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Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

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Abstract:

Objectives: To estimate the prevalence of, and associations between anxiety, depression, PTSD, low subjective wellbeing (SWB), potential traumas and post-migration stress among refugees from Syria resettled in Sweden.

Design: A cross-sectional and population-based questionnaire study based on a known and complete sample frame. The survey included multiple measures of mental ill health and factors of particular relevance for refugees. Weighted analyses were conducted to calculate representative prevalence rates and associations, all supplemented with robust 95% confidence intervals (95% CI).

Setting: Sweden

Participants: A random sample of 1215 individuals from Syria aged 18 to 64 that were granted residency in Sweden on grounds of asylum between 2011 and 2013**.**

Main outcome measures: Anxiety, depression, PTSD and low SWB were assessed through Hopkins Symptom Checklist, Harvard Trauma Questionnaire and WHO-5 wellbeing index, using established cut-offs.

Results: A majority of the participants met the criteria for at least one of the studied types of mental ill health, and the comorbidity was high. Depression was the most the common type 40.2 % (95% CI 36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Refugee related potentially traumatic events (PTEs) experienced before or during migration was common as was substantial levels of post-migration stress. Most types of refugee related PTEs, especially being exposed to interpersonal violence, and post-migration stress were associated with increased risks for anxiety, depression, low SWB and PTSD.

Conclusions: Mental ill health, in terms of anxiety, depression, low SWB and PTSD, are highly elevated and comorbid among refugees from Syria. Increased attention from multiple societal sectors to adequately support Syrian refugees' mental health needs, promoting recovery and reducing post-migration stress are needed.

Strengths and limitations of this study

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country

The non-response rate is substantial, but the availability of register-based information for all eligible study participants enabled construction of non-response weights to obtain reliable estimates.

The robustness of the study findings are supported by a series of sensitivity analyses.

Several measures were taken, such as a double-blind translation and back-translation procedure and cognitive interviewing, to ensure that the questionnaire was appropriate and valid for the target population.

The analyses are based on cross-sectional data, which typically make causal claims hazardous.

Introduction

The war in Syria has since it started in 2011 been responsible for almost half a million deaths[1]. Additionally, more than 11 million individuals have been forced to leave their homes and of these around one million have reached Europe[2]. Sweden has received more than 100 000 asylum seekers from Syria since 2011[2], making Sweden the second largest European recipient of refugees from Syria. However, reliable prevalence rates of mental ill health and stressful or traumatizing experiences in this refugee population is still lacking.

The estimated prevalence of post-traumatic stress disorder (PTSD), anxiety disorders and depression in refugee populations are known to vary extensively between studies and populations. In a review article including 29 studies on long term mental health among war affected refugees, Bogic et al reported prevalence rates ranging from 4.4 to 86% for PTSD, 2.3 to 80% for depression and 20.3 to 88% for anxiety[3]. The available studies, dealing with mental ill health in refugee populations, are generally based on fairly small convenience samples and socio-demographic distribution of the sample frames are usually unknown[3], making it difficult to evaluate the validity of the obtained estimates. Apart from methodological aspects, a plethora of circumstances including differences in pre-migration experiences, support and reception in the resettlement country, immigration laws, individual and socioeconomic resources add to the heterogeneity.

Research on trauma among refugees has revealed that traumatic events prior to migration are strongly associated with mental ill health[4]**.** This association is particularly strong in relation to PTSD, but anxiety and depression also tend to be more common among those who have experienced severe war related traumas[5]**.** The flight in itself may also be difficult and contain traumatic events[6], but potentially traumatizing events (PTEs) experienced during the flight are rarely accounted for when studying the mental health among refugee populations. Several types of post-migration stressful events have been identified as being especially common among migrant/refugee populations. The following have been shown to be associated with mental ill health: intergenerational and spousal conflicts[7 8], ethnic discrimination[9], harsh socio-economical living conditions[10-13], loss of status[11 14], institutional accommodation[15] poor language skills[10 13] and poor social support[11 13 14]. In this study we aim to estimate prevalence of anxiety, depression, PTSD, low subjective wellbeing (SWB), potentially traumatic events (PTEs) and post-migration stress and explore mental ill health comorbidity among recently resettled refugees from Syria in Sweden. The second aim is to explore the associations between PTEs and post-migration stress in relation to the four studied mental ill health measures among recently resettled refugees from Syria.

Methods

In 2016 a postal questionnaire in Arabic was distributed to a random sample of 4000 individuals from Syria aged 18 to 64 who were granted permanent residency in Sweden on grounds of asylum between 2011 and 2013. The sampling frame was the Total Population Register (TPR) maintained by the government agency Statistics Sweden, containing addresses as well as data on vital status including birth- and death year, birth country, educational level and marital status. TPR is a nationwide register covering all individuals with permanent residency. Information on grounds for residency were obtained from the STATIV database, which is a database containing migration related information for individuals that have applied for residency.

The questionnaire included scales and items to measure mental ill health and factors hypothesized to be of particular relevance for refugees' mental health and socioeconomic

integration. In total, 1215 individuals participated in the study, amounting to a response rate of 30.4 %.

A standard double-blind translation and back-translation procedure was used unless adapted Arabic versions of specific parts of the questionnaire already were available. The entire questionnaire was, however, discussed with community experts throughout the translation and adaptation process. Revisions and amendments were done in consensus when such changes were deemed necessary.

Usability of the questionnaire was tested by cognitive interviews conducted in a rehabilitation center for war and torture trauma patients, with ten patients with Arabic as their mother tongue. The interviewees were instructed to read the questions out loud and to follow a Think-Aloud Protocol (TAP). TAP is a method designed to provide information about difficulties that may arise due to problems with comprehension, memory retrieval, judgement and response formatting[16]. Upon any indication of such difficulties, the target item was further scrutinized by the research group, language and community experts, and by examining the psychometrics profile of the item from data compiled from a small pilot study and was modified if needed.

Sociodemographic factors

All sociodemographic data used in this study were retrieved from Statistics Sweden's nationwide database *TRB*. Age was categorized into the following four age-groups: 18–29, 30–39, 40–49, 50–64; educational level was categorized as: 0- 9 years, >9 years without a university degree, > 12 years with a university degree; marital status was categorized as: married, unmarried and divorced/widow/widower; year of immigration was categorized as ≥ 2011 (i.e., 5 years or more since immigration), 2012, 2013. This information, except marital status, were also obtained for the non-respondents for the purpose of constructing non-response weights.

Refugee related potentially traumatic pre- and peri-migration events

To identify respondents that had been exposed to refugee related PTEs before arriving to Sweden, two (identical) checklists were developed to cover the pre- and peri-migration periods separately. The checklists aim to measure PTEs related to the refugee experience in a non-intrusive manner, while simultaneously trying to encapsulate the most common types of refugee related PTEs that have been reported in the scientific literature. In the present study the two checklists have been combined. An assessment is thus made of whether the respondents have been exposed to the following eight types refugee related PTEs before arriving to Sweden: *War at close quarters, Forced separation from family or close friends, Loss or disappearance of family member(s) or loved one(s), Physical violence or assault, Witnessing physical violence or assault, Torture, Sexual violence, Other frightening situations where you felt your life was in danger.*

Post-migration stress

We constructed seven domains of post-migration stress that encircled relevant and common experiences found when reviewing the literature or gathered from Red Cross patients. The seven single item questions used in this study are intended to tap into these separate domains,

i.e., item: *Felt disrespected due to national background (domain:* perceived discrimination*), Bothering difficulties communicating in Swedish (*lack of host country specific competencies*), Unable to buy necessities (*economic strain*), Missing social life from back home (*loss of home country*), Sad because not reunited with family members (*home country and family concerns*), Felt excluded or isolated in the Swedish society (*social strains*)* and *distressing conflicts in family (*family conflicts*).* The respondents were requested to indicate how frequently he or she had experienced these specific situations, on a five-point Likert scale ranging from "never" to "very often", since arriving to Sweden. Those responding "often" or "very often" were classified as having had these types of experiences *often* after resettlement in Sweden.

Mental ill health measures

Hopkins Symptom Checklist (HSCL-25), Harvard Trauma Questionnaire (HTQ) and WHO-5 Wellbeing Index (WHO-5) were employed to estimate different manifestations of mental ill health, i.e., anxiety, depression, PTSD and low SWB. All scales have frequently been used among refugees and in population-based surveys and been shown to possess sound psychometric properties among Arabic speakers[17 18].

HSCL-25 consists of 10 anxiety and 15 depression items. The items, which refer to how specific symptoms have bothered or distressed the individual during the last week, have four response alternatives ranging from "not at all" (1) to "very much" (4). Individual mean item scores were calculated separately for the anxiety and depression subscales. Respondents with a mean item score above 1.80 and 1.75 were classified as having depression or anxiety, respectively[19 20]. Cronbach alpha for the depression and the anxiety scales was 0.93 and 0.92, respectively.

In HTQ the first 16 symptoms from section IV were used to identify individuals with PTSD[19]. This part of HTQ has a similar structure as the HSCL-25, in that it uses the same response format, referring to the same time frame and mean item scores are calculated. In the present study we used the mean item score of 2.06 to distinguish cases of PTSD from non-cases[19]. Cronbach alpha was 0.92.

WHO-5 was used as a global measure of subjective wellbeing. WHO-5 contains five statements of the type "I have felt happy and in a good mood" and the response alternatives range from "all the time" (5) to "never" (0) in relation to the last two weeks. The highest possible value of that scale is 100, as the total score is multiplied by a factor of four. Those with values below 50 are classified as having low SWB[21]. Cronbach alpha was 0.94.

Statistical analysis

As the sample was not entirely representative with regards to socio-demographic factors, inverse probability (or non-response) weights were constructed using logistic regression. These weights were based on the main effects of gender, age-groups, educational level and year of immigration and the interaction effect between gender and age-groups**,** as this was the only two-way interaction that significantly predicted study participation ($p<0.05$) in univariate analyses. All presented analyses are based on weighed data unless otherwise stated. The following analyses were thereafter conducted.

First, the sociodemographic distribution of the sample, the sample frame and the weighted sample were calculated and presented in percentages.

Second, prevalence estimates for anxiety, depression, low SWB and PTSD were calculated for the total population and for sociodemographic sub-populations.

Third, proportions with mental ill health comorbidities and binominal correlations between the four used measures of mental ill health were estimated

Fourth, prevalence of refugee related PTEs, and post-migration stress were calculated. A series of logistic regression analyses were, thereafter, conducted to explore the association between these factors and the four studied measures of mental ill health. The PTEs analyses were adjusted for sociodemographic factors, while the associations between types of post-migration stress and mental ill health were adjusted for the eight PTEs, number of PTEs and number of PTEs squared.

Bootstrapping with 1000 re-samplings and Taylor linearized variance estimation[22] were used to obtain 95% confidence intervals (95% CI) for prevalence rates and odds ratios (ORs), respectively.

To explore potential bias from missing values a series of sensitivity analyses were conducted using Multiple imputation by chained equations (MICE)[23] in SPSS, an approach including a random component which is suitable when missing values are assumed to be missing at random (MAR).The applied MICE model included all categorical variables employed in the study as predictors.

To evaluate whether the cut-offs for mental ill health may have influenced the estimates, a second set of sensitivity analyses were conducted by re-running all regression analyses while specifying the outcomes as continuous variables. As the outcomes had a non-normal distribution a two-step approach was used to obtain more normally distributed variables[24].

In a final set of sensitivity tests all associations between post-migration stress and mental ill health were re-run where post-migration stressful experiences were defined more leniently (i.e., having experienced the specified situation *at least once* since immigrated to Sweden as opposed to having experienced it *often*).

All analyses were conducted with SPSS v. 24.0.

Participant involvement.

Before launching the study a reference group of Syrian refugees with expertise in mental health research, health care and/or Arabic language was set up. The group was consulted on cultural aspects of mental ill health, appropriate data collection methods and language issues. Their input informed the implementation of the study and the construction of the questionnaire. The reference group also assisted us in a social media campaign to explain the study's purpose to the target population and served as Arabic speaking contact persons for those invited to the survey. All results originating from the survey will be disseminated to the study participants through our webpage.

Results

Table 1 shows the distribution of sociodemographic characteristics among the survey participants and among the sample frame, together with the corresponding distribution after weighting for non-response. Table 1 also shows bivariate associations between the sociodemographic characteristics and non-response.

The non-response analysis revealed that younger, not married, less recently immigrated individuals and those with lower educational level were less likely to participate in the study. Women were on the other hand neither over- nor underrepresented. When applying the attrition weights to the sample, the sociodemographic distribution corresponded closely with that of the sample frame, with the expectation that married individuals still were slightly overrepresented.

Table 1. Non-response analysis and sociodemographic characteristics in percentage among respondents, the sample frame and the weighted sample

	Respondents (n=1215)	Sample frame (n=4 000)	Weighted data set	Respondents vs. non-respondents χ2 (p-values)	
Gender				0.4 (0.52)	
Men	62.8	63.5	63.5		
Women	37.2	36.5	36.5		
Age-groups				68.7 (< 0.01)	
18-29	23.3	30.8	30.7		
30-39	32.9	33.7	33.5		
40-49	24.3	21.0	21.0		
50-64	19.5	14.6	14.8		
Marital status				78.9 (< 0.01)	
Married	63.5	52.9	57.5		
Unmarried	31.8	40.8	38.0		
Divorced/widow/widower	4.8	6.4	4.6		
Level of educational				47.2 (< 0.01)	
0- 9 years	40.2	46.4	47.0		
> 9 years without a university degree	21.0	22.3	22.0		
> 12 years with a university degree	38.7	31.5	31.0		
Year of immigration*				34.0 (< 0.01)	
≥ 2011	6.5	10.1	10.3		
2012	27.5	29.5	29.3		
2013	66.0	60.4	60.4		

*This variable indicate the year the individual arrived to Sweden and should not be confused with year for being granted residency used as inclusion criteria.

Prevalence rates of mental ill health

It was estimated that 55.0 % (52.0-58.0) of recently resettled refugees from Syria have at least one of the studied type of mental ill health (Table 2). Depression was the most common type 40.2 % (95 % CI 36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Socio-demographically stratified analyses showed that mental ill health generally were more common among women, with the possible exception of PTSD. The stratified estimates further showed that those in the oldest age-category (i.e., 50-64 years) had elevated rates of mental ill health, in particularly with regard to PTSD. The prevalence rates of anxiety, depression and PTSD were similar across the three educational levels, while low SWB appeared to be more common among individuals with a higher level

of education. Finally it was shown that those who were divorced or had experienced the death of a spouse were more at risk for all the studied types of mental ill health.

Tabell 2. Prevalence of anxiety, depression, low SWB, PTSD or *any* in total and among subpopulations with 95% confidence intervals (95 % CI)*

	Anxiety % (95% CI)	Depression % (95% CI)	Low SWB % (95% CI)	PTSD % (95% CI)	Any** % (95% CI)
Total (weighted)	31.8 (29.2-34.7)	40.2 (36.9-43.3)	37.7 (34.8-40.1)	29.9 (27.2-32.6)	55.0 (52.0-58.0)
Total (unweighted)	31.6 (29.1-34.3)	40.6 (37.8-43.2)	38.3 (35.6-41.2)	30.6 (28.0-33.4)	55.6 (52.7-58.5)
Gender					
Men	27.7 (24.2-31.1)	37.9 (34.1-41.7)	33.1 (31.4-38.9)	29.0 (25.5-32.9)	51.3 (47.1-55.0)
Women	38.8 (34.1-43.7)	44.1 (39.6-48.8)	42.2 (37.0-47.1)	31.3 (26.8-35.7)	61.3 (56.6-66.0)
Age-groups					
18-29	31.5 (25.9-37.4)	38.3 (32.6-44.4)	36.4 (30.6-42.7)	25.6 (20.2-30.9)	54.2 (48.0-60.1)
30-39	26.2 (21.8-30.8)	36.2 (31.4-41.2)	37.0 (32.2-41.9)	27.2 (22.6-31.9)	50.3 (45.0-55.5)
40-49	34.2 (28.1-40.1)	41.5 (36.0-47.0)	35.7 (30.0-41.7)	30.2 (24.9-35.9)	55.7 (50.1-61.6)
50-64	41.9 (35.4-48.8)	51.1 (44.5-63.8)	45.2 (38.1-51.9)	44.7 (37.8-51.3)	65.9 (59.5-72.6)
Level of education					
0- 9 years	33.5 (29.2-38.0)	38.9 (34.5-43.5)	34.3 (29.5-38.8)	30.6 (26.5-35.3)	54.2 (49.2-59.1)
>9 years without a university degree	29.8 (24.0-36.2)	41.7 (35.2-47.5)	35.8 (29.3-42.3)	30.8 (24.8-81.2)	53.4 (47.5-60.6)
> 12 years with a university degree	30.6 (26.3-35.1)	40.9 (36.4-45.9)	44.2 (39.3-48.9)-	28.1 (24.1-32.5)	56.8 (52.1-61.5)
Marital status					
Married	30.9 (27.4-34.0)	37.9 (34.4-41.6)	35.9 (32.3-39.5)	27.3 (24.1-30.7)	52.9 (49.2-56.6)
Unmarried	30.9 (26.2-35.9)	41.6 (36.5-46.8)	39.0 (33.4-44.3)	31.3 (26.7-36.3)	55.9 (50.5-61.2)
Divorced/widow/widower	51.8 (38.0-66.1)	56.5 (41.9-69.5)	50.0 (36.1-62.3)	51.5 (37.9-65.1)	72.8 (60.9-84.8)

*All prevalence rates among subpopulations are weighted. 95 % CI are calculated based on robust standard errors.
** Anxiety, depression, low SWB or PTSD

Mental ill health comorbidity and binominal correlations

The mental ill health comorbidity was substantial among the respondents (Table 3). The different measures of mental ill health overlap and correlate strongly. Some variations indicate that the measures captures partly different facets of mental ill health. The strongest correlations and comorbidities are found between depression and anxiety and between PTSD and depression, while the weakest relationship is found between low SWB and anxiety.

