Mental health, chronic pain and migration-related stress in refugees resettled in Norway and Sweden

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Table of Contents

1 Acknowledgements

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Education is an admirable thing, but it is well to remember from time to time that nothing that is worth knowing can be taught

(O. Wilde)

A loving heart is the truest wisdom

(C. Dickens)

2 Abbreviations

CI$_{95}$	95% confidence interval
CP	Chronic pain
cp-	Checklist-positive (e.g. cp-PTSD)
CRIES	Children Revised Impact of Event Scale
DSM	Diagnostic and Statistical Manual of the American Psychiatric Association
EU	European Union
FI	Functional Impairment
HIC	High income country
HTQ	Harvard Trauma Questionnaire
HSCL	Hopkins Symptoms Checklist
ICD	International Classification of Diseases
IDP	Internally Displaced Persons
LMIC	Low- and middle income country
MICE	Multiple Imputation by Chained Equations
NKVTS	Norwegian Centre for Violence and Traumatic Stress Studies, Norway
OR	Odds ratio
PGH	Perceived General Health
PTEs	Potentially Traumatic Experiences
PTE-AR	Potentially Traumatic Experience Adversity Ratio
PTSD	Posttraumatic Stress Disorder
QoL	Quality of Life
RAS	Refugees and Asylum Seekers
REFUGE	Resettlement in Uprooted Groups Explored (the Norwegian study/research project)
RKH	Red Cross University College, Sweden

STROBE	STrengthening the Reporting of OBservational studies in Epidemiology
SWB	Subjective Wellbeing
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Emergency Fund
URM	Unaccompanied Refugee Minors
WHO	World Health Organization

3   List of papers

Paper I:

Solberg Ø, Nissen A, Vaez M, Cauley P, Eriksson A-K, Saboonchi F. Children at risk: A nation-wide, cross-sectional study examining post-traumatic stress symptoms in refugee minors from Syria, Iraq and Afghanistan resettled in Sweden between 2014 and 2018. Confl Health. 2020;14: 67.

Paper II:

Nissen A, Cauley P, Saboonchi F, Andersen A, Solberg Ø. Cohort profile: Resettlement in Uprooted Groups Explored (REFUGE)-a longitudinal study of mental health and integration in adult refugees from Syria resettled in Norway between 2015 and 2017. BMJ Open. 2020;10: e036101.

Paper III:

Nissen A, Cauley P, Saboonchi F, J Andersen A, Solberg Ø. Mental health in adult refugees from Syria resettled in Norway between 2015 and 2017: a nationwide, questionnaire-based, cross-sectional prevalence study. Eur J Psychotraumatol. 2021;12: 1994218.

Paper IV:

Nissen A, Hynek KA, Scales D, Hilden PK, Straiton M. Chronic pain, mental health and functional impairment in adult refugees from Syria resettled in Norway: a cross-sectional study. BMC Psychiatry. 2022;22: 1–16.

Paper V:

Nissen A, Sengoelge M, Solberg Ø. Post-migration Stressors and Subjective Well-Being in Adult Syrian Refugees Resettled in Sweden: A Gender Perspective. Front Public Health. 2021;9: 717353.

4 General introduction

4.1 Historical, legal and political backdrop

The number of people who have been forced to flee their homes due to conflict, war and persecution, surpassed, for the first time in history, 100 million in the spring of 2022 according to the UNHCR [1]. The number has increased rapidly in the last decade, not least because of the 2011 civil war in Syria and the recent outbreak of war in the Ukraine. Over half of the 100 million forcefully displaced consist of internally displaced persons (IDP), while about one third are refugees [2], the majority of which reside in low- and middle-income countries (LMIC) adjacent to the conflict-affected countries they have escaped, often with limited access to work, housing and basic services such as healthcare and education [2–4]. Around 16% live in high-income countries (HIC), where, even despite the availability of resources and existence of legal frameworks and institutions to safeguard rights, they often continue to face various hardships in securing basic needs [2,3,5]. Climate change will likely contribute to increased migration in the upcoming decades by disrupting livelihoods and constraining access to key resources such as water and fertile land, particularly in LMIC [6–8].

The main international legal documents enshrining the rights of refugees and asylum seekers (RAS) are the 1951 UNHCR Refugee Convention and its 1967 Protocol [9]. Within the European Union (EU), the Receiving Directive, which was revised in 2013, goes further in specifying the rights of RAS and the responsibilities of recipient countries by articulating minimum standards in the reception period [10]. Particular attention is paid to vulnerable persons defined through article 21 in the Directive as:

> *...minors, unaccompanied minors, disabled people, elderly people, pregnant women, single parents with minor children, victims of human trafficking, persons with serious illnesses, persons with mental disorders and persons who have been subjected to torture, rape or other serious forms of psychological, physical or sexual violence, such as victims of female genital mutilation...* [10].

Article 11 in the Directive states in its opening paragraph that "[T]he health, including mental health, of applicants in detention who are vulnerable persons shall be of primary concerns to national authorities". Health is also central to article 17 and 19 in the Directive. More broadly, refugees' right to "the highest attainable standard of physical and mental health" is embedded in the World Health Organization's Constitution, first articulated in 1946 [11]. The focus of the WHO's constitution is of course not on refugees or refugee health per se, but rather on the inalienable and fundamental right to health for all humans.

The surge in the number of refugees arriving in Europe in the years following the outbreak of the Syrian civil war in 2011 propelled migration and migration-related issues to the top of the policy agenda across the continent. The sheer number of refugees arriving, especially in the peak year of 2015, overwhelmed reception systems, tended to polarize political, public and media discourse and caused a hardening of refugee policies and border patrol [3,4,12]. In the process, international conventions and human rights came under attack or were pushed aside, somewhat depending on the political landscape within the European countries [5,12]. Partly as a consequence of the heterogeneity of this landscape and partly as a consequence of differences in existing healthcare systems, the availability of resources and the extent of refugee influx, notable variations exist in the access to and delivery of healthcare to RAS across Europe [13].

In Norway, increasing attention has been given to migrants' health in general and RAS' health in particular in recent years as illustrated through several policy decisions, government strategic objectives and reports:

1) The Government White Paper number 30 (2015-2016) which includes the following stated objectives: i) enhance knowledge on the health of asylum seekers in the early reception phase, and ii) assess the use of health- and welfare services by asylum seekers [14].

2) The Government's strategy for integration for 2019-2022 (*Integration through knowledge*), wherein immigrant health is a clearly stated strategic objective [15].

3) The Directorate of Integration and Diversity's 2021 report on indicators for integration (*Indikatorer for integrering - Tilstand og utviklingstrekk ved inngangen til 2021*), which devoted additional attention to migrants' health compared to past reports [16].

4) The new 'Law on integration through education, training and work', which entered into force in 2021 and introduced a mandatory new life skills course as part of the Norwegian Introduction Program [17]. Central to the new course is a 10-hour module on 'Migration, health and diversity" which focuses on various aspects of physical and mental health in the early phase of resettlement (e.g. normal psychological reactions to stress, health literacy and understanding how the healthcare system in Norway works).

5) The report following the investigation of the tragic drowning death of a Sudanese refugee woman and her two children in Tromsø in 2019, which highlighted the risk of serious mental illness going undetected in newly arrived family-reunification refugees unless systematically investigated [18]. This risk was particularly underlined in the context of the many stressors refugees face in the early resettlement period—e.g. adapting to a new culture and learning a

11

new language, establishing social networks and support systems, and trying to secure a job and gain financial stability.

In practice, it is the responsibility of the local health authorities in municipalities hosting RAS to assess the need for and provide healthcare services to RAS in Norway. The Norwegian Directorate of Health has established guidelines for health assessments to be done in the early resettlement phase, which the local health authorities can utilize to ensure health needs are detected [19]. Importantly, though, the recommended guidelines are just that, recommendations. The extent to which RAS are offered and undergo health screening in reality is uncertain, although one report suggests most municipalities offer some form of health assessment within 3 months of resettlement [20,21]. Furthermore, the guidelines state that potentially traumatic experiences (PTEs) and mental health should only be inquired about if deemed necessary based on existing information. There are no available studies that have systematically evaluated how frequently health care personnel go into these topics in reality. Part of the reason why screening for PTEs and mental health is optional may be that the effectiveness of these types of screens in identifying different trajectories of mental health, functioning and integration is still uncertain, which is one of the major challenges facing refugee research today [3,5,22,23]. For even as refugees constitute a vulnerable group, they are also a highly resilient one, with evidence suggesting most refugees manage to navigate through the psychologically taxing and tumultuous resettlement period without the need for any mental health care intervention [24,25]. Nonetheless, as will be detailed below, the burden of mental health problems is notably higher in refugee populations compared to non-refugee populations, and there is some evidence indicating that (mental) health may play an important role in explaining why refugees lag behind other migrant groups in terms of labor market integration, even many years after resettlement [26–28].

The larger REFUGE project, of which the present thesis is constituent part, must be seen against the above backdrop. Specifically, an overarching aim of the REFUGE project is to help close the knowledge gap on how health, and in particular mental health, is linked to trajectories of integration, explored in the context of pre-, peri- and post-migrations stressors. The aims of the studies in the present thesis are to lay methodologically robust groundwork focusing on the burden of mental ill health in different refugee populations as well as identify important risk and protective factors thereof. In doing so, the studies will help prepare for the second phase of the REFUGE project, namely, the linking of self-report data on (mental) health and migration-related stress to longitudinal registry-based data on health and labor market participation. The REFUGE project was initiated in the aftermath of the outbreak of the Syrian civil war and the subsequent exodus of refugees, some of whom ended up in Norway and Sweden. The close collaboration between the Swedish Red Cross University College (RKH) in Sweden and the Norwegian Centre for Violence and Traumatic Stress Studies (NKVTS) in Norway has resulted in two

methodologically almost identical studies being conducted in these two countries: the Resiliency, Mental Health and Social Participation among Refugees (RMSR) study at RKH, and the REFUGE study at NKVTS. The close collaboration presents a strong opportunity for cross-country comparisons and explorations of the reliability and validity of some of the most frequently used measures for mental health in research on refugee populations [29]. The present thesis consists of three studies conducted on data from the REFUGE-study in Norway—all on adult refugees from Syria—and two studies from the RMSR project in Sweden, one on adult refugees from Syria, and the other on adolescent refugees from Syria, Iraq and Afghanistan.

4.2   The Syrian civil war

In March 2011, the Syrian government violently cracked down on a public demonstration in reaction to a group of teenagers being arrested for anti-government graffiti in the town of Daraa [30]. The conflict quickly escalated and descended into civil war forcing millions of Syrians to flee their homes and many to cross international borders and become refugees. The number of refugees escaping into neighboring countries like Turkey, Lebanon and Jordan increased dramatically in the ensuing years with a relatively high number attempting to reach the European continent via Turkey and the Mediterranean sea [31]. In 2015, Syrian refugees constituted more than half of all new refugees in the world [2]. The number of arrivals to Europe, and especially Greece, also increased markedly in 2015, with the number of first-time asylum applications by non-EU citizens reaching 1.2 million, of which the vast majority were Syrians [32]. Slightly over 30,000 asylum seekers, mostly Syrians, arrived in Norway in 2015 [33], and of these, more than 5,000 were unaccompanied refugee minors, URMs [34]. In comparison, Turkey, which is one of the countries hosting the greatest number of refugees globally, received close to 1,000,000 refugees from Syria in the same year [31], and as of summer 2022, an estimated 3.6 million Syrian refugees live in the country [30]. With Syrian President Bashar al-Assad still in power and having regained control over large swaths of Syrian territory, there is currently limited prospects of the more than 6 million Syrian refugees returning home [35]. In total, the estimated death toll from the Syrian civil war is 400,000, though this number could be substantially higher [35].

4.3 Epidemiological research on refugee mental health—a brief history

Historically, systematic, large-scale investigations of the mental health of refugees were limited prior to the late 1970s and early 1980s, even though preliminary epidemiological evidence on the high prevalence of mental illness in refugee populations was published as early as 1960 by the Norwegian doctor and Holocaust survivor Leo Eitinger [36]. However, starting in the late 1970s, several factors converged to mark the start of the modern era of epidemiological research on refugees and conflict-affected populations [37]. Specifically, the international ban on torture, the large number refugees fleeing the wars in Vietnam, Cambodia and Laos and resettling in Western countries, and the introduction of post-traumatic stress disorder (PTSD) in the third edition of the Diagnostic and Statistical Manual of the American Psychiatric Association, DSM-III [38] all contributed to what would become an rapidly expanding research field in the following decades [39,40]. The introduction of the PTSD diagnosis and the subsequent exponential rise in the number of studies based on or inspired by the psychotraumatologic perspective have at times caused considerable debate, with critical voices arguing that the psychotraumatological approach medicalizes what by many are considered normal reactions to the extreme situations of war and trauma [41,42]. Nonetheless, PTSD, together with depression, are the most heavily studied mental health problems in refugees and conflict-affected populations to date [43], typically in the context of pre-migration PTEs (e.g. exposure to violence and torture, fleeing under life-threatening conditions, separation from family and friends, and prolonged stays in unsafe and overcrowded camps [3]).

In the last decade or so, however, the traditional strong focus on the link between *pre*-resettlement PTEs and mental ill health has increasingly been challenged as too simplistic to adequately capture the intricate web of determinants of refugee mental health and for relying too heavily on an individualistic and deficit model of health [44–46]. In parallel, and partly as a consequence, a growing number of studies have recently started to explore how pre- and post-resettlement factors interact to shape mental health [29,47], as well as conceptualize and study mental health not as the absence of illness and disease, but as a state of positive feelings and positive functioning—i.e. *positive* mental health [48,49]. Defining and measuring positive mental health, however, is not straightforward [50]. Within refugee research, the concepts of subjective well-being (SWB), quality of life (QoL) and life satisfaction have all been used to operationalize positive mental health, however, these overlapping concepts are often defined and used differently across studies [51–53]. Importantly, though, central to all three concepts is that the focus is not on the presence or absence of disease or mental *ill* health, rather, the focus in on individuals' experiences of *positive* mental health states (e.g. happiness, a sense of fulfillment and cheerfulness). Although most studies included in the present thesis focus on mental ill health, study number five explores subjective well-being and how post-migration stress is linked to well-being.

4.4 Mental health, refugees and culture

The theoretical underpinnings and methodological approach of the present thesis is solidly anchored in the field of epidemiology and biomedicine. Epidemiological research has arguably contributed substantially to current understanding of mental health in refugee populations [37]. Nonetheless, several core concepts central to good epidemiological research, especially concepts relating to *validity*, are challenged when confronted with the extreme diversity that characterizes refugee populations. Refugees come from a wide range of cultures and traditions, and their experiences, understandings and expressions of mental health and distress are highly heterogeneous, and often not neatly aligned with illness models in biomedicine and the diagnostic frameworks for taxonomizing mental illnesses created in this tradition [54–56]. Consequently, many of the instruments frequently used to operationalize and measure mental (ill) health—given that they focus on key criteria as set out in these diagnostic frameworks—may yield data with low validity in refugee populations, as reactions considered abnormal in one culture might be considered normal in another. Some of the more ardent critics of how research on refugees and conflicted affected people has developed in the last decades, have even raised more fundamental concerns as to the legitimacy of the field's methodology and aspirations overall, suggesting that the biomedical approach should be used with great caution when applied across cultures, if at all [42,57]. The intensity of this fundamental debate has abated in recent years, though the debate has helped ingrain the importance of transcultural considerations when conducting research on refugees—e.g. how do local illness models and idioms of distress potentially affect study operationalizations and measurements of mental health, what are optimal and valid cut-off values when using questionnaire-based instruments to measure mental ill health, and how may stigma influence reporting and findings [37].

With this as a backdrop, even if the present thesis relies heavily on the concepts and methodologies of epidemiology and biomedicine, I have tried, whenever possible and appropriate, to engage in what has been described as "culturally informed epidemiological research" [58], especially in the later articles of the thesis. In particular, study IV attempts to bring in and reflect on important transcultural issues when investigating the connection between chronic pain and mental ill health in adult refugees from Syria. Nevertheless, existing guidelines and requirements for publications in biomedical and epidemiological journals limit the space available to go into in-depth discussions on these issues.

4.5   Blind men and an elephant

I would like to conclude the General introduction with the parable of the blind men who try to grasp the essentials of an elephant by touching different parts of it—one the trunk, another the ears and a third the tail. Their different exposure to reality, and their inability to see the reality exposed to others, result in a brawl wherein each man feverishly defends his own understanding of the elephant whilst denouncing that presented by others (at least this is how one version of the parable goes). The point being that humans tend to get so fixated on their own experiences and perspectives, that they fail to acknowledge other perspectives that may be of equal relevance and value.

The present thesis explores refugee mental health and important risk and protective factors thereof. Compared to describing an elephant, the task of understanding the myriad factors that shape refugee mental health is an infinitely more challenging task, and the thesis only explores a small part of this complex meshwork of factors. The centrality given to pre-arrival characteristics and especially pre-arrival PTEs, should not be interpreted as suggesting other factors—e.g. factors related to the post-migration environment and resettlement country policies—may not be of equal or even greater importance to refugee mental health [59]. Nonetheless, in order to understand an elephant in its totality, it is of vital importance to have thorough and detailed knowledge of its constituent parts. Thus, I may be similar to one of the blind men in that I focus on the tusk, say, of the elephant, though I really want to avoid the pitfall of claiming that this tusk is the best representation of the whole elephant or even the most essential part of it.

The reality is, of course, that an understanding of refugee mental health requires looking at a multitude of factors spanning a broad range of interwoven elements and constructs. It is necessary to look at factors intrinsic to the refugee him or herself (e.g. socioeconomic variables and history of mental illness), characteristics of the country, culture and social systems left behind (e.g. illness models and gender roles), PTEs before and during flight (e.g. torture and sexual violence), and an infinite number of contextual factors characterizing the situation in the country (s)he has migrated to (e.g. integration policies and discrimination). Historically, there has at times been considerable disagreements as to which of these factors are more important to understanding mental health in refugees [40], although the predominating view today is that refugee mental health can only be understood through integrating all of these factors in a holistic manner [3,59,60]. Even if parts of the present work may suggest a certain myopia in its emphasis on pre-arrival elements, the overarching aim of the work is to contribute with methodological robust evidence that can further the holistic agenda.

5 Background

5.1 The burden of mental ill health in refugee populations—a summary

A large number of studies have documented elevated levels of the most commonly investigated mental health disorders (i.e. PTSD, depression and anxiety) in adult refugee populations compared to general, non-refugee populations [61–63]. The same has been shown in refugee children and adolescents [64,65]. There is, however, large variations in prevalence estimates across individual studies [66,67], which is partly thought to be related to methodological differences—e.g. recruitment strategy and whether self-report data or clinical interviews have been utilized [39,68]. Major review articles repeatedly underline the need for additional studies with more robust methodology than has hitherto been the norm in the field, so that prevalence estimates are less confounded by methodological noise [39,64,66].

5.1.1 Mental illness in adult refugee populations

The estimated PTSD prevalence in adult refugee populations found in major meta-analyses tend to converge around 30% [39,43,66], although some have come up with lower overall estimates [69,70]. The estimates vary considerably across individual studies within these meta-analyses ranging from around 10% in the lower end to above 80% in the higher end [66]. In studies done exclusively on refugees from Syria following the outbreak of the civil war, a similar overall estimate of 30% was reported in a meta-analysis by Nguyen et al. in 2022 which focused on Syrian refugees resettled in high-income, Western countries [71]. A somewhat higher estimate of 40% was reported in a 2020 review by Peconga et. al. which included both refugees and asylum seekers, and placed no restrictions on whether the Syrian refugees were resettled in low, middle or high-income countries [72]. Again, notably different prevalence estimates were reported across the studies included in these two reviews, ranging from around 12% in a study on Syrian refugees in Germany [73] to over 80% in a study on Syrian refugees in Istanbul, Turkey [74]. More recent studies have reported both lower [75] and higher [76] prevalences than the 30-40% reported in the above two meta-analyses on adult refugees from Syria.

The prevalence of depression in adult refugee populations reported in meta-analyses is similar to that of PTSD, i.e. around 30% [39,43,66]. As with PTSD, there is great variation in the reported estimates across individual studies, ranging from under 5% [69,77,78] to around 80% [79]. In fact, there is even considerable variation in the overall estimates when comparing different meta-analyses with each other [61], going from 5% at the lower end [69] to close to 50% at the upper end [80,81]. With respects to adult

refugees from Syria following the civil war, the aggregate prevalence of depression reported by Peconga et al. was 40%, and there was less variation across studies included in the review for depression compared to for PTSD [72]. The meta-analysis by Nguyen et al. reported an overall estimate of 31%, and there was a larger heterogeneity within their included studies, ranging from 15% [82] to 55% [83]. A recent large study on Syrian refugees in Turkey found a prevalence of about 35% [75].

