[14] For example, item-1 asks: "Do you have a feeling that you don't really care about what goes on around you? Response options range from "very seldom or never' to be scored as 1 and 'very often' to be scored as 5.[14] Responses for the items 1, 2, 3, 7, and 10 were reverse coded as per previous study.[38] The instrument has been reported to be an adequate measure of resilience in an Eritrean population.[14] Despite the conflicting findings regarding the dimensionality of SoC-13,[39] our data in the present study fitted well into a single factor structure, except for item-2. Twelve items demonstrated significant loadings onto a single factor (χ^2=57.54; df=34; χ^2/df =1.69; CFI= 0.98; RMSEA= 0.035 (90% CI=0.02, 0.05), which gives supporting evidence that it measures a one dimensional construct as proposed by the original scale developer.[37] Cronbach's alpha value for internal consistency in the pilot study (n=52) and the main study (n=562) were 0.67 and 0.74, respectively.

Social support was measured using the Oslo Social Support Scale (OSS-3).[9] This is a scale consisting of three items in which the sum of scores ranges from 3-14.[40] In a validation study of OSS-3 in Nigeria, Cronbach's alpha value for internal consistency was found to be 0.5.[40] In our pilot study (n=52), Cronbach's alpha value was 0.39 and the alpha value for the main study was 0.58 (n=562). CFA indicated that all the items significantly and adequately loaded onto a single factor ranging from 0.49 to 0.68, with fit indices of χ^2=4.233, χ^2/df=4.233, CFI=0.978,TLI=0.934, RMSEA=0.076 (90%CI=0.014,0.156). All the items received I-CVI of 1, which makes S-CVI to be 1 for the total scale.

Statistical analysis

Associations and direction of associations tested in this study were based on the existing literature. Path analysis was performed to test the significance of association and to identify direct and indirect effects of variables using IBM SPSS Amos, version, 21. The effect of interaction among some coping sub-scales with sub-scales of pre and post-migration living difficulties was calculated by multiplying the respective variables; thereby interaction terms were created. Then, the effect of each interaction term was tested for its significance of association with PTSD or depression symptoms using independent path analysis For Item-level Content Validity Index (I-CVI) values of 0.78 or higher are considered to be valid indices for content validity if the instrument is rated by 6 to 10 experts.[26] In the present study, the cut-off values for fit indices of an acceptable model included values of χ^2/df less than 3; greater than or equal to 0.95 for CFI; greater than or equal to 0.95 for TLI; less than or equal to 0.06 to 0.08 for RMSEA, and less than or equal to 0.08 for SRMR.[41]

Results

Socio-demographic characteristics of participants

Of the 562 participants (Table-1), 304(54.1%) were females. Age ranged from 18-74 years (with mean age=29.6, SD=10.18); the majority was literate and the average duration of stay in the refugee camp was 3.71 years. A high proportion of participants belonged to the Tigrinya ethnic group (92%). Very few participants came from Saho, Bilen, Tigre and Jabelty ethnic groups of Eritrea (constituting 8% altogether). Eighty five percent were followers of Coptic Orthodox Christianity. Participants had a diverse profile of occupations before coming to Ethiopia, but students, ex-soldiers and farmers constituted 71%.

Table-1: The demographic characteristics of participants

Characteristics		Number (%)
Sex	Male	258 (45.9)
	Female	304 (54.1)
Age	Mean(SD)	29.6 (10.2)
	18-24	205 (36.5)
	25-34	219 (39.0)
	35-44	89 (15.8)
	45-54	29 (5.2)
	55-64	15 (2.5)
	65-74	5 (0.9)
Educational Background	Non-literate	67 (11.9)
	Elementary school	232 (41.3)
	Secondary school	238 (42.3)
	College graduate or above	25 (4.5)
Marital status	Single	189 (33.6)
	Married	327 (58.2)
	Divorced	29 (5.2)
	Widowed	17 (3.0)
Religion	Orthodox	477 (84.9)
	Protestant	17 (3.0)
	Catholic	23 (4.1)
	Muslim	44 (7.8)
	Jehovah witness	1 (0.2)
Past occupation in Eritrea	Student	201 (35.8)
	Military	111 (19.8)
	Farmer	89 (15.8)
	Home maid	66 (11.7)
	Educator	23 (4.1)
	Daily laborers	15 (2.7)
	Others	57 (10.1)