Tabell 3. Proportions with different concurrent mental ill health comorbidities with 95% confidence intervals (CI 95 %) and binominal correlations (ϕ)*

	Concurrent anxiety % (95% CI)	Concurrent depression % (95% CI)	Concurrent low SWB % (95% CI)	Concurrent PTSD % (95% CI)
Anxiety	100	86.6 (83.1-90.0)	68.7 (63.9-73.5)	67.3 (62.4-72.2)
Depression	70.0 (65.9-74.2)	100	71.0 (66.9-76.3)	68.0 (62.4-80.8)
Low SWB	58.2 (53.5-62.8)	75.4 (71.4-79.4)	100	61.3 (56.6-65.9)
PTSD	73.0 (68.3-77.8)	90.0 (86.8-93.1)	77.5 (73.1-81.9)	100
Binominal correlations				
	Anxiety ϕ	Depression ϕ	Low SWB ϕ	PTSD ϕ
Anxiety	1			
Depression	0.66	1		
Low SWB	0.44	0.56	1	
PTSD	0.57	0.67	0.52	1

*All analyses are weighted and 95% CI are calculated based on robust standard errors.

Refugee related potentially traumatic pre- and peri-migratory events and their associations with mental ill health

Table 4 shows that potentially traumatic events experienced before or during migration were very common among the resettled refugees from Syria. A total of 85 % report experiencing war at close quarters and 79 % reported being exposed to other frightening (life-threatening) situations. The majority also reported forced separation from family or close friends (67.9 %), and loss of a significant other (64 %). A large proportion had witnessed violence or assault (63 %), a third report having experienced physical violence or assault, and a similar proportion reported that they had been subjected to torture (31.0 %). Seven percent report being subject to sexual violence. On average the refugees from Syria reported that they had experienced 4.2 (4.1-4.3) of the 8 studied types of PTEs before or during the migration. When calculating these means separately for the pre- and the peri-migration periods they were 4.0 (3.9-4.1) and 2.1 (2.0-2.2), respectively.

The results presented in table 4 further show that all types of investigated refugee related PTEs were significantly ($p<0.05$) associated with all studied types of mental ill health (adjusted for sociodemographic factors). Overall these adjusted associations appeared to be strongest in relation to PTSD and weakest in relation to low SWB. Being exposed to the different types of PTEs predicted anxiety and depression similarly, with the possible exception of sexual violence that appeared to be a stronger predictor of anxiety. It is, however, important to interpret differences with some caution given that the confidence intervals are rather wide and overlapping.

Table 4. Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD presented as odds rations (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
War at close quarters	86.9 (1036)	85.1 (82.9-87.5)	1.56 (1.01-2.42)	1.86 (1.23-2.80)	1.98 (1.49-2.65)	2.22 (1.38-3.57)
Forced separation from family or close friends	69.4 (817)	67.9 (65.2-70.9)	2.33 (1.77-3.21)	2.41 (2.80-3.23)	1.55 (1.18-2.04)	1.98 (1.46-2.65)
Loss or disappearance of family member(s) or loved one(s)	64.3 (756)	64.3 (61.3-67.3)	2.11 (1.57-2.82)	1.92 (1.46-2.52)	2.01 (1.50-2.70)	1.55 (1.18-2.04)
Physical violence or assault	30.5 (351)	30.9 (28.1-33.5)	3.47 (2.53-4.76)	3.39 (2.52-4.54)	2.01 (1.50-2.70)	2.01 (1.50-2.70)
Witnessing physical violence or assault	63.3 (740)	63.1 (60.0-66.1)	2.41 (1.79-3.24)	2.53 (1.91-3.35)	2.04 (1.54-2.70)	2.04 (1.54-2.05)
Torture	30.6 (354)	31.0 (28.3-33.9)	2.91 (2.5-3.26)	2.14 (1.61-2.84)	1.64 (1.24-2.19)	1.64 (1.24-2.19)
Sexual violence	6.9 (78)	7.1 (5.5-8.6)	3.36 (1.94-5.83)	2.67 (1.61-4.44)	2.02 (1.20-3.38)	2.02 (1.20-3.38)
Other frightening situation where you felt your life was in danger	80.6 (954)	79.4 (76.9-81.7)	2.90 (1.91-4.39)	3.31 (2.28-4.80)	3.38 (2.33-4.90)	3.38 (2.33-4.90)

* All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are not exposed to the respective refugee related PTEs. 95% CI are based on robust standard errors.

Post-migration stressful experiences and their associations with mental ill health

In table 5 it is shown to what extent the respondents report repeated post-migration stressful experiences and how these are associated with mental ill health, when adjusting for sociodemographic factors and pre- and/or peri-migratory PTEs. Of the investigated types of post-migration stress "often missing social life from back home" and "often feeling sad because not reunited with family members" were the most common and experienced by a majority. Around 20% of the respondents reported that they often had felt excluded or isolated in Sweden, while less than 10 % indicated that they often had experienced ethnic discrimination, extreme poverty or distressing family conflicts after resettlement in Sweden.

All the seven post-migratory stressful experiences were significantly associated with anxiety, depression, low SWB and PTSD, with the exception of *often sad due to not being reunited with family members* that was not significantly associated with anxiety (Table 5). *Often felt disrespected due to one's national background* seemed to be the type of post-migration stressful experience that predicted mental ill health most strongly, while *often felt sad because not reunited with family members* generally exhibited the weakest association with mental ill health. Even though interpretations should be made with cautions, as the confidence intervals in most cases are highly overlapping, the result indicates that post-migration stress is stronger related to PTSD than it is to anxiety.

Table 5. Prevalence rates of post-migration stress and their associations with anxiety, depression, low SWB and PTSD presented as odds ratios (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
Often felt disrespected due to my national background	4.3 (52)	4.3 (3.1-5.5)	5.49 (2.79-10.81)	5.68 (2.83-11.41)	7.04 (3.35-14.78)	5.96 (2.97-11.94)
Often have had bothering difficulties communicating in Swedish	39.0 (469)	37.1 (34.5-39.9)	1.77 (1.30-2.40)	2.39 (1.78-3.19)	2.36 (1.77-3.16)	2.77 (2.00-3.83)
Often been unable to buy necessities	8.5 (103)	8.5 (6.9 -10.2)	3.46 (2.14-5.60)	3.46 (2.14-5.60)	3.21 (1.94-5.32)	4.31 (2.49-7.45)
Often missing my social life from back home	64.1 (773)	62.3 (59.6-65.2)	2.00 (1.46-2.81)	2.37 (1.74-3.23)	2.43 (1.78-3.31)	2.90 (1.97-4.27)
Often felt sad because not reunited with family members	49.8 (581)	50.2 (46.9-53.5)	1.26 (0.93-1.71)	1.41 (1.06-1.86)	1.40 (1.06-1.85)	1.49 (1.08-2.05)
Often felt excluded or isolated in the Swedish society	19.6 (235)	19.8 (17.4-22.2)	2.42 (1.70-3.46)	3.40 (2.39.4.83)	2.89 (2.05-4.08)	3.29 (2.27-4.78)
Often distressing conflicts in family	6.0 (72)	6.0 (4.5-7.5)	2.51 (1.29-4.92)	4.87 (2.25-10.53)	4.64 (2.32-9.29)	5.16 (2.56-10.40)

*All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. 95% CI are calculated based on robust standard errors

Sensitivity analyses

The sensitivity analyses showed result similar to the main analysis (Supplementary material 1-6). The prevalence rates were approximately the same in the multiple imputed datasets (Supplementary material 1) and associations that were significant ($p<0.05$) or non-significant in the main analyses remained so in almost all the sensitivity analyses (Supplementary material 2-6). One exception was that *felt sad because not reunited with family members* was no longer a significant predictor of any mental ill health measures when operationalized more leniently.

Discussion

This study, one of the first of its kind, indicate that refugees from Syria that resettled in Sweden following the war that started in 2011 have prevalence rates of anxiety, depression, low subjective wellbeing and PTSD that range between 30 and 40%. A majority reported symptoms in line with at least one of these four types of mental ill health, and many fulfilled multiple criteria. Mental ill health was generally more common among women, older and the divorced or widowed refugees. The study further showed that refugee related potentially traumatic events and post-migration stress were common. For example, 30 % reported they had experienced torture, while 50 % often had been sad because not being reunited with family members. Finally, it was revealed that practically all investigated types of refugee related PTEs and post-migration stress were significantly associated with anxiety, depression, low SWB and PTSD.

The prevalence rates in this study are in line with many others obtained from previous larger studies on refugees [3 25 26]. Any comparison should, however, be done with caution given that the contexts, methodological aspects and the inclusion criteria usually vary extensively between studies. Nonetheless, some previous findings are more reasonable to contrast with our reported prevalence estimates. A smaller Swedish study among Iraqi asylum seekers aged 18-48 years in which the prevalence of PTSD was estimated to 38% is one of those[27], while Laban et al's study among Iraqi asylum seekers in the Netherlands, where the prevalence of anxiety syndrome was estimated to 22%, depression to 34% and PTSD to 36%, is another such example[28]. These more comparable prevalence estimates are thus similar with those reported here among recent refugees from Syria resettled in Sweden.

That mental ill health is more common among women, older and divorced/widowed refugees are consistent with other research[3 13 26]. However, the finding that mental ill health does not appeared to differ by educational level may seem surprising, but this has also been observed previously among refugees in Sweden[13]. Studies investigating this association among refugees have reported contradictory findings[15 26], which is likely to be attributable (at least partially) to differences between refugee populations and the post-migration conditions.

All eight, deliberately broad, categories of pre- and peri-migratory refugee related PTEs were related to mental ill health. This clearly demonstrates that many types of war related PTEs are associated with different manifestations of mental ill health. Still, it was revealed that the refugee related PTEs were stronger predictors for PTSD than for low SWB. Overall, and in line with previous findings, being exposed to interpersonal violence were the refugee related PTEs with the strongest association to mental ill health[29].

A somewhat puzzling exception is that torture appears to have the weakest association with low SWB among the studied PTEs. This may be because individuals tend to value their current life as less negative, all else being equal, when having experienced harsh former living conditions [30]. The reported associations between refugee related PTEs' and mental ill health are most likely causal in nature, as it seems unreasonable to propose that individuals with mental ill health would be more at risk for refugee related PTEs. Neither does previous research support that under-reporting of PTEs are more common among refugees without mental ill health. It is, if something, more likely that individuals with mental ill health are more prone to under-report PTEs[31], which would suggest that the associations presented

between refugee related PTEs and mental ill health rather are underestimated than overestimated.

The study further showed that all included types of post-migration stress were significantly associated with mental ill health, when adjusting for refugee related PTEs. It should nonetheless be noted that *feeling sad because not reunited with family members'* association with mental ill health was not substantiated in some of the sensitivity analyses. Most of these findings have been found in previous research among other refugee or migrant populations[12 13 32] and are thus in accordance with our expectations**.**

Post-migration stress and mental ill health are on the other hand likely to be reciprocally associated[10]. It has been reported that refugees with PTSD tend to have greater difficulties to learn the language spoken at the resettlement destination[33]**,** and that refugees with mental ill health tend to interpret adverse events as being more stressful, while simultaneously evaluating favorable life events as less positive[34]**.** Without onset information, it is possible that residual confounding may to some extent have distorted the associations between post-migration stress and mental ill health. Another potential source of residual confounding between specific post-migration stress and mental ill health comes from not adjusting for other types of post-migration stress, which was a deliberate choice in order to avoid over adjustment. What nonetheless can be concluded is that these associations not are confounded by refugee related PTEs nor a consequence of reverse causation, as refugee related PTEs pre date post-migration stress and are adjusted for.

Strength and limitations

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country. That the study is based on a random sample drawn from a known sample frame including all eligible participants is a major and unique strength. The availability of the register-based information for all eligible study participants enabled us to evaluate the representativeness of our sample. It also provided the opportunity to construct non-response weights for obtaining more reliable estimates even though the non-response rate is substantial.

All the same, the substantial non-response rate poses the single greatest limitation of the study. It has previously been indicated in a Swedish study that prevalence estimates of mental ill health are likely biased, in a downward direction, as a consequence of that mental ill health tend to be more common among non-respondents[35]. Whether this finding also is applicable for mental health surveys targeting refugees from Syria is not to known. However, the un-stratified weighted and unweighted prevalence rates of mental ill health were similar, and provided some support for that this type of selection bias may be negligible in this case.

The use of several different measures of mental ill health, all with high internal consistency, is also a strength. All employed measures of mental ill health have frequently been used and shown to exhibit good psychometric properties in diverse cultural settings[17-21]. The robustness of our results are supported by the fact that all of these outcomes when analyzed, dichotomized or continuous, often provided similar findings. That being said the cut-offs used in the present study have not yet been validated among refugees from Syria. The cut-offs used in the present study are based on validation studies among other war-tormented populations,

but further studies are needed to substantiate the appropriateness of employing them also in this context.

Another limitation of this study is the use of self-report data in the assessment of mental ill health. Although clinical interviews hold stronger validity, the possibility of conducting such interviews in large scale studies and among the hard to reach population of the refugees are inevitably constrained for logistic and practical reasons.

Cross-sectional studies are well suited for estimating prevalence, while making causal claims based on cross-sectional data should be done with extreme caution – if it is at all reasonable to make such claims. Caution when interpreting the current findings in terms of causality is thus warranted. We advocate, however, that PTEs can be accurately assessed retrospectively, and are likely to precede the mental ill health and thus possible to be studied using a cross-sectional design. To better understand associations between post-migration stress and mental ill health prospective studies are needed, which currently are rare among refugee populations.

Conclusion

Our study shows that prevalence of mental ill health, in terms of anxiety, depression, low subjective wellbeing and PTSD, is highly elevated and comorbid among refugees from Syria. Moreover, refugee related PTEs as well post-migration stress are associated to several different manifestations of mental ill health. Increased attention from multiple societal sectors to adequately support Syrian refugees' mental health needs, promote their recovery and reduce post-migration stress are needed. Also more prospective and population-based research are warranted to better understand the causal mechanisms involved.

Contributors: PT, FS conceptualized and designed the study and the empirical analyses. FS obtained the funding. PT, CA, AM collected the data. PT, AM, CA, ES and FS constructed and/or adapted the questionnaire. ES had a special responsibility with research issues dealing with potentially traumatic events, while AM had the same type of responsibility regarding post migration stress. PT conducted the statistical analyses with advice and support from AL and FS. PT drafted the initial version of the manuscript. All authors contributed in revising and editing the manuscript with substantial methodological and intellectual support and approved the manuscript as submitted. PT and FS are the guarantors of the study.

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Ethics approval: The study was approved by the Stockholm Regional Ethical Review Board (number: 2015/1463-1431 and 2016/549-32).

Data sharing statement: The statistical code is available from the corresponding author. Under Swedish law and ethical approval, individual level data of this kind cannot be publically available. Individual level data can be made available on reasonable request as long as it is in line with Swedish law and ethical approvals.

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Appendix: Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

Content:

Supplementary material 1: Prevalence of anxiety, depression, low SWB, PTSD and *any* in the total and among subpopulations based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set

	Anxiety % *, Dif **	Depression % *, Dif **	Low SWB % *, Dif **	PTSD % *, Dif **	Any % *, Dif **
Total (weighted)	32.4, 0.6	40.2, 0.0	37.8, 0.1	30.2, 0.3	53.6, 2.4
Total (unweighted)	32.2, 0.6	40.6, 0.0	38.4, 0.1	31.0, 0.4	54.2, 1.4
Gender					
Men	28.6, 1.1	38.0, 0.1	35.3, 2.3	29.6, 0.6	49.9, 1.4
Women	39.0, 0.2	44.0, 0.1	42.2, 0.0	31.4, 0.1	60.0, 1.3
Age-groups					
18-29	32.4, 1.1	38.3, 0.0	36.7, 0.3	25.7, 0.1	53.5, 0.7
30-39	26.2, 0.0	36.1, 0.1	36.9, 1.1	28.1, 0.9	48.9, 1.4
40-49	34.4, 0.2	41.6, 0.1	35.2, 0.5	29.6, 0.6	53.7, 2.0
50-64	43.3, 1.4	51.4, 0.3	45.9, 0.7	45.3, 0.6	64.5, 1.4
Level of education					
0- 9 years	34.1, 0.6	39.0, 0.1	34.4, 0.1	30.8, 0.2	52.8, 1.4
>9 years without a university degree	30.7, 0.9	41.7, 0.0	36.1, 0.3	31.5, 0.7	52.8, 0.6
> 12 years with a university degree	30.9, 0.3	40.9 0.0	44.2, 0.0	28.4, 0.3	55.4, 1.4
Marital status					
Married	31.4, 0.5	37.9, 0.0	35.9, 0.0	27.8, 0.5	51.4, 1.5
Unmarried	31.5, 0.6	41.8, 0.2	39.4, 0.4	31.5, 0.2	54.7, 1.2
Divorced/widow/widower	51.6, 0.2	55.2, 1.3	49.5, 0.5	50.2, 1.3	71.7, 1.1

*Pooled prevalence based on five multiple imputed datasets

** Difference between the pooled prevalence estimates based on the five imputed data sets and prevalence estimate prevalence estimate from analysis based on the original non-imputed data set.