It is a bit more difficult to summarize prevalence findings on anxiety in adult refugee populations, partly because there is less available evidence, and partly because anxiety disorders are defined differently across reviews—e.g. sometimes PTSD is defined as part of anxiety disorders and sometimes it is not. Several reviews have concluded that the prevalence of anxiety disorders is moderately lower than that for PTSD and depression, lying somewhere between 10 and 20% [43,69,70]. Others conclude that the prevalence is comparable at roughly 30% or potentially higher [66,81]. For the two meta-analyses on adult Syrian refugees—i.e. the Peconga et al. and Nguyen et al. reviews—the prevalence estimates were around 30% [72] and 40% [71], respectively, ranging from 14% [73] to 60% [84] in the review by Nguyen et al. [71].

5.1.2 *Mental illness in refugee children and adolescents*

As of the end of 2021, there were close to 37 million displaced children and adolescents worldwide of which over 12 million where refugees according to UNICEF [85]. Despite constituting over 40% of the world's forcibly displaced people [2], there has up until recently been fairly scant available evidence on the prevalence of mental illness in refugee children and adolescents [64]. Moreover, due to large variations in methodology, meta-analytic prevalence estimates have been difficult to calculate [67]. Several large reviews in recent years have helped push the field forward, providing a thorough update of prevalence numbers based on accumulated available evidence [64,67]. The prevalence for anxiety, depression and PTSD do not converge smoothly across these and prior reviews, much like in review studies in adult refugee populations. In a 2019 review by Kien et al., the interquartile ranges for anxiety and depression went from about 10% to about 30% whereas for PTSD, there was a higher estimate range: from 19% to over 50%. Significantly lower estimates for all three disorders were reported in a more recent review by Blackmore et al. from 2020, which only included studies that estimated prevalence through clinical interviews (i.e. studies relying on self-report data were excluded) and where certain other methodological criteria had to be met [64]. In the Blackmore et al. review, the estimated prevalence of PTSD was slightly over 20%, whereas the prevalence for depression and anxiety was around 15%.

5.1.3 Methodological considerations in exploring prevalence estimates

Several main conclusions may be drawn from the available evidence on the burden of mental ill health in refugee populations. First and foremost, there is consistent evidence that the prevalence of PTSD, depression and anxiety is markedly higher in refugees than in non-refugee general populations both for adults and children, especially for PTSD. This highlights that recipient countries and healthcare providers need to be alert to and cognizant of the mental health needs of this vulnerable yet resilient population in order to ensure that needs are detected and addressed with appropriate strategies and interventions. Another main conclusion that may be drawn is that markedly different prevalence estimates are reported for all disorders across studies, and even across meta-analyses [39,61,66,72]. In some ways, this may be unsurprising given that refugees differ across a number of key factors known to be important to mental health: characteristics of the country they are fleeing (e.g. culture, religion and belief systems, understanding of health, education level and socioeconomic parameters); type and intensity of conflict they have escaped; the length of and risks associated with the routes of escape; and a whole range of factors related to the resettlement countries and their policies. Interestingly, however, even when prevalence estimates are compared between studies where some of these factors are held constant—i.e. by comparing refugees fleeing the same conflict and through similar routes—there is a surprising degree of variation in estimates as illustrated by the abovementioned review article by Peconga et al. on adult refugees from Syria [71,72].

This heterogeneity in the estimated burden of mental ill health even within the same refugee population (i.e. the same as in all originating from Syria) supports what has already been found in previous reviews, namely, that methodological factors appear to play an important role in explaining the variation in prevalence estimates. In their landmark review article from 2009, Steel et al. examined and tried to quantify the contribution of methodological factors to the variance of prevalence estimates across studies for PTSD and depression [39]. Important findings from this review were that the prevalence tended to be inversely related to sample size (i.e. lower estimates in large samples) and higher if questionnaire data was used versus if diagnostic interviews were used. The latter finding was also reported in a review article by Charlson et al. in 2019, which concluded that questionnaire-based studies tend to inflate prevalence estimates with 50-100% [70]. In the Steel et al. review, there was also evidence that the choice of sampling strategy was associated with prevalence, specifically, that nonrandom, convenience samples tended to yield higher estimates than if samples were chosen based on probability/random sampling strategies. The importance of sampling strategy has been stressed by several other major reviews [43,66,67], and all encourage that future studies move away from convenience sampling if possible.

19

Another source of methodological heterogeneity within the pool of questionnaire-based studies, is that many different instruments exist for any given mental illness [86]. Moreover, even for studies using the same instrument, different cut-offs or criteria to define caseness are frequently applied across studies. This is well illustrated by the six studies on PTSD among Syrian refugees summarized in the Peconga et al. review which measured PTSD with the Harvard Trauma Questionnaire, HTQ [72]. Across the six studies, PTSD caseness was defined in three different ways, with two studies using symptom cluster criteria, three using a cut-off score of 2.5 and one using a cut-off score of 2.06. Interestingly, even for the three studies using the 2.5 cut-off, the estimated prevalence was notably different spanning from 35% in a study from the Kurdistan region in Iraq [87] to 65% in a study from Hungary [88], despite the study populations being similar in terms of exposure to PTEs and sociodemographic variables. There were, however, other key differences, not least that participants in the Hungarian study were asylum seekers recruited at the Hungarian-Serbian border whereas participants in the Iraq study were UNHCR registered refugees living in a refugee camp. These two studies may well illustrate another methodological challenge with using mental health screening instruments, namely, that these instruments cannot easily distinguish temporary distress reactions caused by contextual stressors (e.g. harsh and protracted detentions, uncertain asylum outcomes and lack of daily structure and purpose) from more deeply rooted and potentially long-lasting psychological reactions that could develop into debilitating mental illness [3,23].

As alluded to in the General introduction, applying standardized instruments across different settings, populations and cultures in order to measure underlying mental health constructs requires careful reflection. Historically, there has been a lack of robust psychometric evidence to evaluate transcultural validity and appropriate cut-off values across contexts [89,90], although the number of studies investigating these topics have increased in the last decade or so [91–97]. For example, the HTQ was initially developed from research on refugee populations in Southeast Asia [98]. Nonetheless, the optimal cut-off value to define PTSD caseness obtained in this study (> 2.5) is commonly adopted in studies on very different refugee populations without much empirical evidence to support that this is appropriate [95]. Of the evidence that does exist, results and conclusions are at times quite incongruent [89–91,99], with some studies suggesting that the construct validity of both the HTQ and Hopkins Symptom Checklist (HSCL) scales are fairly robust across cultures [99], whereas others conclude the opposite [89,91]. Similarly, studies on the validity of one of the most frequently used measures of PTSD in refugee children and adolescents, the Children Revised Impact of Event Scale, CRIES-8 [100–102], are also not neatly aligned in their conclusions [103,104]. There is less available evidence overall to evaluate the scale's validity compared to for example the HTQ or HSCL scales.

The push to rid prevalence estimates of methodological noise in order to reach more accurate and consistent estimates across studies, should not make researchers forget or underestimate the complexity and context-dependency of the phenomena under study. That is, a plethora of theory and available evidence suggest that prevalence estimates of mental illness *will* likely vary notably between contexts because there are so many contextual factors that influence mental (ill) health, e.g. the length and brutality of the conflict in question, flight routes, the asylum process, post-resettlement realities and hardships as well as numerous factors characterizing the country and culture refugees have fled. Thus, it has been argued that new methodologically robust epidemiological research exploring the mental health burden across various populations and settings are constantly needed in order to inform healthcare providers and policymakers on how to best address the mental health needs for a given population in a given context [37]. The REFUGE project in general, and a core part of the present thesis in particular, aim at doing just that: assess the burden of mental ill health and important risk and protective factors thereof in a methodological rigorous way for adult and adolescent refugees resettled in Norway and Sweden, the vast majority of which come from Syria.

5.2   Risk and protective factors of mental (ill) health in refugee populations

5.2.1   *Potentially Traumatic Experiences (PTEs)*

Historically, research on refugee mental health has had a strong focus on the now well-established associations and likely causal links between exposure to pre-resettlement PTEs and mental ill health [39,66,105]. Even if a fairly large number of studies have provided evidence in support of this link over the years [105], the lack of agreed upon and standardized ways to measure PTEs has been a problem in the field [22,105,106]. In an attempt to address this problem, researchers at the Red Cross University College in Sweden designed a 16-item scale focusing on important PTEs before and during flight [107]. The scale was developed after a thorough review of the literature, consultation with experts and pilot testing with refugees in a clinical setting. A few meta-analyses have attempted to address the same problem by retrospectively standardizing the various measures used and their associations with mental health [39,66]. Most notably, in 2009 Steel et al. devised the concept of *PTE adversity ratio* (PTE-AR), operationalized as the ratio of experienced PTEs to the number inquired about [39]. In their review, Steel et al. found very strong evidence of a positive dose-response association between PTE-AR and both PTSD and depression. More recent studies have investigated PTEs and the association between PTEs and mental (ill) health

using latent class analysis, and found that exposure to PTEs tend to cluster into three [108] or four [22] subgroups, each with different links to mental health.

Fewer studies exist on the association between PTEs and mental health in child and adolescent refugees, though available evidence supports a similar relationship there [109–111].

5.2.2 Post-migration stress

As already highlighted, the historical focus on the links between pre-resettlement PTEs and mental health has at times been criticized for failing to incorporate and take sufficient account of a whole range of other important determinants of mental health, not least those related to the post-resettlement environment [112]. Important post-migration stressors include, but are not limited to economic hardships, discrimination, social exclusion and lack of resettlement country specific skills (e.g. language). Partly as a consequence of the focus on PTEs before and during fight in the past literature, the last decade or so has witnessed a sharp increase in the number of studies investigating post-migration stressors both as independent risk factors for mental ill health and as important modifiers of the adverse effects of pre-resettlement PTEs on mental health [59,60,113]. It is a bit challenging to succinctly summarize the findings from these studies given the high number of studies conducted and the variety of stressors investigated. Overall, the stressors found to have the strongest link to mental ill health include financial difficulties, unemployment, lack of social networks/social isolation, discrimination and language difficulties [47,113,114]. Similar to PTEs, however, there has not been any established standards as to how post-migration stressors should be measured, which led the abovementioned researchers at the Swedish Red Cross University College to develop and validate a new scale (the Post-Migration Stress Scale) in the early phases of the RMSR-project [115]. With more and more evidence becoming available both on the independent risks of mental ill health conferred by post-migration stressors as well as the importance of post-migration stressors as moderators of the adverse mental health effects of pre-migration PTEs, it is increasingly recognized that only by incorporating all stressors related to the refugee experience can one really start to grasp the complex and interwoven factors influencing mental health and mental health trajectories [3,46,60]. Moreover, since many of these factors are highly dependent on, for example, the country and time-period of resettlement, there is a need for context-specific knowledge [37].

5.2.3 Social support

It is well established that social support is positively associated with health in general and mental health in particular, both for refugee and non-refugee populations and that this is partially due to the stress buffering

effects of social support [48,116–118]. However, findings on the potential moderating role of social support in the adverse association between post-migration stressors and mental health are inconsistent in studies on refugees. In one study on Afghan refugees in the US, social support was not found to moderate the negative effects of discrimination on psychological distress [119]. However, social support was found to be an important moderator between resettlement stress and depression in the Canadian Refugee Resettlement Project [25]. Further research might help clarify these somewhat inconsistent results, and also explore whether the buffering effects of social support are more important for some post-migration stressors than others.

5.2.4   *The risk associated with being an unaccompanied refugee minor (URM)*

Given that the childhood and adolescent periods are critical for cognitive, emotional and social development, ideally in a safe and nurturing environment, major disruptions in this period may confer a particular risk of adverse consequences, both for mental health and more broadly [120]. Going through the disruptive experiences associated with being a refugee is challenging for a child/adolescent even in the presence of a caregiver. Though for a sizable number of refugee minors, the journey and resettlement process have to be tackled without the accompaniment of a protective caregiver or adult [121]. This group of *unaccompanied refugee minors (URMs)* face even greater risks, including exposure to sexual exploitation and abuse. As highlighted in a recent review by Oldroy et al. [122], there is a need for further studies with robust designs on URMs to increase our understanding of this at-risk group and how mental health is influenced by the various experiences and hardships they go through [111,123].

5.3   Pain and mental health in refugee populations

An abundance of evidence exists in non-refugee populations on the associations between mental ill health and somatic distress in general, and pain in particular [124–128]. This interconnectedness of psychological distress and physical symptoms is thought to be linked to genetic factors, shared physiological and neurochemical pathways, as well as environmental factors [129,130].

A fairly large number of studies have documented elevated levels of pain in selected groups of refugees such as torture-exposed refugees or refugees in treatment for mental illness [131–136]. Even though prevalence estimates of pain vary across these studies, most are in the range of 60-90%. Given that pain is a known long-term consequence of torture [137], the high prevalence of pain in torture-exposed refugees

is not surprising. Similarly, the elevated prevalence of pain found in clinical samples may be partly because, as a group, refugees in treatment likely have high traumatic exposure, including exposure to torture and physical violence with potential subsequent issues with pain. Importantly, though, considering the abovementioned strong links between mental ill health and pain documented in non-refugee populations, another reason for the elevated levels of pain found in clinical samples of refugees may be related to mental illness and high levels of mental distress overall.

Surprisingly, there is a paucity of research on pain and the link between pain/somatic distress and mental health in general, unselected, refugee populations given the well-known elevated prevalence of mental illness in this population. Of the available evidence, one two-wave, longitudinal study on adult refugees from Syria in Norway found the prevalence of chronic pain to be around 30%, and further, that chronic pain was linked to mental ill health but only at the follow-up measurement [138]. Strong associations between somatic distress, although not pain in particular, and mental ill health (i.e. anxiety, depression and PTSD) were also documented in several large studies on refugees or people affected by conflict in Turkey [139], Georgia [140] and the Ukraine [141].

Exploring the co-occurrence of psychological and somatic distress across ethnic and cultural groups may be particularly challenging given that distress is experienced, represented and expressed differently in different populations [54,142]. For refugees from Syria and other Arabic countries, stigma surrounding psychological distress and mental illness may also play a role [143]. Specifically, and with the risk of oversimplifying, the expression of certain negative emotions that may be labeled as psychological or psychiatric is not well accepted in Arabic culture, particularly for men [144]. This may partially explain the observation by some researchers working with Arab populations that physical symptoms are often the initial and predominant presenting complaints for individuals with mental health problems [143].

Overall, RAS tend to show low levels of help-seeking behavior and underutilize available mental healthcare services despite high levels of mental ill health [145,146]. Moreover, even if many countries have guidelines for the screening of mental health in newly arrived RAS, including Norway, there is a risk that mental ill health go undetected and untreated [18,147]. One potential contributor to both the low rates of help-seeking behavior and the problem with mental illness going undetected could be a mismatch between illness models and idioms of distress in refugee populations versus in healthcare providers in the country a refugee has resettled in [146]. Further research examining how psychological distress and somatic symptoms are interlinked in refugee populations could help sensitize healthcare providers to culture-specific expressions of distress and illness, thereby making them better equipped to detect distress and give adequate help.

24

Overall, given the high burden of mental ill health in refugee populations, the known biopsychosocial links between psychological distress and somatic symptoms, and the possible misalignment between illness models in refugees and healthcare providers in resettlement countries, it seems that research in this area is highly needed.

5.4 Gender/sex and mental health in refugees

Even if all refugees, given their many hardships prior to, during and after migration, have increased risk of mental ill health compared to non-refugee populations, the experiences of women during war and conflict combined with stressors women face after migration, have been shown to put them at a particular risk of mental ill health [148]. The plight of refugee women in the context of war and displacement has received much less attention than that of refugee men [148,149], and there has been an insufficient focus on gender-specific patterns in large epidemiological studies on the prevalence of and risk and protective factors for mental ill health [43].

As highlighted in a recent Lancet series on women's mental health—not on refugee women, but on women in general—numerous studies have documented sex and gender differences for mental disorders when it comes to prevalence, symptomatology and course among other things [150,151]. Of particular relevance to the present thesis, women have been shown to have increased prevalence, severity and burden of anxiety, trauma-related and stress related disorders compared to men [152]. The reasons for these differences are complex and far from fully understood, with evidence suggesting many biological and societal/environmental factors are involved and likely interact with one another [153,154]. When mental health has been investigated and compared across men and women in epidemiological studies on refugees, explanations for any observed differences, or lack thereof, have tended to focus on social/environmental factors (e.g. gender roles, exposure to sexual violence and gender inequalities [74,155]), however, Acarturk et al. also point to biological factors in a recent, large, study on Syrian refugees in Turkey [75].

As per the definition of the World Health Organization, *sex* refers to the biological/physiological characteristics of men and women and *gender* refers to the socially constructed characteristics [156]. In the review literature on mental health in refugee populations, some authors use the term *sex* [39,43] whereas others use the term *gender* [66]. Similarly, for studies exploring mental health in multivariate frameworks with sex/gender as a predictor of interest, both terms are frequently used and few studies discuss whether the aim is to explore sex (i.e. biological characteristics) or gender (i.e. socially constructed characteristics) as risk/protective factors. Although sex/gender is an important part of studies

III, IV and V, the precision of the variables used to measure sex/gender in these studies—and indeed the high degree of overlap between sex and gender in reality—does not allow separating the effects of sex as a biological construct from those of gender as a social construct. Therefore, to simplify, I will from hereon out use the term *gender* as an umbrella term to refer to both the social and biological constructs. I will also use the phrase "male/female gender as a risk factor for"—intended to denote risk factor exploration in the epidemiological sense—as this phrase results in a more concise language. A similar choice was made in the review by Mohwinkel et al. on gender differences in the mental health of unaccompanied refugee minors [157], which found that female gender was associated with higher vulnerability towards certain mental health problems in unaccompanied refugee minors.

Overall, available evidence on gender and mental health in adult refugee populations is somewhat mixed, with one large review in 2015 concluding that refugee women appear to have higher risk of anxiety and depression, but not PTSD, compared to refugee men [66]. Similarly, among studies looking exclusively at refugees from Syria, one study did not find that women in this population had a higher risk of PTSD [158], however, three other studies did find women at elevated risk [74,75,155]. Importantly, of these four studies, only two applied regression analysis to evaluate gender as a risk factor [74,75]. Using multivariate regression techniques, or other statistical approaches that allow controlling for multiple variables simultaneously, is arguably of high significance if one aims to shed light on *why* women may experience increased risk—e.g. is it predominantly related to their experiences during war (e.g. exposure to sexual violence), or does their risk remain elevated even after controlling for (some of) these experiences, pointing towards the importance of other factors. Needless to say, it is overwhelmingly likely that a multitude of factors matter and interact to impact the risk of mental ill health in refugee women.

In addition to investigating gender as a risk factor for mental ill health in and of itself, studies exploring gender as an important modifier of the adverse effects of post-migration stress on mental health are also emerging [114,159]. For example, a study by Stemple et al. found that language proficiency and intimate and extended family ties were negatively associated with distress in women, but not in men [159], and that the association between gender ideology and mental ill health was gender specific, with traditionally oriented women and egalitarian men experiencing less distress. [160,161]. Gender-specific associations between post-migration stressors and mental health were also suggested in a recent large, four-wave, longitudinal study in Australia by Wu et al. [114]. Part of the explanation for these gender-specific findings is likely linked to gender roles [162] and the often difficult process of relocating from cultures and societies with marked gender separation to societies with less gender separation [160].

With an abundance of evidence from both refugee and non-refugee populations having documented that pain conditions and somatic distress is markedly more prevalent in women [141,163–165], research

exploring the association between mental health and pain should disaggregate analysis and results by gender. Another reason for being attuned to the role of gender when investigating pain and psychological distress among refugees from Syria, is the differences in gender roles and what is considered acceptable ways of expressing distress in Arabic culture, especially in men, as alluded to above [143,144].

Overall, given the historic lack of attention to gender-specific patterns and the role of gender when exploring mental health and migration related stress in refugee populations [43,149,166], several of the studies in the present thesis have a heightened focus on gender either by investigating gender as a risk factor or by exploring gender as an effect modifier.