Direct and mediating predictors of PTSD and depression symptoms

The path model as shown in figure-1 fitted well with the data: [χ^2=39.97; df = 24; χ^2/df =1.67; CFI=0.985; TLI= 0.972; SRMR=0.05; RMSEA=0.034 (90% CI=0.013, 0.053); p=0.022]. In examining the paths in detail, both pre-migration (β=-0.19, p<0.001) and post-migration (β = -0.15, p<0.001) traumatic events were significantly associated with sense of coherence. Sense of coherence in turn was significantly and negatively associated with symptoms of PTSD (β = -0.16, p<0.001) and depression (β= -0.40, p<0.001) (Table-2). Pre-migration living difficulties were directly associated with symptoms of PTSD (β=0.09, p <0.05) and with depression (β= 0.35, p < 0.001). It was also indirectly associated with depression via sense of coherence and post-migration living difficulties. Post-migration living difficulties were directly associated with depression symptoms (β= 0.23, p<0.001) and indirectly associated with PTSD symptoms via sense of coherence, symptoms of depression, and task-oriented coping style.

Table 2: Path coefficients between predictors and endogenous variables in the path model

Predictors	Endogenous variables	Unstandardized Estimate(95%,CI)	Standard Error	Standardized Path Coefficient	p-values
Pre-migration difficulties	Post-migration	0.21 (0.17, 0.25)	0.021	0.39	p<0.001
Post-migration difficulties	Sense of coherence	-0.21 (-0.32, -0.10)	0.056	-0.15	p<0.001
Pre-migration difficulties	Sense of coherence	-0.14 (-0.20, -0.08)	0.031	-0.19	p<0.001
Social support	Sense of coherence	1.28 (1.01, 1.55)	0.139	0.35	p<0.001
Sense of coherence	Depression	-0.59 (-0.68, -0.50)	0.046	-0.40	p<0.001
Pre-migration difficulties	Depression	0.38 (0.31, 0.45)	0.034	0.35	p<0.001
Post-migration difficulties	Depression	0.46 (0.34, 0.58)	0.062	0.23	p<0.001
Pre-migration difficulties	Duration of stay	0.02 (0.00, 0.04)	0.011	0.09	p<0.05
Social support	Depression	-0.78 (-1.05, -0.51)	0.162	-0.14	p<0.001
Post-migration difficulties	Task-oriented coping	0.03 (0.01, 0.05)	0.008	0.16	p<0.001
Social support	Task-oriented coping	0.13 (0.09, 0.17)	0.022	0.22	p<0.001
Duration of stay	PTSD	0.07 (0.04, 0.10)	0.017	0.14	p<0.001
Sense of coherence	Avoidance-oriented coping	-0.01(-0.02, -0.002)	0.004	-0.14	p<0.001
Sense of coherence	PTSD	-0.03 (-0.04, -0.02)	0.007	-0.16	p<0.001
Pre-migration difficulties	PTSD	0.01 (0.00, 0.02)	0.005	0.09	p<0.05
Depression	PTSD	0.04 (0.03, 0.05)	0.006	0.38	p<0.05
Task-oriented coping	PTSD	-0.07(-0.14, -0.004)	0.038	-0.07	p<0.05
Pre-migration difficulties	Emotion-oriented coping	0.01 (0.004, 0.02)	0.003	0.09	p<0.001
Sense of coherence	Emotion-oriented coping	-0.01(-0.02, -0.002)	0.004	-0.14	p<0.01

Duration of stay in the refugee camp, sense of coherence, post-migration living difficulties, task-oriented coping style and depression together mediated the association between pre-migration living difficulties and PTSD symptoms (standardized indirect coefficient = 0.26, p< 0.01). Similarly, task-oriented coping style, sense of coherence and depression symptoms together mediated the association between post-migration living difficulties and PTSD symptoms (standardized indirect coefficient= 0.13, p<0.01) (Table 3).