Supplementary material 2: Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
War at close quarters	85.1, 0.0	1.50-1.61, 0.01, 0.047	1.78-1.88, 0.04, <0.01	1.85-2.05, 0.06 <0.01	2.09-3.33, 0.05, <0.01
Forced separation from family or close friends	67.9, 0.0	2.14-2.35, 0.11, <0.01	2.39-2.49,0.04, <0.01	1.51-1.61, 0-01, <0.01	1.84-2.05, 0.06, <0.01
Loss or disappearance of family member(s) or loved one(s)	64.6, 0.3	2.03-2.10, 0.06, <0.01	1.83-1.97, 0.03, <0.01	1.91-2.03, 0.03, <0.01	1.51-1.61, 0.01, <0.01
Physical violence or assault	31.5, 0.6	3.01-3.58, 0.08, <0.01	3.12-3.34, 0.13, <0.01	1.91-2.03, 0.03, <0.01	1.91-2.03, 0.03, <0.01
Witnessing physical violence or assault	63.2, 0.1	2.25-2.48, 0.07, <0.01	2.42-2.55, 0.03, <0.01	1.99-2.11, 0.02, <0.01	1.99-2.11, 0.03, <0.01
Torture	31.7, 0.7	2.82-2.12, 0.05, <0.01	2.15-2.28, 0.07, <0.01	1.64-1.75, 0.05, <0.01	1.64-1.75, 0.05, <0.01
Sexual violence	7.5, 0.4	2.62-3.64, 0.18, <0.01	2.44-2.77, 0.07, <0.01	1.90-2.24, 0.06, <0.01	1.90-2.24, 0.06, <0.01
Other frightening situation where you felt your life was in danger	79.3, 0.1	2.70-2.98, 0.05, <0.01	3.17-3.29, 0.01, <0.01	3.12-3.37, 0.02, <0.01	3.12-3.37, 0.02, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors.

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 3: Prevalence of different types of post-migration stress and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses on five multiple imputed datasets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
Often felt disrespected due to my national background	4.3, 0.0	4.98-5.46, 0.14, <0.01	5.67-6.18, 0.12, <0.01	4.28-5.00, 0.24, <0.01	4.23-4.65, 1.49, <0.01
Often have had bothering difficulties communicating in Swedish	37.1, 0.0	1.94-2.06, 0.26, <0.01	2.53-2.63, 0.19, <0.01	2.08-2.64, 0.11, <0.01	2.76-2.90,0.04, <0.01
Often been unable to buy necessities	8.5, 0.0	2.95-3.10, 0.43, <0.01	2.95-3.10, 0.43, <0.01	2.76-3.06, 0.29, <0.01	3.46-4.28, 0.53, <0.01
Often missing my social life from back home	62.4 0.1	2.09-2.19, 0.13, <0.01	2.55-2.64, 0.24, <0.01	1.42-2.50, 0.26, <0.01	2.85-3.07, 0.07, <0.01
Often felt sad because not reunited with family members	50.2, 0.0	1.23-1.33, 0.03, 0.08	1.41-1.49, 0.03, <0.01	1.40-1.46, 0.04, <0.01	1.34-1.47, 0.09, 0.03
Often felt excluded or isolated in the Swedish society	19.9, 0.1	2.63-2.85, 0.30, <0.01	3.82-4.04, 0.54, <0.01	2.94-3.13, 0.13, <0.01	3.08-3.37, 0.04, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. P-values are calculated based on robust standard errors

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 4: Associations between refugee related PTEs and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
War at close quarters	0.26, <0.01	0.30, <0.01	0.13, 0.14	0.44, <0.01
Forced separation from family or close friends	0.38, <0.01	0.49, <0.01	0.38, <0.01	0.52, <0.01
Loss or disappearance of family member(s) or loved one(s)	0.30, <0.01	0.34, <0.01	0.20,<0.01	0.45, <0.01
Physical violence or assault	0.61, <0.01	0.61, <0.01	0.40, <0.01	0.73, <0.01
Witnessing physical violence or assault	0.46, <0.01	0.47, <0.01	0.37, <0.01	0.65, <0.01
Torture	0.48, <0.01	0.46, <0.01	0.28, <0.01	0.58, <0.01
Sexual violence	0.53, <0.01	0.52, <0.01	0.37, 0.01	0.68, <0.01
Other frightening situation where you felt your life was in danger	0.54, <0.01	0.64, <0.01	0.57, <0.01	0.83, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors

Supplementary material 5: Associations between post-migration stress and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
Often felt disrespected due to my national background	0.72, <0.01	0.76, <0.01	0.70, <0.01	0.80, <0.01
Often have had bothering difficulties communicating in Swedish	0.28, <0.01	0.39, <0.01	0.41, <0.01	0.42, <0.01
Often been unable to buy necessities	0.64, <0.01	0.60, <0.01	0.55, <0.01	0.57, <0.01
Often missing social life from back home	0.23, <0.01	0.49, <0.01	0.43, <0.01	0.44, <0.01
Often felt sad because not reunited with family members	0.15, 0.02	0.21, <0.01	0.08, 0.20	0.13, 0.03
Often felt excluded or isolated in the Swedish society	0.42, <0.01	0.58, <0.01	0.52, <0.01	0.49, <0.01
Often distressing conflicts in my family	0.60, <0.01	0.84, <0.01	0.79, <0.01	0.63, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

Supplementary material 6: Associations between post-migration stress (using a lenient definition*) and anxiety, depression, low SWB and PTSD (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Anxiety OR (95% CI) **	Depression OR (95% CI) **	Low SWB OR (95% CI) **	PTSD OR (95% CI) **
Felt disrespected due to my national background	37.2 (448)	2.33 (1.70-3.18)	2.29 (1.70-3.07)	2.05 (1.54-2.74)	2.46 (1.76-3.44)
Have had bothering difficulties communicating in Swedish	82.1 (989)	1.50 (0.97-2.33)	1.64 (1.10-2.45)	1.98 (1.10-2.98)	2.57 (1.57-4.24)
Been unable to buy necessities	38.7 (467)	1.94 (1.43-2.63)	1.94 (1.43-2.63)	1.85 (1.39-2.46)	2.12 (1.54-2.92)
Missing social life from back home	93.6 (1128	3.71 (1.62-8.50)	2.72 (1.41-5.23)	1.34 (0.73-2.45)	9.28 (2.79-30.90)
Felt sad because not reunited with family members	84.6 (1004)	1.26 (0.82-1.94)	1.28 (0.86-1.91)	1.39 (0.94-2.06)	1.21 (0.76-1.95)
Felt excluded or isolated in the Swedish society	64.3 (770)	2.13 (1.52-3.00)	3.00 (1.84-4.12)	2.59 (1.89-3.55)	3.10 (2.13-4.54)
Distressing conflicts in my family	35.4 (428)	1.71 (1.26-2.32)	2.44 (1.83-3.25)	2.20 (1.65-2.93)	2.31 (1.68-3.17)

* Defined as having had the respective post-migratory stressful experiences *at least once* since immigrated to Sweden

**All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

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Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

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Abstract:

Objectives: To estimate the prevalence of, and associations between anxiety, depression, PTSD, low subjective wellbeing (SWB), potential traumas and post-migration stress among refugees from Syria resettled in Sweden.

Design: A cross-sectional and population-based questionnaire study based on a known and complete sample frame. The survey included multiple measures of mental ill health and factors of particular relevance for refugees. Weighted analyses were conducted to calculate representative prevalence rates and associations. Associations were investigated through a series of logistic regression analyses. All analyses were supplemented with robust 95% confidence intervals (95% CI).

Setting: Sweden

Participants: A random sample of 1215 individuals (response rate 30.4%) from Syria aged 18 to 64 that were granted residency in Sweden on grounds of asylum between 2011 and 2013**.**

Main outcome measures: Anxiety, depression, PTSD and low SWB were assessed through Hopkins Symptom Checklist, Harvard Trauma Questionnaire and WHO-5 wellbeing index, using established cut-offs.

Results: A majority of the participants met the criteria for at least one of the studied types of mental ill health, and the comorbidity was high. Depression was the most the common type 40.2 % (95% CI 36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Refugee related potentially traumatic events (PTEs) experienced before or during migration was common as was substantial levels of post-migration stress. Most types of refugee related PTEs, especially being exposed to interpersonal violence, and post-migration stress were associated with increased risks for anxiety, depression, low SWB and PTSD.

Conclusions: Mental ill health, in terms of anxiety, depression, low SWB and PTSD, are highly elevated and comorbid among refugees from Syria. Increased attention from multiple societal sectors to adequately support Syrian refugees' mental health needs, promoting recovery and reducing post-migration stress are needed.

Strengths and limitations of this study

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country

The non-response rate is substantial, but the availability of register-based information for all eligible study participants enabled construction of non-response weights to obtain reliable estimates.

The robustness of the study findings are supported by a series of sensitivity analyses.

Several measures were taken, such as a double-blind translation and back-translation procedure and cognitive interviewing, to ensure that the questionnaire was appropriate and valid for the target population.

The analyses are based on cross-sectional data, which typically make causal claims on the basis of temporality ambiguous variables problematic. .

Introduction

The war in Syria has since it started in 2011 been responsible for almost half a million deaths[1]. Additionally, more than 11 million individuals have been forced to leave their homes and of these around one million have reached Europe[2]. Sweden has received more than 100 000 asylum seekers from Syria since 2011[2], making Sweden the second largest European recipient of refugees from Syria. However, reliable prevalence rates of mental ill health and stressful or traumatizing experiences in this refugee population is still lacking. A clearer picture based on robust empirical data of the magnitude of mental ill health among Syrian refugees resettled in Europe, and to what extent they have been exposed to known risk factors are imperative to adequately address their mental health needs on a societal level.

The estimated prevalence of post-traumatic stress disorder (PTSD), anxiety disorders and depression in refugee populations are known to vary extensively between studies and populations. In a review article including 29 studies on long term mental health among war affected refugees, Bogic et al reported prevalence rates ranging from 4.4 to 86% for PTSD, 2.3 to 80% for depression and 20.3 to 88% for anxiety[3]. This type of heterogeneity has also been observed in Fazal et al's systematic review based on studies using psychiatric interviews to assess mental disorders among refugees resettled in western countries[4]. Such disparate rates are of course of little use for estimating how common mental ill health is among Syrian refugees in Europe today. They nonetheless illustrate the problem of regarding groups of refugees as homogenous populations. A plethora of circumstances including differences in pre-migration experiences, support and reception in the resettlement country and immigration laws make extrapolations from one refugee population to another hazardous. And even if such extrapolations in certain cases might appear reasonable, available studies are generally based on fairly small convenience samples and the socio-demographic distribution of the sample frames are usually unknown[3], making it difficult to evaluate the validity of the obtained estimates.

Often when studying refugees' mental ill health, a distinction is made between risk factors encountered before or after the migration[5]. Refugee-related, or war-related, potentially traumatic events (PTEs) are the type of pre-migratory risk factors that has been given most attention in the literature and many of them have also been shown to be strongly associated with mental ill health[6]. Associations of this kind have been observed in many refugee populations and at many different resettlement destinations - including Europe [7 8]**.** In particular experiences of interpersonal violence during the pre-migration phase has been linked to mental health problems[9]. Even though, these types of associations are usually stronger in relation to PTSD, they have commonly also been observed when employing anxiety and depression as outcomes measures [10 11]. What is however seldom taken into account when studying refugees' mental health, is the that the flight in itself may also be difficult and contain additional severe traumatic events[12].

During the post-migration phase refugees (as well as non-refugee migrants) may experience a host of different types of difficulties that can hamper recovery, increase mental ill health or be instrumental for the development of mental ill health[5]. These types of experiences are often referred to as post-migration stress and are typically of a more persistent character than PTEs that tend to be sudden and/or traumatic. Studies have indicated that post-migration experiences in many circumstances tend to be more detrimental to refugees' mental health than PTEs and that PTEs are associated with post-migration stress (see further e.g.,[5]) Several types of post-migration stressful experiences have been identified as being especially common among migrant/refugee populations. Of these have the following been shown to be associated with mental ill health: intergenerational and spousal conflicts[13 14], ethnic discrimination[15],

harsh socio-economical living conditions[16-19], loss of status[7 17], institutional accommodation[20], poor language skills[16 19], and poor social support[7 17 19].

In this study we aim to estimate prevalence of anxiety, depression, PTSD, low subjective wellbeing (SWB), different refugee-related PTEs and different post-migration stressful experiences and explore mental ill health comorbidity among recently resettled refugees from Syria in Sweden. Furthermore our aim is to investigate if different types of refugee-related PTEs and different types post-migration stressful experiences are associated with mental ill health among recently resettled refugees from Syria, as findings from other contexts would indicate.

Methods

Participants

The study population consist of a random sample of 1215 individuals from Syria aged 18 to 64 who were granted permanent residency in Sweden on grounds of asylum between 2011 and 2013. The sampling frame was the Total Population Register (TPR) maintained by the government agency Statistics Sweden, containing addresses as well as data on vital status including birth- and death year, birth country, educational level and marital status. TPR is a nationwide register covering all individuals with permanent residency. Information on grounds for residency were obtained from the STATIV database, which is a database containing migration related information for individuals that have applied for residency.

Procedure

Before launching the study a reference group of Syrian refugees with expertise in mental health research, health care and/or Arabic language was set up. The group was consulted on cultural aspects of mental ill health, appropriate data collection methods and language issues. Their input informed the implementation of the study and the construction of the questionnaire. The reference group also assisted us in a social media campaign to explain the study's purpose to the target population and served as Arabic speaking contact persons for those invited to the survey.

In 2016 a postal questionnaire in Arabic was distributed to a random sample of 4000 refugees from Syria meeting the inclusion criteria, of which 30.4 % (n=1215) chose to participate (the non-response analysis is presented in the results section). Given that the sample frame included 9 662 individuals, a minimum of 1000 respondents were deemed adequate, as the sample size then would consist of more than 10% of the individuals included in the total sample frame. The questionnaire included scales and items to measure mental ill health and factors hypothesized to be of particular relevance for refugees' mental health and socioeconomic integration.
A standard double-blind translation and back-translation procedure was used unless adapted Arabic versions of specific parts of the questionnaire already were available. The entire questionnaire was, however, discussed with community experts in focus groups and individually throughout the translation and adaptation process. Revisions and amendments were done in consensus when such changes were deemed necessary.

Usability of the questionnaire was tested by conducting interviews in a rehabilitation center for war and torture trauma patients, with ten patients with Arabic as their mother tongue. The

interviewees were instructed to read the questions out loud and to follow a Think-Aloud Protocol (TAP). TAP is a method designed to provide information about difficulties that may arise due to problems with comprehension, memory retrieval, judgement and response formatting[21]. Upon any indication of such difficulties, the target item was further scrutinized by the research group, language and community experts, and by examining the psychometrics profile of the item from data compiled from a small pilot study, and was thereafter modified if needed.

Measures

Sociodemographic factors

All sociodemographic data used in this study were retrieved from Statistics Sweden's nationwide database *TRB*. Age was categorized into the following four age-groups: 18–29, 30–39, 40–49, 50–64; educational level was categorized as: 0- 9 years, >9 years without a university degree, > 12 years with a university degree; marital status was categorized as: married, unmarried and divorced/widow/widower; year of immigration was categorized as ≥ 2011 (i.e., 5 years or more since immigration), 2012, 2013. This information, except marital status, were also obtained for the non-respondents for the purpose of constructing non-response weights.

Refugee related potentially traumatic pre- and peri-migration events

To identify respondents that had been exposed to refugee related PTEs before arriving to Sweden, two (identical) checklists were developed to cover the pre- and peri-migration periods separately[22] (the peri-migration period does in this context refer to the period between leaving the home in Syria and arriving to Sweden). The checklists aim to measure PTEs related to the refugee experience in a non-intrusive manner, while simultaneously trying to encapsulate the most common types of refugee related PTEs that have been reported in the scientific literature. In the present study the two checklists have been combined. An assessment is thus made of whether the respondents have been exposed to the following eight types refugee related PTEs before arriving to Sweden: *War at close quarters* (i.e., close proximity to war combat)*, Forced separation from family or close friends, Loss or disappearance of family member(s) or loved one(s), Physical violence or assault, Witnessing physical violence or assault, Torture, Sexual violence, Other frightening situations where you felt your life was in danger*.

Post-migration stress

We constructed seven domains of post-migration stress that encircled relevant and common experiences found when reviewing the literature or reported by Red Cross patients with refugee status. The seven single item questions used in this study are intended to tap into these separate domains, i.e., item: *Felt disrespected due to national background (domain:* perceived discrimination*), Bothering difficulties communicating in Swedish (*lack of host country specific competencies*), Unable to buy necessities (*economic strain*), Missing social life from back home (*loss of home country*), Sad because not reunited with family members (*home country and family concerns*), Felt excluded or isolated in the Swedish society (*social strains*)* and *distressing conflicts in family (*family conflicts*).* The respondents were requested to

indicate how frequently he or she had experienced these specific situations, on a five-point Likert scale ranging from “never” to “very often”, since arriving to Sweden. Those responding “often” or “very often” were classified as having had these types of experiences *often* after resettlement in Sweden.

Mental ill health measures

Hopkins Symptom Checklist (HSCL-25), Harvard Trauma Questionnaire (HTQ) and WHO-5 Wellbeing Index (WHO-5) were employed to estimate different manifestations of mental ill health, i.e., anxiety, depression, PTSD and low SWB. All scales have been frequently used among refugees and in population-based surveys, and have been shown to possess sound psychometric properties among Arabic speakers[23 24].

HSCL-25 consists of 10 anxiety and 15 depression items. The items, which refer to how specific symptoms have bothered or distressed the individual during the last week, have four response alternatives ranging from “not at all" (1) to "very much" (4). Individual mean item scores were calculated separately for the anxiety and depression subscales. Respondents with a mean item score above 1.80 and 1.75 were classified as having depression or anxiety, respectively[25 26]. Cronbach alpha for the depression and the anxiety scales was 0.93 and 0.92, respectively.