6 Aims and objectives

6.1 Main aims of the thesis

Overarching aims of the present thesis are to:

i) Explore the burden of mental ill health and/or chronic pain in different refugee populations resettled in Sweden and Norway, with a particular focus on adult refugees from Syria, and investigate important risk and protective factors thereof.

ii) Investigate the co-occurrence of mental ill health and chronic pain and explore their unique and overlapping associations with perceived general health and daily functioning.

iii) Pursue the above aims through a gender lens, specifically, explore how gender is associated with mental ill health across these refugee populations and whether risk and protective factors are gender-specific (i.e. whether gender is an effect modifier).

iv) Lay methodologically robust groundwork for later studies that will link REFUGE survey data to longitudinal, registry-based data on healthcare service use, labor market marginalization and drug prescription (studies II-IV).

6.2 Main study objectives

Study I: In a sample of refugee adolescents from Iraq, Syria and Afghanistan resettled in Sweden between 2014 and 2018:

      i) Estimate the prevalence of PTSD based on symptom checklist score on CRIES-8.

      ii) Explore the risk of PTSD associated with fleeing as an *unaccompanied* refugee minor compared to as an accompanied minor.

      iii) Investigate gender as a risk factor for PTSD.

Study II: Study II is a cohort profile from the REFUGE-study on adult refugees from Syria resettled in Norway between 2015 and 2017. Objectives are to:

i) Give detailed information on the project overall, including key methodological aspects (e.g. sampling and recruitment strategy).

ii) Provide detailed descriptions of participants and potential selection bias caused by non-participation.

iii) Outline future plans for the study.

Study III: Based on data from the REFUGE-study:

i) Estimate the prevalence of PTSD, anxiety and depression based on symptom checklist scores on the Harvard Trauma Questionnaire and the Hopkins Symptoms Checklist.

ii) Compare these estimates to the estimates found in the Swedish RMSR study, a study with almost identical methodology conducted on adult refugees from Syria resettled in Sweden between 2011 and 2013.

iii) Explore important risk and protective factors of mental ill health, with a focus on gender and potentially traumatic experiences (PTEs).

Study IV: Based on data from the REFUGE-study:

i) Assess the burden of chronic pain and explore the associations of chronic pain with anxiety, depression and PTSD.

ii) Explore unique and overlapping associations of chronic pain and mental ill health with perceived general health and impaired daily functioning.

ii) Investigate gender as an effect modifier in the above associations.

Study V: In a sample of adult refugees from Syria resettled in Sweden between 2011 and 2013:

i) Explore gender-specific associations between post-migration stressors (e.g. financial and discrimination) and subjective well-being.

ii) Investigate whether social support acts as a buffer in the above associations.

7 Methods

7.1 Overview methods—all studies

Design and participants

The present thesis is based on five studies, conducted on three different samples. All studies have cross-sectional designs, with data collected through questionnaire surveys administered via postal mail. The study populations of the five studies are:

Study I   Refugee adolescents between the ages of 16 and 18 from Syria, Iraq and Afghanistan who were granted residency on grounds of asylum and resettled in Sweden between 2014 and 2018.

Study II-IV   Adult refugees from Syria over 18 years of age who were granted residency rights either as a UNHCR quota refugee, through the family reunification program or as an asylum seeker in Norway between January 2015 and December 2017.

Study V   Adult refugees from Syria between the ages of 18 and 64 who were granted permanent residency on grounds of asylum and resettled in Sweden between 2011 and 2013.

Measures—the use of screening instruments

The measures used for mental ill health across studies (i.e. anxiety, depression and PTSD) are all screening instruments. Screening instruments do not have the same diagnostic accuracy as the gold standard clinical interview, especially when used across culturally diverse populations. Nonetheless, screening instruments are convenient and resource-effective when trying to assess mental ill health in large-scale epidemiological studies and are thus frequently used [86]. In order to highlight that "mental illness" is based on a symptom score above a pre-set threshold and *not* the gold standard interview, studies frequently use phrases such as: "symptom-defined PTSD" (study I), "checklist-positive PTSD" or "approximated PTSD prevalence" (studies III and V).

Translations of instruments

Most of the scales used in the five studies existed in translated form prior to the start of the studies, e.g. the Harvard Trauma Questionnaire (HTQ), the Hopkins Symptom Checklist (HSCL-25), the Child

Revised Impact of Event Scale (CRIES-8) and the WHO-5 well-being index. For the scales that did not have a pre-existing and translated version—e.g. the Refugee Post-migration Stress Scale, the Refugee Trauma History Checklist, and the scale used for chronic pain—standardized translation and back translation procedures were done. The scales were also tested for content validity in relevant refugee populations through several pilot studies, and discussed with reference groups consisting of adult Syrians fluent in Arabic (studies II-V). Nonetheless, after the REFUGE-study in Norway study was completed, the research team was notified by several Arabic speaking individuals knowledgeable of the subject matter, that a very formal language was used throughout the questionnaire, including when describing health-related issues. The difference between written and spoken Arabic is known to differ considerably [167], thus it is possible that some participants experienced comprehension difficulties, though it is hard to gauge how many and to what extent. Study II did find that 2.5% of the 2,087 invited participants who were contacted over the phone (as a reminder for participation) answered that they did not understand Arabic. Furthermore, close to 45% had less than 10 years of education among participants, and within this group, it is possible that a not insignificant proportion had limited or no education, which would likely increase the problem associated with comprehension difficulties.

Ethics

Studies were explained to potential participants via several channels: an invitation letter was sent out to selected participants via postal mail (all studies); informational meetings about the study were held at several adult educations centers throughout Norway where refugees and migrants attend compulsory language-training sessions among other things (REFUGE-study); social media campaigns were utilized in both Sweden and Norway and a radio broadcast/campaign was also done in Norway; a Facebook page was set up and monitored by an Arabic speaking person in Norway and the page included links to an animated video about the study in Arabic. Central to all communication was to highlight the purpose of the study, what participation entailed and outline the principle of informed consent and withdrawal procedures. The voluntary nature of the study was stressed and principles of data handling and confidentiality explained. For the Swedish samples, potential participants were informed that returning the questionnaire implied consent to participate. In the Norwegian study, invited participants had to sign and enclose a consent form with the questionnaire.

All studies included contact information in the form of a telephone number that could be used if any questions or concerns came up or in the event of adverse reactions to participation. Experiences from pilot studies in both countries as well as available evidence on the risk of re-traumatization from participation in trauma research [168] suggested the risk of re-traumatization was limited. Nonetheless, many refugees

are vulnerable in the early phase after resettlement, and asking for their involvement in research warrants ethical reflections on possible costs and benefits. Overall, given the strengths of the projects—including the close collaboration between Norway and Sweden, the possibility of linking survey data to unique registry-data in both countries, and the current lack of robust evidence on mental health and the links between mental health and integration at least among refugees in Norway—I believe the studies' potential for adding to current evidence outweighed the risks of adverse consequences and the costs and burdens of participation for refugees.

Reference groups consisting of Syrians and other Arabic speaking persons living in Norway or Sweden were set up in the early phases of study planning in both countries. Some of these persons were refugees themselves and others had experience with mental health research. The reference groups were consulted throughout the planning and conduction of the studies on various issues and gave invaluable advice, particularly on the content, length and wording of the questionnaires and on recruitment strategies. Pilot studies, where the questionnaires were tested by refugees in the presence of members of the research team were also done, and feedback given from participants through focus groups.

Logistical aspects of data collection for the REFUGE study was handled by the research and consulting firm Ipsos, which has extensive experience with and the infrastructure to handle these types of surveys in line with current data-handling regulations. Once collected, data was transferred to and stored in TSD - a cloud-based solution for storing sensitive data administered by the University of Oslo, Norway. All subsequent data analyses were done within the secure TSD virtual domain and only aggregated results were exported from the domain in order to minimize the risk of re-identification of individuals. A similar secure, cloud-based solution, Microdata Online Access (MONA), administered by Statistic Sweden, was used in Sweden.

The Swedish studies were approved by the Stockholm regional ethical review board, and by Statistics Sweden's internal ethical review board. The Norwegian study was approved by the Regional Committee for Medical and Health Ethics, Region southeast (please see individual papers for ethical approval number).

Statistical analyses

Certain elements of data handling and statistical analysis were common across all five studies. Specifically, all variables in the respective studies were inspected for outliers, missing, distributional properties and errors. Simple cross tabulations were used to make descriptive tables and to investigate bivariant associations between categorical variables (chi-square tests of equal proportions), whereas

independent t-tests were used to compare continuous variables. Missing was handled somewhat differently across studies: study I and II handled missing data exclusively through pairwise deletion [169]. The main analyses in study III and V also used pairwise deletion, however, analyses were repeated in sensitivity analyses on imputed data obtained from multiple imputation by chained equation, MICE [170]. The main analyses of study IV was done on MICE imputed data.

Studies I, III, IV and V all used one or several forms of regression analysis (i.e. linear, binary and ordinal logistic regression). Even if specifics relating to how regression models were built for each study are described in the respective sections below, the following elements were common to most/all of the studies. First, regression models were approached within the framework of *explanatory*, not *predictive*, modelling [171]. The focus of explanatory modelling is to investigate causal relationships between predictors of interest and the outcome and distortions/modifiers of these relationships. This is somewhat different from *predictive* modelling where the focus is more on maximizing overall model fit, with R^2 playing a prominent role. The selection of variables to be included in regression models was mostly based on prior knowledge of likely confounders of the primary association(s) of interest, with certain key background variables included for a priori reasons (age, gender, education. civil status and years since arrival). All regression models are presented with unadjusted, partially adjusted and fully adjusted results in line with recommendations in the STROBE guidelines [172] in order to shed light on important confounding patterns. Multicollinearity between predictors in regression models were tested throughout. Whenever appropriate, 95% confidence intervals, denoted CI_{95}, are reported.

The problematic (mis)interpretation of and reliance on p-values and the phrase "statistically significant" within many scientific disciplines today have been pointed out for years [173,174]. Aware of this issue, the papers in the thesis frequently speak of "strength of evidence" when interpreting results instead of the more conventional "statistically significant" phrase, though the phrase does occur. This is a conscious attempt to move away from communicating results in a too black-and-white manner which is sometimes an end-result when focusing on whether findings are above or below the 0.05 threshold. Of course, the problem with p-values runs much deeper [175].

All statistical analysis were done with Stata version 16 or 17 (Stata corporation, College Station, TX, USA).

Analytic plans and pre-registration

For the studies from the REFUGE project in Norway, fairly detailed analytic plans were pre-registered in the ClinicalTrials.gov database (NCT03742128). This was done to increase transparency as to where on

the axis between exploratory and hypothesis-testing research the different parts of analyses were [176,177]. Importantly, none of the fully adjusted regression models were specified in detail prior to data acquisition, thus results must be interpreted as partly hypothesis-generating and in need of further corroborations. All regression models, however, were based on theory and most of the final models were repeated in sensitivity analysis to test the robustness of findings if alternative analytical approaches were used. Nonetheless, it is hard to rule out that the data in some way influenced choices made in "the garden of forking paths" [178,179].

7.2 Study I

Recruitment of participants

Using Statistics Sweden's Total Population Registry covering every individual residing in Sweden on a permanent basis, all adolescents meeting inclusion criteria as highlighted in the first paragraph in the Methods section above were selected and this constituted the study's sampling frame (N=12,313). The sampling frame was split into six strata defined by all possible combinations of gender and country of origin (e.g. girls from Iraq and boys from Iraq constituted two of the strata), and from this, a total of n=5,071 refugee adolescents were sampled using the following procedure: all adolescents in strata with n ≤ 845 (5,071 divided by six) adolescents were selected—i.e. these strata were oversampled. There were three strata with n ≤ 845: girls from Afghanistan, boys from Iraq and girls from Iraq (please refer to Figure 1). The oversampling was done in order to increase the precision of prevalence estimates and maximize power for multivariate analyses in these smaller strata. For the strata with more than 845 adolescents, simple random sampling was used to select 1,258 individuals so that the total n for all six strata combined equaled 5,071. The procedure was chosen based on power analysis for the larger project which included adolescents between 12-15 years (outlined in the published article for study I). The actual sample was drawn by Statistics Sweden. Selected participants were sent the questionnaire through postal mail in June 2018 with a pre-paid return envelope. One reminder card was sent out to all invited adolescents two weeks after the study launch and another six weeks after the launch. The latter was only sent to non-respondents and included that actual questionnaire in addition to the reminder card. Figure 1 summarizes the flow of participants for study I.

Figure 1. Country-specific number of refugee adolescents in source population, number sampled and number participating.
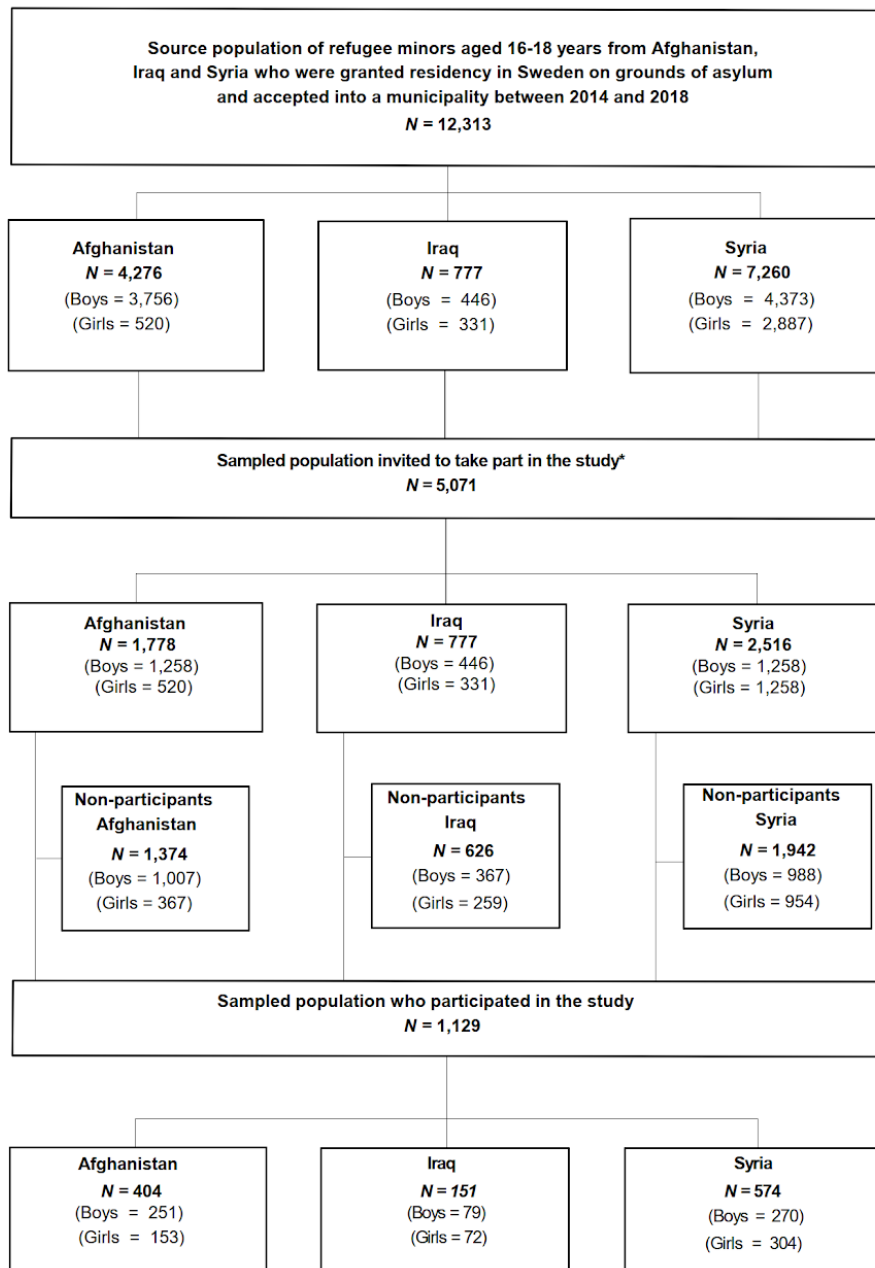
* In strata with n ≤ 845 adolescents (i.e. girls from Afghanistan, and boys and girls from Iraq), all adolescents were selected. For strata with n > 845 adolescents (i.e. boys from Afghanistan, and boys and girls from Syria), simple random sampling was used to select 1,258 adolescents.

Measures

Symptoms of PTSD: the Child Revised Impact of Event scale, CRIES-8, was used to measure symptoms of PTSD [100–102]. The scale is often used in studies on refugee minor [111], and it is the recommended scale to measure PTSD in children and adolescents by the international consortium for health outcome measurements [180]. However, recent studies on the scale's validity in refugee minors are somewhat diverging in their conclusions [103,104]. The scale consists of eight items, with four measuring intrusions and four avoidance in the last seven days with reference to a prior stressful life event. Each item is scored on a four-point Likert scale (0=Not at all; 1=Rarely; 3=Sometimes; 5=Often). Summing the eight items gives a total sumscore ranging from 0 to 40. In line with common practice [103], PTSD caseness was defined by a total score ≥17.

Migratory status on arrival: the STATIV database from Statistics Sweden was used to determine whether a refugee was accompanied or unaccompanied. The database definition of an unaccompanied refugee minor is "…a refugee under 18 years of age who arrives in Sweden without a parent or legal guardian".

Living situation: living situation was included as a potentially important confounding variable. All participants were asked their current living situation and eight potential answer choices were provided. The eight categories were collapsed into the following three categories: 1=refugee adolescents living with mother and/or father or relatives, 2=refugee adolescents living in a family home or with unrelated adults; and 3=refugee adolescents living in an HBV home, which is a government funded institution where unaccompanied refugee adolescents temporarily live and receive basic support.

Data on gender and age was obtained from the Total Population Register database of Statistics Sweden.

Statistical analysis

For common statistical procedures done for all studies, please see the first part of the Methods section above.

Both unweighted and weighted prevalence estimates of PTSD with associated CI_{95} were calculated for the total sample. The weighted estimate was obtained through direct standardization [181]. In this procedure, post-stratification weights are calculated for each of the weight-defining strata (i.e. six in the present study), based on the proportion each stratum constitutes in the source population. Prevalence estimates are then weighted by these post-stratification weights.

Unadjusted and adjusted logistic regression models were applied to investigate whether being unaccompanied versus accompanied was associated with higher odds of symptom-defined PTSD. Because

there were few unaccompanied refugee adolescents from Syria and Iraq, the two countries were combined in this analysis, i.e. the logistic regression models were run on a sample split into: i) Afghanistan and ii) Syria+Iraq. The results of the logistic regression models are presented as odds ratio (ORs) with CI_{95}, indicating the odds of symptom-defined PTSD for a given predictor-level compared to a set reference.

7.3 Study II

<u>Recruitment of participants:</u>

Studies II-IV are based on data from the REFUGE-study conducted in Norway. The inclusion criteria—which are highlighted in the first paragraph in the Methods section—were sent to Norway's Total Population Registry, and the 14,350 individuals meeting these criteria constituted the study's sampling frame. From this sampling frame, 9,990 individuals were selected based on simple random sampling. Selected participants were sent a study invitation letter, a consent form to be signed and the actual questionnaire at the end of November in 2018. In agreement with the ethical approval, one reminder was either sent via postal mail or done via telephone in March and April 2019. The study remained open until early September 2019 due to a low response rate. Of the 9,990 invited participants, 1,235 could not be reached. Of the 8,752 who presumably received the invitation, 902 returned the questionnaire, giving a response rate of roughly 10%. Figure 2 summarizes the flow of participants for study II-IV.

Study II is a cohort profile study, which aims to give a thorough summary of the larger REFUGE study, including procedures for selection and recruitment of participants, descriptions of variables and measures used, descriptive statistics for the sampling frame and study participants, an evaluation of selection bias as well as future plans for data collection and analysis. Limited statistical analyses were done in this study with the exception of exploring bivariate associations to evaluate selection bias.

