



## Are migrants diagnosed with a trauma-related disorder at risk of premature mortality? A register-based cohort study in Denmark

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### ABSTRACT

**Background:** Mental illness is common among refugees displaced by conflict and war. While evidence points to the relatively good health in terms of longevity of migrants resettled in the destination country, less is known about the mortality of the most vulnerable migrants with a trauma-related diagnosis alone and those with an additional comorbid psychotic disorder. This study aimed to provide an overview of the number and mortality of foreign-born individuals diagnosed with Post-Traumatic Stress Disorder or Enduring Personality Change after a Catastrophic Event (PTSD/EPCACE), a psychotic disorder or both.

**Methods:** A nationwide register-based cohort study, including residents in Denmark, followed from 1 January 1995 to 31 December 2016. The exposure was PTSD/EPCACE and psychotic disorders as well as region of origin. Relative all-cause mortality was estimated using Cox proportional hazards regression models and calculated for migrants with one or both groups of disorders compared to those from the same region without the disorder.

**Results:** During the study period, 6,580,000 individuals (50.4% women) were included in the cohort. Of these 1,249,654 (50.5% women) died during follow-up. For men and women from the former Yugoslavia, the Middle East and Northern Africa, a PTSD/EPCACE diagnosis alone or with comorbid psychotic disorder was not associated with increased mortality after adjusting for region of origin. A psychotic disorder alone, however, was associated with an increased mortality rate.

**Conclusion:** Despite the severity of many refugees' traumatic experiences, a diagnosis of a trauma-related psychiatric disorder did not appear to increase the mortality rates.

### 1. Introduction

Migrants constitute a significant and increasing part of European societies. Recent war and unrest have increased the number of asylum seekers, and residence permits granted (UNHCR 2017). As of early 2022, 11% or 640,922 individuals in the Danish population were migrants (Danmarks Statistik 2022). By 2060, the number of non-western immigrants will likely have increased by 7% compared to the 2022 level (Danmarks Statistik 2022) and similar trends are observed across western Europe (International Organization for Migration (IOM) 2017). War, torture and stressors related to the migration process are factors that contribute to migrants' physical and psychological vulnerability (Steel et al., 2009). Mental illness is prevalent among displaced and

war-exposed populations. The most frequently reported mental disorders are Post-Traumatic Stress Disorder (PTSD), depression, anxiety disorders, and psychosis (Steel et al., 2009; Brandt et al., 2019). In a systematic review, the strongest risk factor for developing PTSD was torture and the cumulative exposure to traumatic events (Steel et al., 2009). It has been suggested that as much as 30% of asylum seekers resettled in Western countries have been exposed to torture (Kalt et al., 2013).

PTSD as a diagnosis differs from most other disorders in that in addition to specific symptoms, it requires a traumatic event to have triggered the disorder and that this event is of an exceptionally threatening or catastrophic nature (Maercker et al., 2013). However, concerns have long been raised that the PTSD diagnosis does not capture the more

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complex mental health trajectories following repeated or prolonged interpersonal trauma (Palic et al., 2016). In addition to re-experiencing, avoidance and hyperarousal, some individuals may also be affected by problems in sustaining relationships, affect regulation, a negative self-image (Palic et al., 2016), or experience persisting mistrust and hostility towards the world (Beltran et al., 2008). With the newest revision of the International Classification of Diseases (11th Revision, ICD-11), some of these difficulties related to self-regulation might be captured in the diagnosis of complex PTSD (Maercker et al., 2013). Thus far, the disorder of Enduring Personality Change after Catastrophic Event (EPCACE; F62.0) in the ICD-10 has in effect been used to describe patients with complex traumatisation, such as torture survivors (Palic et al., 2016). This disorder is in the ICD-10 noted to potentially follow after PTSD and explicitly excludes single-event trauma while listing torture and prolonged captivity as predisposing factors (Maercker et al., 2013; Beltran et al., 2008).

However, displaced persons are not only at risk of developing PTSD or EPCACE following exposure to war. Migrant status alone is well documented as an independent risk factor for psychosis (Henssler et al., 2020). More persistent exposures such as poverty, discrimination, psychosocial stress and long-term social defeat may increase the risk of psychosis among migrants (Eaton and Harrison, 2000; Katsounari, 2012). Trauma also figures as a prominent risk factor for psychosis among refugees (Parrett and Mason, 2010) and with interpersonal trauma as a particularly influential risk factor for more severe psychotic disorder trajectories (Gibson et al., 2016). However, diagnostic ambiguity arises as PTSD and psychosis present symptoms that overlap (O'Conghaile and DeLisi, 2015). Flashbacks may be mistaken for intrusions and hallucinations, while mistrust and hypervigilance may be misinterpreted as paranoia (O'Conghaile and DeLisi, 2015; Compean and Hamner, 2019). The negative symptoms likewise share similarities in that withdrawal in psychotic patients may resemble emotional numbing in those who have PTSD. Both disorders may also present with sleep disturbances, detachment, estrangement from other, and derealisation (Compean and Hamner, 2019). Further, when diagnosing migrants, there can be additional complexity where language and illness concepts differ. The diagnostic ambiguity has led to discussions of whether PTSD with secondary psychotic features (PTSD-SP) should be a distinct disorder or whether it represents comorbidity with other psychotic disorders, such as psychotic depression (Compean and Hamner, 2019). In clinical samples of trauma-affected refugees, not only was psychotic symptoms observed even after excluding those with a primary psychotic diagnosis (Nygaard et al., 2017), but psychotic symptoms were found to overlap with a diagnosis of EPCACE (Rathke et al., 2020).

Excess mortality among those diagnosed with schizophrenia and schizophrenia spectrum disorder (Hjorthøj et al., 2017) and psychotic disorders at large (Bradford and Cunningham, 2016) is well-documented in the general population. Mortality studies among those diagnosed with PTSD primarily originate from US veteran studies and generally do find an association between PTSD and premature mortality (Lohr et al., 2015). Research on excess mortality in populations exposed to natural disaster, subsequently diagnosed with PTSD is less clear (Edmondson et al., 2013). Moreover, studies of mortality in war-exposed civilian populations are fewer and inconclusive (Mollica et al., 2001). EPCACE is not frequently studied although a shorter life expectancy has also been documented in personality disorders at large (Nordentoft et al., 2013). This is in contrast to the evidence on migrants' mortality in general. Research indicates that non-refugee migrants have lower mortality than refugees (Hollander et al., 2012) but that both groups generally have lower mortality than the local-born population, (Hajat et al., 2010; Norredam et al., 2012) although considerable variation exists (Ikram et al., 2016; Aldridge et al., 2018).

