



## Course and predictors of posttraumatic stress and depression longitudinal symptom profiles in refugees: A latent transition model

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### ABSTRACT

Exposure to potentially traumatic events and post-migration living difficulties (PMLDs) may explain the high rates of posttraumatic stress disorder (PTSD) and depression in resettled refugees. Latent class analyses (LCAs) in refugees have identified subgroups that differ in symptom profiles of PTSD and comorbid symptoms. However, knowledge on longitudinal symptom profiles in refugees is sparse. Examining longitudinal PTSD and depression symptom profiles could provide information on risk factors underlying worsening of symptoms post-resettlement. Self-rated PTSD (Posttraumatic Diagnostic Scale) and depression (Patient Health Questionnaire-9) symptoms were assessed among 613 refugees who had resettled in Australia up to two years previously (W1) and at 6 months follow-up (W2). PTSD and depression symptom profiles were identified using LCAs for W1 and W2 separately. Latent transition analysis was used to examine (predictors of) changes in symptom profiles, including gender, age, trauma exposure, and PMLDs. Four classes were identified that were consistent across timepoints: a No symptoms (W1 61%; W2 68%), Low PTSD/Moderate depression (W1 16%; W2 10%), Moderate PTSD/depression (W1 16%; W2 14%), and High symptoms class (W1 7%; W2 7%). Higher levels of problems with PMLDs, including being discrimination and family separation, predicted movements out of the No symptom class at W1 to classes with psychopathology at W2. To conclude, most participants did not develop PTSD or depression symptoms. The risk of developing these symptoms seems higher when problems with interpersonal PMLDs increased, pointing to the need for considering these stressors when addressing the mental health needs in this population.

Globally, 26.0 million people are currently registered as a refugee and 4.2 million people are awaiting a decision regarding their asylum application (UNHCR, 2020). Recent conflicts in countries like Syria and Iraq mean that host countries are now home to tens of thousands of refugees, and charged with helping them to adapt to life in their countries of resettlement (UNHCR, 2018). People with a refugee background are often exposed to multiple potentially traumatic events (PTEs) in

their home country and during displacement, such as being tortured (Cheung et al., 2018). It has been repeatedly found that exposure to a greater number of PTEs is associated with elevated psychopathology levels in refugees, such as posttraumatic stress disorder (PTSD) and depression (Bogic et al., 2015; Charlson et al., 2019; Steel et al., 2009).

While lifetime exposure to PTEs is an important predictor of distress, post-migration living difficulties (PMLDs) after resettlement are also

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strong predictors of distress in refugees (Chen et al., 2017; Hou et al., 2020; Li et al., 2016). Resettled refugees are often exposed to socio-economic stressors, including housing, financial, and job insecurity that worsen mental health (Porter and Haslam, 2005). In addition, many refugees face interpersonal difficulties, such as separation from, and worry about, family members, and being discriminated against, which likely increase distress levels (Bendjo et al., 2019; Colic-Peisker and Walker, 2003; Correa-Velez et al., 2010). Furthermore, it is often challenging for resettled refugees to access mental health services due to various reasons, such as lack of knowledge about existing services, self-stigma, and distrust in health care system, which may result in long-term impaired mental health (Byrow et al., 2020). Several reviews have found that these PMLDs are related to higher PTSD and depression levels over and above exposure to pre-migration PTEs (Li et al., 2016; Porter and Haslam, 2005).

The combined burden of the psychological impact of exposure to PTEs in the home country, alongside substantial PMLDs in the host country may explain the higher rates of psychiatric disorders in resettled refugees compared with the host country population (Giacco et al., 2018). A meta-analysis from Steel et al. (2009) shows that three out ten refugees suffers from PTSD and depression. While factor and network analytic studies showed that PTSD and depression are related, yet distinct (Afzali et al., 2017; Blanchard et al., 1998; Grant et al., 2008; Kassam-Adams et al., 2010), they often co-occur (Momartin et al., 2004; Nickerson et al., 2017). Psychiatric disorders have often been studied separately as dichotomous constructs (being “present” or “absent”) or by using population means (cf., Henkelmann et al., 2020). Both approaches ignore the heterogeneity and comorbidity that is often observed in psychological responses, with research suggesting that psychiatric disorders, such as PTSD, may manifest themselves in multiple ways (Galatzer-Levy and Bryant, 2013).

Heterogeneity and comorbidity in refugees’ psychopathology profiles has been examined in prior studies, using advanced statistical approaches, such as latent class analysis (LCA). LCA allows the identification of distinct subgroups (i.e., classes) of people that share similar symptom patterns (Collins and Lanza, 2010). LCAs conducted with refugee samples have shown that qualitatively different symptom profiles of PTSD and comorbid symptoms are distinguishable. For instance, four classes were identified in a sample of West Papuan refugees based on symptoms of PTSD, depression, and intermittent explosive disorder (i.e., a PTSD only, PTSD/depression, intermittent explosive disorder only, and resilient class; Tay et al., 2015). An LCA in a representative refugee sample in Australia yielded five distinct classes based on PTSD, depression, and anxiety symptoms; a high comorbid symptom class, high PTSD class, high depression/anxiety class, moderate PTSD class, and resilient class (Nickerson et al., 2019a). These prior LCA studies show that different symptom profiles of PTSD and comorbid symptoms can be distinguished in people with a refugee background.