In HTQ the first 16 symptoms from section IV were used to identify individuals with PTSD[25]. This part of HTQ has a similar structure as the HSCL-25, in that it uses the same response format, referring to the same time frame and mean item scores are calculated. In the present study we used the mean item score of 2.06 to distinguish cases of PTSD from non-cases[25]. Cronbach alpha was 0.92.

WHO-5 was used as a global measure of subjective wellbeing. WHO-5 contains five statements of the type "I have felt happy and in a good mood" and the response alternatives range from "all the time" (5) to "never" (0) in relation to the last two weeks. The highest possible value of that scale is 100, as the total score is multiplied by a factor of four. Those with values below 50 are classified as having low SWB[27]. Cronbach alpha was 0.94.

Statistical analysis

As the sample was not entirely representative with regards to socio-demographic factors, inverse probability (or non-response) weights were constructed using logistic regression. These weights were based on the main effects of gender, age-groups, educational level and year of immigration and the interaction effect between gender and age-groups**,** as this was the only two-way interaction that significantly predicted study participation ($p<0.05$) in univariate analyses. All presented analyses are based on weighed data unless otherwise stated. The following analyses were thereafter conducted.

First, the sociodemographic distribution of the sample, the sample frame and the weighted sample were calculated and presented in percentages.

Second, prevalence estimates for anxiety, depression, low SWB and PTSD were calculated for the total population and for sociodemographic sub-populations.

Third, proportions with mental ill health comorbidities and binominal correlations between the four used measures of mental ill health were estimated.

Fourth, prevalence of refugee related PTEs, and post-migration stress were calculated. A series of logistic regression analyses were, thereafter, conducted to explore the association between these factors and the four studied measures of mental ill health. All these analyses were adjusted for sociodemographic factors. Further, associations between types of post-migration stress and mental ill health were adjusted for the eight refugee related PTEs, number of PTEs and number of PTEs squared. Post-migration stress factors were on the other hand not adjusted for when examining the associations between different refugee related PTEs and mental ill health, as post-migration stress in this context is likely a potential mediator rather than a confounder. Thus, adjustment of such variables would in these analyses probably result in bias due to over adjustment.

Bootstrapping with 1000 re-samplings and Taylor linearized variance estimation[28] were used to obtain 95% confidence intervals (95% CI) for prevalence rates and odds ratios (ORs), respectively.

To explore potential bias from missing values a series of sensitivity analyses were conducted using Multiple imputation by chained equations (MICE)[29] in SPSS, an approach including a random component which is suitable when missing values are assumed to be missing at random (MAR).The applied MICE model included all categorical variables employed in the study as predictors.

To evaluate whether the cut-offs for mental ill health may have influenced the estimates, a second set of sensitivity analyses were conducted by re-running all regression analyses while specifying the outcomes as continuous variables. As the outcomes had a non-normal distribution a two-step approach was used to obtain more normally distributed variables[30].

In a set of sensitivity tests, all associations between post-migration stress and mental ill health were re-run where post-migration stressful experiences were defined more leniently (i.e., having experienced the specified situation *at least once* since immigrated to Sweden as opposed to having experienced it *often*).

Finally, to examine the potential mediating role/function of post-migratory stressful experiences in the association between PTEs and mental ill health, mediation analyses were performed with number of included types of exposure for PTEs as exogenous, number of types of post-migratory stressful experiences as mediator, and mental ill health as endogenous outcomes.

All analyses were conducted with SPSS v. 24.0 except the mediation analyses that were performed in Mplus version 8.

Results

Table 1 shows the distribution of sociodemographic characteristics among the survey participants and among the sample frame, together with the corresponding distribution after weighting for non-response. Table 1 also shows bivariate associations between the sociodemographic characteristics and non-response.

The non-response analysis revealed that younger, not married, less recently immigrated individuals and those with lower educational level were less likely to participate in the study. Women were on the other hand neither over- nor underrepresented. When applying the attrition weights to the sample, the sociodemographic distribution corresponded closely with that of the sample frame, with the expectation that married individuals still were slightly overrepresented.

Table 1. Sociodemographic characteristics in percentage among respondents, the sample frame and the weighted sample, supplemented with non-response analysis

	Respondents (n=1215)	Sample frame (n=4 000)	Weighted data set	Respondents vs. non-respondents χ2 (p-values)	
Gender				0.4 (0.52)	
Men	62.8	63.5	63.5		
Women	37.2	36.5	36.5		
Age-groups				68.7 (< 0.01)	
18-29	23.3	30.8	30.7		
30-39	32.9	33.7	33.5		
40-49	24.3	21.0	21.0		
50-64	19.5	14.6	14.8		
Marital status				78.9 (< 0.01)	
Married	63.5	52.9	57.5		
Unmarried	31.8	40.8	38.0		
Divorced/widow/widower	4.8	6.4	4.6		
Level of educational				47.2 (< 0.01)	
0- 9 years	40.2	46.4	47.0		
> 9 years without a university degree	21.0	22.3	22.0		
> 12 years with a university degree	38.7	31.5	31.0		
Year of immigration*				34.0 (< 0.01)	
≤2011	6.5	10.1	10.3		
2012	27.5	29.5	29.3		
2013	66.0	60.4	60.4		

*This variable indicate the year the individual arrived to Sweden and should not be confused with year for being granted residency used as inclusion criteria.

Prevalence rates of mental ill health

Table 2 shows that it was estimated that 55.0 % (95 % CI 52.0-58.0) of recently resettled refugees from Syria have at least one of the studied type of mental ill health . Depression was the most common type 40.2 % (36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Socio-demographically stratified analyses showed that mental ill health generally were more common among women, with the possible exception of PTSD. The stratified estimates further showed that those in the oldest age-category (i.e., 50-64 years) had elevated rates of mental ill health, particularly with regard to PTSD. The prevalence rates of anxiety, depression and PTSD were similar across the three educational levels, while low SWB appeared to be more common among individuals with a

higher level of education. Finally it was shown that those who were divorced or had experienced the death of a spouse were more at risk for all the studied types of mental ill health. No difference in prevalence were detected when stratifying analyses by year of immigration, i.e., highly overlapping confidence intervals (data not shown)

Tabell 2. Prevalence of anxiety, depression, low SWB, PTSD or *any* in total and among subpopulations with 95% confidence intervals (95 % CI)*

	Anxiety % (95% CI)	Depression % (95% CI)	Low SWB % (95% CI)	PTSD % (95% CI)	Any** % (95% CI)
Total (weighted)	31.8 (29.2-34.7)	40.2 (36.9-43.3)	37.7 (34.8-40.1)	29.9 (27.2-32.6)	55.0 (52.0-58.0)
Total (unweighted)	31.6 (29.1-34.3)	40.6 (37.8-43.2)	38.3 (35.6-41.2)	30.6 (28.0-33.4)	55.6 (52.7-58.5)
Gender					
Men	27.7 (24.2-31.1)	37.9 (34.1-41.7)	33.1 (31.4-38.9)	29.0 (25.5-32.9)	51.3 (47.1-55.0)
Women	38.8 (34.1-43.7)	44.1 (39.6-48.8)	42.2 (37.0-47.1)	31.3 (26.8-35.7)	61.3 (56.6-66.0)
Age-groups					
18-29	31.5 (25.9-37.4)	38.3 (32.6-44.4)	36.4 (30.6-42.7)	25.6 (20.2-30.9)	54.2 (48.0-60.1)
30-39	26.2 (21.8-30.8)	36.2 (31.4-41.2)	37.0 (32.2-41.9)	27.2 (22.6-31.9)	50.3 (45.0-55.5)
40-49	34.2 (28.1-40.1)	41.5 (36.0-47.0)	35.7 (30.0-41.7)	30.2 (24.9-35.9)	55.7 (50.1-61.6)
50-64	41.9 (35.4-48.8)	51.1 (44.5-63.8)	45.2 (38.1-51.9)	44.7 (37.8-51.3)	65.9 (59.5-72.6)
Level of education					
0- 9 years	33.5 (29.2-38.0)	38.9 (34.5-43.5)	34.3 (29.5-38.8)	30.6 (26.5-35.3)	54.2 (49.2-59.1)
>9 years without a university degree	29.8 (24.0-36.2)	41.7 (35.2-47.5)	35.8 (29.3-42.3)	30.8 (24.8-81.2)	53.4 (47.5-60.6)
> 12 years with a university degree	30.6 (26.3-35.1)	40.9 (36.4-45.9)	44.2 (39.3-48.9)-	28.1 (24.1-32.5)	56.8 (52.1-61.5)
Marital status					
Married	30.9 (27.4-34.0)	37.9 (34.4-41.6)	35.9 (32.3-39.5)	27.3 (24.1-30.7)	52.9 (49.2-56.6)
Unmarried	30.9 (26.2-35.9)	41.6 (36.5-46.8)	39.0 (33.4-44.3)	31.3 (26.7-36.3)	55.9 (50.5-61.2)
Divorced/widow/widower	51.8 (38.0-66.1)	56.5 (41.9-69.5)	50.0 (36.1-62.3)	51.5 (37.9-65.1)	72.8 (60.9-84.8)

Anxiety n= 1185, Depression n= 1203, Low SWB n=1180, PTSD n=1153, Any n=1172
*All prevalence rates among subpopulations are weighted. 95 % CI are calculated based on robust standard errors.
** Anxiety, depression, low SWB or PTSD

Mental ill health comorbidity and binominal correlations

Table 3 shows that the mental ill health comorbidity was substantial among the respondents. The different measures of mental ill health overlap and correlate strongly. Some variations indicate that the measures capture partly different facets of mental ill health. The strongest correlations and comorbidities are found between depression and anxiety and between PTSD and depression, while the weakest relationship is found between low SWB and anxiety.

Tabell 3. Proportions with different concurrent mental ill health comorbidities with 95% confidence intervals (CI 95 %) and binominal correlations (ϕ)*

	Concurrent anxiety % (95% CI)	Concurrent depression % (95% CI)	Concurrent low SWB % (95% CI)	Concurrent PTSD % (95% CI)
Anxiety	100	86.6 (83.1-90.0)	68.7 (63.9-73.5)	67.3 (62.4-72.2)
Depression	70.0 (65.9-74.2)	100	71.0 (66.9-76.3)	68.0 (62.4-80.8)
Low SWB	58.2 (53.5-62.8)	75.4 (71.4-79.4)	100	61.3 (56.6-65.9)
PTSD	73.0 (68.3-77.8)	90.0 (86.8-93.1)	77.5 (73.1-81.9)	100
Binominal correlations				
	Anxiety ϕ	Depression ϕ	Low SWB ϕ	PTSD ϕ
Anxiety	1			
Depression	0.66	1		
Low SWB	0.44	0.56	1	
PTSD	0.57	0.67	0.52	1

*All analyses are weighted and 95% CI are calculated based on robust standard errors.

Refugee related potentially traumatic pre- and peri-migratory events and their associations with mental ill health

Table 4 shows that potentially traumatic events experienced before or during migration were very common among the resettled refugees from Syria. A total of 85 % report experiencing war at close quarters and 79 % reported being exposed to other frightening (life-threatening) situations. The majority also reported forced separation from family or close friends (67.9 %), and loss of a significant other (64 %). A large proportion had witnessed violence or assault (63 %), a third report having experienced physical violence or assault, and a similar proportion reported that they had been subjected to torture (31.0 %). Seven percent report being subjected to sexual violence. On average the refugees from Syria reported that they had experienced 4.2 (4.1-4.3) of the 8 studied types of PTEs before or during the migration. When calculating these means separately for the pre- and the peri-migration periods they were 4.0 (3.9-4.1) and 2.1 (2.0-2.2), respectively.

The results presented in table 4 further show that all types of investigated refugee related PTEs were significantly ($p<0.05$) associated with all studied types of mental ill health (adjusted for sociodemographic factors). Overall these adjusted associations appeared to be strongest in relation to PTSD and weakest in relation to low SWB. Being exposed to the different types of PTEs predicted anxiety and depression similarly, with the possible exception of sexual violence that appeared to be a stronger predictor of anxiety. It is, however, important to interpret differences with some caution given that the confidence intervals are rather wide and overlapping.

Table 4. Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD presented as odds rations (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
War at close quarters	86.9 (1036)	85.1 (82.9-87.5)	1.56 (1.01-2.42)	1.86 (1.23-2.80)	1.98 (1.49-2.65)	2.22 (1.38-3.57)
Forced separation from family or close friends	69.4 (817)	67.9 (65.2-70.9)	2.33 (1.77-3.21)	2.41 (2.80-3.23)	1.55 (1.18-2.04)	1.98 (1.46-2.65)
Loss or disappearance of family member(s) or loved one(s)	64.3 (756)	64.3 (61.3-67.3)	2.11 (1.57-2.82)	1.92 (1.46-2.52)	2.01 (1.50-2.70)	1.55 (1.18-2.04)
Physical violence or assault	30.5 (351)	30.9 (28.1-33.5)	3.47 (2.53-4.76)	3.39 (2.52-4.54)	2.01 (1.50-2.70)	2.01 (1.50-2.70)
Witnessing physical violence or assault	63.3 (740)	63.1 (60.0-66.1)	2.41 (1.79-3.24)	2.53 (1.91-3.35)	2.04 (1.54-2.70)	2.04 (1.54-2.05)
Torture	30.6 (354)	31.0 (28.3-33.9)	2.91 (2.5-3.26)	2.14 (1.61-2.84)	1.64 (1.24-2.19)	1.64 (1.24-2.19)
Sexual violence	6.9 (78)	7.1 (5.5-8.6)	3.36 (1.94-5.83)	2.67 (1.61-4.44)	2.02 (1.20-3.38)	2.02 (1.20-3.38)
Other frightening situation where you felt your life was in danger	80.6 (954)	79.4 (76.9-81.7)	2.90 (1.91-4.39)	3.31 (2.28-4.80)	3.38 (2.33-4.90)	3.38 (2.33-4.90)

* All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are not exposed to the respective refugee related PTEs. 95% CI are based on robust standard errors.

Post-migration stressful experiences and their associations with mental ill health

In table 5 it is shown to what extent the respondents report repeated post-migration stressful experiences and how these are associated with mental ill health, when adjusting for sociodemographic factors and pre- and/or peri-migratory PTEs. Of the investigated types of post-migration stress, *often missing social life from back home* and *often feeling sad because not reunited with family members* were the most common ones, experienced by a majority. Around 20% of the respondents reported that they had often felt excluded or isolated in Sweden, while less than 10 % indicated that they had often experienced ethnic discrimination, extreme poverty or distressing family conflicts after resettlement in Sweden.

All seven post-migratory stressful experiences were significantly associated with anxiety, depression, low SWB and PTSD, with the exception of *often sad due to not being reunited with family members* that was not significantly associated with anxiety (Table 5). *Often felt disrespected due to my national background* seemed to be the type of post-migration stressful experience that predicted mental ill health most strongly, while *often felt sad because not reunited with family members* generally exhibited the weakest association with mental ill health. Even though interpretations should be made with cautions, as the confidence intervals in most cases are highly overlapping, the result indicates that post-migration stress is stronger related to PTSD than it is to anxiety.

Table 5. Prevalence rates of post-migration stress and their associations with anxiety, depression, low SWB and PTSD presented as odds ratios (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
Often felt disrespected due to my national background	4.3 (52)	4.3 (3.1-5.5)	5.49 (2.79-10.81)	5.68 (2.83-11.41)	7.04 (3.35-14.78)	5.96 (2.97-11.94)
Often have had bothering difficulties communicating in Swedish	39.0 (469)	37.1 (34.5-39.9)	1.77 (1.30-2.40)	2.39 (1.78-3.19)	2.36 (1.77-3.16)	2.77 (2.00-3.83)
Often been unable to buy necessities	8.5 (103)	8.5 (6.9 -10.2)	3.46 (2.14-5.60)	3.46 (2.14-5.60)	3.21 (1.94-5.32)	4.31 (2.49-7.45)
Often missing my social life from back home	64.1 (773)	62.3 (59.6-65.2)	2.00 (1.46-2.81)	2.37 (1.74-3.23)	2.43 (1.78-3.31)	2.90 (1.97-4.27)
Often felt sad because not reunited with family members	49.8 (581)	50.2 (46.9-53.5)	1.26 (0.93-1.71)	1.41 (1.06-1.86)	1.40 (1.06-1.85)	1.49 (1.08-2.05)
Often felt excluded or isolated in the Swedish society	19.6 (235)	19.8 (17.4-22.2)	2.42 (1.70-3.46)	3.40 (2.39.4.83)	2.89 (2.05-4.08)	3.29 (2.27-4.78)
Often distressing conflicts in family	6.0 (72)	6.0 (4.5-7.5)	2.51 (1.29-4.92)	4.87 (2.25-10.53)	4.64 (2.32-9.29)	5.16 (2.56-10.40)

*All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. 95% CI are calculated based on robust standard errors

Sensitivity analyses

The sensitivity analyses showed result similar to the main analysis (Supplementary material 1-6). The prevalence rates were approximately the same in the multiple imputed datasets (Supplementary material 1) and associations that were significant ($p<0.05$) or non-significant in the main analyses remained so in almost all the sensitivity analyses (Supplementary material 2-6). One exception was that *felt sad because not reunited with family members* was no longer a significant predictor of any mental ill health measures when operationalized more leniently. It was also revealed that number of types of post-migratory stressful experiences partially mediated the effect of PTEs on included mental ill health outcomes (Supplementary material 7).