However, mortality has not been investigated for migrants diagnosed with a trauma-related diagnosis alone or those with a comorbid psychotic disorder. This evidence gap persists despite the overrepresentation of the most vulnerable and trauma-affected migrants among individuals

diagnosed with these disorders (Steel et al., 2009; Brandt et al., 2019). Moreover, some studies investigating mortality in trauma-affected populations specifically exclude migrants (Gradus et al., 2015). Therefore, this study aimed to provide an overview of the mortality risk of those diagnosed with either PTSD/EPCACE, psychotic disorders or both.

## 2. Materials and Methods

### 2.1. Study design, participants and follow-up

All individuals living in Denmark from 2 April 1968 and onwards have been registered with a personal identifier in the Danish Civil Registration System (CRS). This number is unique and can be used to link information across population registers. The CRS contains information on date of birth, sex, place of birth and vital status. From 1969, the CRS also contains information on emigration and immigration.

Information about diagnoses came from the Danish National Patient Register (DNPR) and the Danish Psychiatric Central Research Register (DPCRR). The DNPR, established in 1977, covers information on the individual patient level for diagnoses, treatments, examinations as well as administrative data. The DPCRR goes back to 1969, registering inpatient contacts. Outpatients, as well as emergency room contacts, are included from 1995 forward. Information on household composition and labour market participation was collected from the Population Statistics Register and the Employment Classification Module. Study participants were identified through the CRS, and the entire population of Denmark was followed from either 1 January 1995, date of 15<sup>th</sup> birthday or date of immigration, whichever came last. Follow-up was concluded on the date study participants were classified as either having; a) died, b) emigrated, c) were lost to follow-up or d) on 31 December 2016, whichever came first.

### 2.2. Definition of variables

The outcome was all-cause mortality and information on vital status and date of death came from the CRS. The main exposure of interest was a diagnosis of PTSD/EPCACE or a psychotic disorder together with region of origin. Cases with a diagnosis were identified in the DNPR and DPCRR, coded according to ICD-10 (International Classification of Disease, 10<sup>th</sup> Edition, [ICD-10]) as the ICD-11 has not yet been implemented in Denmark. The disorders were defined as; i) PTSD/EPCACE (F43.1 and F62.0) and ii) psychotic disorders (F2x, F30.2, F31.2, F31.5, F32.3, and F33.3). Region of origin was divided in the following categories; a) Denmark, b) the Middle East and Northern Africa (MENA) including Afghanistan, the c) former Yugoslavia and d) remaining countries. The former Yugoslavia included Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia. Sub-Saharan Africa, Asia (excluding Afghanistan), northern and southern Americas, Europe (excluding Denmark) and Greenland were grouped into one.

Several possible covariates were included in the analysis. Both employment and family status were included as they are known factors intertwined with long-term health and well-being (Machū et al., 2022; Van Der Noordt et al., 2014). Labour market participation was categorised in three levels as either a) in employment or education, b) retired, or c) unemployed. Household composition was recorded as a binary variable indicating a single adult household. Because individuals could change status multiple times over the observation period, the number of categories for the individual variables were limited to a few categories. Somatic comorbidity was defined as a three-level variable indicating the presence of one or two or more of the 19 diseases included in Charlson Comorbidity Index (CCI) (Thygesen et al., 2011). Substance use disorders (SUD; F1x) were included as a binary variable indicating the presence of any SUD diagnosis. Calendar time was categorical (1995-2000; 2001-2005; 2006-2011; 2012-2016). Calendar time, the exposure diagnoses, variables of CCI and SUD as well as labour market participation and household composition were all treated as

time-varying covariates during follow-up.

### 2.3. Statistical analyses

Summary statistics (count and percentages) were calculated for the study population by sex, region of origin, and exposure diagnosis by the end of the follow-up period. The total person-time was calculated as person-years at risk by the different groups included in the analyses. The crude mortality rates were obtained from the number of events divided by the person-years. Mortality was estimated as mortality rate ratios (MRRs) using a Cox proportional hazards regression model. All analyses were stratified by sex, and age was treated as the underlying time. Three models were fitted, all with mortality as the dependent variable and diagnoses and region of origin as the independent variable. The three models included the following variables; the first model (model 1) included region of origin, the diagnoses and adjusted for calendar time. The intermediate model (model 2), in addition to model 1 variables, also adjusted for household composition and labour market participation, while the final model (model 3) further added variables of CCI and SUD. All models included the main effect of region of origin and its interaction with the diagnoses, allowing us to compare the effect of the trauma-diagnoses, adjusting for region of origin. Proportionality of hazards was checked for time-fixed covariates by diagnostic plots and no major violations were detected. All statistical analyses were carried out in Stata, version 15.1 (StataCorp., College Station, Tex.) and estimates are reported with 95% confidence intervals (CI).

### 2.4. Ethical approval

This study was approved by the Danish Data Protection Agency (7<sup>th</sup> March 2019) and the Danish Health Data Authority (FSE ID 98). The data analysed in this study were not collected for this specific research project but were based on Danish nationwide registers. Individual-level data in the registers can only be accessed through secure servers and only export of aggregated data, as presented in research articles, is allowed as per Danish law. Permission to access data can be made if specific requirements to safeguard the anonymity of the study participants are fulfilled. For these reasons, data cannot be made generally available.

## 3. Results

During the study period from 1 January 1995 to 31 December 2016, 6,598,000 persons (50.3% women) were included in the study cohort, amounting to 100,301,545 person-years and a median (interquartile range, IQR) time at risk of 20 (14.2) years at the end of follow-up. Among the diagnosed individuals, 73,176 (50.9%) were women who had a median (IQR) age at first diagnosis of 43 (31.3), which was higher

than for men (median (IQR) = 38 (24.5)). Table 1 provides an overview of the number of diagnoses in the cohort by sex and region of origin at the end of the observation period. Most notably, men from the MENA represent 2.0% of all males in the cohort but account for 35.5% of the PTSD/EPCACE diagnoses given. For women from the MENA, the equivalent proportions are 1.5% and 24.1%. There is a similar pattern of overrepresentation among the diagnosed men and women from the former Yugoslavia. Men from the former Yugoslavia make up 0.7% of the entire male cohort compared to 10.6% of those diagnosed with PTSD/EPCACE. For women from the former Yugoslavia, the equivalent numbers are 0.7% and 9.4%.