While LCA can be helpful in identifying latent classes of people that differ in terms of symptom profiles, it is still largely unknown how stable these classes are over time. Examining (predictors of) transitions of people across latent classes over time may provide important information on factors associated with transition from the low symptom class to high symptom class, which may help to target early interventions. This avenue of research is indicated because of evidence that PTSD is not a static disorder but instead people’s symptoms fluctuate markedly over time (Bryant et al., 2013). Latent Transition Analysis (LTA) is a statistical technique that allows examination of (predictors of) longitudinal latent classes (Collins and Lanza, 2010). To the best of our knowledge, LTA has only been used once in a sample of people exposed to conflict and/or war. In this LTA study, Tay et al. (2017) identified three classes at both measurement occasions (12 months apart), in a Sri Lankan sample exposed to conflict, based on anxiety and depression symptoms. These three classes were a low symptoms, depression only, and comorbid symptoms class. Over time most people (44%) demonstrated a persistent symptom trajectory, characterized by staying in the comorbid

or depression only symptom class, followed by a recovery trajectory which represented people (24%) moving out of the comorbid or depression only class into the low symptom class. One out five people showed a low symptom trajectory, representing people in the low symptom class at both time points and 13% reported a worsened trajectory characterized by moving out the low symptom class into the comorbid or depression only class. Being a woman, past exposure to PTEs, job loss, and lack of access to health care were predictors of the persistent and worsening symptom trajectories.

The current study expands prior research on symptom profiles in refugees by examining, for the first time, longitudinal symptom profiles of PTSD and depression. We used LCA to identify symptom profiles at baseline and six months later in a sample of refugees resettled in Australia. LCA was chosen because it allows examination of whether subgroups of people are distinguishable based on responses on individual items. Identifying these subgroups has implications for research and practice. It may provide insights in commonly reported symptom-profiles in refugees, which informs researchers about the (co-)occurrence of PTSD and depression responses. So far, research on psychopathology in refugees has been dominated by focusing on rates or mean levels of PTSD, and less frequently on depression, and even few studies have focused on both. Moreover, examining individual differences in PTSD and depression symptom-profiles could reveal subgroups that are not detectable by examining rates and mean levels of PTSD and depression separately. For instance, prior LCA research on PTSD has identified a subgroup characterized by subclinical PTSD, which may need a different treatment approach in order to prevent late-onset PTSD or long-term negative outcomes (Breslau et al., 2005; Lenferink et al., 2019).

In addition, we examined transitions in PTSD and depression symptom profiles over time, using LTA. Furthermore, we explored which commonly reported risk factors for distress in refugees were related to change in symptom profiles over time, including background characteristics (i.e., gender and age), exposure to PTEs, and PMLDs. Based on prior research (Chen et al., 2017; Li et al., 2016; Tay et al., 2017), we focused on the following seven PMLDs that have been consistently associated with poorer mental health in refugees: 1) housing problems, 2) financial difficulties, 3) job insecurity, 4) separation from family, 5) worry about family members, 6) being discriminated against, and 7) difficulties accessing treatment for health or mental health problems. The majority of prior research in this area has examined the associations between these risk factors and mental health outcomes concurrently (Li et al., 2016). Investigating how these risk factors impact the worsening of psychiatric symptoms in the post-resettlement phase may provide crucial insights for policy makers and service providers that may help to improve services for refugees to address their mental health needs. Accordingly, in this study we examined to what extent these common risk factors are related the transitions of people moving out of the class with low symptoms within 2 years after resettlement (W1) into classes with elevated symptoms 6 months later (W2).

## Methods

### Participants and procedures

Current data were part of a longitudinal online survey study that aims to examine determinants of mental health in refugees resettled in Australia (Nickerson et al., 2019b, 2020). To be included in the current study, participants had to (a) be a refugee or asylum seeker, (b) have arrived in Australia after January 2011 and participated in the study within two years after arrival, (c) be at least 18 years old, (d) be a resident of the Australian community at the time of assessments and not residing in a detention centre or immigration facility, (e) be a permanent resident or Australian citizen, and (f) have sufficient proficiency in Arabic, Tamil, Farsi, or English language. People were recruited by various methods, including snowball sampling and social media

advertising and advertisements at Australian support services for refugees and asylum seekers. The UNSW Human Research Ethics Committee approved this study (HC14106). The sample included 620 participants. In total, 6 people completed W1 but not W2 and 1 person completed W2 but not W1. After removing these 7 people, our final sample size consisted of 613 people. Mean time between W1 and W2 assessment was 6.34 (SD = 0.78) months.

### Measures

Posttraumatic stress disorder symptoms were assessed with the DSM-IV version of the 17-item Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997). One item (“Feeling as if your future plans or hopes will not come true (for example you will not have a career, marriage, children or a long life)”) was excluded following prior research (Nickerson et al., 2015). Four items were added to assess PTSD in terms of DSM-5 (American Psychiatric Association, 2013). These items included negative cognitions about oneself or the world, blaming the self or others, negative emotional states, and self-destructive or reckless behaviour. Participants choose the answer on a 4-point Likert scale that best described how often they were bothered by each symptom during the past month. Total scores of the 20 items could range from 20 to 80, which higher scores representing higher PTSD levels. The following instruction was provided: “Below is a list of problems that people sometimes have after experiencing a traumatic event. Please read each one carefully and choose the answer that best describes how often that problem has bothered you in the past month. Rate each problem with respect to the traumatic events that currently bother you most. We did not refer to a specific index trauma, because refugees have often experienced several traumatic events that are highly salient and we considered it unnecessarily burdensome to require them to identify a single event as the worst. A symptom was considered absent when rated with 1 (“Not at all/only one time”) or 2 (“Once a week or less/once in a while”) and present when rated with 3 (“2 to 4 times a week/half the time”) or 4 (“5 or more times a week/almost always”). Probable PTSD caseness was determined based on the DSM-5 diagnostic scoring rule (American Psychiatric Association, 2013) requiring  $\geq 1$  intrusive symptom,  $\geq 1$  avoidance symptom,  $\geq 2$  symptoms reflecting negative alterations in cognition and mood, and  $\geq 2$  symptoms representing alterations in arousal and reactivity. The PDS has strong psychometric properties in culturally diverse samples (Foa et al., 1997; Norris and Aroian, 2008). Cronbach’s alpha levels in current study were 0.96 at both W1 and W2.