Table 3: Mediation analysis between exposure to trauma during pre and post- migration period and symptoms (PTSD and depression)

Hypothesized relationship	Mediating variables	Standardized Direct Effect	Standardized Indirect Effect	Result
Pre-migration living difficulties→ PTSD	Duration of stay in the camp, sense of coherence, post-migration living difficulties, task-oriented coping, depression	0.09*	0.26£	Partially mediated
Post-migration living difficulties → PTSD	Task-oriented coping, sense of coherence and depression	-0.05 (n.s)	0.13£	Partially mediated
Pre-migration living difficulties→ Depression	Sense of coherence and post-migration living difficulties	0.35¥	0.19£	Partially mediated
Post-migration living difficulties→ Depression	Sense of coherence	0.23¥	-0.06£	Partially mediated

* p< 0.05; £ p< 0.01; ¥ p< 0.001; n.s = not significant

Pre-migration and post migration living difficulties were not significantly associated with social support. Hence, social support was not a mediator for the association between exposure to trauma and symptoms in this path model (see figure-1).

Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.

The association between pre-migration living difficulties and depression was strengthened by exposure to post-migration living difficulties (β= 0.23, p< 0.001). Pre-migration living difficulties were significantly and positively associated with emotion-oriented coping style (β= 0.09, p < 0.05) as well as post-migration living difficulties (β=0.39, p < 0.001). On the other hand, post-migration living difficulties were associated positively with task-oriented coping style

(β=0.16, p< 0.001). Depression partially mediated and strengthened the association between post-migration trauma and symptoms of PTSD (β= 0.38, p< 0.001).

Moderators

Test for moderation (interaction effect) (Table-4) illustrates that sense of coherence and task-oriented coping style did not moderate the effect of pre/post-migration living difficulties on PTSD or depression symptoms (p>0.05). However, the interaction between social support and post-migration living difficulties resulted in an inverse association with depression (p<0.05), which shows a moderating role of social support on the effect of post-migration living difficulties on depression symptoms.

Table 4: Moderation analysis for sense of coherence, task-oriented coping style and social support

Model	Main and interaction predictors	Standardized path coefficient to PTSD (n=562)	Standardized path coefficient to depression(n=562)
1	Pre-migration living difficulties	0.248¥	0.440¥
	pre-migration living difficulties x Sense of coherence	0.057	0.022
	Sense of coherence	-0.372¥	-0.513¥
2	Post-migration living difficulties	0.103£	0.371¥
	Post-migration living difficulties x Sense of coherence	-0.036	0.053
	Sense of coherence	-0.407¥	-0.536¥
3	Pre-migration living difficulties	0.353¥	0.547¥
	pre-migration living difficulties x Task-oriented coping	0.027	-0.004
	Task-oriented coping	-0.092*	-0.012
4	Post-migration living difficulties	0.221¥	0.466¥
	Post-migration living difficulties x task-oriented coping	-0.019	-0.061
	Task-oriented coping	-0.076	0.000
5	Pre-migration living difficulties	0.327¥	0.536¥
	pre-migration living difficulties x social support	0.037	-0.006
	social support	-0.249¥	-0.295¥
6	Post-migration living difficulties	0.193¥	0.445¥
	Post-migration living difficulties x social support	-0.029	-0.106*
	Social support	-0.253¥	-0.259¥

¥ p < 0.001, £ p<0.01, * p < 0.05

Emotion–oriented coping style appeared to have a moderating effect upon PTSD symptoms, with an interaction with the threat for life sub-scale of pre-migration living difficulties both in females (β= -0.120, p< 0.05) (n=304) and males (β= -0.114, p< 0.05) (n=258) (Table-5). Similarly, the interaction between emotion-oriented coping styles with the threat for abuse sub-scale of pre-migration trauma was negatively and significantly associated both with PTSD and depression symptoms (model-6). Sub-group analysis by gender (Table-5: models 7-12) showed that exposure to post-migration trauma was associated with symptoms of PTSD only in females (p<0.001).

Table-5: The significance of path coefficients for the main effect and interaction effect for factors associated with symptoms of PTSD and depression.