Table 2 and 3 outline the number of deaths and person-years analysed for men and women, respectively, by diagnosis and region of origin. The lowest unadjusted mortality rates were observed for men and women from the MENA region across the groups of disorders. The psychotic disorders showed the highest mortality rates irrespective of the region of origin and gender. As expected, the covariates unemployment, somatic morbidity and substance abuse showed higher unadjusted mortality rates compared to being in employment, healthy and not diagnosed with a SUD, for both men and women.

Table 4 and 5 report the estimates from the stratified regressions, models 1 to 3. The tables show the main effect of region of origin as well as the effect of the exposure diagnoses, adjusted for region. The main effect of region of origin in the first model (model 1) indicates that men (MRR=0.68 [95% CI: 0.65,0.71]) and women (MRR=0.66 [95% CI: 0.62,0.70]) from the MENA region without the exposure disorders had significantly lower MRRs as compared to the Danish-born references. For those from the former Yugoslavia, the estimated mortality was marginally higher compared to the Danish-born reference in model 1 for men (MRR=1.06 [95% CI: 1.01,1.10]) and women (MRR=1.06 [95% CI: 1.01,1.12]).

Among the diagnosed, no detectable differences were observed for migrant men with and without a PTSD diagnosis (Table 4), after adjusting for the main effect of region. In contrast, highly elevated MRRs were observed for men for all regions of origin among those diagnosed with psychotic disorders, adjusted for region. For migrant men diagnosed with both groups of disorders, the evidence was mixed with no detectable differences observed between those from the MENA region and former Yugoslavia and individuals from the same region without one of the disorders. A similar pattern was observed among women with the disorders in question, although a deviation from the pattern observed for women was seen in model 1; Women from the MENA region diagnosed with PTSD/EPCACE had a lower MRR (0.57 (95% CI: 0.33,0.98)) than undiagnosed women from the MENA (Table 5). Including the covariates of civil status and labour market participation (model 2) and CCI and SUD (model 3) strengthened the association of PTSD/EPCACE with mortality while it for psychotic disorders attenuated across the regions of origin.

**Table 1**  
Diagnoses in the population by sex and region of origin (end of follow-up).

	None		PTSD/EPCACE		Psychosis		Both		total	
	n	%	n	%	n	%	n	%	n	%
<i>Women</i>										
MENA	44509	1.4%	3612	24.1%	871	1.6%	422	19.8%	49414	1.5%
F. Yugoslavia	19636	0.6%	1414	9.4%	495	0.9%	180	8.4%	21725	0.7%
Denmark	2688112	82.8%	8114	54.1%	49199	87.8%	1196	56.0%	2746621	82.8%
Other	493642	15.2%	1850	12.3%	5485	9.8%	338	15.8%	501315	15.1%
Total	3245899	100%	14990	100%	56050	100%	2136	100%	3319075	100%
<i>Men</i>										
MENA	58875	1.8%	4686	35.5%	1762	3.2%	1024	41.0%	66347	2.0%
F. Yugoslavia	20426	0.6%	1394	10.6%	545	1.0%	293	11.7%	22658	0.7%
Denmark	2648605	82.6%	5581	42.3%	47011	85.6%	802	32.1%	2701999	82.4%
Other	480416	15.0%	1535	11.6%	5590	10.2%	380	15.2%	487921	14.9%
Total	3208322	100%	13196	100%	54908	100%	2499	100%	3278925	100%

MENA, the Middle East and North Africa; F. Yugoslavia, Former Yugoslavia; Other, remaining countries  
PTSD, Post-traumatic stress disorder; EPCACE, Enduring personality change after catastrophic event

**Table 2**  
Mortality rates for males per 1000 person-years analysed - all-cause mortality.

	PTSD/EPCACE			Psychotic disorder			PTSD/EPCACE and psychotic disorder			None			Total		
	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)
<i>Region</i>															
MENA	71	27747	2.56 (2.02-3.23)	154	18630	8.26 (7.05-9.67)	21	8450	2.49 (1.62-3.81)	2002	712949	2.81 (2.68-2.93)	2248	767777	2.93 (2.81-3.04)
F. Yugoslavia	44	10226	4.29 (3.20-5.78)	56	5664	9.89 (7.61-12.84)	12	2239	5.36 (3.04-9.43)	1898	318356	5.96 (5.70-6.24)	2010	336485	5.96 (5.71-6.24)
Denmark	420	35994	11.66 (10.59-12.83)	14262	456273	31.26 (30.75-31.76)	99	4625	21.41 (17.57-26.07)	572774	43989012	13.01 (12.99-13.05)	587555	44485903	13.21 (13.16-13.24)
Other	59	8505	6.94 (5.37-8.95)	902	51111	17.64 (16.53-18.83)	30	2434	12.33 (8.62-17.62)	25344	3735755	6.78 (6.70-6.87)	26335	3797805	6.92 (6.85-7.01)
<i>Single adult household</i>															
No	540	75391	7.16 (6.58-7.79)	14591	497113	29.35 (28.87-29.82)	150	16174	9.26 (7.90-10.88)	560885	44577178	12.58 (12.55-12.61)	576166	45165856	12.75 (12.72-12.78)
Yes	54	7082	7.62 (5.83-9.96)	783	34565	22.64 (21.12-24.30)	12	1573	7.62 (4.33-13.42)	41133	4178893	9.83 (9.75-9.93)	41982	4222113	9.93 (9.84-10.03)
<i>Labour market participation</i>															
Employed/education	102	25200	4.04 (3.33-4.91)	1025	107407	9.54 (8.98-10.15)	28	2144	13.06 (9.01-18.91)	67250	35091997	1.91 (1.89-1.92)	68405	35226748	1.93 (1.92-1.96)
Retired	186	3295	56.45 (48.89-65.17)	7003	55377	126.45 (123.53-129.46)	31	393	78.78 (55.40-112.03)	439310	7213332	60.89 (60.71-61.07)	446530	7272397	61.39 (61.21-61.57)
Unemployed <sup>†</sup>	306	53978	5.66 (5.07-6.33)	7346	368893	19.91 (19.46-20.37)	103	15209	6.76 (5.58-8.21)	95458	6450744	14.80 (14.69-14.89)	103213	6888824	14.98 (14.89-15.07)
<i>CCI</i>															
None	156	61872	2.52 (2.16-2.95)	4841	400690	12.08 (11.75-12.42)	61	13017	4.69 (3.64-6.01)	105806	39997645	2.64 (2.62-2.66)	110864	40473226	2.74 (2.72-2.75)
One	128	14303	8.95 (7.53-10.64)	3798	85755	44.28 (42.89-45.71)	41	3267	12.55 (9.24-17.03)	148841	5962961	24.96 (24.82-25.08)	152808	6066286	25.19 (25.05-25.32)
Two or more	310	6297	49.22 (44.03-55.02)	6735	45233	148.90 (145.37-152.50)	60	1463	41.02 (31.85-52.82)	347371	2795466	124.26 (123.84-124.68)	354476	2848458	124.43 (124.04-124.85)
<i>SUD</i>															
No	325	67119	4.83 (4.33-5.40)	9136	329495	27.73 (27.16-28.30)	50	11909	4.20 (3.18-5.54)	541227	47036848	11.50 (11.48-11.53)	550738	47445371	11.60 (11.58-11.64)
Yes	269	15354	17.51 (15.55-19.73)	6238	202183	30.85 (30.10-31.62)	112	5838	19.19 (15.93-23.08)	60791	1719224	35.35 (35.07-35.64)	67410	1942598	34.70 (34.43-34.96)
<b>Total</b>	<b>594</b>	<b>82473</b>	<b>7.20 (6.65-7.80)</b>	<b>15374</b>	<b>531678</b>	<b>28.92 (28.46-29.37)</b>	<b>162</b>	<b>17747</b>	<b>9.13 (7.83-10.65)</b>	<b>602018</b>	<b>48756072</b>	<b>12.34 (12.32-12.38)</b>	<b>618148</b>	<b>49387970</b>	<b>12.51 (12.49-12.55)</b>