Figure 2 The flow of participants for studies II-IV
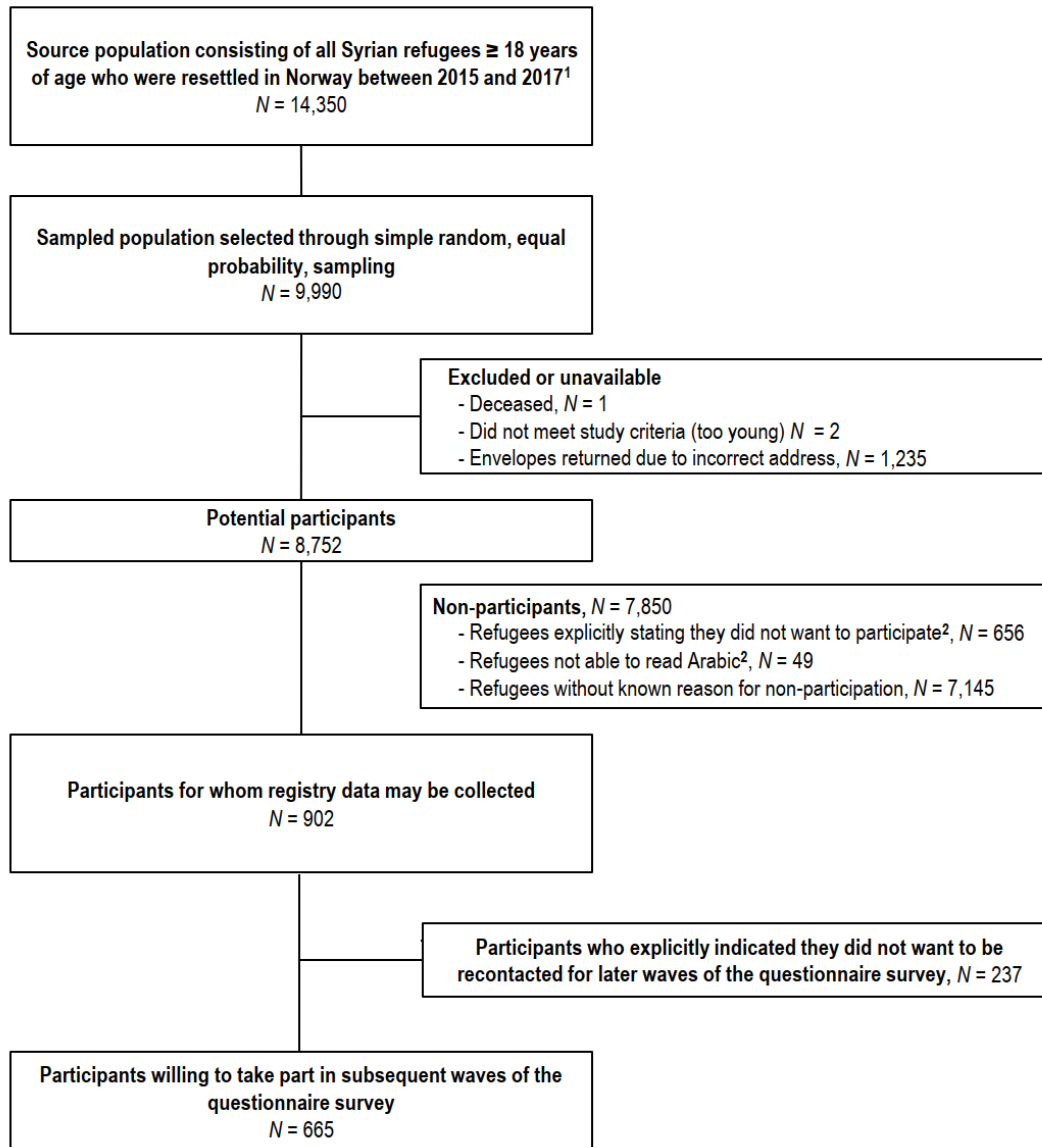
[1] Refugees were either resettlement/quota refugees; asylum seekers who had been granted asylum in Norway; or individuals coming through the program *Family immigration with a person who has protection (asylum) in Norway*. The source population was identified through the Norwegian National Registry (NNR)

[2] Information was obtained when non-responders were contacted during the telephone reminder

7.4 Study III

Recruitment of participants:

As described under study II above (i.e. study III used the exact same participants as study II).

Measures:

Symptoms of PTSD: symptoms of PTSD were measured with the Harvard Trauma Questionnaire (HTQ) [98]. Each of the 16 items in the scale are scored on a four-point Likert scale going from 1=Not at all to 4=Very much. A mean-item score was calculated for all participants who answered a minimum of 13 items. The 16 items are based on the criteria for PTSD as set out in the American Psychiatric Association's Diagnostic and Statistical Manual of mental disorders, version four DSM-IV [182]. The HTQ scale is one of the most frequently used scale to measure PTSD symptoms in refugee populations [86], and it was originally developed by Mollica et al. when studying refugees in Southeast Asia [98]. Available evidence on the scale's transcultural validity is somewhat inconsistent, with studies both critical to [89,90] and supportive of it [99]. The cut-off chosen to define checklist-positive PTSD (cp-PTSD) was 2.06, selected to be consistent with the collaborative study in Sweden on which study III was modeled [29]. The 2.06 cut-off is empirically based on a study of traumatized adults in primary healthcare centers in Bosnia and Herzegovina which found that a cut-off of 2.06 optimized sensitivity and specificity [97]. The more conventional 2.5 cut-off was used in sensitivity analysis to contrast prevalence estimates using the two different cut-offs. Cronbach's alpha for the HTQ scale was 0.92 in the sample.

Symptoms of depression and anxiety: the Hopkins Symptoms Checklist (HSCL-25) was used to measure symptoms of depression and anxiety. The first ten items of this scale measure anxiety symptoms whereas the last 15 measure depression [183]. All items are answered on a four-point Likert scale going from 1=Not at all to 4=Extremely. The HSCL scale is also frequently used in studies on refugee populations [86], with some studies supporting its cross-cultural validity [99], whereas other studies, however, suggest the issue of validity needs further evaluation [91,95]. A mean-item score was calculated for all participants with less than three missing on either subscale. The selected cut-offs were 1.75 for anxiety and 1.80 for depression, selected to be consistent with the collaborative study in Sweden [29] and in line with recommendations from the abovementioned study in Bosnia and Herzegovina [97]. Cronbach's alpha for the two scales were 0.93 (anxiety) and 0.94 (depression).

Potentially traumatic experiences (PTEs): the Refuge Trauma History Checklist (RTHC) was used to measure PTEs [106,107]. The RTHC scale consists of eight items about PTEs *prior to* flight (e.g. exposure to torture, exposure to sexual violence), and the same eight items *during* flight. All 16 items are scored with Yes/No. To facilitate comparison with existing literature, the PTE-variable was modelled using the *PTE adversity ratio* (PTE-AR) introduced by Steel et al. in their 2009 meta-analysis [39]. The PTE-AR thus equals the total number of PTEs a refugee reports to have experienced divided by 16 (e.g. someone having experienced 8 of the 16 PTEs would get a PTE-AR of 0.5). The variable was divided into

four categories: <0.20, 0.20-0.29, 0.30-0.39 and ≥ 0.40. The scale has been preliminarily validated in a sample of adult refugees from Syria resettled in Sweden [107].

Sociodemographic and background variables: data on age and gender was obtained from the Total Population Registry of Norway. Age was categorized into 18-29 years, 30-39 years, 40-49 years, 50-64 years, and ≥ 65 years. Education and marital status were based on self-report data, with education split into ≤ 9 years, 10-12 years and > 12 years. Marital status was split into married, divorced/separated/widower(ed) and unmarried. All sociodemographic variables were handled in the same way as in the collaborative study in Sweden in order to facilitate comparison [29].

The following flight-related measures were included: length of flight (self-report data, divided into < 3 months, 3 months-2 years, 2-4 years, > 4 years); time in Norway (self-report data, divided into categories < 2 years, 2-3 years, 3-4 years, > 4 years); refugee status upon arrival (self-report data with the following answer categories: asylum seeker, quota refugee, family reunion refugee, and others); arrived with... (self-report data from question asking whether a refugee had arrived alone, with friends but no family/spouse, or with family and/or spouse); prior family in Norway (self-report data from question on whether other family members had previously resettled in Norway).

Statistical analysis

For common statistical procedures done for all studies, please see the first part of the Methods section above.

Weighted and unweighted prevalence estimates for PTSD (using both the 2.06 and the 2.5 cut-off), anxiety and depression were calculated using Stata's *proportion* command. Weighted prevalence estimates used post-stratification weights [181], with weight-defining strata defined by of all possible combinations of age group and civil status. The choice to stratify by these two variables was made because respondents and the sampling frame differed notably in their distribution for both variables. This was in contrast to gender, where the distributions were very similar for respondents and the sampling frame.

Logistic regression models were used to explore the unadjusted and adjusted association of sociodemographic/background variables, individual PTEs and PTE-ARs with each mental health outcome (PTSD, anxiety and depression). The main analyses were done using pairwise deletion (i.e. only respondents with answers on all variables included in a regression model contributed data to that model). Because there was a fairly high number with missing, fully adjusted models were repeated with imputed data, obtained through the multiple imputation by chained equation (MICE) procedure [170]. The

40

imputation model included all variables in the fully adjusted main models with the exception of the variable *Arrived with...* which had to be excluded because of perfect prediction. Furthermore, as a second sensitivity analysis, all fully adjusted models were rerun with outcomes modelled linearly—i.e. the mean-item scores for HTQ and HSCL were used as outcome.

7.5 Study IV

Recruitment of participants:

As described under study II above (i.e. study IV used the exact same participants as study II and III).

Measures:

Chronic pain (CP): the ten items used to measure CP in this study consisted of two parts. The first part, comprised of five items, inquired about pain and stiffness in muscle and joints and was taken directly from the Tromsø study which has been used extensively in large epidemiological studies in Norway in the last decades [184,185]. The second part, which was composed specifically for the present study, asked about general pain in five body regions (e.g. neck/shoulders and upper back). Participants were asked to indicate whether they had been troubled with this pain for more than three consecutive months in the last year. The five items in both parts had the following three answer choices: 1=Not troubled; 2=Somewhat troubled; 3=Very troubled. The 10 items were combined into one overall CP variable which had the following three categories: 1=participants who answered "not troubled" (=1) on *all* items and had no more than one missing; 2=participants who answered at least one item with "somewhat troubled" and no items with "very troubled (=2); and 3=participants who answered at least one item with "very troubled" (=3). The three categories were labeled "No CP", "Some CP" and "Severe CP". In sensitivity analysis, the two constituent parts of the CP variable were analyzed separately—i.e. one part on pain and stiffness in muscle and joints and the other part on general pain. The scoring was the same as for the 10-item combined variable.

Perceived general health (PGH): consisted of one question taken from the European social survey in 2010 [186]. The item asks, "how is your health in general", and provides the following answer choices: very bad (=1); bad (=2); fair (=3); good (=4); very good (=5) and don't know (=6). The variable was dichotomized into "Good PGH" (answer choices 4 and 5) and "Poor PGH" (answer choices 1-3). The "don't know" category was recoded as missing.

Function impairment (FI): the item on function impairment was also taken from the European social survey. The item asks: "Are you hampered in your daily activities in any way by any longstanding illness, or disability, infirmity or mental health problem?". There are four possible answer choices provided: no (=1); yes, to some extent (=2); yes, a lot (=3); and don't know (=4). This variable was dichotomized into "No FI" (answer choice 1) vs. "Some/a lot FI" (answer choices 2 and 3), whereas the "don't know" category was recoded as missing.

Mental ill health: checklist-positive (cp) PTSD, anxiety and depression were all included in the present study. The descriptions of these measures are found under study III above, and the coding of caseness for PTSD, anxiety and depression was identical to that in study III. In the main analyses, all variables were handled dichotomously, whereas in sensitivity analysis, the three mental health variables were combined into one overall mental health variable named *Any mental health problem*. This new variable was equal to zero (=0) if *all* of anxiety, depression and PTSD were below cut-off, and positive (=1) if *any* of them were above threshold.

PTEs, sociodemographic and background variables: the same variables as described under study III above were included.

Statistical analysis

For common statistical procedures done for all studies, please see the first part of the Methods section above.

As opposed to the other studies with regression models, study IV used elements of stepwise, forward model-building strategies. Specifically, sociodemographic and background variables were only included in adjusted regression models if they were associated with the outcome above the .05 threshold in bivariate analysis. The exception was age, gender and PTE-AR, which were included a priorily for theoretical reasons. Due to a fairly high number of missing, regression models were run on imputed data obtained through the MICE procedure outlined above [170]. Unadjusted and adjusted ordered logistic regression models were used to investigate the association of mental health variables with CP given that CP was a three-category ordinal variable. In ordered logistic regression, the OR indicates the odds of being in the higher outcome category in a dichotomized version of the outcome, regardless of where the outcome is split. With three levels of CP, there are two potential cut points to dichotomize this variable - i.e. (Some+Severe CP) vs. No CP; and Severe CP vs. (No+Some CP). An underlying assumption with ordered logistic regression is proportional odds (i.e. same ORs for both cut-offs). Crude and adjusted logistic regression were used to investigate the association of all mental health variables and CP with both

PGH and FI. Furthermore, Wald test for interactions was used to test gender as an effect modifier both in: i) the associations of mental ill health variables with CP, and ii) the associations of mental ill health and CP with PGH and FI.

As a sensitivity analysis, the ordered logistic regression models were repeated with CP split into its two constituent parts (e.g. musculoskeletal pain/stiffness and general pain). Furthermore, the fully adjusted logistic models of PGH and FI were rerun with the combined mental health variable, *Any mental health disorder*, coded as outlined above.

7.6 Study V

Recruitment of participants

The inclusion criteria as outlined in the first paragraph of the Methods section above were given to Statistics Sweden and used to identify the study's sampling frame from the Swedish Total Population Register (TPR). In total, 9,662 individuals met the criteria and from this group, a sample of 4,000 individuals were selected using simple, random sampling in February 2016. All of the sampled individuals were then sent a study invitation letter in the mail which contained an information letter, the actual questionnaire and a pre-paid return envelope. Of the 4,000 invited participants, 1,215 returned the questionnaire, giving a response rate of just above 30%.

Measures

Subjective Well-being (SWB): the WHO-5 Well-being index (WHO-5) was used to measure SWB. The WHO-5 is one of the most frequently used scales to measure SWB and it has been shown to have good psychometric properties across different populations and cultures, including among refugees [92,187,188]. The scale consists of five items (e.g. " I have felt cheerful and in good spirits" and " I have felt active and vigorous"), and each item is rated on a six-point Likert scale going from 0=None of the time to 5=All of the time. The scores on the five items are then summed and multiplied by four to get a total score on SWB ranging from 0 (lowest possible SWB) to 100 (highest possible SWB). The variable was dichotomized at 50 based on evidence from prior studies [187], with a score above 50 indicating high SWB. Cronbach's alpha for the scale in the study was 0.94.

Post-migration stressors: the Refugee Post-Migration Stress Scale (RPMS) was used to measure post-migration stress [115]. The original scale consists of 24 items exploring seven post-migration stressors: 1) Perceived discrimination (from hereon denoted *discrimination)*; 2) Lack of resettlement country specific competencies (from hereon denoted *competency strain)*; 3) Material and economic strain (from hereon denoted *financial strain)*; 4) Social strain; 5) Loss of home country; 6) Family and home country concerns; and 7) Family conflict. A preliminary study has found support for the scale's validity and ease of use among adult refugees from Syria, though suggested the number of items be reduced from 24 to 21 [115]. As study V focuses on post-migration stressors related to the resettlement country, only the first four stressors were included in analysis. Three of the stressors—i.e. *competency strain, financial strain* and *social strain*—consists of three items, and the last stressor—discrimination—is comprised of four items. All items describe potential experiences that participants rate on a five-point Likert scale going from 1=Never to 5=Very often based on how frequently they have experienced each one. Examples of items include: "Discrimination in school or at work" and "Feeling disrespected due to my national background" (*discrimination*); "Bothering difficulties communicating in Swedish" and "Difficulties understanding documents and forms from authorities" (*competency strain*); "Worry about unstable financial situation" and "Worry about debts" (*financial strain*); and "Feeling excluded or isolated in the Swedish society" and "Frustration because I am not able to make use of my competences in Sweden" (*social strain*). Participants' scores for each of the four stressors were categorized into low, medium and high strain based on the following criteria: low strain=participants who answered 1 (never) or 2 (seldom) on all items for a given stressor; high strain=participants who answered 4 (often) or 5 (very often) on *all* items for a given stressor; and medium strain=all remaining participants. Cronbach's alpha ranged from 0.80 to 0.84 for the four stressors.

Social support: the ENRICHD Social Support Instrument (ESSI) was used to measure social support [189]. The original scale consists of six questions tapping into various aspects of social support (e.g. "Is there someone available to you to give you good advice about your problem?"), all scored on a five-point Likert scale going from 1=None of the time to 5=All of the time. A 7th item asks whether a respondent is married or living with a partner (Yes/No). The 7th item was not included in the questionnaire, and item 4 was also dropped for the purpose of study V given empirical evidence suggesting that the internal consistency of the scale is improved if item 4 is omitted [189]. The sum-score of the remaining five items was then calculated, with a possible range from 5 (lowest social support) to 25 (highest social support). The variable was then dichotomized, with a score of ≤ 18 categorized as "low social support" and a score > 18 as "high social support". Overall, the scale has been shown to have adequate to good psychometric properties, including in a validation study on the same sample of adult refugees from Syria that was used in study V [190,191].

Potentially traumatic experiences (PTEs): the Refuge Trauma History Checklist (RTHC) was used to measure PTEs [106,107], and the variable was handled in the exact same way as described above under study III—i.e. by calculating a PTE adversity ratio (PTE-AR).

Mental ill health: PTSD, anxiety and depression were included in sensitivity analysis to examine potential confounding by these variables of the main associations of interest—i.e. the association between post-migration stressors and SWB. PTSD was measured with the Harvard Trauma Questionnaire (HTQ) and anxiety and depression with the Hopkins Symptom Checklist (HSCL-25). Dichotomous versions of all three variables were used, and the dichotomization followed the exact same procedure as outlined under study III above.

Sociodemographic and background variables: gender, age, years of education, civil status, and year of immigration were included. All variables were obtained from the Swedish Total Population Register, held by Statistics Sweden. The following categorizations were done: age: 18-29 years, 30-39 years, 40-49 years, ≥ 50 years; education: 0-9 years, 10-12 years 13-14 years and ≥ 15 years; and marital status married, divorced/separated/widower(ed) and unmarried.

Statistical analysis

For common statistical procedures done for all studies, please see the first part of the Methods section above.

The associations between post-migration stressors and SWB were explored with crude and adjusted logistic regression analysis. In the logistic models, high SWB was coded as 0 and low SWB as 1, thus the ORs presented compare the odds of having low vs. high SWB for different level of post-migration strain compared to the set reference (low strain). The adjusted models controlled for age, education, civil status, year of immigration, PTE-AR, social support and the other post-migration stressors investigated. Gender was tested as an effect modifier using Wald test for interaction (H_0=homogenous odds), with p-values presented alongside gender-specific associations. Interactions between gender and post-migration stressors were tested one at a time. Finally, for post-migration stressors with significant associations with SWB in fully adjusted models, social support was tested as an effect modifier using the Wald test in a similar manner as with gender.

8 Results

8.1 Main results study I

Of the 5,071 invited refugee adolescents from Syria, Afghanistan and Iraq resettled in Sweden, 1,129 returned the questionnaire, giving a response rate of 22.3%. (see Figure 1). The overall weighted prevalence estimate of PTSD based on a CRIES-8 score ≥ 17 was 42.0% (CI_{95} 38.9-45.1%). Refugee adolescents from Afghanistan had a notably higher estimate at 56.9% (CI_{95} 51.5-62.2%) compared to refugee adolescents from Syria (33.4%, CI_{95} 29.4-37.6%) and Iraq (36.8%, CI_{95} 28.9-45.4%). *Unaccompanied* refugee adolescents from Afghanistan had higher odds of PTSD in the adjusted logistic regression model compared to *accompanied* refugee adolescents from Afghanistan (OR = 1.92, CI_{95} 1.08-3.40), however, there was no evidence that being unaccompanied was associated with higher odds of PTSD in refugee adolescents from Syria and Iraq. Gender was not associated with the prevalence of PTSD in the sample.