Nine depression symptoms according to DSM-5 (American Psychiatric Association, 2013) were assessed with the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001). The participant selected an answer option on a 4-point Likert scale that described how often he/she was bothered by each symptom during the past two weeks. In line with earlier LCA studies (Armour et al., 2015), a symptom was considered absent when rated with 0 (“Not at all”) or 1 (“Several days”) and present when rated with 2 (“More than half of the days”) or 3 (“Nearly every day”). Total scores could range from 0 to 27, with higher scores reflecting higher depression levels. A total score of  $\geq 10$  was used for determining probable depression caseness (Kroenke et al., 2001). Psychometric properties of the PHQ-9 are adequate across samples with various cultural backgrounds (Alzahrani et al., 2020; Dadfar et al., 2018; Kroenke et al., 2001). In the current study, Cronbach’s alpha levels were 0.91 at W1 and 0.93 at W2.

Exposure to and/or witnessing of PTEs were assessed with the 16-item Harvard Trauma Questionnaire (Mollica et al., 1992). Each item represents a PTE, e.g., “torture”. Participants choose one or more of four options, including “experienced myself”, “witnessed this happening to others”, “learned about this happening to a friend/family member”, and “none of the above”. Each item was dichotomized such that experiencing and/or witnessing an event indicated presence of exposure to the PTE. A total score at W1, that could range from 0 to 16, was included in this study indicating trauma count.

PMLDs were assessed using a version of the Post-migration Living Difficulties Checklist adapted to the Australian context (Silove et al., 1998; Steel et al., 1999). Participants were instructed to rate to what extent each living difficulty was experienced as a problem in the last 6 months on a 5-point scale ranging from 1 (“was not a problem/did not happen”) to 5 (“a very serious problem”). We selected the following 7 PMLDs assessed at W2 in our study for theoretical (i.e., were deemed most crucial) and pragmatic reasons (i.e., to limit the number of predictors to include in the multivariate prediction model); (1) difficulties relating to housing (e.g., poor housing conditions, difficulty finding somewhere suitable to live, having to frequently change place of residence), (2) not enough money to buy food, pay the rent and bills, or buy necessary clothes, (3) not being able to find work, (4) separation from family, (5) worry about family back home, (6) discrimination or conflict with other people in Australia, and (7) difficulties accessing treatment for health or mental health problems.

### Data analysis

Latent transition analysis (LTA) was used for data-analysis in Mplus version 8.4 (Muthén & Muthén, 1998–2017a). LTA consists of three consecutive steps. Firstly, LCAs were conducted at W1 and separate LCAs were executed at W2. Following prior LCA and LTA studies (Minihan et al., 2018; Landau et al., 2016; Tay et al., 2017), dichotomized PTSD and depression symptoms were used as indicators for LCAs. Models with one up to six class solutions were examined. Selection of optimal class solution was based on the following comparative fit statistics; 1) a lower (sample-size adjusted) Bayesian Information Criterion (SA-BIC and BIC), 2) a lower Akaike Information Criterion (AIC), 3) a higher entropy  $R^2$  value, and 4) a significant  $p$ -value ( $< 0.05$ ) of the Vuong–Lo–Mendell–Rubin test (VLMRt), Lo–Mendell–Rubin–Likelihood Ratio Test (LMR-LRt), and the Bootstrap–Likelihood Ratio Test (BLRt). Parsimony and interpretability were also taken into account when comparing model fit. Consistent with prior research (Lenferink et al., 2019; Minihan et al., 2018; Nickerson et al., 2014), probability estimates (i.e., prevalence of each symptom per class) of 0.60 or higher were considered high, between 0.16 and 0.59 moderate, and 0.15 or lower was considered as low probability. To avoid model solutions based on local maxima we used 500 random sets of starting values and 200 final stage optimizations. A maximum of 1.5% of the data on PTSD and depression items were missing at W1 and W2. Full information maximum likelihood estimation was used to account for missing data on LCA indicators. For descriptive purposes, differences in rates of probable caseness of PTSD and depression between the classes were tested using Chi-square tests.

Secondly, we examined the levels of measurement invariance between the classes at W1 and W2 for the final models resulting from step 1, by comparing models in which the parameters (i.e., thresholds) were held equal across W1 and W2 (i.e., full measurement invariance) with models in which the parameters were allowed to vary freely across W1 and W2 (i.e., full measurement variance). The assumption of measurement invariance ensures that the number and symptom profiles across classes are the same across the two time points, which facilitates interpretation of the transition probability estimates (Nylund et al., 2006). A non-significant log-likelihood difference test was considered to demonstrate full measurement invariance.

Thirdly, an unconditional LTA was performed with regressing W2 class-membership on W1 class-membership. This allows the evaluation of the probability of participants transitioning from one class at W1 to

another class at W2 or the probability of staying in the same class over time (i.e., transition probabilities).