MENA, the Middle East and North Africa; F. Yugoslavia, Former Yugoslavia; Other, remaining countries

CCI, Charlson Comorbidity Index; SUD, Substance Use Disorder

<sup>†</sup> Includes missing values

**Table 3**  
Mortality rates for females per 1000 person-years analysed - all-cause mortality.

	PTSD/EPCACE			Psychotic disorder			PTSD/EPCACE and psychotic disorder			None		Total			
	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)	Deaths	Person-years	Crude MR (95% CI)
<i>Region</i>															
MENA	13	17783	0.73 (0.42-1.26)	34	8399	4.04 (2.89-5.66)	N/A <sup>†</sup>	N/A <sup>†</sup>	N/A <sup>‡</sup>	950-960 <sup>‡</sup>	>540000 <sup>‡</sup>	1.76 (1.64-1.87)	1004	571280	1.76 (1.64-1.87)
F. Yugoslavia	27	10231	2.64 (1.81-3.85)	60	5321	11.27 (8.75-14.51)	6	1505	3.99 (1.79-8.88)	1383	311204	4.44 (4.21-4.67)	1476	328260	4.50 (4.26-4.73)
Denmark	411	58088	7.08 (6.41-7.79)	17338	469853	36.89 (36.35-37.45)	92	7359	12.50 (10.18-15.33)	582626	45247573	12.88 (12.83-12.91)	600467	45782873	13.11 (13.08-13.15)
Other	51	10091	5.04 (3.83-6.65)	1085	50305	21.57 (20.32-22.89)	9-14 <sup>†</sup>	>2000 <sup>‡</sup>	5.54 (3.14-9.75)	27410-27420 <sup>‡</sup>	>4168000 <sup>†</sup>	6.58 (6.50-6.65)	28559	4231162	6.75 (6.66-6.83)
<i>Single adult household</i>															
No	473	87946	5.37 (4.91-5.88)	17718	493421	35.90 (35.38-36.43)	102	12553	8.13 (6.69-9.87)	581577	46025668	12.64 (12.59-12.66)	599870	46619589	12.86 (12.83-12.90)
Yes	29	8247	3.52 (2.43-5.05)	799	40456	19.75 (18.42-21.17)	10	1241	8.06 (4.33-14.98)	30798	4244042	7.25 (7.17-7.33)	31636	4293986	7.37 (7.29-7.45)
<i>Labour market participation</i>															
Employed/education	74	32483	2.27 (1.81-2.85)	517	98201	5.25 (4.83-5.74)	5	2372	2.10 (0.88-5.05)	32803	31940180	1.03 (1.02-1.04)	33399	32073236	1.04 (1.03-1.05)
Retired	209	4591	45.52 (39.75-52.13)	13503	124821	108.18 (106.37-110.01)	40	607	65.85 (48.31-89.79)	512697	9963224	51.46 (51.32-51.60)	526449	10093243	52.15 (52.02-52.29)
Unemployed <sup>†</sup>	219	59119	3.70 (3.24-4.23)	4497	310856	14.47 (14.05-14.90)	67	10814	6.20 (4.87-7.87)	66875	8366307	7.99 (7.93-8.05)	71658	8747096	8.18 (8.13-8.25)
<i>CCI</i>															
None	92	72270	1.27 (1.04-1.56)	4353	368742	11.80 (11.46-12.16)	25	9578	2.60 (1.76-3.85)	105031	40816709	2.56 (2.56-2.58)	109501	41267299	2.64 (2.64-2.66)
One	137	17675	7.75 (6.55-9.16)	5312	105521	50.34 (49.00-51.71)	27	3072	8.79 (6.03-12.82)	176765	6752360	26.17 (26.05-26.30)	182241	6878629	26.48 (26.37-26.62)
Two or more	273	6248	43.70 (38.81-49.20)	8852	59615	148.49 (145.43-151.61)	60	1144	52.45 (40.71-67.54)	330579	2700641	122.40 (121.98-122.82)	339764	2767648	122.76 (122.34-123.18)
<i>SUD</i>															
No	311	84313	3.68 (3.29-4.12)	15034	426259	35.27 (34.71-35.84)	57	10314	5.53 (4.25-7.16)	584074	49230319	11.85 (11.83-11.89)	599476	49751206	12.05 (12.01-12.08)
Yes	191	11880	16.07 (13.94-18.53)	3483	107618	32.35 (31.30-33.46)	55	3480	15.81 (12.13-20.58)	28301	1039391	27.23 (26.91-27.55)	32030	1162369	27.55 (27.26-27.85)
<b>Total</b>	<b>502</b>	<b>96193</b>	<b>5.21 (4.78-5.70)</b>	<b>18517</b>	<b>533878</b>	<b>34.67 (34.18-35.18)</b>	<b>112</b>	<b>13794</b>	<b>8.12 (6.75-9.76)</b>	<b>612375</b>	<b>50269710</b>	<b>12.17 (12.15-12.21)</b>	<b>631506</b>	<b>50913575</b>	<b>12.40 (12.36-12.42)</b>

PTSD, Post-traumatic stress disorder; EPCACE, Enduring personality change after catastrophic event  
MENA, the Middle East and North Africa; F. Yugoslavia, Former Yugoslavia; Other, remaining countries