8.2 Main results study II

Study II is a cohort profile describing the larger REFUGE-study and the sample of adult refugees from Syria resettled in Norway who participated (the same sample is used for studies III and IV). Thus, there are few findings to report from this study beyond descriptive statistics on participants and comparative statistics on participants versus the sampling frame. Of the 9,990 invited refugees, 8,752 were reached either via mail or phone, and 902 responded, giving a response rate of roughly 10% for studies II-IV (see Figure 2). As a group, participants were older and a higher proportion were married compared to the sampling frame, however, the proportion of women was very similar. An important characteristic of participants was the high exposure to PTEs before and during flight. Specifically, around 30% reported to have experienced physical violence or assault and over a quarter had experienced torture prior to flight and close to 60% had experienced a frightening situation where they felt their life was in danger during flight. Refugees who returned the questionnaire in the weeks immediately following study launch (early responders) did not differ systematically from refugees who returned the questionnaire months later after a reminder had been sent out (late responders), with one exception, namely, newly arrived refugees were more likely to be early responders compared to refugees who had resided in Norway for more than four years (χ^2 p-value <0.001).

8.3 Main results study III

The weighted, approximated, prevalence estimates for PTSD, anxiety and depression based on screening instruments were: 29.7% (CI_{95} 25.4-34.4%), 30.1% (CI_{95} 25.7-34.9%), and 45.2% (CI_{95} 40.6-49.8%), respectively. The prevalence estimate for PTSD was more than halved if the commonly used HTQ cut-off of 2.5 was used to define caseness instead of the study's pre-registered cut-off of 2.06. There were clear dose-response associations between exposure to potentially traumatic experiences (PTE-AR) and all mental ill health variables, with stepwise increases in the prevalence of all illnesses for each one-category increase in PTE-AR. In fully adjusted logistic regression models, the odds of checklist-positive PTSD when comparing refugees in the highest PTE-AR category to refugees in the lowest category was close to eight times higher, whereas for anxiety and depression, it was four to five times higher. There was strong evidence that female gender was associated with increased odds of both anxiety and depression, with ORs roughly 2.5 times higher than in males. For PTSD, only a weak tendency of higher odds in women was found. Lastly, there was some evidence that length of time in Norway was associated with increased odds of both anxiety and depression.

8.4 Main results study IV

The overall proportion who reported to experience severe levels of chronic pain was 43.1%. There was very strong evidence both in unadjusted and adjusted analysis that checklist-positive anxiety, depression and PTSD were associated with higher odds of chronic pain (fully adjusted ORs: $OR_{anxiety}$ = 2.42, CI_{95} 1.64-3.55; $OR_{depression}$ = 2.28, CI_{95} 1.53-3.42; OR_{PTSD} = 1.97, CI_{95} 1.32 - 2.94). Similarly, female gender was associated with approximately 50% higher odds of severe chronic pain compared to male gender. In fully adjusted logistic regression models of poor perceived general health (PGH) containing both chronic pain and mental ill health variables, there was very strong evidence of higher odds of poor PGH health in refugees with some or severe levels of chronic pain ($OR_{some\ CP}$ = 3.80, CI_{95} 1.84-7.86; $OR_{severe\ CP}$ = 19.1, CI_{95} 9.22-39.5) whereas the evidence for mental ill health variables was considerably weaker. Specifically, there was some evidence that PTSD was associated with higher odds of poor PGH (OR_{PTSD} = 1.98, CI_{95} 1.19-3.32) but weak to no evidence for anxiety and depression ($OR_{anxiety}$ = 1.49, CI_{95} 0.92-2.41; $OR_{depression}$ = 1.76, CI_{95} 1.05-2.96). The association between mental ill health variables and functional impairment (FI) in fully adjusted models was highly gender specific. More precisely, there was no evidence that anxiety, depression or PTSD were associated with FI in women after controlling for chronic pain, however, there was very strong evidence that both anxiety and PTSD were associated with FI in men ($OR_{anxiety}$ = 3.23, CI_{95} 1.71-6.10; OR_{PTSD} = 3.12, CI_{95} 1.62-6.02). Finally, there was very strong evidence that reporting

severe levels of chronic pain was associated with markedly higher odds of FI ($OR_{severe\ CP}$ = 20.3, CI_{95} 8.56-48.0), and there was no evidence that this association varied across gender.

8.5 Main results study V

Of the 4,000 invited adult refugees from Syria resettled in Sweden, 1,215 returned the questionnaire, giving a response rate of just above 30%. The proportion who reported low subjective well-being (SWB) was 38.2% and there was strong evidence that this proportion was higher in women (43.1%) then in men (35.3%) in unadjusted analysis (χ^2 p-value = 0.008). All post-migration stressors investigated (i.e. financial strain, social strain, competency strain and discrimination) were strongly and adversely associated with SWB in unadjusted analysis, however, in fully adjusted logistic regression models, only financial strain and social strain showed strong and statistically significant associations. Moreover, there was very strong evidence that gender modified the association between social strain and low SWB, with a marked association in men but none in women ($OR_{high\ vs.\ low\ social\ strain,\ men}$ = 9.21, CI_{95} 4.91-21.6 vs. $OR_{high\ vs.\ low\ social\ strain,\ women}$ =1.03, CI_{95} 0.40-2.64; Wald test for homogenous odds: p-value = 0.001). There was also a tendency for gender to moderate the association between financial strain and SWB, especially in sensitivity analysis on imputed data (p-value$_{Wald}$=0.026), again with a stronger association in men compared to women ($OR_{high\ vs.\ low\ financial\ strain,\ men}$ = 10.30, CI_{95} 4.91-21.6 vs. $OR_{high\ vs.\ low\ financial\ strain,\ women}$ = 3.84 CI_{95} 1.68-8.79). Lastly, there was some evidence that social support buffered the adverse association between financial strain and SWB, with a weaker association in refugees with high levels of social support ($OR_{high\ versus\ low\ financial\ strain,\ high\ social\ support}$ = 4.33, CI_{95} 1.95-9.60) versus refugees with low levels of social support ($OR_{high\ versus\ low\ financial\ strain,\ low\ social\ support}$ = 11.30, CI_{95} 5.13-24.9).

9 Discussion

The discussion section focuses on findings on an aggregate level as they pertain to the main aims of the thesis. Individual study objectives and results are still at times discussed if perceived to be of particular relevance to the overall discussion. Readers are referred to the published papers for more elaborate discussions of specific findings in individual studies.

9.1 Burden of mental ill health and chronic pain (CP)

The overall findings of a high burden of mental ill health in both study I on refugee adolescents from Iraq, Syria and Afghanistan resettled in Sweden (PTSD only), and study III on adult refugees from Syria resettled in Norway (PTSD, anxiety and depression) are congruent with a large body of prior evidence documenting elevated levels of mental ill health in both adult and adolescent refugee populations [61,64]. Few prior studies have examined chronic pain (CP) in unselected, general refugee populations, thus, the finding of high levels of CP among adult Syrian refugees in Norway adds important evidence to the field. The elevated rates of mental ill health and CP are one of the most important findings in the present thesis, and highlight the need for continued efforts to ensure the (mental) health needs of refugee populations, adult and adolescents alike, are detected and addressed.

PTSD, anxiety and depression in adult refugees

Study III's approximated prevalence of PTSD (29.7%) anxiety (30.1%) and depression (45.2%) are fairly well aligned with major reviews in the field [43,66] and with estimates in Steel et al.'s meta-analysis based on pooled data from more than 80,000 refugees in different contexts and with the effects of methodological factors (e.g. sampling strategy) and exposure to PTEs weighted in [39]. Importantly though, a notable conclusion in the review by Steel et al., which is echoed in many reviews and meta-analyses in the field, is the great interstudy heterogeneity of prevalence estimates. Steel and others have made important contributions towards disentangling and quantifying the effects of both substantive and methodological factors across studies [39,66,192]. Nonetheless, the need for further context- and population-specific studies and estimates is frequently underlined [37,193], and this is linked to the high degree of specificity that characterizes each refugee situation and population—e.g. length and severity of

the conflict in question. flight routes, cultural characteristics—as well as accumulating evidence of the importance of stressors in the post-migratory environment to refugee mental health, stressors which are known to vary considerably between resettlement countries and within resettlement countries over time [59,60,113].

Therefore, Table 1 below compares prevalence findings and key design and methodological aspects of the present thesis (study III) with the most relevant, methodologically robust and contextually similar studies available on adult Syrian refugees to date. The following tentative conclusions may be drawn from the table:

1) Compared to the collaborative study conducted in Sweden by Tinghög et al. [29], with virtually identical methodology and very similar study population (e.g. in terms of PTE exposure), prevalence estimates for PTSD, anxiety and depression were very similar though the approximated prevalence of depression was slightly higher in Norway. This supports the reliability of the methods used in the two studies—though not necessarily the validity—and thus strengthens findings in both studies overall.

2) Compared to the other four studies on Syrian refugees resettled in a high-income Western country [73,158,194,195], study III's approximated prevalence of PTSD was similar to that found by Javanbakht et al. in the US [158] and Chung et al. in Sweden [194], though considerably higher than that found by Georgiadou et al. in Germany [73] and Strømme et al. in Norway [195]. A potential reason for this is that the degree of exposure to PTEs in these two latter studies was notably lower than in study III and the studies by Javanbakht et al. and Chung et al.. For example, around 25% of refugees in study III reported to have experienced torture vs. only 6% of participants in the Georgiadou et al. study, and whereas over 80% in study III reported exposure to at least one potentially traumatic experience, this percentage was only around 40 in the Strømme et al. study. It is also important to note that the HTQ cut-off to define caseness in study III was 2.06 vs. 2.5 in the Strømme et al. study. The 2.5 cut-off is the most commonly used cut-off and also the one recommended based on the original research on Indochinese refugees [98]. The weighted, approximated, prevalence estimated in study III dropped to 13.1% if the 2.5 cut-off was used. The 2.06 threshold in study III was chosen based on relevant prior research from Bosnia and Herzegovina which suggested this was the optimal cut-off in terms of balancing sensitivity and specificity [97], and because 2.06 was used in the collaborative study in Sweden [29]. The above discussion highlights the importance of scrutinizing methodological elements when comparing prevalence estimates across studies and

Table 1 Comparison of approximated prevalence estimates of mental ill health among adult refugees from Syria in the present thesis with relevant other studies of similar methodology and setting

	Prevalence (%)			Pre-, peri- and post-migration characteristics				Methodological characteristics			
	PTSD	Anx	Dep	LMIC/ adjacent	HIC/ Western	Refugee status	Level of PTEs	Sampling strategy	Sample size	Response rate (%)	Measure/case definition
Present thesis	29.7	30.1	45.2		X (Norway)	Resettled Norway	High	Random sample from full pop. registries	902	10.3	PTSD: HTQ > 2.06 Anx: HSCL-25 > 1.75 Dep: HSCL-25 > 1.80
Tinghög et al. 2017 [29]	29.9	31.8	40.2		X (Sweden)	Resettled Sweden	High	Random sample from full pop. registries	1,215	30.4	PTSD: HTQ > 2.06 Anx: HSCL-25 > 1.75 Dep: HSCL-25 > 1.80
Acarturk et al. 2021 [75]	19.6	36.1	34.7	X (Turkey)		Resettled Turkey	Medium	Random sample from district in Istanbul	1,678	59.0	PTSD: PCL-5 ≥ 33 Anx: HSCL-25 ≥ 2.0 Dep: HSCL-25 ≥ 2.1
Javanbakht et al. 2019 [158]	32.2	40.3	47.7		X (USA)	Resettled USA	NR	Recruited at mandatory health screening	157	87.7	PTSD: PCL-C sumscore, DSM-IV criteria Anx: HSCL-25 > 1.75 Dep: HSCL-25 > 1.75
Georgiadou et al. 2018 [73]	11.4	13.5	14.5		X (Germany)	Resettled Germany	Medium	Registry-based	518	38.6	PTSD: Essen Trauma Inventory (questionnaire) Anx: GAD-7 sum > 10 Dep: PHQ-9 sum > 15
Chung et al. 2018 [194]	30.0				X (Sweden)	Resettled Sweden	High	Convenience	564	NA	PTSD: HTQ, cluster criteria
Strømme et al. 2020 [195]	7.0		35.0	X (Norway/ Lebanon)		Resettled/quota ref. awaiting resettlement	Low	Convenience	827	85.0	PTSD: HTQ > 2.5 Anx/Dep: HSCL-10 > 1.85
Gammouh et al. 2015 [196]			29.5	X (Jordan)		NR/not relevant	NR	Convenience (cities in Jordan)	773	95.3	Beck Depression Inventory sum > 31
Kazour et al. 2017 [197]	27.2			X (Lebanon)		Living in camp	Medium	Convenience (camps Bekaa)	452	90.0	Mini International Neuropsychiatric Interview, MINI
Ibrahim et al. 2017 [87]	35-38			X (Iraq)		UNHCR refugees living in camp	High	Convenience (camp)	100	91.0	PTSD: HTQ > 2.5
Keri et al. 2015 [88]	65.0				X (Hungary)	Asylum seekers Hungarian-Serbian border		Convenience/ random	450	NA	PTSD: HTQ > 2.5
Alpak et al. 2015 [155]	33.5			X (Turkey)		Living in camp	Medium/ high	Random selection from within camp	352	100	PTSD: Diagnostic Psychiatric Interview
Acarturk et al. 2018 [74]	83.5			X (Turkey)		Living in camp close to Syrian border	High	Random sample from within camp	781	78.1	PTSD: IES-R > 32

51

also points to the need for further research on optimal cut-offs to define caseness in screening instruments.

3) Study III's prevalence estimate for PTSD was notably lower than that found in the Keri 2015 and Acarturk et al. 2017 studies [74,198]. For the former of these two studies, PTSD caseness was defined by the 2.5 cut-off on the HTQ scale, which yielded a prevalence rate of 13.1% in study III, which stands in marked contrast to the 65% prevalence estimate reported by Keri [88]. A key explanation for these markedly contrasting numbers is likely that study III was conducted on refugees from Syria who had been granted asylum and resettled in Norway whereas the study population in Keri's study were *asylum seekers* at the Hungarian-Serbian border, many of whom had recently fled conflict and faced highly uncertain futures. The elevated risk for mental ill health conferred by the many hardships and uncertainties of the asylum process has been well documented in prior studies [199–201]. Similarly, participants in the Acarturk et al. 2017 study resided in a refugee camp very close to the Syrian border, thus likely also faced a high degree of uncertainty and harsh conditions, including being constantly reminded of the horrors of war given the proximity to the ongoing conflict. An important conclusion from this is that the burden of mental ill health in resettled refugees vs. asylum seekers may be very different even if both groups come from the same culture, have escaped the same conflict and likely have similar traumatic exposure. Moreover, it points to the importance of investigating long-term mental health in refugees in order to examine if, and under what conditions, the high level of mental distress seen in asylum seekers abate after resettlement.

4) Study III's approximated prevalence of anxiety and depression were roughly comparable to two of the three other studies on Syrian refugees resettled in high-income Western countries— i.e. the studies by Javanbakht et al. and Strømme et al.. Interestingly, though, the burden of anxiety in study III was lower than in the study by Javanbakht et al. (30.1% vs 40.3%), even if identical measures and cut-offs were used, and the prevalence for PTSD and depression were very similar in the two studies. Equally interesting, even despite the notable differences in trauma exposure and estimated PTSD prevalence between study III and the study by Strømme et al., the estimated burden of anxiety/depression were comparable in the two studies. This may suggest that, compared to symptoms of PTSD, symptoms of anxiety and depression may be more strongly influenced by factors in the post-migratory environment than by pre-arrival PTEs. Arguably in support of this interpretation is the finding that time in Norway was *positively* associated with anxiety and depression, though there was limited/no evidence that

this was the case for PTSD in adjusted models. Still, there were clear dose-response relationships between PTE-ARs and both anxiety and depression in study III, even if the strength of the associations for the highest PTE-AR group were much weaker than for PTSD.

PTSD in refugee adolescents

The number of available high-quality studies to compare study I's estimated PTSD prevalence in refugee adolescents has up until recently been rather limited [64,67], though several new studies have been conducted in the last five years or so, especially on unaccompanied refugee minors (URMs) [202,203]. In their review from 2019, Kien et al. [67] refrained from doing a meta-analysis to estimate PTSD prevalence across studies due to the high heterogeneity between studies and instead reported results narratively using the interquartile range, which went from 19.0 to 52.7 % [67]. The overall estimate of 42.0% found in study I is thus in line with rough aggregate estimates in prior evidence. A more recent review of studies published since 2017 on URMs highlights the same heterogeneity, with estimates for PTSD ranging from 4.6% to 43% [203]. Somewhat illustratively, a similar variation is reflected *within* study I, that is, the study found notable differences in PTSD prevalence between refugee adolescents from Afghanistan (56.9%) compared refugee adolescents from Iraq and Syria (36.8% and 33.4%, respectively). One potential explanation could be that there were more URMs from Afghanistan, however, *accompanied* refugee adolescents (ARMs) from Afghanistan had moderately higher prevalence estimates compared to ARMs from Iraq and Syria (48.9% vs. 37.2% and 33.8%, respectively). Given identical methodology, recruitment procedure and resettlement country, these findings suggest that at least part of the heterogeneity in the literature is due to real differences between refugee cohorts coming from different countries and experiences. In terms of accompaniment-status as a risk factor, study I did find that URM from Afghanistan had higher odds of PTSD than ARM, which is consistent with existing evidence on the particularly vulnerable situation of refugee adolescents who are separated from their parents/guardians [110,204]. However, accompaniment-status was not associated with PTSD in refugee youths from Iraq and Syria, although the study was probably underpowered to detect such an association if one existed (i.e. there were few URMs from these two countries).

Some of the noted limitations in the literature on refugee minors to date include the frequent use of small, non-random and highly heterogenous samples, as well as the use of a wide range of assessment methods making it hard to compare findings across studies [202]. Therefore, study I arguably adds to present knowledge since it relied on random sampling from full populations registries, recruited a large sample and assessed PTSD through a frequently used and psychometrically tested instrument, the CRIES-8 scale. Nonetheless, as documented by Kien et al. [67], prevalence estimates in refugee minors based on self-

report data obtained through screening instruments tend to give inflated estimates compared to if the gold standard clinical interview is used. Thus, the true PTSD prevalence in study I's population is likely lower than the reported numbers. In a review by Blackmore et al. in 2020, which only included studies on refugee minors where PTSD was determined through clinical interviews, the overall PTSD prevalence was estimated at 22.7%.

Chronic pain (CP) in adult refugees

The proportion who reported severe CP in study IV (43.1%), is moderately higher than that estimated by two other studies on adult refugees from Syria resettled in Norway and Ireland, which found that 30% and 25.1%, respectively, had experienced CP in the last six months [195,205]. This discrepancy may be related to how CP was measured (e.g. study IV used ten items tapping into pain in the last year in different body regions vs. the other two studies which used a single item on overall pain in the last six months), and/or the fact that the two study populations were different in terms of their exposure to PTEs [195] and likely PTSD prevalence levels [195,205]. There are few other studies on CP in general, unselected, refugee populations to directly compare with, though similar levels of pain (i.e. around 40%) was reported in a study on refugees from Syria in Turkey, even if the focus of the study was on general somatic distress and not pain in particular [139]. Unsurprisingly, the level of severe CP found in study IV was notably lower than that reported in studies on selected refugee groups such as torture-exposed refugees or refugees in treatment for mental health problems, where reported pain levels frequently are above 60% [131,132,134–136,206].

When comparing the proportion with severe musculoskeletal pain in study IV to that found in a large epidemiological study on the general Norwegian population using more or less identical measures, the level of pain was notably higher in refugees: 35.2% vs. 15.8% [184]. There are several possible explanations for this marked difference. It could be due to the high level of war-related exposures among refugees in study IV—38.0% reported having experienced physical violence, torture and/or sexual violence, which are all known to be associated with subsequent pain. Furthermore, it may be related to poor transcultural construct validity of the measure used for pain [207,208], differences in idioms of distress and/or acceptable ways of expressing distress [143,144]. Lastly, it could be a reflection of the high level of mental ill health, given the well-established links between psychopathology and pain found in non-refugee populations [126–129,209,210].