Discussion

This study, one of the first of its kind, indicate that refugees from Syria that resettled in Sweden following the war that started in 2011 have prevalence rates of anxiety, depression, low subjective wellbeing and PTSD that range between 30 and 40%. A majority reported symptoms in line with at least one of these four types of mental ill health, and many fulfilled multiple criteria. Mental ill health was generally more common among women, older and the divorced or widowed refugees. The study further showed that refugee related potentially traumatic events and post-migration stress were common. For example, 30 % reported they had experienced torture, while 50 % often had been sad because not being reunited with family members. Finally, it was revealed that practically all investigated types of refugee related PTEs and post-migration stress were significantly associated with anxiety, depression, low SWB and PTSD.

The prevalence rates in this study are in line with many others obtained from previous larger studies on refugees [3 31 32]. Any comparison should, however, be done with caution given that the contexts, methodological aspects and the inclusion criteria usually vary extensively between studies. Nonetheless, some previous findings are more reasonable to contrast with our reported prevalence estimates as both pre- and post-migration conditions exhibit several similarities. A smaller Swedish study among Iraqi asylum seekers aged 18-48 years in which the prevalence of PTSD was estimated to 38% is one of those[33], while Laban et al's study among Iraqi asylum seekers in the Netherlands, where the prevalence of anxiety syndrome was estimated to 22%, depression to 34% and PTSD to 36%, is another such example[34]. These more comparable prevalence estimates are thus similar with those reported here among recent refugees from Syria resettled in Sweden. Moreover, in two recent studies on Syrian refugees living in refugee camps in Turkey and Lebanon the prevalence of PTSD was estimated to around 30 percent[35 36]

In Bogic et al's review article it was revealed that mental ill health appear to be particularly common among refugees from former Yugoslavia or Cambodia and among refugees resettled in the US[3]. The prevalence rates reported here are generally lower than those reported among Cambodians in US[37] (at least with regard to depression), but comparable to estimates among refugees from former Yugoslavia resettled in different parts of Europe[32]. The high rates of mental ill health among the Syrian refugees are probably most appropriately interpreted in light of the high exposure to war-related PTEs described in the present article and the sheer magnitude of human rights violation during the Syrian conflict[38].

It is difficult to establish the extent of applicability of the mental ill health prevalence from this study to Syrian refugee populations resettled in other European countries. However, as long as post-migration conditions and differences in immigration legislation or asylum policies at the resettlement destination do no distort comparability, these estimates are likely to be transferable to a large degree. In this regard, it should be emphasized that time passed since resettlement may also influence transferability of the prevalence estimates, since the adverse effects of war-related PTEs as well as post-migration stress tend to diminish with time[39 40].

That mental ill health is more common among women, older and divorced/widowed refugees are consistent with other research[3 19 32]. These associations are commonly also observed in non-refugee populations. However, the finding that mental ill health does not appeared to

differ by educational level may seem surprising, but this has also been observed previously among refugees in Sweden[19]. Studies investigating this association among refugees have nonetheless reported contradictory findings[20 32], which is likely to be attributable (at least partially) to differences between refugee populations and the post-migration conditions. A possible explanation on a more theoretical level may be that the buffering effect of higher education (or buffering effects related to higher education) is canceled out as a result of that refugees with a higher educational level experience greater loss of status. Loss of status, or downward social mobility as it also sometimes is called, has been shown to have an adverse effect on refugees' mental health[41].

All eight, deliberately broad, categories of pre- and peri-migratory refugee related PTEs were related to mental ill health. This clearly demonstrates that many types of refugee-related PTEs are associated with different manifestations of mental ill health. Still, it was revealed that the refugee related PTEs were stronger predictors for PTSD than for low SWB. Overall, and in line with previous findings, the PTEs that showed the strongest associations with mental ill health were those that involved exposure to interpersonal violence[42].

A somewhat puzzling exception is that torture appears to have the weakest association with low SWB among the studied PTEs. This may be because individuals tend to value their current life as less negative, all else being equal, when having experienced harsh former living conditions [43]. The reported associations between refugee related PTEs' and mental ill health are most likely causal in nature, as it seems unreasonable to propose that individuals with mental ill health would be more at risk for refugee related PTEs. Neither does previous research support that under-reporting of PTEs are more common among refugees without mental ill health. It is, if something, more likely that individuals with mental ill health are more prone to under-report PTEs[44], which would suggest that the associations presented between refugee related PTEs and mental ill health are underestimated rather than overestimated.

The study further showed that all included types of post-migration stress were significantly associated with mental ill health, when adjusting for refugee related PTEs. Similar findings have been shown in previous research among other refugee or migrant populations[18 19 45] which corroborate our expectations**.** A notable exception was that *feeling sad because not reunited with family members'* association with mental ill health was not substantiated in some of the sensitivity analyses. These non-associations were primarily detected in the sensitivity analyses where a very lenient cut-off was used, i.e., *feeling sad because not reunited with family members* at least once since immigrated to Sweden. Such low thresholds for endorsing this statement may perhaps indicate less severe emotional distress, which could explain the lack of substantial association with mental ill health. Furthermore, not being united with one's family could be viewed as a proxy for lack of an important source of social support [46], which is strongly associated with mental health [47 48] . The displayed weak association in the present study contradicts both clinical practice and previous findings. An explanation may also be that some respondents have interpreted *family* in a wider sense including distant relatives. If this is the case, which is not entirely unlikely, it would imply that the item is a suboptimal proxy of social support.

Post-migration stress and mental ill health are on the other hand likely to be reciprocally associated[16]. It has been reported that refugees with PTSD tend to have greater difficulties to learn the language spoken at the resettlement destination[49]**,** and that refugees with mental ill

health tend to interpret adverse events as being more stressful, while simultaneously evaluating favorable life events as less positive[50]**.** Without onset information, it is possible that residual confounding may to some extent have distorted the associations between post-migration stress and mental ill health. Another potential source of residual confounding between specific post-migration stress and mental ill health comes from not adjusting for other types of post-migration stress, which was a deliberate choice in order to avoid over adjustment. What nonetheless can be concluded is that these associations are not confounded by refugee related PTEs nor a consequence of reverse causation, as refugee related PTEs predate post-migration stress and are adjusted for.

Strength and limitations

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country. That the study is based on a random sample drawn from a known sample frame including all eligible participants is a major and unique strength. The availability of the register-based information for all eligible study participants enabled us to evaluate the representativeness of our sample. It also provided the opportunity to construct non-response weights for obtaining more reliable estimates even though the non-response rate is substantial.

All the same, the substantial non-response rate poses the single greatest limitation of the study. It has previously been indicated in a Swedish study that prevalence estimates of mental ill health are likely biased, in a downward direction, as a consequence of that mental ill health tend to be more common among non-respondents[51]. Whether this finding also is applicable for mental health surveys targeting refugees from Syria is not known. However, the weighted and unweighted prevalence rates of mental ill health were similar, and provided some support for that this type of selection bias may be negligible in this case.

The use of several different measures of mental ill health, all with high internal consistency, is also a strength. All employed measures of mental ill health have frequently been used and shown to exhibit good psychometric properties in diverse cultural settings[23-27]. The robustness of our results are supported by the fact that all of these outcomes when analyzed, dichotomized or continuous, provided similar findings. That being said, the cut-offs used in the present study have not yet been validated among refugees from Syria. The cut-offs used in the present study are based on validation studies among other war-tormented populations, but further studies are needed to substantiate the appropriateness of employing them also in this context.

Another limitation of this study is the use of self-report data in the assessment of mental ill health. Although clinical interviews may hold stronger validity, the possibility of conducting such interviews in large scale studies and among the hard to reach population of the refugees are inevitably constrained for logistic and practical reasons. Moreover, it should be emphasized that the single items used to identify different war-related PTEs and types of post-migration stress neither capture nor include all factors that are likely to be of importance in this context. Nonetheless, the included items cover a broad range of aspects that according to previous research have been shown to be associated with mental ill health among refugees.

Cross-sectional studies are well suited for estimating prevalence, while making causal claims based on cross-sectional data should be done with extreme caution – if it is at all reasonable to make such claims. Caution when interpreting the current findings in terms of causality is thus warranted. We advocate, however, that PTEs can be accurately assessed retrospectively, and are likely to precede the mental ill health and thus possible to be studied using a cross-sectional design. To better understand associations between post-migration stress and mental ill health prospective studies are needed, which currently are rare among refugee populations.

Conclusion

Our study shows that prevalence of mental ill health, in terms of anxiety, depression, low subjective wellbeing and PTSD, is highly elevated and comorbid among refugees from Syria. Moreover, refugee related PTEs as well post-migration stress are associated to several different manifestations of mental ill health. Increased attention from multiple societal sectors to adequately support Syrian refugees' mental health needs, promote their recovery and reduce post-migration stress are needed. Also more prospective and population-based research are warranted to better understand the causal mechanisms involved.

Contributors: PT, FS conceptualized and designed the study and the empirical analyses. FS obtained the funding. PT, CA, AM collected the data. PT, AM, CA, ES and FS constructed and/or adapted the questionnaire. ES had a special responsibility with research issues dealing with potentially traumatic events, while AM had the same type of responsibility regarding post-migration stress. PT conducted the statistical analyses with advice and support from AL and FS. PT drafted the initial version of the manuscript. All authors contributed in revising and editing the manuscript with substantial methodological and intellectual support and approved the manuscript as submitted. PT and FS are the guarantors of the study.

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Ethics approval: The study was approved by the Stockholm Regional Ethical Review Board (number: 2015/1463-1431 and 2016/549-32).

Data sharing statement: The statistical code is available from the corresponding author. Under Swedish law and ethical approval, individual level data of this kind cannot be publically available. Individual level data can be made available on reasonable request as long as it is in line with Swedish law and ethical approvals.

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Appendix: Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

Content:

Supplementary material 1: Prevalence of anxiety, depression, low SWB, PTSD and *any* in the total and among subpopulations based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set

	Anxiety % *, Dif **	Depression % *, Dif **	Low SWB % *, Dif **	PTSD % *, Dif **	Any % *, Dif **
Total (weighted)	32.4, 0.6	40.2, 0.0	37.8, 0.1	30.2, 0.3	53.6, 2.4
Total (unweighted)	32.2, 0.6	40.6, 0.0	38.4, 0.1	31.0, 0.4	54.2, 1.4
Gender					
Men	28.6, 1.1	38.0, 0.1	35.3, 2.3	29.6, 0.6	49.9, 1.4
Women	39.0, 0.2	44.0, 0.1	42.2, 0.0	31.4, 0.1	60.0, 1.3
Age-groups					
18-29	32.4, 1.1	38.3, 0.0	36.7, 0.3	25.7, 0.1	53.5, 0.7
30-39	26.2, 0.0	36.1, 0.1	36.9, 1.1	28.1, 0.9	48.9, 1.4
40-49	34.4, 0.2	41.6, 0.1	35.2, 0.5	29.6, 0.6	53.7, 2.0
50-64	43.3, 1.4	51.4, 0.3	45.9, 0.7	45.3, 0.6	64.5, 1.4
Level of education					
0- 9 years	34.1, 0.6	39.0, 0.1	34.4, 0.1	30.8, 0.2	52.8, 1.4
>9 years without a university degree	30.7, 0.9	41.7, 0.0	36.1, 0.3	31.5, 0.7	52.8, 0.6
> 12 years with a university degree	30.9, 0.3	40.9 0.0	44.2, 0.0	28.4, 0.3	55.4, 1.4
Marital status					
Married	31.4, 0.5	37.9, 0.0	35.9, 0.0	27.8, 0.5	51.4, 1.5
Unmarried	31.5, 0.6	41.8, 0.2	39.4, 0.4	31.5, 0.2	54.7, 1.2
Divorced/widow/widower	51.6, 0.2	55.2, 1.3	49.5, 0.5	50.2, 1.3	71.7, 1.1

*Pooled prevalence based on five multiple imputed datasets

** Difference between the pooled prevalence estimates based on the five imputed data sets and prevalence estimate prevalence estimate from analysis based on the original non-imputed data set.

Supplementary material 2: Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
War at close quarters	85.1, 0.0	1.50-1.61, 0.01, 0.047	1.78-1.88, 0.04, <0.01	1.85-2.05, 0.06 <0.01	2.09-3.33, 0.05, <0.01
Forced separation from family or close friends	67.9, 0.0	2.14-2.35, 0.11, <0.01	2.39-2.49,0.04, <0.01	1.51-1.61, 0-01, <0.01	1.84-2.05, 0.06, <0.01
Loss or disappearance of family member(s) or loved one(s)	64.6, 0.3	2.03-2.10, 0.06, <0.01	1.83-1.97, 0.03, <0.01	1.91-2.03, 0.03, <0.01	1.51-1.61, 0.01, <0.01
Physical violence or assault	31.5, 0.6	3.01-3.58, 0.08, <0.01	3.12-3.34, 0.13, <0.01	1.91-2.03, 0.03, <0.01	1.91-2.03, 0.03, <0.01
Witnessing physical violence or assault	63.2, 0.1	2.25-2.48, 0.07, <0.01	2.42-2.55, 0.03, <0.01	1.99-2.11, 0.02, <0.01	1.99-2.11, 0.03, <0.01
Torture	31.7, 0.7	2.82-2.12, 0.05, <0.01	2.15-2.28, 0.07, <0.01	1.64-1.75, 0.05, <0.01	1.64-1.75, 0.05, <0.01
Sexual violence	7.5, 0.4	2.62-3.64, 0.18, <0.01	2.44-2.77, 0.07, <0.01	1.90-2.24, 0.06, <0.01	1.90-2.24, 0.06, <0.01
Other frightening situation where you felt your life was in danger	79.3, 0.1	2.70-2.98, 0.05, <0.01	3.17-3.29, 0.01, <0.01	3.12-3.37, 0.02, <0.01	3.12-3.37, 0.02, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors.

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 3: Prevalence of different types of post-migration stress and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses on five multiple imputed datasets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
Often felt disrespected due to my national background	4.3, 0.0	4.98-5.46, 0.14, <0.01	5.67-6.18, 0.12, <0.01	4.28-5.00, 0.24, <0.01	4.23-4.65, 1.49, <0.01
Often have had bothering difficulties communicating in Swedish	37.1, 0.0	1.94-2.06, 0.26, <0.01	2.53-2.63, 0.19, <0.01	2.08-2.64, 0.11, <0.01	2.76-2.90,0.04, <0.01
Often been unable to buy necessities	8.5, 0.0	2.95-3.10, 0.43, <0.01	2.95-3.10, 0.43, <0.01	2.76-3.06, 0.29, <0.01	3.46-4.28, 0.53, <0.01
Often missing my social life from back home	62.4 0.1	2.09-2.19, 0.13, <0.01	2.55-2.64, 0.24, <0.01	1.42-2.50, 0.26, <0.01	2.85-3.07, 0.07, <0.01
Often felt sad because not reunited with family members	50.2, 0.0	1.23-1.33, 0.03, 0.08	1.41-1.49, 0.03, <0.01	1.40-1.46, 0.04, <0.01	1.34-1.47, 0.09, 0.03
Often felt excluded or isolated in the Swedish society	19.9, 0.1	2.63-2.85, 0.30, <0.01	3.82-4.04, 0.54, <0.01	2.94-3.13, 0.13, <0.01	3.08-3.37, 0.04, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. P-values are calculated based on robust standard errors

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 4: Associations between refugee related PTEs and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
War at close quarters	0.26, <0.01	0.30, <0.01	0.13, 0.14	0.44, <0.01
Forced separation from family or close friends	0.38, <0.01	0.49, <0.01	0.38, <0.01	0.52, <0.01
Loss or disappearance of family member(s) or loved one(s)	0.30, <0.01	0.34, <0.01	0.20,<0.01	0.45, <0.01
Physical violence or assault	0.61, <0.01	0.61, <0.01	0.40, <0.01	0.73, <0.01
Witnessing physical violence or assault	0.46, <0.01	0.47, <0.01	0.37, <0.01	0.65, <0.01
Torture	0.48, <0.01	0.46, <0.01	0.28, <0.01	0.58, <0.01
Sexual violence	0.53, <0.01	0.52, <0.01	0.37, 0.01	0.68, <0.01
Other frightening situation where you felt your life was in danger	0.54, <0.01	0.64, <0.01	0.57, <0.01	0.83, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors

Supplementary material 5: Associations between post-migration stress and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
Often felt disrespected due to my national background	0.72, <0.01	0.76, <0.01	0.70, <0.01	0.80, <0.01
Often have had bothering difficulties communicating in Swedish	0.28, <0.01	0.39, <0.01	0.41, <0.01	0.42, <0.01
Often been unable to buy necessities	0.64, <0.01	0.60, <0.01	0.55, <0.01	0.57, <0.01
Often missing social life from back home	0.23, <0.01	0.49, <0.01	0.43, <0.01	0.44, <0.01
Often felt sad because not reunited with family members	0.15, 0.02	0.21, <0.01	0.08, 0.20	0.13, 0.03
Often felt excluded or isolated in the Swedish society	0.42, <0.01	0.58, <0.01	0.52, <0.01	0.49, <0.01
Often distressing conflicts in my family	0.60, <0.01	0.84, <0.01	0.79, <0.01	0.63, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

Supplementary material 6: Associations between post-migration stress (using a lenient definition*) and anxiety, depression, low SWB and PTSD (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Anxiety OR (95% CI) **	Depression OR (95% CI) **	Low SWB OR (95% CI) **	PTSD OR (95% CI) **
Felt disrespected due to my national background	37.2 (448)	2.33 (1.70-3.18)	2.29 (1.70-3.07)	2.05 (1.54-2.74)	2.46 (1.76-3.44)
Have had bothering difficulties communicating in Swedish	82.1 (989)	1.50 (0.97-2.33)	1.64 (1.10-2.45)	1.98 (1.10-2.98)	2.57 (1.57-4.24)
Been unable to buy necessities	38.7 (467)	1.94 (1.43-2.63)	1.94 (1.43-2.63)	1.85 (1.39-2.46)	2.12 (1.54-2.92)
Missing social life from back home	93.6 (1128	3.71 (1.62-8.50)	2.72 (1.41-5.23)	1.34 (0.73-2.45)	9.28 (2.79-30.90)
Felt sad because not reunited with family members	84.6 (1004)	1.26 (0.82-1.94)	1.28 (0.86-1.91)	1.39 (0.94-2.06)	1.21 (0.76-1.95)
Felt excluded or isolated in the Swedish society	64.3 (770)	2.13 (1.52-3.00)	3.00 (1.84-4.12)	2.59 (1.89-3.55)	3.10 (2.13-4.54)
Distressing conflicts in my family	35.4 (428)	1.71 (1.26-2.32)	2.44 (1.83-3.25)	2.20 (1.65-2.93)	2.31 (1.68-3.17)

* Defined as having had the respective post-migratory stressful experiences *at least once* since immigrated to Sweden

**All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

Supplementary material 7: Estimates of direct effect of number of types of PTE exposures, and indirect effect of number of types of post-migratory stressful experiences modelled as mediator, with mental ill health as outcome. Estimates are unstandardized with corresponding bias-corrected bootstrapped confidence intervals (CI) and robust standard errors (SE).