Lastly, we examined to what extent gender (1 = male, 2 = female), age, trauma count, and the seven PMLDs predicted latent transition probabilities from W1 to W2 classes simultaneously (associations between covariates indicated no concern for multicollinearity<sup>1</sup>). Following prior research (Forbes et al., 2016), we only focused on transition probabilities for participants moving out of the No Symptoms class to one of the three symptom classes. For binary covariates Mplus provides conditional transition probability estimates for each covariate value (e.g., a probability of transition if the participant is male and a comparative conditional probability if the participant is female) (Muthén & Muthén, 1998–2017b). These conditional transition probabilities were transformed to odds ratios (Muthén and Asparouhov, 2011) and were compared, yet these could not be statistically tested in Mplus. For continuous covariates (i.e., age, trauma count, and PMLDs), multinomial logistic regression analyses were performed which results in estimates that reflect the ability of each covariate to predict the transition probability from moving out of the No symptoms class (using the trajectory of staying in the No Symptom class as reference group; Muthén & Muthén, 1998–2017c). Odds ratios were calculated based on estimates. The maximum likelihood with robust standard errors estimator were used to estimate conditional transition probabilities. Missing data on predictors were less than 1% and imputed using multiple imputation by generating 20 data sets.

## Results

### Participants

The 613 participants were 39.2 years old (SD = 12.46) on average and 326 were male (53%). Most participants were Iraqi (N = 449, 73%) or Syrian (N = 135, 22%). The majority (N = 564, 92%) completed the measures in Arabic language, 30 (5%) in English, 16 (3%) in Farsi, and 3 (1%) in Tamil. The mean length of time in Australia was 10.26 (SD = 4.91) months at W1. On average 2.99 (SD = 3.52) PTEs were experienced or witnessed at W1. See Table 1 for sample characteristics and descriptive statistics of the measures used. Supplementary Table 1 shows an overview of endorsement of PTSD and depression symptoms across W1 and W2. Supplementary Table 2 presents an overview of the frequencies of reported PTEs at W1. In total, 214 people (35%) reported 0 PTEs, 78 (13%) 1 PTE, and 321 (52%) multiple PTEs. The three most frequently reported PTEs were: lack of food or water (n = 246, 40%), being close to death (n = 227, 37%), and lack of shelter (n = 219, 36%).

### Latent class models at W1 and W2

Table 2 shows the fit indices for the 1 to 6 class models at W1 and W2. At both time points the 4 class model yielded the best statistical fit. The 4 class models showed the lowest BIC values, which is the preferred fit statistic to rely on according to van de Schoot et al. (2017). In addition, the VLMRt and LMRt *p*-values indicated that the 4 class models showed a significant better fit than the 3 class models, while the 5 class models did not show a significantly better fit than the 4 class models.

Fig. 1a and b shows the probability estimates, which represent the prevalence of each PTSD and depression symptom per class. For W1, the most common class (No symptoms class; 61.2%) consisted of participants that showed a low probability of endorsing PTSD and depression symptoms. The second class (Low PTSD/Moderate Depression class;

<sup>1</sup> The highest association found between predictors was between “Not enough money to buy food, pay the rent and bills, or buy necessary clothes” and “Difficulties relating to housing (e.g., poor housing conditions, difficulty finding somewhere suitable to live, having to frequently change place of residence)” ( $r = 0.63, p < .001$ ).

**Table 1**  
Sample characteristics (N = 613).

Male gender, N (%)	326 (53%)
W1 age in years, M (SD)	39.20 (12.46)
Country of origin, N (%)	
Iraq	449 (73%)
Syria	135 (22%)
Iran	10 (2%)
Afghanistan	5 (1%)
Sri Lanka	2 (1%)
Burma	1 (1%)
Pakistan	1 (1%)
Other	10 (1.6%)
W1 length of time in Australia in months, M (SD)	10.26 (4.91)
W1 trauma count, M (SD)	2.99 (3.52)
W2 PMLDs, M (SD)	
Problems relating to housing difficulties	1.81 (SD = 1.14)
Problems relating to not enough money to buy food, pay the rent and bills, or buy necessary clothes	1.99 (SD = 1.18)
Problems relating to not being able to find work	2.34 (SD = 1.31)
Problems relating to being separated from family	1.27 (SD = 0.76)
Problems relating to worry about family back home	2.52 (SD = 1.39)
Problems relating to discrimination or conflict with other people in Australia	1.26 (SD = 0.61)
Problems relating to difficulties accessing treatment for health or mental health problems	1.26 (SD = 0.71)
W1 PTSD levels, M (SD)	30.16 (11.36)
W1 PTSD probable caseness, N (%)	42 (7.2%)
W1 depression levels, M (SD)	6.57 (5.87)
W1 depression probable caseness, N (%)	156 (25.4%)
W2 PTSD levels, M (SD)	29.73 (11.91)
W2 PTSD probable caseness, N (%)	50 (8.3%)
W2 depression levels, M (SD)	6.26 (6.04)
W2 depression probable caseness, N (%)	150 (25.0%)

Note. W1 = Wave 1; W2 = Wave 2.

16.2%) reported a low probability of 16 out of 20 PTSD symptoms, while 7 out of 9 depression symptoms had moderate probability. Class 3 (Moderate PTSD/depression class; 15.8%) was characterized by a moderate probability of almost all PTSD and depression symptoms. The fourth and smallest class (High symptoms class; 6.9%) represented participants with high probability of 15 (of 20) PTSD and 8 (of 9) depression symptoms.

For W2, similar classes emerged as W1, a No symptoms class; 68.2%), Low PTSD/Moderate depression class (10.9%), Moderate PTSD/depression class (13.7%), and High symptoms class (7.2%).