9.2 Risk and protective factors

Potentially Traumatic Experiences (PTEs)

Given the known importance of exposure to PTEs for mental ill health in refugee populations [39,66] this was an important variable in all studies in the thesis except for study I, and was thoroughly investigated as an independent risk factor for mental ill health in study III in particular. Findings from study III of clear and strong associations between PTEs and each of the mental health variables investigated (i.e. PTSD, anxiety and depression) in fully adjusted models, thus corroborate a large body of evidence on the importance of PTEs for mental health in refugee populations, including in studies on Syrian refugees [29,74,155]. A challenge with research on this topic hitherto, is that exposure to PTEs has been measured and statistically modeled in quite different ways across studies [105,106]. The present thesis may help address this weakness by using a new scale developed by our collaborating partners in Sweden which aims to offer a standard and succinct way of measuring pre- and peri-traumatic PTEs in refugee populations [107]. Furthermore, the choice to model PTEs according to the solution introduced by Steel at al.—i.e. through calculating a PTE *adversity ratio* (PTE-AR) in studies III-V—facilitates comparisons with aggregate findings from a large number of prior studies [39] and yielded interesting results. Specifically, the approximated prevalence for PTSD and depression across successive categories of PTE-AR in study III were noticeably similar to the meta-analytically derived estimates reported by Steel et al.: 10.0 vs. 11.1%, 23.4 vs. 25.7%, 30.3 vs. 28.6% and 48.2 vs. 35.5% for PTSD; and 20.6 vs. 13.7%, 23.4 vs. 21%, 38.5% vs. 34.8% and 52.5% vs. 40% for depression in study III and Steel et al., respectively. The difference in prevalence in the highest PTE-AR category, both for PTSD and depression, is possibly because refugees in study III had, as a group, a higher degree of exposure to PTE compared to the refugees included in the Steel et al. study, likely with more refugees closer to a PTE-AR of 1.0 (which would push the prevalence in this group up if a linear effect is assumed). A slightly different version of the same narrative if given by the stepwise increasing ORs for PTSD, anxiety and depression with increasing PTE-ARs in fully adjusted logistic regression models. In terms of evaluating PTEs as a *risk factor*, using multivariable regression is arguably more correct given that potential confounding noise is reduced. Again, the ORs for PTSD and depression for successive PTE-AR categories were quite similar to those reported in the Steel et al. study, with the exception of the highest PTE-AR category, where ORs were higher in study III.

PTE was also a central part of analyses in studies IV and V, however, not primarily to investigate PTEs as an independent risk factor for CP and/or subjective well-being (SWB), but rather to reduce confounding noise and to shed light on potential causal relationships. Nonetheless, study IV found clear stepwise

increasing levels of CP for successive PTE-AR levels, and study V found the same for SWB, albeit in the opposite direction (i.e. higher PTE-ARs were associated with lower SWB). An interesting and important finding in adjusted analyses in study IV was that this strong unadjusted association between PTE-AR and CP was no longer significant at the $p<0.05$ level after adjusting for PTSD, anxiety and depression. This may suggest that the unadjusted association was spurious/caused by confounding by mental health or that the associations of PTEs and mental health with CP are causally related [211]. Theoretically, the latter explanation makes more sense, with one interpretation being that most or all of the effect of PTEs on CP is related to, or mediated by, mental ill health.

Post-migration stress

The strong associations between post-migration stressors and subjective well-being (SWB) found in study V are broadly congruent with a large and increasing body of literature documenting the importance of stress related to the post-displacement environment for refugee mental health [59,60,113]. Of the four stressors investigated (i.e. financial strain, social strain, competency strain and discrimination), only the former two showed significant association with SWB in fully adjusted models which included sociodemographic- and flight-related variables, PTEs and the other post-migration stressors. All of the stressors, however, were strongly associated with SWB in unadjusted bivariate analysis.

Moreover, the adjusted associations were somewhat gender specific for financial strain (strong association in men and weak to moderate association in women) and highly gender specific for social strain (strong association in men and *no* association in women). The tendency for a gender-specific effect between financial strain and subjective well-being is somewhat contrary to a large four-wave study from Australia which did not find a similar gender pattern in a large sample of refugees resettled there [114]. This inconsistency may be partly because the Australian study used a wider construct to measure 'economic stress', incorporating employment and housing status, whereas study V focused on worries related to personal finances. Although no prior study has investigated social support as a moderator between financial strain and mental health in refugee populations (to my knowledge), the protective effect of social support against financial strain found in study V is broadly in line with several related studies in refugees [25,212] and existing theory on the positive health effects of social support [117,118].

The highly gender-specific association between social strain and SWB was surprising and is not easily related to existing evidence. The aforementioned Australian study by Wu et al. did find a gender-specific association between loneliness and mental health, however, the association was stronger in women, which is contrary to our study. Furthermore, 'social strain' in study V tapped into status loss and frustration for

not being able to use one's competence in addition to feeling isolated, and these concepts are clearly different from loneliness. A tentative and somewhat speculative explanation as to why social strain is more closely linked to SWB in men may be related to traditional gender roles in Syria and other Middle Eastern countries, with the identity of men closely linked with being able to provide for the family [213,214]. The gender patterns found in study V need to be corroborated by further evidence.

The absence of an association between discrimination and SWB in fully adjusted analysis is somewhat incongruent with existing evidence, with several studies having documented a clear adverse relationship between discrimination and mental health [47,114,212]. One of these studies used a longitudinal design and found that the association tended to be time-sensitive, with a stronger association between discrimination and PTSD (though not severe mental illness) in later waves of the study, roughly 3 to 4 years after refugees had resettled [114]. However, in the other two studies, refugees had fairly recently arrived—the majority less than 3 years prior to study start—thus weakening the support for a lagged time-effect potentially explaining the inconsistency of study V's findings with existing evidence [47,212]. Another potential explanation could be that study V studied *positive* mental health vs. the other studies which investigated mental *ill* health, though it is not very intuitive why discrimination should only influence mental *ill* health and not well-being/positive mental health. Lastly, as discussed further under confounding in the limitation section, there is a chance that including all post-migration stressors in the same regression model has resulted in overadjustment bias, wherein a true effect of discrimination on SWB is masked by controlling for an intermediate variable [215].

Length of stay in Norway:

Study III's relatively strong finding that length of stay in Norway was positively associated with both anxiety and depression was a bit surprising as this has not been a consistent finding in the literature to date [113], with some studies finding a positive association [216], others a negative one [217,218], and yet others no association [219]. One interpretation of this finding could be that the length of time in Norway is positively associated with a long and protracted asylum process, which fairly solid evidence has documented to be linked to mental ill health [147,201]. It may also reflect the impact of various context-specific stressors related to the post-migratory environment which differ by resettlement country and which, over time, could undermine mental health (e.g. difficulties getting access to the labor market).

9.3   Chronic pain, mental health and functioning

The finding in study IV of strong associations between all of the mental ill health variables (i.e. PTSD, anxiety and depression) and chronic pain (CP) is in line with a large bulk of evidence in non-refugee populations in the last decades [129,209,210,220] and consistent with current understanding of pain and psychopathology as existing in a bidirectional relationship with shared neural mechanisms [127,128]. A fair number of studies have also documented clear links between pain and mental ill health in torture-exposed refugees and refugees in treatment for mental health problems [134,221,222], however, only a few studies have explored this topic in general, unselected, refugee populations. Specifically, one longitudinal, two-wave, study in Norway on refugees from Syria found relatively strong associations between CP and PTSD symptoms, and a tendency for an association between anxiety/depression and CP [138]. However, the associations were only found at the follow-up measure and not at baseline. Similarly, another study on Syrian refugees resettled in Ireland found a strong association between anxiety and pain [205]. Expanding beyond pain, several large studies have documented clear links between somatic distress and mental ill health in various refugee and forcefully displaced people [139–141]. All of these studies used the Patient Health Questionnaire to measure somatic distress, and of the 15 items comprising this scale, six ask about pain. Overall, therefore, the findings from study IV align well with existing evidence. It is somewhat surprising that there is such a paucity of studies on pain and mental health in general refugee populations given the fairly advanced state of knowledge on this topic in the literature in non-refugee populations and the known high burden of mental ill health in refugees. Moreover, successfully treating either condition likely requires that both are treated [127,223].

An important finding on perceived general health (PGH) was that CP showed markedly stronger association with PGH than any of the mental health variables when all were included in the same regression model. Still, there was moderate evidence that PTSD was associated with PGH and some evidence that depression was. Importantly, though, the strength of association was ten-fold lower than for severe levels of CP. Interestingly, a similar finding was reported in the abovementioned study from Ireland, i.e. when anxiety, PTSD symptoms and CP was entered into a multivariable regression model on PGH, only CP remained significant [205]. One interpretation of this finding is that most (or *all* in the case of the Irish study) of the effect of mental ill health on PGH is causally related to or overlapping with CP (e.g. CP acts as a mediator). Given how close CP and psychopathology are intertwined as discussed in the prior paragraph, this seems like a more reasonable explanation than that CP is a confounder. A somewhat incongruent finding in study IV vs. the Irish study is that the measure of association (i.e. the OR) was much stronger for CP than for the mental health variables in study IV's unadjusted and partially adjusted models, which was opposite in the Irish study.

The finding that functional impairment (FI) was associated with both mental health and CP is very much in line with expectations and congruent with two prior studies on this topic in refugees, even if even if one of these studies explored somatic distress and not pain [140,222]. Neither study, however, compared the strength of the associations when adjusted for each other. Thus, study IV's finding that the adjusted association was much stronger for CP than for mental health is novel. Similarly, I am unaware of other studies that have investigated gender as a modifier of the above associations, meaning the highly interesting finding that both anxiety and PTSD showed strong associations with FI after adjusting for CP in men, but not in women, cannot easily be related to prior literature. Given that this analysis was done post-hoc, it may be a chance finding. However, in light of the fairly strong finding in study V of gender-specific links between the post-migration stressor social strain and subjective well-being, it could be that a real gendered effect is a play here too. Specifically, there was a tendency for a stronger link between the mental health variables, especially anxiety, and CP in women compared to men, thus any adverse effect of mental ill health on FI may be masked when CP and mental health are included in the same regression model (e.g. due to overadjustment bias [215]).

9.4   Gender findings

The relatively robust finding in study III that female gender was a risk factor for anxiety and depression in fully adjusted analysis, and tended to be so for PTSD, may add important evidence to a somewhat inconsistent evidence base to date, with some studies reporting similar results [43,74,155,158] whereas others not [39,66,72]. Given the strength of this finding in study III, the inconsistency in existing evidence is somewhat puzzling. One potential explanation may be related to PTEs. Specifically, study III indicates that PTEs may be an important confounder when investigating gender as a risk factor for mental ill health in refugees. That is, in study III, male gender was positively associated with exposure to PTEs—i.e. proportionally more men than women were in the higher PTE-AR categories—and if this was not adjusted for, the erroneous conclusion would be that female gender was not a risk factor for mental ill health, whereas adjusted results showed strong evidence for this. In fact, for PTSD, comparing prevalence rates crudely between men and women could even suggest that male gender was a risk factor for PTSD, however, this picture was completely reversed upon adding PTEs in adjusted models. Confounding by PTEs may be part of the reason why gender was not associated with PTSD in study I, where data on PTE was not collected.

The potential confounding problem of PTEs did not cause the same distortion when investigating CP and SWB for men and women in articles IV and V. That is, there was clear evidence, both in unadjusted and adjusted models, that female gender was associated with an increased risk of both CP and low SWB. In terms of pain, the results are consistent with a broad literature documenting elevated levels of pain in women compared to men in both refugee and non-refugee populations [139,140,164,165]. There is less available evidence to compare study V's gender findings, though one Swedish study on quality of life found the opposite association. That is, men reported lower quality of life than women in a fairly small sample of Iranian refugees [224]. More studies are thus needed to investigate gender as a risk/protective factor of positive mental health outcomes (e.g. well-being and quality of life).

Evaluating gender as a risk factor gets a little tricky (in an epidemiological sense), especially when using the term *gender* as an umbrella term to denote both the biological (sex) and social (gender) constructs. For example, if women are exposed to some of the most horrific PTEs (e.g. sexual violence) to a much larger degree than men, and this increases the risk of mental ill health notably, is it then correct to control for this in multivariate regression analysis when evaluating risk? On the one side, the risk of being the victim of sexual violence is arguably very closely tied to the social construct of being a woman, and thus adjusting for exposure to sexual violence could arguably remove (statistically) a key explaining factor as to why women face an elevated risk of mental ill health. On the other hand, as in study III, *not* controlling for PTEs could lead to the erroneous conclusion that women and men have equal risks of mental ill health, because the noise caused by confounding by PTEs has not been accounted for. If the aim is to shed light on biological sex as a risk factor, then arguably, adjusting for different PTEs, as well as stressors in the post-migration environment, will push results and findings towards addressing this aim (though it is difficult in reality to control for all the ways in which gender and sex overlap for a number of reasons). Whether controlling for PTEs and post-migration conditions is the right thing to do or not, depends on the research question(s) asked. This points to the importance of being precise in objectives (and language) when exploring gender/sex in relation to mental health in refugee populations. For example, it is possible for men in a cohort of refugees to have higher prevalence of, say, PTSD, than women, though at the same time, that female gender is a risk factor for PTSD at any given level of exposure to PTEs.

The important effect modifying role of gender in the associations between both mental ill health and function impairment (study IV), and between post-migration stressors and subjective well-being (study V) has been discussed in preceding paragraphs. Even if these findings are more exploratory than hypothesis-testing in nature and thus in need of further corroborating evidence, these gender-specific findings are an important overall conclusion in the thesis. As highlighted by previous researchers [43,149,166], there has

been insufficient focus on gender in the field of refugee research to date, including in larger epidemiological studies [43], thus future research should attempt to address this shortcoming.

9.5   Methodological reflections, strengths and limitations

As is apparent throughout the above discussions, a large number of studies have been done on several of the topics investigated in the present thesis, especially on the prevalence of mental illness and the importance of pre- and peri-migration PTEs as risk factors for mental ill health [39,61,66,67,202]. Thus, one may legitimately ask if further research on this topic is needed. Two arguments are likely central to any defense of a need for more studies. The first is eloquently presented by one of the pioneers of epidemiological research in refugee populations, Dr. Derrick Silove, in a recent article reflecting on the role epidemiology has played in the field of refugee mental health over the years [37]. A main conclusion in his reflections is that the well-known heterogeneity in study findings on the burden of mental ill health in refugee populations and risk factors thereof is intrinsically linked to the high degree of contextual specificity of each refugee situation—both those relating to the refugees themselves and the realities they have left behind on a micro and macro level, as well as the realities of the post-resettlement environment, and how these interact. Thus, there is a recurring need of new epidemiological studies in order to capture the situation of different refugee cohorts resettling in vastly different and continuously changing post-resettlement contexts. The second argument also addresses the large heterogeneity of existing evidence, but highlights the role played by methodological factors—e.g. sub-optimal sampling and recruitment strategies, small samples giving low statistical power, the use of a wide variety of measures which to a varying degree have been psychometrically tested in refugee populations and the reliance on cross-sectional designs. These shortcomings in methods and design have resulted in an aggregate evidence base where true signals and methodological noise are hard to separate. Thus leading researchers in the field repeatedly call for additional methodologically rigorous evidence in order to reduce this noise [37,39]. As highlighted in the General introduction, an important aim of the REFUGE project in general, and this thesis in particular, is to help address this weakness, thus a detailed and thorough section on Methodological reflections is warranted.

9.5.1 *Selection bias*

Many, if not most, studies on mental health in refugee populations to date have used convenience sampling rather than probability-based sampling [39,67], and very few studies have sampled from full populations registries [29]. Using convenience samples may lead to problems with selection bias, whereby participants in a study systematically differ from the target population—i.e. the populations one wishes to generalize findings to—on key variables being studied. Cognizant of this limitation in the field, all studies included in the present thesis were based on simple random sampling from full population registries in either Norway (studies II, III and IV) or Sweden (studies I and V). Given that a key aim of several of the studies were to estimate nation-wide prevalences of mental ill health and/or chronic pain, the choice of sampling strategy was arguably particularly important to ensure valid estimates. In all studies, however, and in particular in the REFUGE study in Norway, the issue of selection bias was re-introduced by an overall limited willingness to participate across studies leading to response rates of about 10% (studies III and IV), 22% (study I) and 30% (study V). The difficulties of recruiting refugees into research studies are well-known and part of the reason many studies end up with small samples and/or samples with a low response rate [225]. Given that all samples in the thesis were drawn from full population registries with known distributions of key sociodemographic variables such as age, gender, civil status and country of birth, it was possible to estimate post-stratification weights which were used to correct for potential bias in prevalence estimates caused by varying willingness to participate across strata of these variables [181]. Importantly, though, if willingness to participate was non-random with respect to the health variables of interest (e.g. if refugees with PTSD were more or less willing to participate than refugees without PTSD *within* strata, which some evidence in non-refugee populations suggests [226,227]), then post-stratification weighting may not fully correct for selection bias [228].

Study II and III attempted to shed light on potential distortions in findings caused by non-participation and subsequent selection bias. Specifically, respondents were divided into groups based on *when* they answered the questionnaire in the nine-month period the survey was open (i.e. early responders vs. late responder), and this was used as a proxy for willingness to participate and tested in bivariate analysis against other key variables in the studies, including the mental health outcomes (PTSD, anxiety and depression). These analyses found that willingness to participate was negatively correlated with length of time in Norway, however, willingness to participate was not clearly associated with mental health with the exception of a slight tendency for early responders to have more PTSD symptoms. This provides some reassurance that selection bias has not grossly distorted prevalence estimates in study III and IV. Further reassurance comes from the fact that prevalence estimates in study III and the collaborative study in Sweden—which had a response rate of 30% [29]—were very similar, since the two studies used almost

identical methodology and had study populations that were highly comparable in terms of sociodemographic characteristics and exposure to pre- and peri-migration PTEs. Nonetheless, I can by no means rule out that selection bias has affected our estimated burden of mental ill health.

A further potential source of selection bias is missing data, which was fairly frequent for some of the variables included across studies. To counter this problem, study IV used imputed data in main analysis, and studies III and V used imputed data as part of sensitivity analysis and found similar results as in analysis done with missing handled through pairwise deletion. This suggests limited problems with selection bias caused by missing data.

Exposure-disease associations are generally thought to be more robust against selection bias and non-representative samples [229,230], thus I am less concerned that the low response rates across studies have distorted findings on risk and protective factors.

9.5.2   *Information bias*

Mental ill health

Measuring mental (ill) health and estimating the prevalence of mental illness using self-report screening instruments have clear advantages in terms of cost and ease of use when conducting large epidemiological studies. Moreover, most key instruments in the thesis' studies—e.g. the HTQ, CRIES-8 and HSCL scales and the WHO well-being index—have all been frequently used in both refugee and non-refugee populations, meaning comparative evidence is abundant. The use of screening instruments, however, has several important drawbacks as well.

First of all, the intention of screening instruments is to do just that: *screen for* possible mental ill health. A key feature of most screening instruments is that their primary goal is to efficiently and with acceptable accuracy identify individuals with a heightened risk of a condition based on their results on the screen, or conversely, identify individuals without a condition with acceptable accuracy. The actual diagnosis of a mental illness, of course, requires a clinical interview by a mental healthcare professional and cannot be made solely based on screen results. Thus individuals identified as "at-risk" based on their screening score are typically denoted as "possible" or "probable" cases (in the present thesis, the terms "checklist-positive" is frequently used), to emphasize that they are not true cases—that is, true as defined by the gold standard clinical interview. In general, screening instruments want to have high *sensitivity*, defined as the percentage of true positives that are correctly identified as cases by their screen result. The closer the sensitivity is to 100%, the better. The price paid for high sensitivity is reduced *specificity*, defined as the

percentage of true negatives that are correctly identified as non-cases by their screen result. Ideally, a screen would want a specificity of 100% as well. In reality, however, virtually no test has close to 100% sensitivity and 100% specificity, rather, a balance between these two has to be found and this usually depends on how the consequences of false positives vs. false negatives are weighted against one another. In relation to mental health, the balancing of sensitivity vs. specificity is arguably somewhat influenced by whether the screen is used in a clinical or research setting. In a clinical setting, the negative consequence of false positives is limited in the sense that all screen-positives will go through a more thorough clinical evaluation to establish whether true mental illness is present or not (i.e. false positives will be correctly identified as non-cases). This will tend to push the balance point towards higher sensitivity, even at the slight expense of reduce specificity. This is because, from a clinical point of view, a mistake one wants to avoid is to *not* detect someone with true mental illness. Nonetheless, false positives may contribute to medicalizing and psychopathologizing individuals who are not necessarily struggling with mental health issues and cause needless worry and anxiety.

From a research point of view, pushing the balance towards higher sensitivity at the expense of specificity will have the consequence of inflating prevalence estimates, because the number of false positives will increase. And, there is fairly solid evidence from meta-analysis that this may be the case in the refugee mental health literature. That is, studies who investigate the prevalence of mental illness in refugee populations through the use of screening instruments tend to find higher prevalence estimates compared to studies who rely on the gold standard diagnostic interview [39,67], with one meta-analysis suggesting a 1.5 to 2-fold overestimation [70]. Thus, the prevalence estimates of study I, III and IV in the present thesis are likely higher than the true prevalence in the target populations. This is a key limitation and underlines the importance of a constant focus on the difference between prevalence estimates from questionnaire-based studies vs. those using clinical interviews.