CCI, Charlson Comorbidity Index; SUD, Substance Use Disorder

<sup>†</sup> Includes missing values

<sup>‡</sup> Obscured because of low numbers

**Table 4**  
Mortality rate ratios (MRR) for males per 1000 person-years analysed - all-cause mortality.

Exposure		Model 1 MRR (95% CI)	p	Model 2 MRR (95% CI)	p	Model 3 MRR (95% CI)	p
Main effect of region	MENA	0.68 (0.65,0.71)	<0.001	0.47 (0.45,0.49)	<0.001	0.55 (0.53,0.58)	<0.001
	F. Yugoslavia	1.06 (1.01,1.10)	0.019	0.78 (0.74,0.82)	<0.001	0.94 (0.90,0.98)	0.006
	Denmark	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Other	1.13 (1.12,1.15)	<0.001	0.95 (0.94,0.96)	<0.001	1.00 (0.98,1.01)	0.845
Interaction PTSD/EPCACE	MENA	1.06 (0.84,1.35)	0.605	0.65 (0.51,0.82)	<0.001	0.65 (0.52,0.83)	<0.001
	F. Yugoslavia	0.92 (0.68,1.24)	0.578	0.58 (0.43,0.78)	<0.001	0.64 (0.47,0.86)	0.003
	Denmark	2.05 (1.86,2.26)	<0.001	1.45 (1.32,1.60)	<0.001	0.96 (0.87,1.06)	0.438
	Other	1.48 (1.15,1.92)	0.002	0.91 (0.70,1.17)	0.446	0.80 (0.62,1.04)	0.091
Psychotic disorder	MENA	3.79 (3.21,4.46)	<0.001	2.32 (1.97,2.74)	<0.001	1.88 (1.59,2.21)	<0.001
	F. Yugoslavia	1.88 (1.44,2.45)	<0.001	1.35 (1.03,1.76)	0.028	1.09 (0.83,1.42)	0.533
	Denmark	3.35 (3.29,3.41)	<0.001	2.35 (2.31,2.39)	<0.001	1.80 (1.77,1.83)	<0.001
	Other	3.30 (3.09,3.53)	<0.001	2.22 (2.07,2.38)	<0.001	1.61 (1.51,1.73)	<0.001
PTSD/EPCACE and psychotic disorder	MENA	1.18 (0.76,1.81)	0.461	0.64 (0.42,0.98)	0.042	0.51 (0.33,0.79)	0.002
	F. Yugoslavia	1.34 (0.76,2.37)	0.311	0.80 (0.45,1.41)	0.445	0.84 (0.48,1.48)	0.546
	Denmark	4.60 (3.78,5.61)	<0.001	2.62 (2.15,3.19)	<0.001	1.53 (1.26,1.86)	<0.001
	Other	2.77 (1.94,3.96)	<0.001	1.63 (1.14,2.33)	0.008	0.99 (0.69,1.42)	0.952
None	MENA	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	F. Yugoslavia	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Denmark	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Other	1.00 (ref)		1.00 (ref)		1.00 (ref)	
Covariates Single adult household	No			1.00 (ref)		1.00 (ref)	
	Yes			1.17 (1.16,1.18)	<0.001	1.17 (1.16,1.18)	<0.001
Labour market participation	Employed/education			1.00 (ref)		1.00 (ref)	
	Retired			3.69 (3.62,3.76)	<0.001	2.29 (2.25,2.33)	<0.001
	Unemployed			4.47 (4.42,4.52)	<0.001	2.38 (2.35,2.40)	<0.001
CCI	None			1.00 (ref)		1.00 (ref)	
	One					3.87 (3.84,3.90)	<0.001
	Two or more					11.77 (11.68,11.87)	<0.001
SUD	No			1.00 (ref)		1.00 (ref)	
	Yes					2.32 (2.30,2.34)	<0.001

PTSD, Post-traumatic stress disorder; EPCACE, Enduring personality change after catastrophic event  
MENA, the Middle East and North Africa; F. Yugoslavia, Former Yugoslavia; Other, remaining countries  
CCI, Charlson Comorbidity Index; SUD, Substance Use Disorder

#### 4. Discussion

The trauma-related diagnoses of PTSD and EPCACE are over-represented among those emigrating from the MENA region and former Yugoslavia. While the results from the regression analyses confirm previous research demonstrating a lower MRR of migrants from the MENA region compared to those born in Denmark, no increase in mortality was observed among those with a PTSD/EPCACE diagnosis when taking region of origin into account. Similarly, the highly elevated MRRs for psychotic disorders have been demonstrated in various populations. We did not, however, find a dose-response relationship in terms of further elevated MRRs of those with comorbid PTSD/EPCACE and psychotic disorders, except for Danish-born men and women (model 1).

It is counterintuitive that a diagnosis of PTSD/EPCACE for men and women from the MENA and former Yugoslavia is associated with a lower mortality rate compared to the undiagnosed from the same region (Model 2 and 3 and model 1 for women from the MENA). The relative long-term health advantage of refugees and migrants with a PTSD diagnosis has been observed elsewhere. A population-based study from Sweden indicated that refugees with PTSD had a significantly lower mortality rate compared to Swedish born individuals with the same disorder (Helgesson et al., 2022). Yet the magnitude of the effect in this study comparing the diagnosed individuals to those from the same region of origin could suggest that the results are skewed by other factors such as a strong selection of those receiving a PTSD/EPCACE diagnosis or in the estimation of mortality in this group. Migrant groups use health care services differently according to country of origin and compared to the background population (Nielsen et al., May 2012). The differential contact to the health care system could be one mechanism influencing the observed results.

Moreover, evidence suggests that migrants self-select into their destination countries based on individual migrant characteristics and the reception context at the destination country (Hagen-Zanker and Mallett, 2016). The migration process can be both highly stressful and dangerous and migrants in poor health, and those lacking the necessary resources will be less likely to make the journey. One study also finds that internally displaced population have a higher mortality rate than those fleeing to other countries as refugees (Heudtlass et al., 2016). Therefore these results might indicate that despite their potential traumatic experiences and poor mental health, individuals reaching Europe and who gain residence permit are indicatively a resilient group as shown in several other studies (Helgesson et al., 2022; Aldridge et al., 2018).