Rates of probable caseness of PTSD and depression differed significantly between the classes at Wave 1 ( $\chi^2_{W1PTSD} (3) = 264.04, p < .001$ ;  $\chi^2_{W1depression} (3) = 391.57, p < .001$ ) and Wave 2 ( $\chi^2_{W2PTSD} (3) = 332.75, p < .001$ ;  $\chi^2_{W2depression} (3) = 389.36, p < .001$ ). See Supplementary Table 3 for more details.

### Unconditional latent transition model

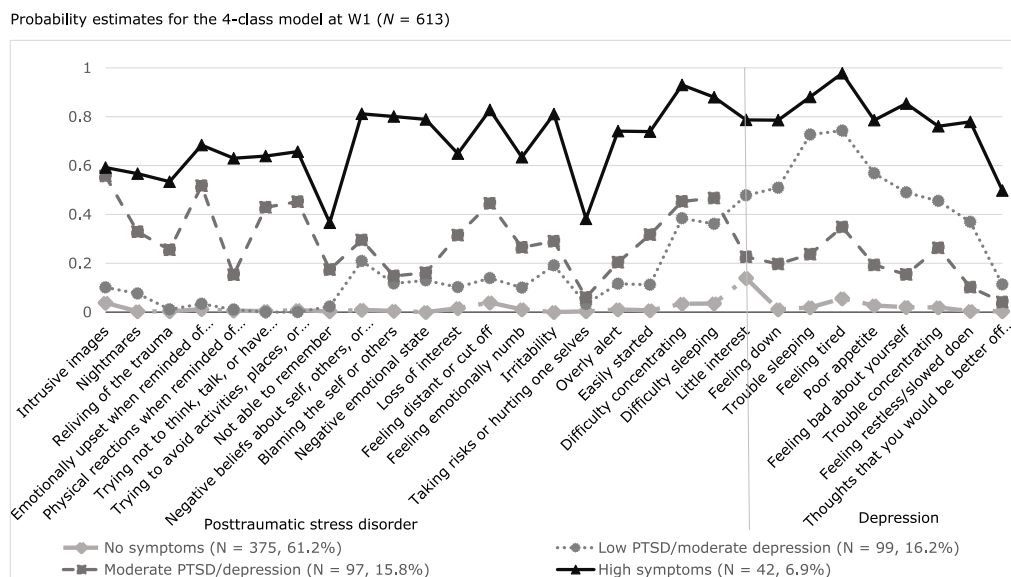
The loglikelihood difference test between the unconstrained (i.e., allowing thresholds to vary freely) and constrained latent transition model (where thresholds were held equal) was not significant ( $\Delta\text{Loglikelihood} = 71.93 (116), p > .995$ ). This offered support to assume full measurement invariance, which was applied in further LTA.

Table 3 shows the probability of participants remaining (diagonal in the table) in the same class at 6 months follow-up (i.e., a stable trajectory) or moving (off-diagonal in table) to a different class at 6 months follow-up representing a recovery or worsening trajectory. The most common stable trajectory was the no symptoms trajectory which comprised 88% of participants. A small minority moved out of the No symptom class at W1 to the (i) Low PTSD/Moderate depression class (4%), (ii) Moderate PTSD/depression class (6%), and (iii) High

**Table 2**  
Fit indices latent class models (N = 613).

W1									
	LL	BIC(LL)	AIC(LL)	SABIC(LL)	Entropy R <sup>2</sup>	VLMRt p-value	LMRt p-value	BLRt p-value	N smallest class
1 Class	-6951.74	14089.61	13961.48	13997.54					
2 Classes	-5290.77	10960.22	10699.54	10772.91	0.96	<.001	<.001	<.001	182
3 Classes	-4955.87	10482.97	10089.73	10200.41	0.94	<.001	<.001	<.001	46
4 Classes	-4782.51	10328.81	9803.03	9951.01	0.94	<.001	<.001	<.001	42
5 Classes	-4700.71	10357.76	9699.42	9884.71	0.94	0.504	0.507	<.001	24
6 Classes	-4645.44	10439.76	9648.87	9871.47	0.94	0.627	0.628	<.001	28
<b>W2</b>									
1 Class	-6755.044	13696.22	13568.09	13604.15					
2 Classes	-4842.909	10064.50	9803.82	9877.19	0.96	<.001	<.001	<.001	161
3 Classes	-4491.382	9554.00	9160.76	9271.44	0.96	<.001	<.001	<.001	44
4 Classes	-4339.809	9443.40	8917.62	9065.60	0.96	0.040	0.041	<.001	44
5 Classes	-4264.66	9485.66	8827.32	9012.61	0.96	0.591	0.593	<.001	25
6 Classes	-4196.873	9542.63	8751.75	8974.35	0.94	0.780	0.780	<.001	31

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; BLRt = Bootstrap-Likelihood Ratio Test; SA-BIC = Sample-size Adjusted Bayesian Information Criterion; LL = Log-Likelihood; Lo-Mendell-Rubin-Likelihood Ratio Test (LMR-LRT); VLMRT = Vuong Lo-Mendell-Rubin-Likelihood Ratio Test; W1 = Wave 1; W2 = Wave 2.



Note. PTSD = Posttraumatic stress disorder; W1 = Wave 1.