The PTSD prevalence estimates of study III is potentially further overestimated by the use of a cut-off value of 2.06 on the HTQ rather than the most commonly used 2.5 cut-off established by Mollica et al. in a study on Indochinese refugees [98]. This has already been discussed above and highlights a further limitation in both the present thesis and in current evidence, namely, that cut-off values established in one refugee population may not necessarily be correct in another due to poor transcultural validity [95,99]. As far as I am aware, the optimal cut-off on the HTQ for the purpose of predicting likely PTSD in Syrians has not been investigated, thus further research on this is needed to improve validity. A more fundamental concern than the choice of optimal cut-off is whether mental illnesses as defined and operationalized in the current diagnostic frameworks (the DSM-V and ICD-11) are valid constructs across highly heterogeneous cultures, potentially with different understandings and experiences of health in general and

mental health in particular [54–56]. The evidence on this is mixed both for the HTQ and HSCL scales, with some studies supporting the transcultural validity of the full scales or elements of the scales [90,99] whereas others are more critical [89,90]. Two recent studies by Vindbjerg et al. on the HTQ and the HSCL in Arabic-speaking populations found some support for the HSCL-anxiety subscale (though advised that two items be deleted), but concluded that the depression subscale should be used with great caution, if at all, in Arabic speaking populations [91]. Similarly, for the study on the HTQ scale, there was limited support for the validity of using a total, or mean-item, score on the scale [231]. Instead, the authors suggest that the scale be divided into two subscales, one on arousal/intrusion and one on avoidance/numbing. More research on the construct validity of both scales in Arabic-speaking populations is warranted.

Lastly, as mentioned in the Methods section (Overview methods—all studies), another source of information bias may have been caused by the use of a very formal language in the questionnaire. The difference between written and spoken Arabic is considerable [167], thus it is possible that comprehension difficulties has resulted in misclassification bias (likely nondifferential misclassification bias), which may have pushed results either away from or towards the null [232].

9.5.3   Confounding

Put simply, confounding occurs when an exposure-outcome association of interest is distorted by a third variable (confounder) which is a risk factor for the outcome in question and associated with the exposure, but not on the causal pathway between them [233]. Failing to take account of confounders will result in biased measures of associations, pushed either away from or towards the null depending on the directions of associations. The problem of confounding may be addressed both at the design and analysis stage of observational studies as long as confounders are known and data exists on them if they are to be addressed at the analytic stage. Thus, identifying confounders is important so that researchers may take account of them when planning and analyzing future studies.

An important confounder in study III was PTEs when investigating gender as a risk factor for mental ill health outcomes. As discussed in more detail above, this sheds important light on the inconsistency in prior research on female gender as a risk factor for PTSD in refugee populations. Specifically, part of the reason that some studies have not found women to be at elevated risk may be because exposure to PTE was not controlled for [e.g. 158,197]. This, at least, was an important finding in study III, where bivariate—or crude/unadjusted—analysis suggested no association between gender and mental ill health,

whereas moderate (PTSD) to marked (anxiety/depression) associations where found in fully adjusted analysis.

There were also notable changes in the ORs going from unadjusted to fully adjusted analysis in study V when exploring the associations between post-migration stressors and SWB, suggesting possible confounding effects at least by statistical rules [233]. For example, there was very strong evidence (p<0.001) that competency strain was associated with low SWB even in adjusted models including all background variables, PTE-AR and discrimination as long as financial strain and social strain were *not* controlled for in the model. However, the statistical consequence of adding these latter two stressors was that no association between competency strain and SWB remained (p=0.20). One way to interpret this result would be to think of financial strain (and social strain) as confounders of the relationship between competency strain and SWB. It is also conceivable that this interpretation violates the last requirement for a confounder described above if financial strain is on the causal pathway between competency strain and SWB. For example, if a refugee experiences difficulties communicating in the language of the resettlement country and/or has a hard time understanding documents (both part of the competency strain measure in study V), then this may lead to difficulties finding a job and subsequent financial strain, which may then lower SWB. Regardless of which interpretation is correct, an important conclusion from this is that when the associations of multiple post-migration stressors and mental health are investigated in the same study, results may be heavily influenced by whether stressors are tested in regression models individually or whether they are included in the same model.

If the latter explanation above is correct, i.e. that there is a causal pathway going from competency strain → financial strain → low SWB, then the actual effect of competency strain on SWB would be underestimated in the fully adjusted model due to overadjustment bias [215]. Put differently and in causal language, the effect of competency strain on SWB when investigated in a regression model containing both competency strain and financial strain (and all the other relevant variables), is the effect exerted by competency strain that is *not mediated* through financial strain. Future studies may wish to explore this either with structural equation modelling and/or longitudinal designs.

9.5.4 *Cross-sectional designs and causality*

All studies included in the thesis used cross-sectional designs which mean that any causal inferences must be done with great caution. Nonetheless, cross-sectionality does not necessarily disqualify causal reflections, as argued in a recent epidemiological paper on this topic [234]. One finding that may lend support to the assumption that an underlying causal relationship exists between variables is that of a dose-

response effect—or biological gradient, as more famously set out in the Bradford Hill criteria [235]. And a dose-response effect was a very clear finding in study III between PTEs and mental ill health, especially for PTSD. Furthermore, this finding is highly consistent with prior evidence on the dose-response relationship between traumatic exposure and symptoms of PTSD in refugees and war-affected populations [39,236,237]. Furthermore, given that the temporal order between pre- and peri-migration PTEs and current symptoms of PTSD, in theory at least, is straightforward, it is tempting to conclude a causal pathway exists. This suggests that screening for PTEs in refugee populations in the early phase of resettlement may be a sound strategy for identifying individuals at risk of developing mental ill health in general, and PTSD in particular. And, in some countries, including Norway, questions on PTEs have a central place in early mental health screenings [19]. From a methodological point of view, the correctness of this hypothesized causal pathway may be partly undermined if recall bias is heavily at play. That is, if PTSD symptoms impact upon the recollection of or narrative weight given to past trauma—i.e. if individuals with a high PTSD symptom load remember and report more PTEs even if not subjected to higher exposure in reality, which is suggested by some evidence [239]—then a form of 'reverse causality' might partly drive the strong dose-response association behind PTEs and PTSD. Importantly, though, the measure for PTEs used in the present studies, the Refugee Trauma History Checklist, asks about eight PTEs major life events (e.g. torture, sexual violence, physical violence and assault), all answered with yes/no. It seems unlikely that recall bias should grossly effect the dichotomous reporting of such major events. Nonetheless, the 'reverse causality' mechanism cannot be ruled out.

9.5.5 *Hypothesis testing versus exploratory findings*

In the last decade or so, the fundamental scientific principle of reproducibility has been at the center of an important and ongoing debate across academic disciplines, in particular in the fields of biomedicine and psychology [240,241]. A focal point in the debate is the concern that a notable proportion of published scientific findings fail to replicate and that many may in fact be false [240,242]. Numerous culprits and possible remedies have been proposed, with pre-registration constituting a much discussed remedy. The key concept in pre-registration is the critical importance of distinguishing and being transparent about whether studies are hypothesis-testing or hypothesis-generating (exploratory/data-driven), since the interpretation of and weight given to findings from these two approaches vary considerably [176]. In order to make the distinction between them, researchers are encouraged to deposit, in as much details as possible, descriptions of various aspects of their planned study (e.g. aims and objectives, recruitment strategies, sample size and analytic plans) in publicly available and time-stamped databases. This will facilitate transparency and enable readers to evaluate deviations from protocol and analytic plans and the

potential serious consequences thereof, not least inflated type-I error rates [178,179,243]. Moreover, it will help against publication bias, another suggested important culprit of the reproducibility crisis. Lastly, though frequently neglected [244], pre-registration of observational studies has been an ethical requirement by the World Medical Association's as summarized in the Declaration of Helsinki since 2013 [245].

Cognizant of the reproducibility and pre-registration debate, the REFUGE project did a thorough pre-registration for key studies to come out of the survey data. Thus, study III on the prevalence of mental ill health and study IV on the prevalence of CP and the co-occurrence of CP with mental ill health were both pre-registered in the ClinicalTrial.gov database (NCT03742128). For study III, the analytic plan was also included in the supplementary material of the published article to highlight original plans and deviations from them. Importantly, the multivariate regression analysis done in both study III and IV were *not* pre-registered in detail, thus findings from these regression analyses must be considered as exploratory in nature and in need of further corroborating evidence. Importantly, the majority of variables included in the regression models for study III were thoroughly described beforehand, including how they were to be handled statistically (e.g. how age would be categorized). One exception was that the handling of the PTE variable was decided after data was available, though this was done in an identical manner to the Steel et al. meta-analysis, thus it was not based on idiosyncrasies in the dataset. Study IV deviated more from the pre-registered plans, thus findings here, except for the burden of severe chronic pain, are more exploratory in nature.

10 Conclusions and possible implications

10.1 Conclusions

1) The studies in the present thesis document a high burden of mental ill health (i.e. PTSD, depression and anxiety) and chronic pain in adult and adolescent refugees who have resettled in Norway and Sweden in the last decade and this is consistent with a large body of prior evidence.

2) Gender—in the present thesis used to denote both the biological and social characteristics of men/women—is both an independent risk factor for mental ill health and chronic pain (with women at higher risk) and an important effect modifier in the relationship of other risk and protective factor with mental ill health and chronic pain.

3) The cumulative exposure to potentially traumatic experiences before and during flight is a strong risk factor for mental ill health in general, and PTSD in particular, and there is a clear underlying dose-response relationship.

4) There are strong links between mental ill health and chronic pain, and their adverse associations with perceived general health and daily functioning are highly overlapping, with an apparent stronger association for chronic pain in multivariate models.

6) The presumed adverse effects of mental ill health on functional impairment appears to be highly gender specific, with a strong effect in men but none in women after adjusting for chronic pain.

7) The presumed negative effects of social strain in particular, but also financial strain, on subjective well-being appears to be highly gender specific, with no effect in women but a strong effect in men.

10.2 Possible implications for research and policy

The low response rate in all studies included in the present thesis—especially the REFUGE study in Norway—suggests future research looking to recruit large and representative samples of refugees from populations registries should carefully weight the methodological advantages of this recruitment strategy against the risk of low participation, especially if study invitations are sent via postal mail. For the

REFUGE study, the low response rate occurred despite fairly extensive recruitment efforts including, for example: the use of a reference group consisting of Syrians living in Norway which advised on key aspects of the study including recruitment; many Q&A sessions at adult learning centers for refugees throughout the country to explain and promote the study; a dedicated study Facebook page, continuously monitored by an Arabic speaker, which was shared by key member of the Syrian community in Norway as identified by the reference groups; an animated cartoon in Arabic which explained the study and important principles in research (e.g. confidentiality, informed consent); a radio broadcast on the study; and the distribution of information about the study to all community centers in Norway working with refugees. A similar study in terms of study population (adult refugees from Syria) and research aims (mental health) conducted in Turkey in 2018, managed to recruit 1,678 individuals, which constituted 59% of the sampling frame, though recruitment in this study was done via telephone. It is possible that this recruitment strategy is better for boosting participation compared to postal distribution, however, there are also many other possible explanations.

Research to date, including this thesis, has relied too heavily on self-report questionnaire instruments when assessing the burden of mental ill health without sufficient evidence on the validity of this approach across highly heterogenous refugee groups and settings. Future validation studies evaluating questionnaire instruments against the gold standard clinical interview are needed, both to explore issues of construct validity and to establish optimal cut-offs for different refugee populations.

Set against the large bulk of cross-sectional evidence documenting elevated levels of mental ill health in refugee populations, especially in the early phase of resettlement, there is a notable lack of longitudinal studies on the development of these symptoms over time. Given the many stressors in the early years of resettlement (e.g. uncertainty, grief, loss of social networks, language difficulties) and their known adverse associations with mental health, future studies should investigate the extent to which early-phase symptoms of mental distress or illness reliably predict long-term mental health trajectories and other important outcomes related to integration (e.g. participation in education and employment).

Overall, research on mental health in refugee populations needs to include a stronger focus on the role of gender given the accumulating evidence of strong gender-specific effects across a number of topics (e.g. gender appears to be an important effect modifier between certain post-migratory stressors—e.g. social strain—and mental health).

Given the close links between chronic pain and mental health found in the present thesis, the known stigma associated with mental health in many cultures, and the strong, though preliminary, finding that pain may be more important for functional impairment than mental health in refugee populations, further studies on the importance of pain to refugee (mental) health are warranted. Moreover, future studies

70

should consider investigating the topics of pain and mental health together, given their apparent overlap, and since successfully treating one likely requires addressing both.

Overall, the present thesis lends scientific support to the increased focus on mental health in government strategic objectives and policies in Norway as outlined in the first section of the General introduction [14–17]. As tragically demonstrated by the drowning death of a resettled Sudanese refugee women and her two children in 2019, the total burden some refugees have to handle in the tumultuous first period in a new country, may lead to severe psychological stress that could have disastrous consequences unless detected and addressed [18]. The official recommendations from the Norwegian Directorate of Health in Norway are currently that mental health and potentially traumatic experiences should be screened for—if deemed necessary based on available information—both in the early phase after arrival (e.g. the first few weeks) and after about three months [19]. There is currently limited evidence on the extent to which these recommendations are used in reality, what constitute important reasons and potential barriers if they are not, and what proportion of refugees who, based on interviewers judgement, actually do undergo a PTE and mental health screen. Further systematic knowledge on all these elements are needed. Moreover, although the present thesis, and an abundance of prior evidence, suggest a high burden of mental ill health in refugee populations, there is still a lack of knowledge as to the overall benefits and potential costs of, for example, introducing a compulsory mental health screen of all refugees shortly after arrival. For even though this would very likely help identify refugees with mental ill health and enable mitigation efforts to be initiated early, it could potentially also result is adverse consequences—e.g. unnecessary worry and pathologization of refugees who, despite a high level of psychological distress, will manage just fine once the initial stressful resettlement period is past. Moreover, if the threshold for worrisome psychological distress warranting further follow-up is set too low, the resultant load placed on already strained health services by false positives will also add to the total cost of such a strategy. Balancing the above concerns in a good way will necessitate good data, and this data is currently not available.

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12 Papers I-V

Paper I

I

Conflict and Health

Children at risk: A nation-wide, cross-sectional study examining post-traumatic stress symptoms in refugee minors from Syria, Iraq and Afghanistan resettled in Sweden between 2014 and 2018

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Abstract

Background: The objective of the present study was to assess nation-wide, representative prevalence estimates for symptom-defined posttraumatic stress disorder (PTSD) within populations of refugee minors from Afghanistan, Syria and Iraq resettled in Sweden.

Methods: A nation-wide, cross-sectional, questionnaire study with a stratified sample of refugee minors, aged 16–18 years, from Afghanistan, Iraq and Syria, resettled in Sweden between 2014 and 2018 ($N = 5071$) was conducted. The response rate was 22.3%, leaving $n = 1129$ refugee minors (boys 53.1% / girls 46.9%) in the final sample. Symptom-defined prevalences of PTSD were measured using CRIES-8 with ≥17 as cut-off. Data were analyzed using frequency distributions, and strata-specific PTSD prevalences with 95% confidence intervals (95% CIs), were estimated. The association between migratory status on arrival (unaccompanied vs. accompanied) and PTSD was estimated using crude and adjusted odds ratios (OR) utilizing logistic regression analyses with 95% CIs.

Results: Overall, the weighted PTSD prevalence was 42% (95% CI 38.9–45.1), with minors from Afghanistan presenting the highest prevalence (56.9, 95% CI 51.5–62.2), compared to minors from Iraq (36.8, 95% CI 28.9–45.4) and Syria (33.4, 95% CI 29.4–37.6). Unaccompanied minors from Afghanistan had higher odds of PTSD compared to accompanied minors from Afghanistan (OR = 1.92, 95% CI 1.08–3.40). Gender differences were non-significant.

Conclusions: High prevalences of symptom-defined PTSD among refugee minors in general and in unaccompanied minors from Afghanistan in particular, were revealed. Findings calls for continued efforts to support this especially vulnerable group.

Keywords: Refugee minors, Posttraumatic stress disorder, Afghanistan, Syria, Iraq

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Background

According to the United Nations Children's Fund (UNICEF), 170,000 unaccompanied refugee minors—youth under 18 years of age separated from their parents/guardian—applied for asylum in Europe in 2015 and 2016 [1]. Often withheld at border-crossings, beaten, forced to sleep outdoors, and left without access to basic needs, these refugee children, throughout their flight, are especially at risk [2].

Indeed, research focusing on refugee children and unaccompanied refugee minors has consistently reported heightened risk for mental health disorders, including posttraumatic stress disorder (PTSD), within this population and existing evidence suggests that mental health disorders tend to be highly prevalent, even several years after resettlement [3–12]. Prior research has shown that a number of factors are associated with the development of mental health problems in refugee children and adolescents, such as exposure to violence, stress in the post-migration context, family stress, separation from parents, and discrimination [13–16]. The host country environment has also been shown to be particularly important in the determination of longer-term mental health outcomes and adaptation to the country of resettlement [16]. However, although scientific knowledge about this vulnerable population has increased over the years, recent reviews have highlighted the need for further examination, due to high variability within reported findings and methodological inconsistencies in the design and measures used [17, 18]. This includes a wide range of prevalence levels for PTSD (range: 19–60%), and other mental health disorders and long-term outcomes [19, 20]. In fact, there is a notable lack of consensus among researchers regarding the long-term outcomes of mental health problems in this population, and clear findings regarding estimates of long-term prevalences are currently lacking [19, 20]. However, a few studies have suggested that, while the mental health of refugee youth previously diagnosed with depression or PTSD may improve slightly over time, metal health problems are likely to still be present at follow up [19]. It has also been suggested that PTSD and depression can lead to poor performance in school, which may in turn lead to a higher likelihood of engagement in risky behaviour [19]. Studies focusing on mental health in minors have also largely been based on small, non-random samples, often with predominantly unaccompanied, male participants [8, 21–26], highlighting an underlying problem of convenience sampling. Such samples are often non-representative and might, in some cases, provide biased or incomplete information about the populations in question [17]. According to Kien and colleagues (2018), the research field therefore currently lacks reliable prevalence data for several European countries, including Sweden. In sum, the current lack of representative and methodologically consistent studies suggests that research conducted with large, randomly selected samples, and standardized, validated measures, in order to improve consistency and generalizability of findings, is highly warranted [17, 20, 27].

Findings related to gender differences among unaccompanied refugee minors have also thus far been largely inconclusive. Although female gender has been shown to be associated with a heightened vulnerability towards certain mental health problems, a lack of representative studies and relevant data for male refugees should encourage caution when interpreting findings [28, 29]. Still, refugee and asylum-seeking females are typically disproportionately vulnerable to threats such as sexual exploitation and abuse, as well as associated negative mental health outcomes [29, 30]. This seems to hold true for girls as well as women, with studies finding that underage girls experienced exposure to sexual violence at a far greater rate than boys, and that they were found to show more symptoms of anxiety and behavioral problems than their male counterparts [31]. This vulnerability may be a significant factor that contributes to the overrepresentation of males in samples of unaccompanied refugee minors - families may simply feel that it is safer to send their boys than their girls on the dangerous journey to Europe [9].

Previous studies also differ considerably, both in where they are conducted and in the nationalities that are studied [17]. The asylum-process, legal frameworks and integration policies used in each country are known to vary greatly and the different refugee populations are by no means equivalent in terms of pre-flight and migratory experiences. Furthermore, the proportions of accompanied and unaccompanied minors within the refugee populations differ widely and differences in education levels, socio-economic status, religious and sociocultural values all contribute to variations in post-migratory stress levels and affect mental health outcomes [32]. Considering this, the field is in need of representative studies including different refugee populations from the same region, resettled in one country, under one legal framework, with both accompanied and unaccompanied minors, in order to establish methodologically more sound comparative analyses.