Model	Main and interaction predictors	Standardized path coefficient to PTSD			Standardized path coefficient to Depression		
		Total (n=562)	Female (n=304)	Male (n=258)	Total (n=562)	Female (n=304)	Male (n=258)
1	Threat for life (Pre-migration)	0.362¥	0.052¥	0.421¥	0.483¥	0.720¥	0.484¥
	Threat for life(pre-m) x Task-oriented coping	0.035	0.085	0.026	0.026	0.206	0.057
	Task-oriented coping	-0.089*	-0.055	-0.094	0.009	0.768	-0.044
2	Threat for life (Pre-migration)	0.362¥	0.317¥	0.428¥	0.492¥	0.514¥	0.494¥
	Threat for life(pre-m) x Avoidance-oriented coping	-0.069	-0.048	-0.059	-0.046	-0.021	-0.030
	Avoidance-oriented coping	0.021	0.081	-0.038	0.028	0.115	-0.044
3	Threat for life (Pre-migration)	0.362¥	0.319¥	0.422¥	0.483¥	0.514¥	0.484¥
	Threat for life(pre-m) x Emotion-oriented coping	-0.127£	-0.120*	-0.114*	-0.047	-0.060	-0.015
	Emotion-oriented coping	0.001	0.006	-0.020	0.053	0.067	0.021
	Threat for Abuse (Pre-migration)	0.203¥	0.224¥	0.181£	0.504¥	0.538¥	0.461¥
4	Threat for Abuse(pre-m) x Task-oriented coping	0.010	0.019	-0.002	-0.079*	-0.098	-0.060
	Task-oriented coping	-0.066	-0.069	-0.064	-0.012	0.015	-0.038
	Threat for Abuse (Pre-migration)	0.195¥	0.206¥	0.180£	0.490¥	0.530¥	0.450¥
5	Threat for Abuse(pre-m) x Avoidance-oriented coping	-0.025	-0.006	-0.024	-0.005	0.030	-0.017
	Avoidance-oriented coping	0.034	0.077	-0.002	0.030	0.089	-0.014
	Threat for Abuse (Pre-migration)	0.238¥	0.227¥	0.269¥	0.517¥	0.543¥	0.495¥
6	Threat for Abuse(pre-m) x Emotion-oriented coping	-0.180¥	0.133*	-0.240¥	-0.116£	-0.093	-0.154£
	Emotion-oriented coping	-0.009	0.011	-0.036	0.006	0.030	-0.024
	Threat for life (Post-migration)	0.190¥	0.293¥	0.078	0.449£	0.502¥	0.400¥
7	Threat for life(post-m) x Task-oriented coping	-0.035	-0.009	-0.034	-0.070*	-0.056	-0.090
	Task-oriented coping	-0.073	-0.072	-0.069	0.002	0.063	-0.061
	Threat for life (Post-migration)	0.182¥	0.281¥	0.067	0.453¥	0.522¥	0.382¥
8	Threat for life(post-m) x Avoidance-oriented coping	-0.019	-0.013	-0.016	0.029	0.045	0.017
	Avoidance-oriented coping	0.037	0.083	-0.002	0.050	0.114*	-0.007
9	Threat for life (Post-migration)	0.182¥	0.281¥	0.063	0.452¥	0.521¥	0.382¥
	Threat for life(post-m) x Emotion-oriented coping	.0004	0.034	-0.040	0.008	0.000	0.012
	Emotion-oriented coping	0.022	0.023	0.020	0.075a	0.061	0.088
	Threat for Abuse (Post-migration)	0.206¥	0.281¥	0.106	0.328¥	0.380¥	0.280¥
10	Threat for Abuse(post-m) x Task-oriented coping	0.004	0.029	-0.034	-0.054	-0.107*	-0.002
	Task-oriented coping	-0.061	-0.072	-0.061	0.038	0.078	-0.006
	Threat for Abuse (Post-migration)	0.199¥	0.276¥	0.093	0.329¥	0.387¥	0.273¥
11	Threat for Abuse(post-m) x Avoidance-oriented coping	0.024	0.025	0.049	0.033	0.040	0.023
	Avoidance-oriented coping	0.052	0.097	0.013	0.069	0.126*	0.014
12	Threat for Abuse (Post-migration)	0.201¥	0.272¥	0.111	0.331¥	0.384¥	0.278¥
	Threat for Abuse(post-m) x Emotion-oriented coping	-0.005	-0.018	0.003	-0.033	-0.014	-0.052
	Emotion-oriented coping	0.040	0.050	0.027	0.109*	0.111*	0.106*
13	Task oriented coping	-0.049	-0.025	-0.072	0.038	0.114*	-0.039
	Task-oriented coping x Emotion –oriented coping	-0.025	0.014	-0.067	-0.125£	-0.115*	-0.148*
	Emotion-oriented coping	0.033	0.043	0.035	0 .098*	0.077	0.125*