**Fig. 1a.** Probability estimates for the 4-class model at W1 (N = 613). Note. PTSD = Posttraumatic stress disorder; W1 = Wave 1.

symptoms class (2%) at W2. About half of the participants in the High symptoms class at W1 were still in this class at W2. About one third of the participants in the Moderate PTSD/depression class and one third of the participants in the Low PTSD/Moderate depression class were in the same class at W2; they were more likely to follow a recovery trajectory by transitioning to the No symptoms class. Fig. 2 shows the latent transition model.

*Conditional latent transition model*

Table 4 shows the results of the conditional latent transition model including gender, age, trauma count at W1, and the seven PMLDs at W2 simultaneously. Compared with participants who stayed in the No symptoms class at W2, participants who moved from the No symptoms class at W1 to the Low PTSD/Moderate depression class were 3.10 (95% CI 1.56–6.15) times more likely to report problems relating to discrimination by or conflict with other people in Australia, while taking all predictors into account.

Compared with participants who stayed in the No symptoms class at W2, participants who moved from the No symptoms class at W1 to the Moderate PTSD/depression class were 2.03 (95% CI 1.02–4.04) times

more likely to experience problems with discrimination by or conflict with other people in Australia. In addition, these participants were 4.26 (95% CI 2.06–8.80) times more likely to experience problems with separation from family and 2.29 (95% CI 1.32–3.97) times more likely to report problems relating to housing difficulties. Lastly, women were at least twice as likely to move to this class compared with men. These effects were found while taking the other predictors into account.

Participants moving from the No symptom class to the High symptoms class were 3.86 (95% CI 1.60–9.32) times more likely to report problems with discrimination by or conflict with other people in Australia compared with participants staying in the No symptom class, when, again, taking all predictors into account<sup>2</sup>

<sup>2</sup> We reran the analyses including 6 people who completed W1 but not W2. The results did not change meaningfully (results are therefore not reported). More specifically, similar symptom-profiles were found at W1 and W2, measurement invariance was demonstrated ( $\Delta\text{Loglikelihood} = 113.34 (107)$ ,  $p > .200$ ), and the same variables were related to transitioning out of the No symptom class to one of the psychopathology classes.

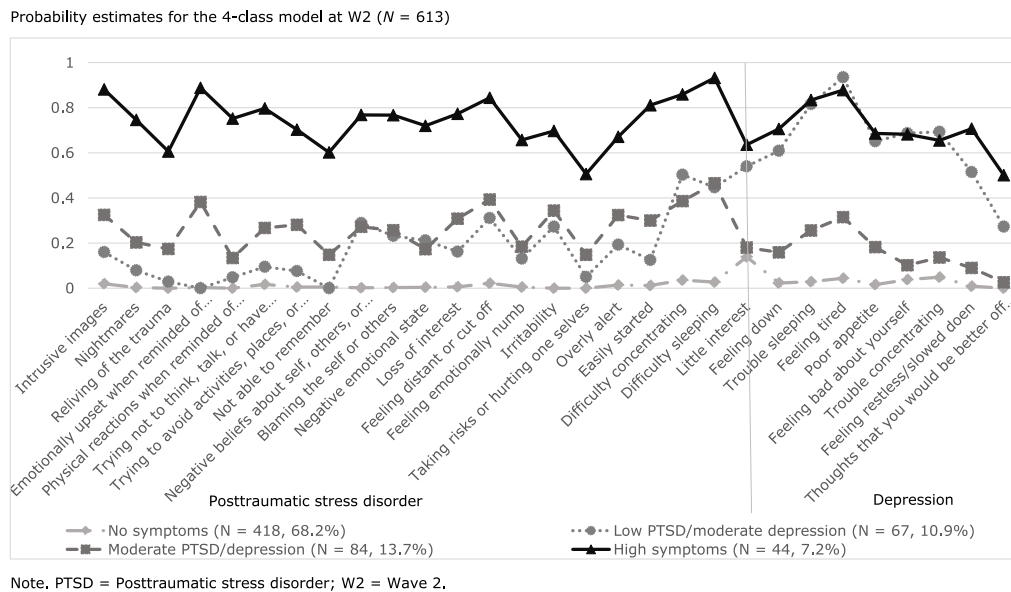


Fig. 1b. Probability estimates for the 4-class model at W2 (N = 613). Note. PTSD = Posttraumatic stress disorder; W2 = Wave 2.

Table 3  
Transition probabilities.

	No symptoms at W2	Low PTSD/Moderate depression at W2	Moderate PTSD/depression at W2	High symptoms at W2
No symptoms at W1	0.883	0.039	0.064	0.015
Low PTSD/Moderate depression at W1	0.450	0.347	0.130	0.073
Moderate PTSD/depression at W1	0.378	0.141	0.317	0.163
High symptoms at W1	0.091	0.209	0.214	0.486

Note. Diagonal estimated indicate the probability of participants remaining in the same class from W1 through W2. The off-diagonal estimates represent the probability of participants transitioning to another class from W1 through W2; W1 = Wave 1; W2 = Wave 2.