The adjustments included in models 2 and 3 indicated that being a single adult household for men was associated with increased mortality, but for women, the opposite was the case. While this variable for men may indicate a degree of social isolation, for women, it likely reflects that women on average live longer and thus are more likely to be widowed at the later stages of their life. Similarly, the variable of labour market participation showed that both unemployment and retirement was associated with increased mortality risk for both men and women. The unemployment category included both disability pension and other social benefits. This category may, therefore, both be associated with poorer health, older age, and indicate a relatively lower socioeconomic status. Non-western migrants in Denmark are overrepresented in the lower-income quintiles, and thus adjusting for job status, consequently, reduces the main effect of region substantially (Lundby Hansen et al., 2019). Retirement, on the other hand, is correlated with higher age and thus naturally associated with mortality (Machû et al., 2022; Van Der Noordt et al., 2014).

Both psychotic disorders and PTSD are frequently co-occurring with

**Table 5**  
Mortality rate ratios (MRR) for females per 1000 person-years analysed - all-cause mortality.

Exposure		Model 1 MRR (95% CI)	p	Model 2 MRR (95% CI)	p	Model 3 MRR (95% CI)	p
Main effect of region	MENA	0.66 (0.62,0.70)	<0.001	0.49 (0.46,0.53)	<0.001	0.54 (0.50,0.57)	<0.001
	F. Yugoslavia	1.06 (1.01,1.12)	0.030	0.85 (0.81,0.90)	<0.001	0.95 (0.90,1.00)	0.059
	Denmark	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Other	1.07 (1.06,1.09)	<0.001	0.97 (0.95,0.98)	<0.001	0.98 (0.97,0.99)	0.004
Interaction PTSD/EPCACE	MENA	0.57 (0.33,0.98)	0.043	0.35 (0.20,0.61)	<0.001	0.40 (0.23,0.69)	0.001
	F. Yugoslavia	0.91 (0.62,1.33)	0.620	0.59 (0.40,0.86)	0.006	0.65 (0.44,0.95)	0.025
	Denmark	1.70 (1.54,1.87)	<0.001	1.35 (1.23,1.49)	<0.001	0.98 (0.89,1.08)	0.669
	Other	1.63 (1.24,2.15)	<0.001	1.15 (0.87,1.51)	0.317	0.91 (0.69,1.19)	0.488
Psychotic disorder	MENA	2.93 (2.08,4.13)	<0.001	2.07 (1.47,2.91)	<0.001	1.79 (1.27,2.53)	0.001
	F. Yugoslavia	2.12 (1.63,2.74)	<0.001	1.77 (1.37,2.30)	<0.001	1.45 (1.12,1.87)	0.005
	Denmark	2.40 (2.36,2.43)	<0.001	2.15 (2.11,2.18)	<0.001	1.71 (1.68,1.73)	<0.001
	Other	2.55 (2.40,2.71)	<0.001	2.26 (2.13,2.41)	<0.001	1.68 (1.58,1.79)	<0.001
PTSD/EPCACE and psychotic disorder	MENA	N/A <sup>†</sup>		N/A <sup>†</sup>		N/A <sup>†</sup>	
	F. Yugoslavia	1.59 (0.71,3.54)	0.257	0.96 (0.43,2.15)	0.925	0.90 (0.41,2.02)	0.806
	Denmark	3.22 (2.62,3.95)	<0.001	2.28 (1.86,2.80)	<0.001	1.31 (1.06,1.60)	0.010
	Other	1.85 (1.05,3.26)	0.033	1.12 (0.62,2.02)	0.712	0.77 (0.43,1.40)	0.396
None	MENA	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	F. Yugoslavia	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Denmark	1.00 (ref)		1.00 (ref)		1.00 (ref)	
	Other	1.00 (ref)		1.00 (ref)		1.00 (ref)	
Covariates Single adult household	No			1.00 (ref)		1.00 (ref)	
	Yes			0.85 (0.84,0.86)	<0.001	0.93 (0.92,0.94)	<0.001
Labour market participation	Employed/education			1.00 (ref)		1.00 (ref)	
	Retired			3.51 (3.41,3.60)	<0.001	2.31 (2.25,2.37)	<0.001
	Unemployed			4.16 (4.11,4.23)	<0.001	2.52 (2.48,2.56)	<0.001
CCI	None			1.00 (ref)		1.00 (ref)	
	One					4.02 (3.98,4.05)	<0.001
	Two or more					11.49 (11.40,11.57)	<0.001
SUD	No			1.00 (ref)		1.00 (ref)	
	Yes					2.09 (2.07,2.12)	<0.001

PTSD, Post-traumatic stress disorder; EPCACE, Enduring personality change after catastrophic event  
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<sup>†</sup> Because of low numbers

substance abuse (Jacobsen et al., 2001; Hunt et al., 2018) which is associated with a shorter lifespan (Nordentoft et al., 2013). Including CCI and SUD does not substantially affect the estimates for those from the MENA or former Yugoslavia, diagnosed with PTSD/EPCACE. While it reduces the estimates for those with psychotic disorders, adjusted for the main effect of region, it increases the estimates for the main effect of region for the MENA and former Yugoslavia for both men and women as compared to the Danish-born reference. Other studies have found lower rates of SUD among non-western migrants (Horyniak et al., 2016). It has been hypothesised that different cultural norms and religious practices act as a protective factor against developing a SUD (Horyniak et al., 2016). Substance abuse and poor health will, to a degree, be on the causal pathway from the exposure to the outcome. Adjusting for SUD and CCI will probably underestimate the mortality of those diagnosed with PTSD/EPCACE and psychotic disorders. This could also be the case for labour market participation and civil status (single adult household). Consequently, model 1 is presented as the primary analysis and the most plausible estimate.

#### 4.1. Strengths and limitations

There has long been a discussion on how to avoid underestimating mortality in migrant populations (Weitof et al., 1999). The concern is that the observed relatively lower mortality rate does not reflect a real health advantage but rather is a consequence of re-migration not accounted for in the analysis. No convincing evidence has been found to support this notion of the 'salmon bias' in which elder or those in poor health return to their country of origin (Norredam et al., 2015). Furthermore, this bias can be minimised as we did here, by adjusting for region of origin (Hollander et al., 2012).

The study estimates the mortality of those migrants with PTSD/EPCACE or a psychotic disorder on the premise that these diagnoses constitute an indicator of vulnerability and traumatic experiences. Yet, as we do not find indication that a PTSD/EPCACE disorder alone or with comorbid psychotic disorder is an increased risk factor for early death, it is also a possibility that a formal diagnosis in the registries is indicative of the individuals' resources and resilience in general as they have been able to navigate the health care system. We were unfortunately not able to include data on specific traumatic experiences, symptom severity, or refugee status (asylum seeker, family reunification migrant or other migrants) which limits the extent of the conclusions.