¥ p< 0.001, £ p< 0.01, * p< 0.05

Task-oriented coping style was independently and negatively associated with PTSD (Table 5: model-1), while emotion-oriented coping style showed a positive and independent association with depression (Table 5: models 9, 12 and 13).The interaction between emotion-oriented and task-oriented coping styles was negatively and significantly associated with depression both in females (β= -0.12, p< 0.05) and males (B= -0.15, p< 0.05). Emotion-oriented coping had an inverse association with symptoms when it interacted with other variables (Table 5: Model-3, 6 and13). An avoidance-oriented coping style was positively associated with symptoms of depression for females when tested as an independent predictor (Table 5: models-8 and11).

Discussion

In the present study that aimed to investigate the mediating and moderating roles of theoretically relevant factors (i.e. sense of coherence, adaptive coping style and social support) between exposure to traumatic events and psychological symptoms, findings supported our alternative hypotheses. Sense of coherence partially mediated (but did not moderate) the effect of exposure to pre and post traumatic events on symptoms of PTSD and depression. The same effect was shown with a task-oriented coping style, which partially mediated (but did not moderate) the effect of exposure to post-migration traumatic events on PTSD symptoms. However, social support moderated the effect of post-migration living difficulties on symptoms of depression, whereas use of emotion-oriented coping strategies moderated the effect of exposure to pre-migration traumatic events on symptoms of PTSD and depression.

Our finding that the duration of stay in the refugee camp exacerbated symptoms is consistent with previous findings in Australia[42] where prolonged detention and temporary protection of

refugees contributed substantially to the risk of PTSD, depression and other mental health-related disabilities. The likely explanation for the exacerbating effect of longer duration of stay for worsening symptoms of PTSD symptoms in the present study is that the longer refugees stay in the camp, the greater the chance to be exposed to different post-migration traumas and abuses. Meager support, limited employment opportunities and resources and being in this situation for a prolonged period are also other stressors that could lead them to experience some form of psychological symptoms. As refugees stay longer in the camp, their chance of leaving the camp might decrease overtime, resulting in a sense of hopelessness that exacerbated their psychological symptoms.

The finding of increased use of emotion-oriented and task-oriented coping styles with increased exposure to pre-migration and post-migration living difficulties, respectively, is in line with previous findings of Tibetan refugees in India.[5] The indirect (mediated) effect of pre-migration living difficulties on depression and PTSD symptoms via the path of post-migration living difficulties seen in the present study has theoretical support in the literature.[1,17] The association between pre-migration living difficulties and PTSD was mediated by post-migration living difficulties among Zimbabwean refugees in South Africa.[1] A recent study has also reported that post-migration stressors accounted for greater variance in the level of depression and anxiety compared to experiences of trauma and loss.[17] This indicates that being exposed to pre-migration trauma alone is not the sole factor affecting the mental wellbeing of refugees, but post-migration living circumstances are also likely to play an intervening (mediating) role. The mediating role of post-migration living difficulties in the present study can be best explained by the continuous exposure of Eritrean refugees to stressful conditions of the camp life in Ethiopia, like poverty

and economic dependency, poor and overcrowded housing. These experiences are likely to worsen the effect of exposure to traumatic events in their home country before migration.

The association between sense of coherence and reduced symptoms of PTSD and depression in this study is in line with reports from other studies that describe an inverse association between sense of coherence and psychological distress in many cultural contexts.[3, 14-15,37] On the other hand, sense of coherence mediated the association between traumatic events and psychological symptoms in this study which is again in agreement with previous findings.[3-4] However, its moderating role between exposure to trauma and psychological symptoms reported in other studies[7] was not found in this study.