### Discussion

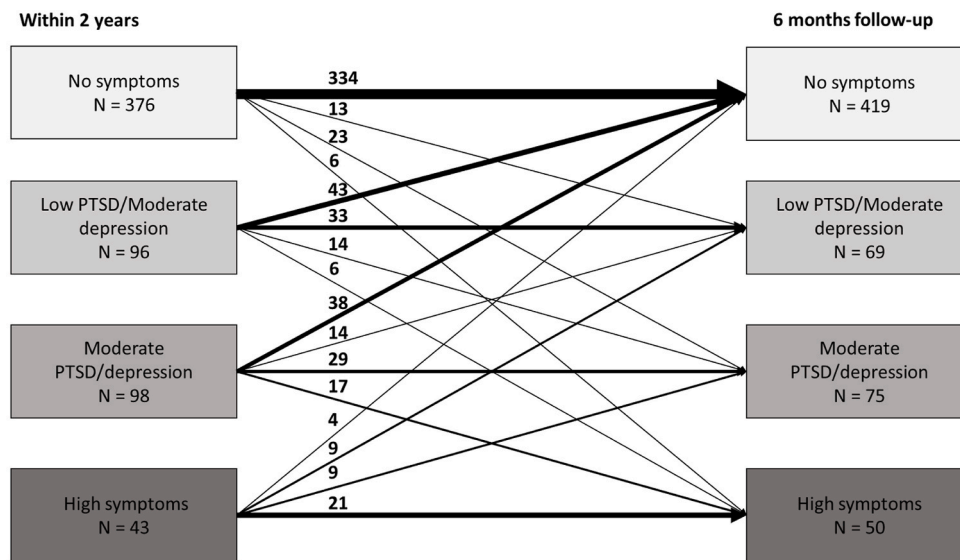
The aim of this study was to identify transitions in PTSD and depression symptom profiles in refugees resettled in Australia, and the factors that modulate transition between classes over time. Our first main finding was that four symptom profiles emerged from the data that differed in nature and severity of symptoms: No symptoms, Low PTSD/Moderate depression, Moderate PTSD/depression, and High symptoms classes were found. The finding that this four-class solution was similar across the two waves of measurements supports the stability of the latent class structure.

While prior LCA research in people with a refugee background also showed that subgroups of people are distinguishable based on qualitatively different symptoms profiles of PTSD and comorbid symptoms (Heeke et al., 2017; Nickerson et al., 2014, 2019a; Tay et al., 2015), none of these studies included only PTSD and depression symptoms. This is surprising, given that PTSD and depression symptoms are the most prevalent symptoms in refugees (Henkelmann et al., 2020). Unlike these prior LCA studies, we did not find support for a PTSD only class.

Our findings indicate that elevated PTSD symptoms are often present in combination with elevated depression symptoms, while not vice versa (as evidenced by the Low PTSD/Moderate depression class). This finding indicates that overlooking depression in research and practice, by focusing solely on PTSD, may yield an incomplete picture of distress in this population. Moreover, this finding also suggests that PTSD and depression symptom-profiles could be described as qualitatively, rather than dimensionally distinct.

Our second main finding was that across time, the majority of participants did not report symptoms of PTSD or depression. Prior systematic reviews and meta-analyses on prevalence rates of mental disorders in refugees also found that the majority do not report clinically relevant psychopathology levels after resettlement (Fazel et al., 2005; Henkelmann et al., 2020; Steel et al., 2009). The no symptoms trajectory found in our study was also the most stable response as evidenced by the highest transition probability; 88% of the participants in the No symptom class at W1 stayed in this class at W2. This also accords with a review of 54 prior longitudinal trajectory studies showing that 66% of people reported no symptoms after exposure to a PTE (Galatzer-Levy et al., 2018). Our finding highlights again the human capacity to thrive after past and on-going adversity.

Our third main finding was that participants who transitioned out of the No symptom class to one of the psychopathology classes were at least two times more likely to report problems relating to discrimination by or conflict with other people in Australia compared with participants staying in the No symptom class even when taking all other predictors (e.g., exposure to PTEs) into account. This aligns with prior research showing that perceived discrimination emerged as strongest predictor of PTSD and depression in a random sample of 1215 Syrian refugees resettled in Sweden, when taking prior PTEs into account (Tinghög et al., 2017). We also found that problems associated with being separated from family increased the likelihood of developing Moderate PTSD and depression symptoms. Problems relating to being separated from family emerged as the strongest predictor of moving out of the No disorder class. This accords with research showing that separation from family members negatively impacts mental health in a representative sample of resettled refugees in Germany (Löbel, 2020). This effect might be explained by fear for family members being harmed in their country of origin (Nickerson et al., 2010; Schweitzer et al., 2006). Moreover, our finding that family separation was a differential predictor of transitioning between classes (i.e., it was only related to moving out of the No symptom class to the Moderate PTSD/depression class and not to the



Note. PTSD = Posttraumatic Stress Disorder. Thickness of the lines represent the magnitude of transition probabilities.

Fig. 2. Unconditional latent transition model ( $N = 613$ ). Note. PTSD = Posttraumatic Stress Disorder. Thickness of the lines represent the magnitude of transition probabilities.

other classes) offers further support that classes differ meaningfully, which underlines the usefulness of LTA.

In line with a prior meta-analysis (Hou et al., 2020), our findings indicate that it seems pivotal to prioritize addressing interpersonal stressors, including discrimination by, or conflict with, others and separation from families, rather than material issues (e.g., difficulties relating to housing, employment, and money) to prevent worsening of psychological symptoms. For instance, refugee resettlement services targeted at improving connectedness between social networks (i.e., families, people from similar ethnic background, refugee society, and host country community) could strengthen a sense of belonging to counter adverse effects of PMLDs (Elliott and Yusuf, 2014; Pittaway et al., 2016; Weine, 2011). Moreover, this could provide a safe environment to prevent problems relating to PMLDs, which is utmost important for this population who are, more than other trauma samples, faced with ongoing stressors. It has also been argued that PMLDs may even compromise effects of trauma treatments (Nickerson et al., 2011), pointing to the need for trauma therapists to carefully consider the impact of PMLDs when addressing the mental health care needs in this population. In addition to well-established trauma-focused treatments for refugees, such as cognitive behavioral and narrative exposure therapy (Lambert and Alhassoon, 2015), focusing more on targeting PMLDs in treatment may enhance outcomes. Theoretical and empirical work suggest that PMLDs (partly) mediate the association between pre-migration trauma exposure and PTSD and comorbid symptoms (Lies et al., 2021; Miller and Rasmussen, 2010; Riley et al., 2017). Complementing trauma-focused treatment with psychosocial interventions focused on PMLDs, as described in guidelines by Miller and Rasmussen (2010), might therefore be a fruitful avenue to pursue for alleviating PTSD and depression in refugees.