Moreover, the group of psychotic disorders included in the analysis, represent a broad spectrum of disorders with various complex causes and does not, like the PTSD/EPCACE diagnosis, necessitate a traumatic event to precede the diagnosis. The highest mortality rates were seen for psychotic disorders alone, perhaps indicating that the psychotic disorders comorbid with PTSD/EPCACE were less severe than those in the psychotic disorder group solely. Finally, it should be noted that many factors throughout the individual's life that affect the risk of excess mortality. A few factors of education, employment, and family structure were included here. These and other potential factors not included here are however complex social phenomena and their relationship with longevity not easily captured in an observational study (Machū et al., 2022; Van Der Noordt et al., 2014).

#### 5. Conclusion

This study provided an overview of the number of migrants and refugees diagnosed with two trauma-related diagnoses, Post-Traumatic Stress Disorder (PTSD) and Enduring Personality Change after

Catastrophic Experience (EPCACE), the latter being largely un-researched. The study adds to the literature on mortality of migrants by addressing a gap in research specifically related to the mortality of those with a trauma-related diagnosis and comorbid psychosis. The findings suggest that severe trauma-related diagnoses of PTSD/EPCACE are not associated with excess mortality among those from the Middle East and Northern Africa and former Yugoslavia, even in the face of comorbid psychotic disorders.

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### Declaration of Competing Interest

The authors confirm that they have no conflict of interest to report.