The moderating role of social support seen in this study is in line with evidence of previous studies.[10] However, this is unlike the recent report which indicated that perceived social support had a moderating effect of exposure to trauma on symptoms of PTSD among Eritrean and Sudanese asylum seekers in Israel.[10] The current findings showed that social support moderated the effect of exposure to post-migration trauma on symptoms of depression. The absence of a mediating role of social support between exposure to trauma and symptoms of PTSD and depression is in agreement with findings from a study conducted in African Americans aged between 18 and 54 in the National Co-morbidity Study, which reported that social support did not mediate the effects of financial strain or traumatic events on psychological symptoms.[43]

A task-oriented coping style mediated the relationship between exposure to post-migration trauma and symptoms of PTSD in this study, which signifies the importance of this coping strategy for Eritrean refugees. This finding is also consistent with findings in Tibetan refugees in

India.[5] However, use of a task-oriented coping style did not have the moderating effect of exposure to trauma on psychological health indicated in previous studies, including the findings from displaced Ethiopians from Eritrea who were living in temporary shelters in Ethiopia.[18] An avoidance-oriented coping style was not found to be associated with lower symptoms in this studies, in contrast to findings from previous studies from Ethiopian[18] and Congolese sample,[8] where an avoidance-coping strategy was found to be beneficial. The likely explanation for this is the composition of the refugee participants: most were literate, with an urban-orientation.

The strong association between depression and PTSD symptoms supported what was reported in the Zimbabwean sample.[1] However, since our finding was based on a cross-sectional study, it is noteworthy regarding the direction of causality because of the possibility that elevated symptoms of depression might have been driven by heightened symptoms of PTSD or vice-versa. The inverse association between the interaction term (i.e. emotion-oriented coping style and task-oriented coping style) and reduced symptoms of depression for both sexes seen in the present study has supported one of our hypotheses, and this finding is in line with the report from the Democratic Republic of Congo.[8]

Our findings that PTSD symptoms are differentially associated with post-migration trauma in females, not in males, may imply the ongoing gender-based vulnerability of female refugees to post-migration abuses in the refugee camps, which are also reported in previous studies conducted in refugee camps in Ethiopia.[44-45] Particularly, gender based physical violence was reported in a previous study from Eritrean refugee population living in Shimelba, one of the biggest refugee camps in Northern Ethiopia.[44] Another study in Somali female refugees reported

that they were vulnerable to rape during transit and abduction in the refugee camp in South Eastern Ethiopia.[45] The pre/post-migration living difficulties in this study should be understood with caution because Eritrean refugees traveled only a short distance to cross the border to a neighboring country that has a similar culture. The essence of pre/post migration living difficulties described in the literature denotes something different for refugees who had traveled long distances and those who had entirely different culture in comparison with the culture of the host country.

The association between emotion-oriented coping style and reduced symptoms of PTSD, when it interacted with the threat for life sub-scale of pre-migration difficulties may imply that this coping style has a potential benefit for those persons who encountered life threatening trauma. This coping strategy may help to release traumatic memories, thereby reducing PTSD symptoms. The moderating effect of emotion-oriented coping strategy for pre-migration abuse (sexual and physical) in reducing symptoms (PTSD and depression) implies its potential use for refugees who had experienced abuse in Eritrea to deal with symptoms of both conditions. The protective role of this coping style was also reported by previous studies in other African humanitarian settings.[8,18]

Implications of the findings

The differential association between PTSD symptoms and post-migration living difficulties for females, unlike males, may necessitate intervention for ongoing post-migration traumatic abuses uniquely for female refugees. This finding also informs national and international policy makers for special protection of women refugees from violation of their human rights.

The current finding that duration of stay in camp mediated the effect of pre-migration trauma on PTSD calls for accelerated resettlement, repatriation or integration of Eritrean refugees within the host society. Enhancement of social support for the refugees also seems important, because this study has shown that it has a fairly strong positive association with increased sense of coherence, which in turn is associated with decreasing symptoms of PTD and depression. Future studies should focus on longitudinal study designs to replicate the present findings from Eritrean samples in humanitarian settings.