Several limitations should be kept in mind while interpreting our findings. Firstly, PTSD and depression symptoms were assessed with measures that were partly validated in Arabic, Tamil, and Farsi language. Therefore, we cannot rule out that cultural differences may cause differences in interpretations of the items, which may have biased the findings. Secondly, self-report measures, instead of diagnostic interviews, were used, which may have overestimated symptom levels (Lim et al., 2018). Thirdly, data were obtained from a non-representative sample, which may have led to overrepresentation or

underrepresentation of distressed participants (Nickerson et al., 2019b). Collecting data among representative samples could overcome this limitation in future research.

Notwithstanding these limitations, this is, to the best of our knowledge, one of the largest longitudinal studies in people with a refugee background. This allowed us to employ an advanced longitudinal statistical method (i.e., LTA) that has not been used in prior refugee samples and rarely been used in trauma samples in general. Our findings indicate individual differences in PTSD and depression symptom profiles in refugees within 2,5 years of resettlement in Australia. Most refugees do not develop PTSD and depression symptoms after resettlement. Interpersonal PMLDs, including discrimination by, or conflict with, other people in Australia and separation from family, were the most important predictors of late-onset distress. This study therefore provides a unique perspective on (predictors of) symptom profiles of PTSD and depression over time, which enhances our understanding of the (co-) occurrence of PTSD and depression symptoms and key factors to tackle this global mental health issue.

#### Author statement

Lonneke Lenferink: Conceptualization, Formal analysis, Methodology, Writing original draft.

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**Table 4**  
Estimates for covariates predicting transition probabilities ( $N = 613$ ).

Covariate	B	SE	<i>p</i>	OR	95% CI	
<b>No Symptoms class to Low PTSD/Moderate depression class vs. staying in the No Symptoms class</b>						
Age	0.03	0.03	0.206	1.03	0.97	1.09
Trauma count at W1	−0.37	0.69	0.598	0.69	0.18	2.67
Problems relating to housing difficulties	−0.08	0.78	0.923	0.92	0.20	4.26
Problems relating to not enough money to buy food. pay the rent and bills. or buy necessary clothes	0.27	0.81	0.740	1.31	0.27	6.41
Problems relating to not being able to find work	0.36	0.30	0.230	1.43	0.80	2.58
Problems relating to being separated from family	−0.05	1.04	0.964	0.95	0.12	7.30
Problems relating to worry about family back home	−20.65	23.66	0.383	–	–	–
Problems relating to discrimination or conflict with other people in Australia	1.13	0.35	0.001	3.10	1.56	6.15
Problems relating to difficulties accessing treatment for health or mental health problems	0.37	0.37	0.315	1.45	0.70	2.99
<b>No Symptoms class to Moderate PTSD/depression class vs. staying in the No Symptoms class</b>						
Age	0.01	0.03	0.710	1.01	0.95	1.07
Trauma count at W1	0.34	0.32	0.292	1.40	0.75	2.63
Problems relating to housing difficulties	0.83	0.28	0.003	2.29	1.32	3.97
Problems relating to not enough money to buy food. pay the rent and bills. or buy necessary clothes	0.01	0.40	0.990	1.01	0.46	2.21
Problems relating to not being able to find work	0.41	0.22	0.065	1.51	0.98	2.32
Problems relating to being separated from family	1.45	0.37	<.001	4.26	2.06	8.80
Problems relating to worry about family back home	−0.21	0.40	0.600	0.81	0.37	1.78
Problems relating to discrimination or conflict with other people in Australia	0.71	0.35	0.043	2.03	1.02	4.04
Problems relating to difficulties accessing treatment for health or mental health problems	0.16	0.23	0.491	1.17	0.75	1.84
<b>No Symptoms class to High symptoms class vs. staying in the No Symptoms class</b>						
Age	0.06	0.04	0.152	1.06	0.98	1.15
Trauma count at W1	−0.03	0.88	0.972	0.97	0.17	5.45
Problems relating to housing difficulties	0.22	0.50	0.652	1.25	0.47	3.32
Problems relating to not enough money to buy food. pay the rent and bills. or buy necessary clothes	0.91	0.68	0.178	2.48	0.66	9.42
Problems relating to not being able to find work	0.70	0.37	0.056	2.01	0.98	4.16
Problems relating to being separated from family	0.52	1.19	0.664	1.68	0.16	17.33
Problems relating to worry about family back home	−0.53	0.76	0.486	0.59	0.13	2.61
Problems relating to discrimination or conflict with other people in Australia	1.35	0.45	0.003	3.86	1.60	9.32
Problems relating to difficulties accessing treatment for health or mental health problems	0.11	0.37	0.775	1.12	0.54	2.31

Note. – could not be computed; SE = standard error; OR = odds ratio; CI = Confidence Interval; For gender results are not shown in table, because these transition probabilities could not be statistically compared.

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## Declarations of interest

None.

## Declaration of competing interest

We declare to have no conflict of interest.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2021.12.009>.

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