### References

- Aldridge, R.W., et al., 2018. Global patterns of mortality in international migrants: a systematic review and meta-analysis. *The Lancet* 392 (10164), 2553–2566. [https://doi.org/10.1016/S0140-6736\(18\)32781-8](https://doi.org/10.1016/S0140-6736(18)32781-8).
- Beltran, R.O., Llewellyn, G.M., Silove, D., 2008. Clinicians' understanding of International Statistical Classification of Diseases and Related Health Problems, 10th Revision diagnostic criteria: P62.0 enduring personality change after catastrophic experience. *Compr Psychiatry* 49 (6), 593–602. <https://doi.org/10.1016/j.comppsy.2008.04.006>.
- Bradford, D.W., Cunningham, N., 2016. Psychotic disorders cause the greatest mortality disparity among mental disorders, though more deaths are attributable overall to mood and anxiety disorders. *Evid Based Ment Health* 19 (2). <https://doi.org/10.1136/eb-2015-102100>.
- Brandt, L., Hensler, J., Müller, M., Wall, S., Gabel, D., Heinz, A., 2019. Risk of Psychosis Among Refugees. *JAMA Psychiatry* 76 (11), 1133–1140. <https://doi.org/10.1001/jamapsychiatry.2019.1937>.
- Compean, E., Hamner, M., 2019. Posttraumatic stress disorder with secondary psychotic features (PTSD-SP): Diagnostic and treatment challenges. In: *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 88. Elsevier Inc., pp. 265–275. <https://doi.org/10.1016/j.pnpbp.2018.08.001>
- Danmarks Statistik, 2022. *Indvandrer i Danmark 2022*. Copenhagen.
- Eaton, W., Harrison, G., 2000. Ethnic disadvantage and schizophrenia. *Acta Psychiatr Scand* 102 (s407), 38–43. <https://doi.org/10.1034/j.1600-0447.2000.00007.x>.
- Edmondson, D., et al., 2013. Association of posttraumatic stress disorder and depression with all-cause and cardiovascular disease mortality and hospitalization among hurricane Katrina survivors with end-stage renal disease. *Am J Public Health* 103 (4). <https://doi.org/10.2105/AJPH.2012.301146>.
- Gibson, L.E., Alloy, L.B., Ellman, L.M., 2016. Trauma and the psychosis spectrum: A review of symptom specificity and explanatory mechanisms. In: *Clinical Psychology Review*, 49. Elsevier Inc., pp. 92–105. <https://doi.org/10.1016/j.cpr.2016.08.003>
- Gradus, J.L., Antonsen, S., Svensson, E., Lash, T.L., Resick, P.A., Hansen, J.G., 2015. Trauma, Comorbidity, and Mortality Following Diagnoses of Severe Stress and Adjustment Disorders: A Nationwide Cohort Study. *Am J Epidemiol* 182 (5), 451–458. <https://doi.org/10.1093/aje/kwv066>.
- Hagen-Zanker, J., Mallett, R., 2016. *Journeys to Europe The role of policy in migrant decision-making*. ODI Insights (February), 8.
- Hajat, A., Blakely, T., Dayal, S., Jatrana, S., 2010. Do New Zealand's immigrants have a mortality advantage? Evidence from the New Zealand Census-Mortality Study. *Ethn Health* 15 (5), 531–547. <https://doi.org/10.1080/13557858.2010.496479>.
- Helgesson, M., et al., 2022. Mental and somatic disorders and the subsequent risk of all-cause and cause-specific mortality in refugees, non-refugee migrants and the Swedish-born youth: a population-based cohort study in Sweden. *BMJ Open* 12 (5), e054351. <https://doi.org/10.1136/bmjopen-2021-054351>.
- Hensler, J., et al., 2020. Migration and schizophrenia: meta-analysis and explanatory framework. *Eur Arch Psychiatry Clin Neurosci* 270 (3), 325–335. <https://doi.org/10.1007/s00406-019-01028-7>.
- Heudtlass, P., Speybroeck, N., Guha-Sapir, D., 2016. Excess mortality in refugees, internally displaced persons and resident populations in complex humanitarian emergencies (1998-2012) - Insights from operational data. *Confl Health* 10 (1). <https://doi.org/10.1186/s13031-016-0082-9>.
- Hjorthøj, C., Stürup, A.E., McGrath, J.J., Nordentoft, M., 2017. Years of potential life lost and life expectancy in schizophrenia: a systematic review and meta-analysis. *Lancet Psychiatry* 4 (4), 295–301. [https://doi.org/10.1016/S2215-0366\(17\)30078-0](https://doi.org/10.1016/S2215-0366(17)30078-0).
- Hollander, A.-C., Bruce, D., Ekberg, J., Burström, B., Borrell, C., Ekblad, S., 2012. Longitudinal study of mortality among refugees in Sweden. *Int J Epidemiol* 41, 1153–1161. <https://doi.org/10.1093/ije/dys072>.
- Horyniak, D., Melo, J.S., Farrell, R.M., Ojeda, V.D., Strathdee, S.A., 2016. Epidemiology of Substance Use among Forced Migrants: A Global Systematic Review. *PLoS One* 11 (7), e0159134. <https://doi.org/10.1371/journal.pone.0159134>.
- Hunt, G.E., Large, M.M., Cleary, M., Lai, H.M.X., Saunders, J.B., 2018. Prevalence of comorbid substance use in schizophrenia spectrum disorders in community and clinical settings, 1990–2017: Systematic review and meta-analysis. *Drug Alcohol Depend* 191, 234–258. <https://doi.org/10.1016/j.drugalcdep.2018.07.011>.
- Ikram, U.Z., et al., 2016. All-cause and cause-specific mortality of different migrant populations in Europe. *Eur J Epidemiol* 31 (7), 655–665. <https://doi.org/10.1007/s10654-015-0083-9>.
- International Organization for Migration (IOM), 2017. *World Migration Report 2018*. Geneva.
- Jacobsen, L.K., Southwick, S.M., Kosten, T.R., 2001. Substance use disorders in patients with posttraumatic stress disorder: A review of the literature. *American Journal of Psychiatry* 158 (8), 1184–1190. <https://doi.org/10.1176/appi.ajp.158.8.1184>.
- Kalt, A., Hossain, M., Kiss, L., Zimmerman, C., 2013. Asylum seekers, violence and health: A systematic review of research in high-income host countries. *American Journal of Public Health* 103 (3). <https://doi.org/10.2105/AJPH.2012.301136>.
- Katsounari, I., 2012. The Impact of Context in Understanding the Relationship between Post-Traumatic Stress Disorder and Psychotic Features in Survivors of Torture. *International Journal of social science and humanities* 1 (2), 4–10.
- Lohr, J.B., et al., 2015. Is Post-Traumatic Stress Disorder Associated with Premature Senescence? A Review of the Literature. *Am J Geriatr Psychiatry* 23, 709. <https://doi.org/10.1016/j.jagp.2015.04.001>.
- Lundby Hansen, M., Heiberg, C.-C., Sloth Bjerre Hansen, J., Due Bostrup, T., 2019. *Indkomster, fordeling & incitamentter 2019*. Copenhagen.
- Machù, V., Arends, I., Veldman, K., Bültmann, U., 2022. Work-family trajectories and health: A systematic review. *Adv Life Course Res* 52, 100466. <https://doi.org/10.1016/j.alcr.2022.100466>.
- Maercker, A., et al., 2013. Proposals for mental disorders specifically associated with stress in the International Classification of Diseases-11. *The Lancet* 381 (9878), 1683–1685. [https://doi.org/10.1016/S0140-6736\(12\)62191-6](https://doi.org/10.1016/S0140-6736(12)62191-6).
- Mollica, R.F., Sarajlić, N., Chernoff, M., Lavelle, J., Vuković, I.S., Massagli, M.P., 2001. Longitudinal study of psychiatric symptoms, disability, mortality, and emigration among Bosnian refugees. *J Am Med Assoc* 286 (5), 546–554. <https://doi.org/10.1001/jama.286.5.546>.
- Nielsen, S.S., Hempler, N.F., Waldorff, F.B., Kreiner, S., Krasnik, A., May 2012. Is there equity in use of healthcare services among immigrants, their descendants, and ethnic Danes? *Scand J Public Health* 40 (3), 260–270. <https://doi.org/10.1177/1403494812443602>.
- Nordentoft, M., et al., 2013. Excess Mortality, Causes of Death and Life Expectancy in 270,770 Patients with Recent Onset of Mental Disorders in Denmark, Finland and Sweden. *PLoS One* 8 (1), e55176. <https://doi.org/10.1371/journal.pone.0055176>.
- Norredam, M., et al., 2015. Remigration of migrants with severe disease: myth or reality?—a register-based cohort study. *Eur J Public Health* 25 (1), 84–89. <https://doi.org/10.1093/eurpub/cku138>.
- Norredam, M., Olsbjerg, M., Petersen, J.H., Juel, K., Krasnik, A., 2012. Inequalities in mortality among refugees and immigrants compared to native Danes – a historical prospective cohort study. *BMC Public Health* 12 (1), 757. <https://doi.org/10.1186/1471-2458-12-757>.
- Nygaard, M., Sonne, C., Carlsson, J., 2017. Secondary psychotic features in refugees diagnosed with post-traumatic stress disorder: A retrospective cohort study. *BMC Psychiatry* 17 (1), 5. <https://doi.org/10.1186/s12888-016-1166-1>.
- OConghaile, A., DeLisi, L.E., 2015. Distinguishing schizophrenia from posttraumatic stress disorder with psychosis. *Curr Opin Psychiatry* 28 (3), 249–255. <https://doi.org/10.1097/YCO.0000000000000158>.
- Palic, S., Zerach, G., Shevlin, M., Zeligman, Z., Elkhit, A., Solomon, Z., 2016. Evidence of complex posttraumatic stress disorder (CPTSD) across populations with prolonged trauma of varying interpersonal intensity and ages of exposure. *Psychiatry Res*. <https://doi.org/10.1016/j.psychres.2016.10.062>.
- Parrett, N.S., Mason, O.J., 2010. Refugees and psychosis: A review of the literature. *Psychosis* 2 (2), 111–121. <https://doi.org/10.1080/17522430903219196>.
- Rathke, H., Poulsen, S., Carlsson, J., Palic, S., 2020. PTSD with secondary psychotic features among trauma-affected refugees: The role of torture and depression. *Psychiatry Res* 287, 112898. <https://doi.org/10.1016/j.psychres.2020.112898>.
- Steel, Z., Chey, T., Silove, D., Marnane, C., Bryant, R.A., van Ommeren, M., 2009. *Association of Torture and Other Potentially Traumatic Events With Mental Health Outcomes Among Populations Exposed to Mass Conflict and Displacement: A Systematic Review and Meta-analysis*. *JAMA* 302 (5), 537–549.
- Thygesen, S.K., Christiansen, C.F., Christensen, S., Lash, T.L., Sørensen, H.T., 2011. The predictive value of ICD-10 diagnostic coding used to assess Charlson comorbidity index conditions in the population-based Danish National Registry of Patients. *BMC Med Res Methodol* 11 (1), 83. <https://doi.org/10.1186/1471-2288-11-83>.
- UNHCR, 2017. *Global Report 2017*. Geneva.
- Van Der Noordt, M., IJzelenberg, H., Droomers, M., Proper, K.I., 2014. Health effects of employment: A systematic review of prospective studies. *Occup Environ Med* 71 (10), 730–736. <https://doi.org/10.1136/oemed-2013-101891>.
- Weitoff, G.R., Gullberg, A., Hjerm, A., Rosén, M., 1999. Mortality Statistics in Immigrant Research: Method for Adjusting Underestimation of Mortality. *Int J Epidemiol* 24 (4), 756–763.