	Direct effect			Indirect effect		
	Estimate	SE	95% CI	Estimate	SE	95% CI
Anxiety	.044	.006	.031-.056	.013	.002	.009-.019
Depression	.045	.007	.032-.058	.017	.003	.012-.023
Low SWB	.024	.007	.011-.037	.017	.003	.012-.023
PTSD	.056	.006	.044-.068	.017	.003	.012-.022

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

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

		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	8
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	4 and 10
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Supplied in table 2 (page11), table 4 (page 13) and table 5 (page 14).
Outcome data	15*	Report numbers of outcome events or summary measures	8,13 and 14
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	10-15
		(*b*) Report category boundaries when continuous variables were categorized	6-7
		(*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	Appendix and page 6
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
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	17-18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	15 and 17
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	19

*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.

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Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

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Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

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Abstract:

Objectives: To estimate the prevalence of, and associations between anxiety, depression, PTSD, low subjective wellbeing (SWB), potential traumas and post-migration stress among refugees from Syria resettled in Sweden.

Design: A cross-sectional and population-based questionnaire study based on a known and complete sample frame. The survey included multiple measures of mental ill health and factors of particular relevance for refugees. Weighted analyses were conducted to calculate representative prevalence rates and associations. Associations were investigated through a series of logistic regression analyses. All analyses were supplemented with robust 95% confidence intervals (95% CI).

Setting: Sweden

Participants: A random sample of 1215 individuals (response rate 30.4%) from Syria aged 18 to 64 that were granted residency in Sweden on grounds of asylum between 2011 and 2013**.**

Main outcome measures: Anxiety, depression, PTSD and low SWB were assessed through Hopkins Symptom Checklist, Harvard Trauma Questionnaire and WHO-5 wellbeing index, using established cut-offs.

Results: A majority of the participants met the criteria for at least one of the studied types of mental ill health, and the comorbidity was high. Depression was the most the common type 40.2 % (95% CI 36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Refugee related potentially traumatic events (PTEs) experienced before or during migration was common as was substantial levels of post-migration stress. Most types of refugee related PTEs, especially being exposed to interpersonal violence, and post-migration stress were associated with increased risks for anxiety, depression, low SWB and PTSD.

Conclusions: Mental ill health, in terms of anxiety, depression, low SWB and PTSD, are highly elevated and comorbid among refugees from Syria. Increased attention from multiple societal sectors to adequately support Syrian refugees' mental health needs, promoting recovery and reducing post-migration stress are needed.

Strengths and limitations of this study

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country

The non-response rate is substantial, but the availability of register-based information for all eligible study participants enabled construction of non-response weights to obtain reliable estimates.

The robustness of the study findings are supported by a series of sensitivity analyses.

Several measures were taken, such as a double-blind translation and back-translation procedure and cognitive interviewing, to ensure that the questionnaire was appropriate and valid for the target population.

The analyses are based on cross-sectional data, which typically make causal claims on the basis of temporality ambiguous variables problematic. .

Introduction

The war in Syria has since it started in 2011 been responsible for almost half a million deaths[1]. Additionally, more than 11 million individuals have been forced to leave their homes and of these around one million have reached Europe[2]. Sweden has received more than 100 000 asylum seekers from Syria since 2011[2], making Sweden the second largest European recipient of refugees from Syria. However, reliable prevalence rates of mental ill health and stressful or traumatizing experiences in this refugee population is still lacking. A clearer picture based on robust empirical data of the magnitude of mental ill health among Syrian refugees resettled in Europe, and to what extent they have been exposed to known risk factors are imperative to adequately address their mental health needs on a societal level.

The estimated prevalence of post-traumatic stress disorder (PTSD), anxiety disorders and depression in refugee populations are known to vary extensively between studies and populations. In a review article including 29 studies on long term mental health among war affected refugees, Bogic et al reported prevalence rates ranging from 4.4 to 86% for PTSD, 2.3 to 80% for depression and 20.3 to 88% for anxiety[3]. This type of heterogeneity has also been observed in Fazal et al's systematic review based on studies using psychiatric interviews to assess mental disorders among refugees resettled in western countries[4]. Such disparate rates are of course of little use for estimating how common mental ill health is among Syrian refugees in Europe today. They nonetheless illustrate the problem of regarding groups of refugees as homogenous populations. A plethora of circumstances including differences in pre-migration experiences, support and reception in the resettlement country and immigration laws make extrapolations from one refugee population to another hazardous. And even if such extrapolations in certain cases might appear reasonable, available studies are generally based on fairly small convenience samples and the socio-demographic distribution of the sample frames are usually unknown[3], making it difficult to evaluate the validity of the obtained estimates.

Often when studying refugees' mental ill health, a distinction is made between risk factors encountered before or after the migration[5]. Refugee-related, or war-related, potentially traumatic events (PTEs) are the type of pre-migratory risk factors that has been given most attention in the literature and many of them have also been shown to be strongly associated with mental ill health[6]. Associations of this kind have been observed in many refugee populations and at many different resettlement destinations - including Europe [7 8]**.** In particular experiences of interpersonal violence during the pre-migration phase has been linked to mental health problems[9]. Even though, these types of associations are usually stronger in relation to PTSD, they have commonly also been observed when employing anxiety and depression as outcomes measures [10 11]. What is however seldom taken into account when studying refugees' mental health, is the that the flight in itself may also be difficult and contain additional severe traumatic events[12].

During the post-migration phase refugees (as well as non-refugee migrants) may experience a host of different types of difficulties that can hamper recovery, increase mental ill health or be instrumental for the development of mental ill health[5]. These types of experiences are often referred to as post-migration stress and are typically of a more persistent character than PTEs that tend to be sudden and/or traumatic. Studies have indicated that post-migration experiences in many circumstances tend to be more detrimental to refugees' mental health than PTEs and that PTEs are associated with post-migration stress (see further e.g.,[5]) Several types of post-migration stressful experiences have been identified as being especially common among migrant/refugee populations. Of these have the following been shown to be associated with mental ill health: intergenerational and spousal conflicts[13 14], ethnic discrimination[15],

harsh socio-economical living conditions[16-19], loss of status[7 17], institutional accommodation[20], poor language skills[16 19], and poor social support[7 17 19].

In this study we aim to estimate prevalence of anxiety, depression, PTSD, low subjective wellbeing (SWB), different refugee-related PTEs and different post-migration stressful experiences and explore mental ill health comorbidity among recently resettled refugees from Syria in Sweden. Furthermore our aim is to investigate if different types of refugee related PTEs and different types post-migration stressful experiences are associated with mental ill health among recently resettled refugees from Syria, as findings from other contexts would indicate.

Methods

Participants

The study population consist of a random sample of 1215 individuals from Syria aged 18 to 64 who were granted permanent residency in Sweden on grounds of asylum between 2011 and 2013. The sampling frame was the Total Population Register (TPR) maintained by the government agency Statistics Sweden, containing addresses as well as data on vital status including birth- and death year, birth country, educational level and marital status. TPR is a nationwide register covering all individuals with permanent residency. Information on grounds for residency were obtained from the STATIV database, which is a database containing migration related information for individuals that have applied for residency.

Procedure

Before launching the study a reference group of Syrian refugees with expertise in mental health research, health care and/or Arabic language was set up. The group was consulted on cultural aspects of mental ill health, appropriate data collection methods and language issues. Their input informed the implementation of the study and the construction of the questionnaire. The reference group also assisted in a social media campaign to explain the study's purpose to the target population and served as Arabic speaking contact persons for those invited to the survey.

In 2016 a postal questionnaire in Arabic was distributed to a random sample of 4000 refugees from Syria meeting the inclusion criteria, of which 30.4 % (n=1215) chose to participate (the non-response analysis is presented in the results section). Given that the sample frame included 9 662 individuals, a minimum of 1000 respondents were deemed adequate, as the sample size then would consist of more than 10% of the individuals included in the total sample frame. The questionnaire included scales and items to measure mental ill health and factors hypothesized to be of particular relevance for refugees' mental health and socioeconomic integration.

A standard double-blind translation and back-translation procedure was used unless adapted Arabic versions of specific parts of the questionnaire already were available. The entire questionnaire was, however, discussed with community experts in focus groups and individually throughout the translation and adaptation process. Revisions and amendments were done in consensus when such changes were deemed necessary.

Usability of the questionnaire was tested by conducting interviews in a rehabilitation center for war and torture trauma patients, with ten patients with Arabic as their mother tongue. The interviewees were instructed to read the questions out loud and to follow a Think-Aloud Protocol (TAP). TAP is a method designed to provide information about difficulties that may arise due to problems with comprehension, memory retrieval, judgement and response formatting[21]. Upon any indication of such difficulties, the target item was further scrutinized by the research group, language and community experts, and by examining the psychometrics profile of the item from data compiled from a small pilot study, and was thereafter modified if needed.

Measures

Sociodemographic factors

All sociodemographic data used in this study were retrieved from Statistics Sweden's nationwide database *TRB*. Age was categorized into the following four age-groups: 18–29, 30–39, 40–49, 50–64; educational level was categorized as: 0- 9 years, >9 years without a university degree, > 12 years with a university degree; marital status was categorized as: married, unmarried and divorced/widow/widower; year of immigration was categorized as ≥ 2011 (i.e., 5 years or more since immigration), 2012, 2013. This information, except marital status, were also obtained for the non-respondents for the purpose of constructing non-response weights.

Refugee related potentially traumatic pre- and peri-migration events

To identify respondents that had been exposed to refugee related PTEs before arriving to Sweden, two (identical) checklists were developed to cover the pre- and peri-migration periods separately[22] (the peri-migration period does in this context refer to the period between leaving the home in Syria and arriving to Sweden). The checklists aim to measure PTEs related to the refugee experience in a non-intrusive manner, while simultaneously trying to encapsulate the most common types of refugee related PTEs that have been reported in the scientific literature. In the present study the two checklists have been combined. An assessment is thus made of whether the respondents have been exposed to the following eight types refugee related PTEs before arriving to Sweden: *War at close quarters* (i.e., close proximity to war combat)*, Forced separation from family or close friends, Loss or disappearance of family member(s) or loved one(s), Physical violence or assault, Witnessing physical violence or assault, Torture, Sexual violence, Other frightening situations where you felt your life was in danger*.

Post-migration stress

We constructed seven domains of post-migration stress that encircled relevant and common experiences found when reviewing the literature or reported by Red Cross patients with refugee status. The seven single item questions used in this study are intended to tap into these separate domains, i.e., item: *Felt disrespected due to national background (domain:* perceived discrimination*), Bothering difficulties communicating in Swedish (*lack of host country specific competencies*), Unable to buy necessities (*economic strain*), Missing social life from back home (*loss of home country*), Sad because not reunited with family members (*home

country and family concerns*), Felt excluded or isolated in the Swedish society (*social strains*)* and *distressing conflicts in family (*family conflicts*).* The respondents were requested to indicate how frequently he or she had experienced these specific situations, on a five-point Likert scale ranging from "never" to "very often", since arriving to Sweden. Those responding "often" or "very often" were classified as having had these types of experiences *often* after resettlement in Sweden.

Mental ill health measures

Hopkins Symptom Checklist (HSCL-25), Harvard Trauma Questionnaire (HTQ) and WHO-5 Wellbeing Index (WHO-5) were employed to estimate different manifestations of mental ill health, i.e., anxiety, depression, PTSD and low SWB. All scales have been frequently used among refugees and in population-based surveys, and have been shown to possess sound psychometric properties among Arabic speakers[23 24].

HSCL-25 consists of 10 anxiety and 15 depression items. The items, which refer to how specific symptoms have bothered or distressed the individual during the last week, have four response alternatives ranging from "not at all" (1) to "very much" (4). Individual mean item scores were calculated separately for the anxiety and depression subscales. Respondents with a mean item score above 1.80 and 1.75 were classified as having depression or anxiety, respectively[25 26]. Cronbach alpha for the depression and the anxiety scales was 0.93 and 0.92, respectively.

In HTQ the first 16 symptoms from section IV were used to identify individuals with PTSD[25]. This part of HTQ has a similar structure as the HSCL-25, in that it uses the same response format, referring to the same time frame and mean item scores are calculated. In the present study we used the mean item score of 2.06 to distinguish cases of PTSD from non-cases[25]. Cronbach alpha was 0.92.

WHO-5 was used as a global measure of subjective wellbeing. WHO-5 contains five statements of the type "I have felt happy and in a good mood" and the response alternatives range from "all the time" (5) to "never" (0) in relation to the last two weeks. The highest possible value of that scale is 100, as the total score is multiplied by a factor of four. Those with values below 50 are classified as having low SWB[27]. Cronbach alpha was 0.94.

Statistical analysis

As the sample was not entirely representative with regards to socio-demographic factors, inverse probability (or non-response) weights were constructed using logistic regression. These weights were based on the main effects of gender, age-groups, educational level and year of immigration and the interaction effect between gender and age-groups**,** as this was the only two-way interaction that significantly predicted study participation ($p<0.05$) in univariate analyses. All presented analyses are based on weighed data unless otherwise stated. The following analyses were thereafter conducted.

First, the sociodemographic distribution of the sample, the sample frame and the weighted sample were calculated and presented in percentages.

Second, prevalence estimates for anxiety, depression, low SWB and PTSD were calculated for the total population and for sociodemographic sub-populations.

Third, proportions with mental ill health comorbidities and binominal correlations between the four used measures of mental ill health were estimated.

Fourth, prevalence of refugee related PTEs, and post-migration stress were calculated. A series of logistic regression analyses were, thereafter, conducted to explore the association between these factors and the four studied measures of mental ill health. All these analyses were adjusted for sociodemographic factors. Further, associations between types of post-migration stress and mental ill health were adjusted for the eight refugee related PTEs, number of PTEs and number of PTEs squared. Post-migration stress factors were on the other hand not adjusted for when examining the associations between different refugee related PTEs and mental ill health, as post-migration stress in this context is likely a potential mediator rather than a confounder.

To examine this assumption, the mediating role/function of post-migratory stressful experiences in the association between PTEs and mental ill health, mediation analyses were performed with number of included types of exposure for PTEs as exogenous, number of types of post-migratory stressful experiences as mediator, and mental ill health as endogenous outcomes.

Bootstrapping with 1000 re-samplings and Taylor linearized variance estimation[28] were used to obtain 95% confidence intervals (95% CI) for prevalence rates and odds ratios (ORs), respectively.

To explore potential bias from missing values a series of sensitivity analyses were conducted using Multiple imputation by chained equations (MICE)[29] in SPSS, an approach including a random component which is suitable when missing values are assumed to be missing at random (MAR).The applied MICE model included all categorical variables employed in the study as predictors.

To evaluate whether the cut-offs for mental ill health may have influenced the estimates, a second set of sensitivity analyses were conducted by re-running all regression analyses while specifying the outcomes as continuous variables. As the outcomes had a non-normal distribution a two-step approach was used to obtain more normally distributed variables[30].

In a set of sensitivity tests, all associations between post-migration stress and mental ill health were re-run where post-migration stressful experiences were defined more leniently (i.e., having experienced the specified situation *at least once* since immigrated to Sweden as opposed to having experienced it *often*).

All analyses were conducted with SPSS v. 24.0 except the mediation analyses that were performed in Mplus version 8.

Results

Table 1 shows the distribution of sociodemographic characteristics among the survey participants and among the sample frame, together with the corresponding distribution after weighting for non-response. Table 1 also shows bivariate associations between the sociodemographic characteristics and non-response.

The non-response analysis revealed that younger, not married, less recently immigrated individuals and those with lower educational level were less likely to participate in the study. Women were on the other hand neither over- nor underrepresented. When applying the attrition weights to the sample, the sociodemographic distribution corresponded closely with that of the sample frame, with the expectation that married individuals still were slightly overrepresented.

Table 1. Sociodemographic characteristics in percentage among respondents, the sample frame and the weighted sample, supplemented with non-response analysis

	Respondents (n=1215)	Sample frame (n=4 000)	Weighted data set	Respondents vs. non-respondents χ2 (p-values)	
Gender				0.4 (0.52)	
Men	62.8	63.5	63.5		
Women	37.2	36.5	36.5		
Age-groups				68.7 (< 0.01)	
18-29	23.3	30.8	30.7		
30-39	32.9	33.7	33.5		
40-49	24.3	21.0	21.0		
50-64	19.5	14.6	14.8		
Marital status				78.9 (< 0.01)	
Married	63.5	52.9	57.5		
Unmarried	31.8	40.8	38.0		
Divorced/widow/widower	4.8	6.4	4.6		
Level of educational				47.2 (< 0.01)	
0- 9 years	40.2	46.4	47.0		
> 9 years without a university degree	21.0	22.3	22.0		
> 12 years with a university degree	38.7	31.5	31.0		
Year of immigration*				34.0 (< 0.01)	
≤2011	6.5	10.1	10.3		
2012	27.5	29.5	29.3		
2013	66.0	60.4	60.4		

*This variable indicate the year the individual arrived to Sweden and should not be confused with year for being granted residency used as inclusion criteria.