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Data availability and sharing: All necessary data to understand in manuscript (MS) is included in tables or text within the MS. The row data in SPSS format will be deposited in the Department of Psychiatry, Addis Ababa University (AAU), and can be accessed in accordance with data sharing policy of Institutional Review Board (IRB) of College of Health Sciences, AAU.

Authors' contributions: BG is the Principal Investigator (PI) of this study. He led in generating the research idea, design and methods of the study, writing the research protocol, validating measures, data collection, analysis, interpretation and writing of the findings. AA has made contribution in revising the research protocol, the research design, validation of measures, analysis

and interpretation of data, and critically reviewing the final manuscript. GM made contribution in checking and editing the statistical analysis and critically reviewing of the drafted manuscript. All the authors approved the final version.

Ethical Considerations: This study had ethical clearance from Institutional Ethical Review Board (IRB) of College of Health Sciences, Addis Ababa University. Participants were provided with information sheet about the study regarding its objective, relevance, beneficence, risk, participant's rights and others. Then, a written consent from each participant was obtained before engaging him/her to participate. Ethical issues as outlined by declaration of Helsinki for human participants in medical research were adhered.

Competing interests: Authors declare that there is no conflict of interest.

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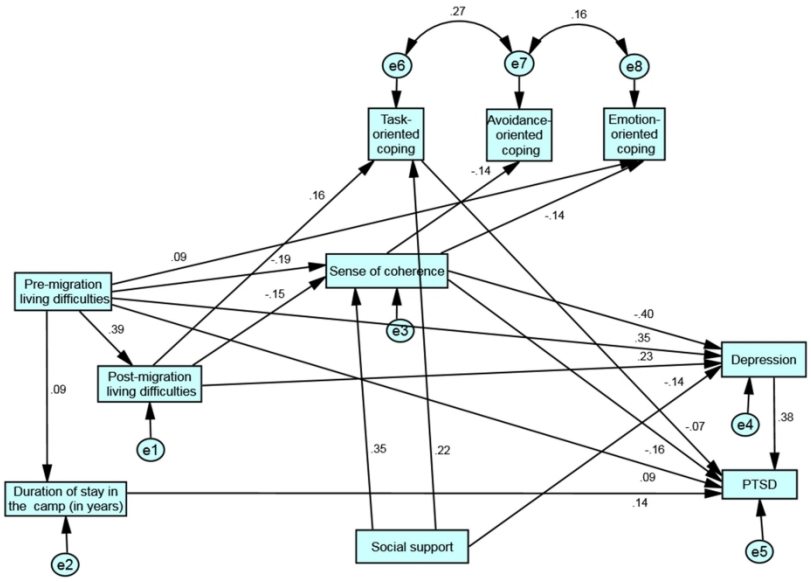
Caption

Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.

Legend to Figure-1

All paths are depicting standardized significant coefficients. Rectangles represent observed variables; circles represent disturbance (error terms); one sided arrows together with coefficient values are equivalent to regression beta weights between the two variables connected by these arrows; double headed arrows represent co-variances between error terms.

Figure-1: Path model depicting direct and indirect (mediated) association between exposure to trauma and mental health outcomes.



Legend: All paths are depicting standardized significant coefficients. Rectangles represent observed variables, circles represent disturbance (error) terms; one sided arrows together with coefficient values are equivalent to regression beta weights between the two variables; double headed arrows represent co-variances between error terms.

279x238mm (300 x 300 DPI)

Symptoms of Post Traumatic Stress Disorder and Depression among Eritrean refugees in Ethiopia: Identifying Direct, Meditating and Moderating Predictors from Path Analysis

(FOR REVISED MANUSCRIPT: Manuscript ID bmjopen-2017-021142.R1**)**

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

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2,3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-6
Objectives	3	State specific objectives, including any pre-specified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-14
Bias	9	Describe any efforts to address potential sources of bias	3,8,14
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	14
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	14

		(*b*) Describe any methods used to examine subgroups and interactions	14, 21,26
		(*c*) Explain how missing data were addressed	7,8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7,8
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	NA
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8,14-15
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	NA
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	14,17
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	20-22
Discussion			
Key results	18	Summarise key results with reference to study objectives	22-27
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	3, 22-27
Generalisability	21	Discuss the generalisability (external validity) of the study results	26-27
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	27

NA-Not Applicable

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

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