Prevalence rates of mental ill health

Table 2 shows that it was estimated that 55.0 % (95 % CI 52.0-58.0) of recently resettled refugees from Syria have at least one of the studied type of mental ill health. Depression was the most common type 40.2 % (36.9-43.3), followed by low SWB 37.7 % (34.8-40.1), anxiety 31.8 % (29.2-34.7), and PTSD 29.9 % (27.2-32.6). Socio-demographically stratified analyses showed that mental ill health generally were more common among women, with the possible exception of PTSD. The stratified estimates further showed that those in the oldest age-category (i.e., 50-64 years) had elevated rates of mental ill health, particularly with regard to PTSD. The prevalence rates of anxiety, depression and PTSD were similar across the three educational levels, while low SWB appeared to be more common among individuals with a

higher level of education. Finally it was shown that those who were divorced or had experienced the death of a spouse were more at risk for all the studied types of mental ill health. No difference in prevalence were detected when stratifying analyses by year of immigration, i.e., highly overlapping confidence intervals (data not shown)

Tabell 2. Prevalence of anxiety, depression, low SWB, PTSD or *any* in total and among subpopulations with 95% confidence intervals (95 % CI)*

	Anxiety % (95% CI)	Depression % (95% CI)	Low SWB % (95% CI)	PTSD % (95% CI)	Any** % (95% CI)
Total (weighted)	31.8 (29.2-34.7)	40.2 (36.9-43.3)	37.7 (34.8-40.1)	29.9 (27.2-32.6)	55.0 (52.0-58.0)
Total (unweighted)	31.6 (29.1-34.3)	40.6 (37.8-43.2)	38.3 (35.6-41.2)	30.6 (28.0-33.4)	55.6 (52.7-58.5)
Gender					
Men	27.7 (24.2-31.1)	37.9 (34.1-41.7)	33.1 (31.4-38.9)	29.0 (25.5-32.9)	51.3 (47.1-55.0)
Women	38.8 (34.1-43.7)	44.1 (39.6-48.8)	42.2 (37.0-47.1)	31.3 (26.8-35.7)	61.3 (56.6-66.0)
Age-groups					
18-29	31.5 (25.9-37.4)	38.3 (32.6-44.4)	36.4 (30.6-42.7)	25.6 (20.2-30.9)	54.2 (48.0-60.1)
30-39	26.2 (21.8-30.8)	36.2 (31.4-41.2)	37.0 (32.2-41.9)	27.2 (22.6-31.9)	50.3 (45.0-55.5)
40-49	34.2 (28.1-40.1)	41.5 (36.0-47.0)	35.7 (30.0-41.7)	30.2 (24.9-35.9)	55.7 (50.1-61.6)
50-64	41.9 (35.4-48.8)	51.1 (44.5-63.8)	45.2 (38.1-51.9)	44.7 (37.8-51.3)	65.9 (59.5-72.6)
Level of education					
0- 9 years	33.5 (29.2-38.0)	38.9 (34.5-43.5)	34.3 (29.5-38.8)	30.6 (26.5-35.3)	54.2 (49.2-59.1)
>9 years without a university degree	29.8 (24.0-36.2)	41.7 (35.2-47.5)	35.8 (29.3-42.3)	30.8 (24.8-81.2)	53.4 (47.5-60.6)
> 12 years with a university degree	30.6 (26.3-35.1)	40.9 (36.4-45.9)	44.2 (39.3-48.9)-	28.1 (24.1-32.5)	56.8 (52.1-61.5)
Marital status					
Married	30.9 (27.4-34.0)	37.9 (34.4-41.6)	35.9 (32.3-39.5)	27.3 (24.1-30.7)	52.9 (49.2-56.6)
Unmarried	30.9 (26.2-35.9)	41.6 (36.5-46.8)	39.0 (33.4-44.3)	31.3 (26.7-36.3)	55.9 (50.5-61.2)
Divorced/widow/widower	51.8 (38.0-66.1)	56.5 (41.9-69.5)	50.0 (36.1-62.3)	51.5 (37.9-65.1)	72.8 (60.9-84.8)

Anxiety n= 1185, Depression n= 1203, Low SWB n=1180, PTSD n=1153, Any n=1172
*All prevalence rates among subpopulations are weighted. 95 % CI are calculated based on robust standard errors.
** Anxiety, depression, low SWB or PTSD

Mental ill health comorbidity and binominal correlations

Table 3 shows that the mental ill health comorbidity was substantial among the respondents. The different measures of mental ill health overlap and correlate strongly. Some variations indicate that the measures capture partly different facets of mental ill health. The strongest correlations and comorbidities are found between depression and anxiety and between PTSD and depression, while the weakest relationship is found between low SWB and anxiety.

Tabell 3. Proportions with different concurrent mental ill health comorbidities with 95% confidence intervals (CI 95 %) and binominal correlations (ϕ)*

	Concurrent anxiety % (95% CI)	Concurrent depression % (95% CI)	Concurrent low SWB % (95% CI)	Concurrent PTSD % (95% CI)
Anxiety	100	86.6 (83.1-90.0)	68.7 (63.9-73.5)	67.3 (62.4-72.2)
Depression	70.0 (65.9-74.2)	100	71.0 (66.9-76.3)	68.0 (62.4-80.8)
Low SWB	58.2 (53.5-62.8)	75.4 (71.4-79.4)	100	61.3 (56.6-65.9)
PTSD	73.0 (68.3-77.8)	90.0 (86.8-93.1)	77.5 (73.1-81.9)	100
Binominal correlations				
	Anxiety ϕ	Depression ϕ	Low SWB ϕ	PTSD ϕ
Anxiety	1			
Depression	0.66	1		
Low SWB	0.44	0.56	1	
PTSD	0.57	0.67	0.52	1

*All analyses are weighted and 95% CI are calculated based on robust standard errors.

Refugee related potentially traumatic pre- and peri-migratory events and their associations with mental ill health

Table 4 shows that potentially traumatic events experienced before or during migration were very common among the resettled refugees from Syria. A total of 85 % report experiencing war at close quarters and 79 % reported being exposed to other frightening (life-threatening) situations. The majority also reported forced separation from family or close friends (67.9 %), and loss of a significant other (64 %). A large proportion had witnessed violence or assault (63 %), a third report having experienced physical violence or assault, and a similar proportion reported that they had been subjected to torture (31.0 %). Seven percent report being subjected to sexual violence. On average the refugees from Syria reported that they had experienced 4.2 (4.1-4.3) of the 8 studied types of PTEs before or during the migration. When calculating these means separately for the pre- and the peri-migration periods they were 4.0 (3.9-4.1) and 2.1 (2.0-2.2), respectively.

The results presented in table 4 further show that all types of investigated refugee related PTEs were significantly ($p<0.05$) associated with all studied types of mental ill health (adjusted for sociodemographic factors). Overall these adjusted associations appeared to be strongest in relation to PTSD and weakest in relation to low SWB. Being exposed to the different types of PTEs predicted anxiety and depression similarly, with the possible exception of sexual violence that appeared to be a stronger predictor of anxiety. It is, however, important to interpret differences with some caution given that the confidence intervals are rather wide and overlapping.

Table 4. Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD presented as odds rations (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
War at close quarters	86.9 (1036)	85.1 (82.9-87.5)	1.56 (1.01-2.42)	1.86 (1.23-2.80)	1.57 (1.05-2.35)	2.22 (1.38-3.57)
Forced separation from family or close friends	69.4 (817)	67.9 (65.2-70.9)	2.33 (1.77-3.21)	2.41 (2.80-3.23)	1.98 (1.49-2.65)	2.91 (2.09-4.06)
Loss or disappearance of family member(s) or loved one(s)	64.3 (756)	64.3 (61.3-67.3)	2.11 (1.57-2.82)	1.92 (1.46-2.52)	1.55 (1.18-2.04)	3.38 (1.75-3.25)
Physical violence or assault	30.5 (351)	30.9 (28.1-33.5)	3.47 (2.53-4.76)	3.39 (2.52-4.54)	2.01 (1.50-2.70)	3.96 (2.89-5.43)
Witnessing physical violence or assault	63.3 (740)	63.1 (60.0-66.1)	2.41 (1.79-3.24)	2.53 (1.91-3.35)	2.04 (1.54-2.70)	3.57 (2.60-4.90)
Torture	30.6 (354)	31.0 (28.3-33.9)	2.91 (2.5-3.26)	2.14 (1.61-2.84)	1.64 (1.24-2.19)	2.89 (2.14-3.91)
Sexual violence	6.9 (78)	7.1 (5.5-8.6)	3.36 (1.94-5.83)	2.67 (1.61-4.44)	2.02 (1.20-3.38)	3.18 (2.24-6.48)
Other frightening situation where you felt your life was in danger	80.6 (954)	79.4 (76.9-81.7)	2.90 (1.91-4.39)	3.31 (2.28-4.80)	3.38 (2.33-4.90)	6.18 (3.80-10.03)

* All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are not exposed to the respective refugee related PTEs. 95% CI are based on robust standard errors.

Post-migration stressful experiences and their associations with mental ill health

In table 5 it is shown to what extent the respondents report repeated post-migration stressful experiences and how these are associated with mental ill health, when adjusting for sociodemographic factors and pre- and/or peri-migratory PTEs. Of the investigated types of post-migration stress, *often missing social life from back home* and *often feeling sad because not reunited with family members* were the most common ones, experienced by a majority. Around 20% of the respondents reported that they had often felt excluded or isolated in Sweden, while less than 10 % indicated that they had often experienced ethnic discrimination, extreme poverty or distressing family conflicts after resettlement in Sweden.

All seven post-migratory stressful experiences were significantly associated with anxiety, depression, low SWB and PTSD, with the exception of *often sad due to not being reunited with family members* that was not significantly associated with anxiety (Table 5). *Often felt disrespected due to my national background* seemed to be the type of post-migration stressful experience that predicted mental ill health most strongly, while *often felt sad because not reunited with family members* generally exhibited the weakest association with mental ill health. Even though interpretations should be made with cautions, as the confidence intervals in most cases are highly overlapping, the result indicates that post-migration stress is stronger related to PTSD than it is to anxiety.

Table 5. Prevalence rates of post-migration stress and their associations with anxiety, depression, low SWB and PTSD presented as odds ratios (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Weighted % (95% CI)*	Anxiety OR (95% CI) *	Depression OR (95% CI) *	Low SWB OR (95% CI) *	PTSD OR (95% CI) *
Often felt disrespected due to my national background	4.3 (52)	4.3 (3.1-5.5)	5.49 (2.79-10.81)	5.68 (2.83-11.41)	7.04 (3.35-14.78)	5.96 (2.97-11.94)
Often have had bothering difficulties communicating in Swedish	39.0 (469)	37.1 (34.5-39.9)	1.77 (1.30-2.40)	2.39 (1.78-3.19)	2.36 (1.77-3.16)	2.77 (2.00-3.83)
Often been unable to buy necessities	8.5 (103)	8.5 (6.9 -10.2)	3.46 (2.14-5.60)	3.46 (2.14-5.60)	3.21 (1.94-5.32)	4.31 (2.49-7.45)
Often missing my social life from back home	64.1 (773)	62.3 (59.6-65.2)	2.00 (1.46-2.81)	2.37 (1.74-3.23)	2.43 (1.78-3.31)	2.90 (1.97-4.27)
Often felt sad because not reunited with family members	49.8 (581)	50.2 (46.9-53.5)	1.26 (0.93-1.71)	1.41 (1.06-1.86)	1.40 (1.06-1.85)	1.49 (1.08-2.05)
Often felt excluded or isolated in the Swedish society	19.6 (235)	19.8 (17.4-22.2)	2.42 (1.70-3.46)	3.40 (2.39.4.83)	2.89 (2.05-4.08)	3.29 (2.27-4.78)
Often distressing conflicts in family	6.0 (72)	6.0 (4.5-7.5)	2.51 (1.29-4.92)	4.87 (2.25-10.53)	4.64 (2.32-9.29)	5.16 (2.56-10.40)

*All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. 95% CI are calculated based on robust standard errors

The results presented in table 6 reveal that number of types of post-migratory stressful experiences partially mediated the effect of PTEs on all the included mental ill health outcomes.

Table 6. Estimates of direct effect of number of types of PTE exposures, and indirect effect of number of types of post-migratory stressful experiences modelled as mediator, with mental ill health as outcome*

	Direct effect			Indirect effect		
	Estimate	SE	95% CI	Estimate	SE	95% CI
Anxiety	.044	.006	.031-.056	.013	.002	.009-.019
Depression	.045	.007	.032-.058	.017	.003	.012-.023
Low SWB	.024	.007	.011-.037	.017	.003	.012-.023
PTSD	.056	.006	.044-.068	.017	.003	.012-.022

* Estimates are unstandardized with corresponding bias-corrected bootstrapped confidence intervals (CI) and robust standard errors (SE).

Sensitivity analyses

The sensitivity analyses showed result similar to the main analysis (Supplementary material 1-6). The prevalence rates were approximately the same in the multiple imputed datasets (Supplementary material 1) and associations that were significant ($p<0.05$) or non-significant in the main analyses remained so in almost all the sensitivity analyses (Supplementary material 2-6). One exception was that *felt sad because not reunited with family members* was no longer a significant predictor of any mental ill health measures when operationalized more leniently.

Discussion

This study, one of the first of its kind, indicate that refugees from Syria that resettled in Sweden following the war that started in 2011 have prevalence rates of anxiety, depression, low subjective wellbeing and PTSD that range between 30 and 40%. A majority reported symptoms in line with at least one of these four types of mental ill health, and many fulfilled multiple criteria. Mental ill health was generally more common among women, older and the divorced or widowed refugees. The study further showed that refugee related potentially traumatic events and post-migration stress were common. For example, 30 % reported they had experienced torture, while 50 % often had been sad because not being reunited with family members. Finally, it was revealed that practically all investigated types of refugee related PTEs and post-migration stress were significantly associated with anxiety, depression, low SWB and PTSD.

The prevalence rates in this study are in line with many others obtained from previous larger studies on refugees [3 31 32]. Any comparison should, however, be done with caution given that the contexts, methodological aspects and the inclusion criteria usually vary extensively between studies. Nonetheless, some previous findings are more reasonable to contrast with our reported prevalence estimates as both pre- and post-migration conditions exhibit several similarities. A smaller Swedish study among Iraqi asylum seekers aged 18-48 years in which the prevalence of PTSD was estimated to 38% is one of those[33], while Laban et al's study among Iraqi asylum seekers in the Netherlands, where the prevalence of anxiety syndrome was estimated to 22%, depression to 34% and PTSD to 36%, is another such example[34]. These more comparable prevalence estimates are thus similar with those reported here among recent refugees from Syria resettled in Sweden. Moreover, in two recent studies on Syrian refugees living in refugee camps in Turkey and Lebanon the prevalence of PTSD was estimated to around 30 percent[35 36]

In Bogic et al's review article it was revealed that mental ill health appear to be particularly common among refugees from former Yugoslavia or Cambodia and among refugees resettled in the US[3]. The prevalence rates reported here are generally lower than those reported among Cambodians in US[37] (at least with regard to depression), but comparable to estimates among refugees from former Yugoslavia resettled in different parts of Europe[32]. The high rates of mental ill health among the Syrian refugees are probably most appropriately interpreted in light of the high exposure to war-related PTEs described in the present article and the sheer magnitude of human rights violation during the Syrian conflict[38].

It is difficult to establish the extent of applicability of the mental ill health prevalence from this study to Syrian refugee populations resettled in other European countries. However, as long as post-migration conditions and differences in immigration legislation or asylum policies at the resettlement destination do no distort comparability, these estimates are likely to be transferable to a large degree. In this regard, it should be emphasized that time passed since resettlement may also influence transferability of the prevalence estimates, since the adverse effects of war-related PTEs as well as post-migration stress tend to diminish with time[39 40].

That mental ill health is more common among women, older and divorced/widowed refugees are consistent with other research[3 19 32]. These associations are commonly also observed in non-refugee populations. However, the finding that mental ill health does not appeared to

differ by educational level may seem surprising, but this has also been observed previously among refugees in Sweden[19]. Studies investigating this association among refugees have nonetheless reported contradictory findings[20 32], which is likely to be attributable (at least partially) to differences between refugee populations and the post-migration conditions. A possible explanation on a more theoretical level may be that the buffering effect of higher education (or buffering effects related to higher education) is canceled out as a result of that refugees with a higher educational level experience greater loss of status. Loss of status, or downward social mobility as it also sometimes is called, has been shown to have an adverse effect on refugees' mental health[41].

All eight, deliberately broad, categories of pre- and peri-migratory refugee related PTEs were related to mental ill health. This clearly demonstrates that many types of refugee-related PTEs are associated with different manifestations of mental ill health. Still, it was revealed that the refugee related PTEs were stronger predictors for PTSD than for low SWB. Overall, and in line with previous findings, the PTEs that showed the strongest associations with mental ill health were those that involved exposure to interpersonal violence[42].

A somewhat puzzling exception is that torture appears to have the weakest association with low SWB among the studied PTEs. This may be because individuals tend to value their current life as less negative, all else being equal, when having experienced harsh former living conditions [43]. The reported associations between refugee related PTEs' and mental ill health are most likely causal in nature, as it seems unreasonable to propose that individuals with mental ill health would be more at risk for refugee related PTEs. Neither does previous research support that under-reporting of PTEs are more common among refugees without mental ill health. It is, if something, more likely that individuals with mental ill health are more prone to under-report PTEs[44], which would suggest that the associations presented between refugee related PTEs and mental ill health are underestimated rather than overestimated.

The study further showed that all included types of post-migration stress were significantly associated with mental ill health, when adjusting for refugee related PTEs. Similar findings have been shown in previous research among other refugee or migrant populations[18 19 45] which corroborate our expectations**.** A notable exception was that *feeling sad because not reunited with family members'* association with mental ill health was not substantiated in some of the sensitivity analyses. These non-associations were primarily detected in the sensitivity analyses where a very lenient cut-off was used, i.e., *feeling sad because not reunited with family members* at least once since immigrated to Sweden. Such low thresholds for endorsing this statement may perhaps indicate less severe emotional distress, which could explain the lack of substantial association with mental ill health. Furthermore, not being united with one's family could be viewed as a proxy for lack of an important source of social support [46], which is strongly associated with mental health [47 48] . The displayed weak association in the present study contradicts both clinical practice and previous findings. An explanation may also be that some respondents have interpreted *family* in a wider sense including distant relatives. If this is the case, which is not entirely unlikely, it would imply that the item is a suboptimal proxy of social support.

That the association between refugee-related PTEs and mental ill health appears to be partially mediated by post-migration stress is an important finding that deserves to be investigated in more detail. This observation nonetheless indicates that exposure to PTEs

make refugees particularly susceptible to adverse stressful experiences during resettlement. Whether this is to be attributed to that PTEs reduce refugees coping resources or that refugee related PTEs make individuals more likely to become exposed to difficult situations, or both, remains unclear. Nickerson et al found in their cross-sectional study among refugees resettled in Switzerland that difficulties in regulating emotions meditated the association between trauma exposure and mental ill health almost completely, while it partially mediated the association between post-migration stress and PTSD, and depression[49]. Emotion dysregulation may thus be an essential causal mechanism for explaining also the findings reported in the present study.

Post-migration stress and mental ill health are on the other hand likely to be reciprocally associated[16]. It has been reported that refugees with PTSD tend to have greater difficulties to learn the language spoken at the resettlement destination[50], and that refugees with mental ill health tend to interpret adverse events as being more stressful, while simultaneously evaluating favorable life events as less positive[51]. Without onset information, it is possible that residual confounding may to some extent have distorted the associations between post-migration stress and mental ill health. Another potential source of residual confounding between specific post-migration stress and mental ill health comes from not adjusting for other types of post-migration stress, which was a deliberate choice in order to avoid over adjustment. What nonetheless can be concluded is that these associations are not confounded by refugee related PTEs nor a consequence of reverse causation, as refugee related PTEs predate post-migration stress and are adjusted for.

Strength and limitations

This is the first larger comprehensive study of mental ill health among recently resettled refugees from Syria in a European country. That the study is based on a random sample drawn from a known sample frame including all eligible participants is a major and unique strength. The availability of the register-based information for all eligible study participants enabled us to evaluate the representativeness of our sample. It also provided the opportunity to construct non-response weights for obtaining more reliable estimates even though the non-response rate is substantial.

All the same, the substantial non-response rate poses the single greatest limitation of the study. It has previously been indicated in a Swedish study that prevalence estimates of mental ill health are likely biased, in a downward direction, as a consequence of that mental ill health tend to be more common among non-respondents[52]. Whether this finding also is applicable for mental health surveys targeting refugees from Syria is not known. However, the weighted and unweighted prevalence rates of mental ill health were similar, and provided some support for that this type of selection bias may be negligible in this case.

The use of several different measures of mental ill health, all with high internal consistency, is also a strength. All employed measures of mental ill health have frequently been used and shown to exhibit good psychometric properties in diverse cultural settings[23-27]. The robustness of our results are supported by the fact that all of these outcomes when analyzed, dichotomized or continuous, provided similar findings. That being said, the cut-offs used in the present study have not yet been validated among refugees from Syria. The cut-offs used in the present study are based on validation studies among other war-tormented populations, but

further studies are needed to substantiate the appropriateness of employing them also in this context.

Another limitation of this study is the use of self-report data in the assessment of mental ill health. Although clinical interviews may hold stronger validity, the possibility of conducting such interviews in large scale studies and among the hard to reach population of the refugees are inevitably constrained for logistic and practical reasons. Moreover, it should be emphasized that the single items used to identify different war-related PTEs and types of post-migration stress neither capture nor include all factors that are likely to be of importance in this context. Nonetheless, the included items cover a broad range of aspects that according to previous research have been shown to be associated with mental ill health among refugees.

Cross-sectional studies are well suited for estimating prevalence, while making causal claims based on cross-sectional data should be done with extreme caution – if it is at all reasonable to make such claims. Caution when interpreting the current findings in terms of causality is thus warranted. We advocate, however, that PTEs can be accurately assessed retrospectively, and are likely to precede the mental ill health and thus possible to be studied using a cross-sectional design. To better understand associations between post-migration stress and mental ill health prospective studies are needed, which currently are rare among refugee populations.

Conclusion

Our study shows that prevalence of mental ill health, in terms of anxiety, depression, low subjective wellbeing and PTSD, is highly elevated and comorbid among refugees from Syria. Moreover, refugee related PTEs as well as post-migration stress are associated to several different manifestations of mental ill health. Increased attention from multiple societal sectors, the governmental and health care sector in particular, to adequately support Syrian refugees' mental health needs, promote their recovery and reduce post-migration stress are needed. The results further indicate that health care workers should not only focus on treatment related to previous PTEs, but also support refugees in their efforts to dampen the adverse effects of post-migration stress. Also more prospective and population-based research are warranted to better understand the causal mechanisms involved.

Contributors: PT, FS conceptualized and designed the study and the empirical analyses. FS obtained the funding. PT, CA, AM collected the data. PT, AM, CA, ES and FS constructed and/or adapted the questionnaire. ES had a special responsibility with research issues dealing with potentially traumatic events, while AM had the same type of responsibility regarding post-migration stress. PT conducted the statistical analyses with advice and support from AL and FS. PT drafted the initial version of the manuscript. All authors contributed in revising and editing the manuscript with substantial methodological and intellectual support and approved the manuscript as submitted. PT and FS are the guarantors of the study.

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Ethics approval: The study was approved by the Stockholm Regional Ethical Review Board (number: 2015/1463-1431 and 2016/549-32).

Data sharing statement: The statistical code is available from the corresponding author. Under Swedish law and ethical approval, individual level data of this kind cannot be publically available. Individual level data can be made available on reasonable request as long as it is in line with Swedish law and ethical approvals.

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Appendix: Prevalence of mental ill health, traumas and post-migration stress among refugees from Syria resettled in Sweden after 2011: a population-based survey

Content:

Supplementary material 1: Prevalence of anxiety, depression, low SWB, PTSD and *any* in the total and among subpopulations based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set

	Anxiety % *, Dif **	Depression % *, Dif **	Low SWB % *, Dif **	PTSD % *, Dif **	Any % *, Dif **
Total (weighted)	32.4, 0.6	40.2, 0.0	37.8, 0.1	30.2, 0.3	53.6, 2.4
Total (unweighted)	32.2, 0.6	40.6, 0.0	38.4, 0.1	31.0, 0.4	54.2, 1.4
Gender					
Men	28.6, 1.1	38.0, 0.1	35.3, 2.3	29.6, 0.6	49.9, 1.4
Women	39.0, 0.2	44.0, 0.1	42.2, 0.0	31.4, 0.1	60.0, 1.3
Age-groups					
18-29	32.4, 1.1	38.3, 0.0	36.7, 0.3	25.7, 0.1	53.5, 0.7
30-39	26.2, 0.0	36.1, 0.1	36.9, 1.1	28.1, 0.9	48.9, 1.4
40-49	34.4, 0.2	41.6, 0.1	35.2, 0.5	29.6, 0.6	53.7, 2.0
50-64	43.3, 1.4	51.4, 0.3	45.9, 0.7	45.3, 0.6	64.5, 1.4
Level of education					
0- 9 years	34.1, 0.6	39.0, 0.1	34.4, 0.1	30.8, 0.2	52.8, 1.4
>9 years without a university degree	30.7, 0.9	41.7, 0.0	36.1, 0.3	31.5, 0.7	52.8, 0.6
> 12 years with a university degree	30.9, 0.3	40.9 0.0	44.2, 0.0	28.4, 0.3	55.4, 1.4
Marital status					
Married	31.4, 0.5	37.9, 0.0	35.9, 0.0	27.8, 0.5	51.4, 1.5
Unmarried	31.5, 0.6	41.8, 0.2	39.4, 0.4	31.5, 0.2	54.7, 1.2
Divorced/widow/widower	51.6, 0.2	55.2, 1.3	49.5, 0.5	50.2, 1.3	71.7, 1.1

*Pooled prevalence based on five multiple imputed datasets

** Difference between the pooled prevalence estimates based on the five imputed data sets and prevalence estimate prevalence estimate from analysis based on the original non-imputed data set.

Supplementary material 2: Prevalence of refugee related PTEs and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses of five multiple imputed data sets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
War at close quarters	85.1, 0.0	1.50-1.61, 0.01, 0.047	1.78-1.88, 0.04, <0.01	1.85-2.05, 0.06 <0.01	2.09-3.33, 0.05, <0.01
Forced separation from family or close friends	67.9, 0.0	2.14-2.35, 0.11, <0.01	2.39-2.49,0.04, <0.01	1.51-1.61, 0-01, <0.01	1.84-2.05, 0.06, <0.01
Loss or disappearance of family member(s) or loved one(s)	64.6, 0.3	2.03-2.10, 0.06, <0.01	1.83-1.97, 0.03, <0.01	1.91-2.03, 0.03, <0.01	1.51-1.61, 0.01, <0.01
Physical violence or assault	31.5, 0.6	3.01-3.58, 0.08, <0.01	3.12-3.34, 0.13, <0.01	1.91-2.03, 0.03, <0.01	1.91-2.03, 0.03, <0.01
Witnessing physical violence or assault	63.2, 0.1	2.25-2.48, 0.07, <0.01	2.42-2.55, 0.03, <0.01	1.99-2.11, 0.02, <0.01	1.99-2.11, 0.03, <0.01
Torture	31.7, 0.7	2.82-2.12, 0.05, <0.01	2.15-2.28, 0.07, <0.01	1.64-1.75, 0.05, <0.01	1.64-1.75, 0.05, <0.01
Sexual violence	7.5, 0.4	2.62-3.64, 0.18, <0.01	2.44-2.77, 0.07, <0.01	1.90-2.24, 0.06, <0.01	1.90-2.24, 0.06, <0.01
Other frightening situation where you felt your life was in danger	79.3, 0.1	2.70-2.98, 0.05, <0.01	3.17-3.29, 0.01, <0.01	3.12-3.37, 0.02, <0.01	3.12-3.37, 0.02, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors.

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 3: Prevalence of different types of post-migration stress and their associations with anxiety, depression, low SWB and PTSD (ORs) based on analyses on five multiple imputed datasets, and compared to estimates from original non-imputed data set.

	%*, Dif **	Anxiety OR Range *** OR Dif **** P-value *****	Depression OR Range *** OR Dif **** P-value *****	Low SWB OR Range *** OR Dif **** P-value *****	PTSD OR Range *** OR Dif **** P-value *****
Often felt disrespected due to my national background	4.3, 0.0	4.98-5.46, 0.14, <0.01	5.67-6.18, 0.12, <0.01	4.28-5.00, 0.24, <0.01	4.23-4.65, 1.49, <0.01
Often have had bothering difficulties communicating in Swedish	37.1, 0.0	1.94-2.06, 0.26, <0.01	2.53-2.63, 0.19, <0.01	2.08-2.64, 0.11, <0.01	2.76-2.90,0.04, <0.01
Often been unable to buy necessities	8.5, 0.0	2.95-3.10, 0.43, <0.01	2.95-3.10, 0.43, <0.01	2.76-3.06, 0.29, <0.01	3.46-4.28, 0.53, <0.01
Often missing my social life from back home	62.4 0.1	2.09-2.19, 0.13, <0.01	2.55-2.64, 0.24, <0.01	1.42-2.50, 0.26, <0.01	2.85-3.07, 0.07, <0.01
Often felt sad because not reunited with family members	50.2, 0.0	1.23-1.33, 0.03, 0.08	1.41-1.49, 0.03, <0.01	1.40-1.46, 0.04, <0.01	1.34-1.47, 0.09, 0.03
Often felt excluded or isolated in the Swedish society	19.9, 0.1	2.63-2.85, 0.30, <0.01	3.82-4.04, 0.54, <0.01	2.94-3.13, 0.13, <0.01	3.08-3.37, 0.04, <0.01

All analyses are weighted and associations are adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post-migration stressful experiences. P-values are calculated based on robust standard errors

*Pooled prevalence from five multiple imputed data sets.

** Difference between the pooled prevalence estimates from analyses based on the five multiple imputed datasets and prevalence estimate from analysis based on the original non-imputed data set.

*** Range of ORs in the five multiple imputed data sets.

**** Difference between pooled ORs from analyses based on five multiple imputed data sets and ORs from analyses based on the original non-imputed data set.

***** Pooled p-values from analyses of five multiple imputed data sets.

Supplementary material 4: Associations between refugee related PTEs and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
War at close quarters	0.26, <0.01	0.30, <0.01	0.13, 0.14	0.44, <0.01
Forced separation from family or close friends	0.38, <0.01	0.49, <0.01	0.38, <0.01	0.52, <0.01
Loss or disappearance of family member(s) or loved one(s)	0.30, <0.01	0.34, <0.01	0.20,<0.01	0.45, <0.01
Physical violence or assault	0.61, <0.01	0.61, <0.01	0.40, <0.01	0.73, <0.01
Witnessing physical violence or assault	0.46, <0.01	0.47, <0.01	0.37, <0.01	0.65, <0.01
Torture	0.48, <0.01	0.46, <0.01	0.28, <0.01	0.58, <0.01
Sexual violence	0.53, <0.01	0.52, <0.01	0.37, 0.01	0.68, <0.01
Other frightening situation where you felt your life was in danger	0.54, <0.01	0.64, <0.01	0.57, <0.01	0.83, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education and marital status. The reference categories are *not* exposed to the respective refugee related PTEs. P-values are calculated based on robust standard errors

Supplementary material 5: Associations between post-migration stress and anxiety, depression, low SWB and PTSD when outcomes are model as continuous variables (OLS)*

	Anxiety % β, p-value	Depression β, p-value	Low SWB β, p-value	PTSD β, p-value
Often felt disrespected due to my national background	0.72, <0.01	0.76, <0.01	0.70, <0.01	0.80, <0.01
Often have had bothering difficulties communicating in Swedish	0.28, <0.01	0.39, <0.01	0.41, <0.01	0.42, <0.01
Often been unable to buy necessities	0.64, <0.01	0.60, <0.01	0.55, <0.01	0.57, <0.01
Often missing social life from back home	0.23, <0.01	0.49, <0.01	0.43, <0.01	0.44, <0.01
Often felt sad because not reunited with family members	0.15, 0.02	0.21, <0.01	0.08, 0.20	0.13, 0.03
Often felt excluded or isolated in the Swedish society	0.42, <0.01	0.58, <0.01	0.52, <0.01	0.49, <0.01
Often distressing conflicts in my family	0.60, <0.01	0.84, <0.01	0.79, <0.01	0.63, <0.01

*All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

Supplementary material 6: Associations between post-migration stress (using a lenient definition*) and anxiety, depression, low SWB and PTSD (ORs) with 95 % confidence intervals (95% CI)

	% (n)	Anxiety OR (95% CI) **	Depression OR (95% CI) **	Low SWB OR (95% CI) **	PTSD OR (95% CI) **
Felt disrespected due to my national background	37.2 (448)	2.33 (1.70-3.18)	2.29 (1.70-3.07)	2.05 (1.54-2.74)	2.46 (1.76-3.44)
Have had bothering difficulties communicating in Swedish	82.1 (989)	1.50 (0.97-2.33)	1.64 (1.10-2.45)	1.98 (1.10-2.98)	2.57 (1.57-4.24)
Been unable to buy necessities	38.7 (467)	1.94 (1.43-2.63)	1.94 (1.43-2.63)	1.85 (1.39-2.46)	2.12 (1.54-2.92)
Missing social life from back home	93.6 (1128	3.71 (1.62-8.50)	2.72 (1.41-5.23)	1.34 (0.73-2.45)	9.28 (2.79-30.90)
Felt sad because not reunited with family members	84.6 (1004)	1.26 (0.82-1.94)	1.28 (0.86-1.91)	1.39 (0.94-2.06)	1.21 (0.76-1.95)
Felt excluded or isolated in the Swedish society	64.3 (770)	2.13 (1.52-3.00)	3.00 (1.84-4.12)	2.59 (1.89-3.55)	3.10 (2.13-4.54)
Distressing conflicts in my family	35.4 (428)	1.71 (1.26-2.32)	2.44 (1.83-3.25)	2.20 (1.65-2.93)	2.31 (1.68-3.17)

* Defined as having had the respective post-migratory stressful experiences *at least once* since immigrated to Sweden

**All analyses are weighted and adjusted for gender, age-groups, level of education, marital status, all eight types of studied refugee-related PTEs, no. of types of PTEs and no. of types of PTEs squared. The reference categories are not often having been exposed to the respective post migration stressful experiences. P-values are calculated based on robust standard errors

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

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

		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	8
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	4 and 10
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Supplied in table 2 (page11), table 4 (page 13) and table 5 (page 14).
Outcome data	15*	Report numbers of outcome events or summary measures	8,13 and 14
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	10-15
		(*b*) Report category boundaries when continuous variables were categorized	6-7
		(*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	Appendix and page 6
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
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	17-18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	15 and 17
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	19

*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.