In 2015, European countries received unusually high numbers of asylum-seekers from Syria, Afghanistan, and Iraq. According to Eurostat [33], the highest number of unaccompanied minor applicants was registered in Sweden (approx. 35,000 unaccompanied minors, 40% of the EU total). In the EU, entry procedures for unaccompanied refugee minors who lodge an application for asylum are well-established and more-or-less harmonized across member states. In Sweden, an asylum application

is submitted to the Swedish Migration Board and, in most cases, entry is permitted for unaccompanied refugee minors. A key component of the reception arrangements for unaccompanied refugee minors is the appointment of a guardian, or a custodian, and/or public counsel. The appointed guardian acts not only to provide legal support in the asylum process, but also with regard to other aspects of the unaccompanied refugee minors stay. Minors seeking asylum in Sweden have the right to attend school on the same terms as other children living in the country and to study at upper secondary school level as long as these studies begin before they turn 18 years old. Asylum-seeking minors also have the right to medical care and dental care on the same terms as other children living in Sweden (Swedish Migration Agency, Children in the asylum process). Accommodation and other care facilities for unaccompanied refugee minors is provided, with the type of accommodation varying depending on the minors' individual needs and age.

Considering the aforementioned, the objective of the present study was to assess nation-wide, representative prevalence estimates for symptom-defined PTSD within populations of refugee minors from Afghanistan, Syria and Iraq resettled in Sweden. We hypothesized that PTSD prevalences for unaccompanied minors would be significantly higher compared to accompanied minors, and that the PTSD prevalence for unaccompanied girls would be significantly higher, compared to boys. Considering that one out of two unaccompanied minors originates from Afghanistan, PTSD prevalence estimates were expected to vary by country, with minors from Afghanistan reporting the highest PTSD prevalences, due to the expected large proportion of unaccompanied minors within this subsample and the high symptom burden linked to being unaccompanied. In order to overcome some of the above-mentioned methodological shortcomings, we used a well-known, validated and methodologically comparable measure for symptom-defined PTSD within a large, randomly drawn sample of resettled refugee minors in Sweden.

Method
Design, sampling and participants
The present study has a cross sectional design. The source population of the study consisted of a known and completed population of $N = 12,313$ girls and boys aged 16 to 18 years from Syria, Iraq and Afghanistan who were granted residency in Sweden on grounds of asylum, and were accepted into a municipality between 2014 and 2018 (See flow chart, Fig. 1). The source population was identified through the Total Population Register (TPR), covering every individual that has resided in Sweden on a permanent basis held by Statistics Sweden. The source population was stratified by gender and country of birth resulting in a total of 6 strata. From this stratified source population, a sample of $n = 5071$ refugee minors (41% of the complete source population), was drawn and included in the study (see power analysis). The following sampling strategy was used. From the three smallest strata (girls from Afghanistan, and both boys and girls from Iraq) containing less than $n = 845$ ($n = 5071$ divided by 6 strata), all refugee minors were included. For the remaining three largest strata (boys from Afghanistan, and both boys and girls from Syria, $n = 3774$), simple random sampling was used to select $n = 1258$ from each stratum. The rationale for including all refugee minors in the three smallest strata, i.e. to oversample these strata, was to increase the precision of stratified estimates, and to guard against the risk of small sample sizes from these strata of the source population, which may have occurred if proportional allocation for sampling had been applied [34].

Power analysis
This study is an age-specific sub-study of a larger, nation-wide, cross-sectional questionnaire study conducted in Sweden in 2018 (Refugee Children and Adolescence's Health, RCAH), the source population of which consisted of all refugee minors (aged 12 to 18 years) from Syria, Iraq and Afghanistan who were granted residency in Sweden on grounds of asylum and accepted into a municipality between 2014 and 2018 ($N = 25,584$). The initial power analysis for this study was done with the overall aim of estimating the prevalence of common mental health problems in the target population with adequate precision. Due to large heterogeneity of previously reported estimates of common mental health problems among refugee minors [35], the power analyses were replicated with two hypothesized point prevalence estimates of 20% and 50%. Based on an estimate of 20%, the analysis indicated that a sample size of $n = 1537$ would be needed for 0.02 precision at a 95% confidence level. The analysis also indicated that this sample size of approximately 1500 individuals would provide sufficient power for estimation of a higher prevalence at 50%, albeit with slightly less precision (d = 0.025). Considering the expected non-response rates inherent in survey studies of refugee populations, this would require a 30% response rate of n ≈ 5000 (15% for $n = 10,000$) from the sample. As these response rates were deemed achievable, and with the consideration of the logistical constrains of the study, the sample size of $n = 10,000$ for RCAH study, with approximately $n = 5000$ between 16 to 18 years old, which corresponds to a substantive proportion (41%) of the total source population, was selected.

An information letter explaining the purpose of the study and what participation entailed was sent out to the sampled population on June 5th 2018 and the actual questionnaire was distributed via postal mail on June 12th, 2018, with a pre-paid return envelope enclosed. Two reminders were sent out to non-responders: the first on June 26th (reminder card only); and the second on August 31st (reminder card and questionnaire). Information about the study was also presented online using Swedish Red Cross University College's webpages and featured in an online magazine targeting refugee adolescents and Swedish youth in general. Addresses were re-checked and updated prior to posting the second reminder. Enclosed with the questionnaire was an informed consent form where it was explicitly stated that participation was voluntary and that submission of the questionnaire implied consent. The information provided also included a phone number participants could call if they had any questions or concerns related to the study.

The study was approved by the Stockholm Regional Ethical Review Board (*Approval number: 2018/456–31/ 5*). Statistics Sweden was responsible for conducting the survey. Data was analyzed anonymously.

Adaptation and development of the questionnaire

A standard double-blind translation and back-translation procedure was used for linguistic adaptation of the questionnaire to Arabic and Dari/Farsi for all sections except where pre-validated and adapted scales already existed. Cognitive testing by *verbal probing* was performed; i.e. an interview in which a series of probe questions in regard to respondents' potential difficulties in comprehension, retrieval of information and judgment and responses to the questionnaires' content, is administrated by an interviewer. This was performed for each linguistic version of the questionnaire, with $n = 15$ native Arabic and Dari/ Farsi speaking children. In cases of detecting difficulties, the content of the questionnaire was discussed with professional interpreters as well as native speaking community members. Following these procedures, minor adjustments in wording and phrasing of some of the content of the questionnaire were performed.

Symptom-defined posttraumatic stress disorder (PTSD)

Symptom-defined posttraumatic stress disorder (PTSD) was assessed through the Child Revised Impact of Event Scale (CRIES-8) [36]. The scale is frequently used to measure PTSD among unaccompanied refugee minors [17, 18, 30] The scale consists of eight items measuring intrusion (four items) and avoidance (four items) in the last 7 days related to a stressful life event. Each item is scored on a 4-point frequency scale (0 = Not at all; 1 = Rarely; 3 = Sometimes; 5 = Often), giving a total score ranging from 0 to 40. In the present study, a total score ≥ 17 defined a PTSD case, i.e. minors with a mean scored equal to or above 17 were considered to have PTSD like symptoms or as being at risk for PTSD, regardless of how many items were answered. A cut-off score of 17 is in accordance with previous studies on unaccompanied refugee minors [22]. In order to minimize the risk of inflating PTSD prevalence estimates, we decided to include all individuals who had answered at least one item on the scale. By doing so, we included a higher number of non-PTSD participants in the denominator of the prevalence estimate fraction, hence avoiding inflation. Participants with all 8 items missing were excluded (6,4%).

Migratory status on arrival

The variable used to define a participant as an unaccompanied vs. accompanied refugee minor was provided by Statistics Sweden's database STATIV (www.scb.se). The STATIV database is developed by Statistics Sweden together with the Swedish Integration Board to provide data within different areas of society from an integration policy perspective. Specifically, STATIV states that *"an unaccompanied refugee minor is defined as a refugee under 18 years of age who arrives in Sweden without a parent or other legal guardian"*.

Living situation

A potentially important factor for unaccompanied refugee minors is whether they are reunited with their mother and/or father or other family member in the host country. Presumably, the potential negative impact of fleeing as an unaccompanied minor may be partly remedied if one is reunited with family/relatives, or, conversely, exacerbated if one is not. We therefore decided to include living situation in the present study and asked all participants which adults they lived with. There were 8 possible answer choices: 1. *I live with both my mother and father*; 2. *My parents do not live together and I live with my mother most/all of the time*; 3. *My parents do not live together and I live with my father most/all of the time*; 4. *My parents do not live together and I live equally with my mother and father*; 5. *I live with one or more adult relatives*; 6. *I live with an unrelated adult/adults*; 7. *I live in a family home or equivalent*; 8. *I live in an HVB-home*. A HVB-home is government funded institution/home where unaccompanied minors temporarily live and receive basic support. Answer categories 1–5 were combined into the category "*With mother and/ or father or relatives*" due to few observations in some categories. Likewise, categories 6 and 7 were combined into the category "*Family home or unrelated adults*".

Demographics

Data on gender and age at the time of assessment were obtained through the Statistics Sweden population registry.

Statistical analyses

The data set was first cleaned and checked for errors and missing values. The number of missing values for a given variable can be gauged from the tables. Frequency distributions were calculated through cross-tabulations. Point estimates with 95% confidence intervals (95% CIs) of symptom-defined PTSD prevalences were calculated across strata of covariates (i.e. gender, age, migratory status on arrival and living situation), both for the total sample and the sample split by refugees' country of origin. Point estimates were not calculated if there were less than 5 individuals in a cell when cross-tabulating covariates with PTSD. In order to correct for potentially bias in PTSD prevalence estimates caused by study design and non-response, weighted prevalence estimates (with 95% CI) was also calculated for the total sample and the sample split on country of birth using post-stratification weights [37]. In post-stratification weighting, strata-specific prevalences in the sample are weighted to reflect the source population's distribution across strata. The strata used for post-stratification weights in the present study were based on the study design with the stratified source population (i.e. six strata in total). Chi-square tests for categorical variables were used to compare differences only in symptom-defined PTSD prevalence across country of birth, age gender, migratory status, and living situation.

Logistic regression analysis was used in order to estimate the association between migratory status on arrival (unaccompanied vs. accompanied) and symptom-defined PTSD, and is presented as crude and adjusted odds ratios (ORs) with 95% CIs and p-values from Wald test of equal odds. Regression models were built in a two-step, forward approach starting with crude associations and then adding age and gender as potential confounders, both for a priori reasons. Only individuals without missing values for all model variables were included in analyses, and the total number contributing data to a given model is noted in Table 3. Due to limited numbers of unaccompanied refugee minors from Iraq and Syria, and the fairly similar gender and age distribution in these subsamples, the two countries were combined in regression analyses in order to increase power.

No pre-registered document, with detailed plans for analyses, exists. Specific strategies for analyses were determined with data at hand. We have therefore attempted to keep analyses simple and transparent in order 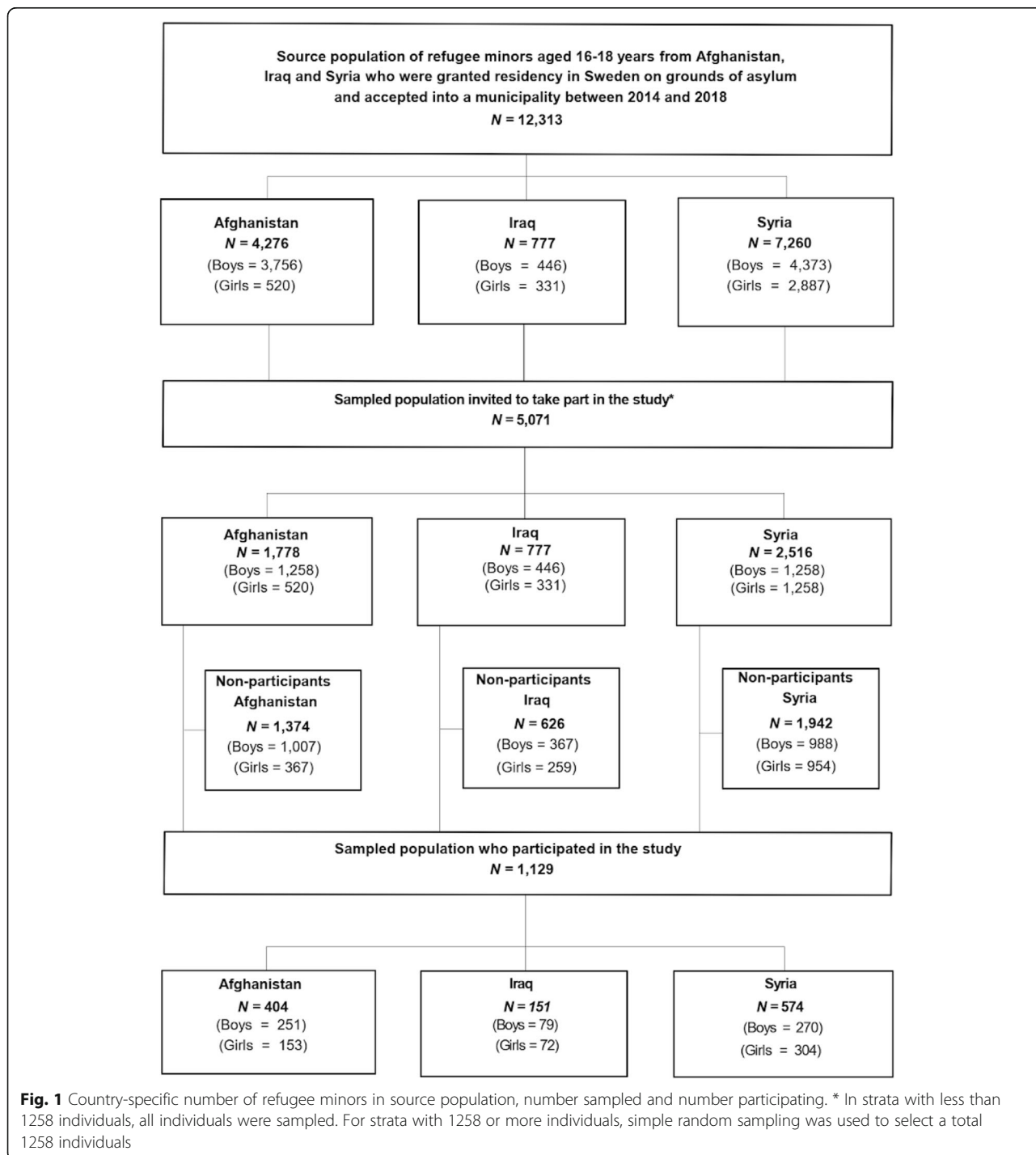to reduce the chance of pursuing random noise in the data which could result from including large numbers of candidate variables and multiple testing [38]. Still, the broader study objectives and hypotheses were prospectively outlined in written documents, such as ethics application and study protocol.

Results

Of the 5071 sampled refugee minors, 1129 returned the questionnaire for an overall response rate of 22.5% (See Fig. 1 for details). Country-specific response rates were: Afghanistan 22.7% (404 of 1778); Iraq 19.4% (151 of 777); and Syria 22.8% (574 of 2516). Descriptive statistics for the participants are presented in Table 1. There was a clear difference between refugee minors from Afghanistan compared to Syria and Iraq, with participants from Afghanistan both older and with a higher proportion of boys. Most notably, however, was that the refugee minors from Afghanistan were much more likely to be unaccompanied (over 60% compared to around 10% for Syria and Iraq), and live in a family home, with unrelated adults or in an HVB home (i.e. not with their mother and/or father or other relatives).

Regarding the differences in distribution between respondents and non-respondents, there were no significant differences in regard to country of birth ($p = 141$). Boys were somewhat less likely than girls to participate (59.9% boys among non-respondents vs. 53.1% boys among respondents, $p < 0.01$), and there were slight differences in regard to age (16 years: 28% among non-respondents vs. 30.7% among respondents, 17 years: 31.9% among non-respondents vs. 33.3% among respondents, 18 years: 40.1% among non-respondents vs. 36.0% among respondents, $p < 0.05$). Unaccompanied refugee minors comprised 28.7% of the respondents while the corresponding proportion among non-respondents was 38.2% ($p < 0.001$). Assessment of Cohen's h effect size, however, revealed that all differences in proportions between respondents and non-respondents were small to negligible (h = 0.030–0.084 for age, h = 0.137 for gender, h = 0.202 for unaccompanied migratory status).

The estimated prevalence of symptom-defined PTSD for total sample was 42.0% in the weighted analysis (95% CIs: 38.9–45.1; see Table 2). Country-specific analysis showed that refugee minors from Afghanistan had a higher prevalence of symptom-defined PTSD (56.1%) compared to refugee minors from Syria (33.6%) and Iraq (37.1%) (chi-square p-value < 0.001). Weighted country-specific prevalence estimates differed only marginally from unweighted estimates. There was no significant difference in symptom-defined PTSD prevalence between Syria and Iraq (chi-square p-value = 0.44). Furthermore, there was no evidence of a difference between symptom-defined PTSD prevalence between boys and girls, neither

Fig. 1 Country-specific number of refugee minors in source population, number sampled and number participating. * In strata with less than 1258 individuals, all individuals were sampled. For strata with 1258 or more individuals, simple random sampling was used to select a total 1258 individuals

in the total sample (chi-square *p*-value = 0.36), nor within any of the countries (*p*-values = 0.73, 0.30 and 0.41 for Syria, Iraq and Afghanistan, respectively). In the sample as a whole, the results showed that unaccompanied refugee minors had higher symptom-defined PTSD prevalence than accompanied ones (53.7% vs. 37.1%; chi-square *p*-value < 0.001), although the prevalence in the unaccompanied group was markedly smaller in weighted

analysis (43.1%). When comparing PTSD prevalences in unaccompanied vs. accompanied refugee minors within countries, there was only statistical evidence that the two groups differed in participants from Afghanistan (chi-square *p*-value = 0.035). There was no evidence of a difference in PTSD prevalence between unaccompanied and accompanied refugee minors within the subsample from Syria (chi-square p-value = 0.74). No statistical test

Table 1 Characteristics of study sample of resettled refugee minors in Sweden, by total and country of birth[1]

	Total sample N = 1129		Syria N = 574		Iraq N = 151		Afghanistan N = 404	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Gender								
Boys	600	(53.1)	270	(47.0)	79	(52.3)	251	(62.1)
Girls	529	(46.9)	304	(53.0)	72	(47.7)	153	(37.9)
Total	1129	(100.0)	574	(100.0)	151	(100.0)	404	(100.0)
Age								
16	347	(30.7)	202	(35.2)	54	(35.8)	91	(22.5)
17	376	(33.3)	207	(36.1)	42	(27.8)	127	(31.4)
18	406	(36.0)	165	(28.7)	55	(36.4)	186	(46.1)
Total	1129	(100.0)	574	(100.0)	151	(100.0)	404	(100.0)
Migratory status on arrival								
Accompanied	805	(71.3)	511	(89.0)	139	(92.1)	155	(38.4)
Unaccompanied	324	(28.7)	63	(11.0)	12	(7.9)	249	(61.6)
Total	1129	(100.0)	574	(100.0)	151	(100.0)	404	(100.0)
Living situation								
With mother and/or father or relatives	832	(78.7)	545	(97.5)	135	(94.4)	152	(42.8)
Family home or with unrelated adults	112	(10.6)	10	(1.8)	6	(4.2)	96	(27.0)
HVB home[2]	113	(10.7)	4	(0.7)	2	(1.4)	107	(30.2)
Total	1057	(100.00)	559	(100.0)	143	(100.0)	355	(100.0)

[1] Newly resettled refugee minors defined as refugees aged 16 to 18 years who were granted residency in Sweden on grounds of asylum and accepted into a municipality between 2014 and 2018
[2] HVB-home is a government funded institution/home where unaccompanied minors temporarily live and receive basic support

was done for the subsample from Iraq because of insufficient number of observations.

When exploring the association between migratory status on arrival (unaccompanied vs. accompanied) and symptom-defined PTSD with logistic regression, there was some evidence that unaccompanied refugee minors from Afghanistan had higher odds of PTSD compared to accompanied minors from Afghanistan after adjusting for age and gender (OR = 1.92; 95% CI 1.08–3.40; *p*-value 0.026). Age and gender were both negative confounders of this relationship with the crude OR biased towards the null (see Table 3). There was no evidence of an association between migratory status and PTSD in either unadjusted or adjusted models for Syria and Iraq (combined in analyses for power issues). Similarly, there was no evidence that gender was associated with symptom-defined PTSD.

As living situation and migratory status on arrival were strongly correlated ($r = 0.75$), there was a risk of multicollinearity issues if both variables were added to the same logistic regression model. With this risk highlighted, when living situation was included in the adjusted regression model for Afghanistan, the OR for PTSD comparing unaccompanied to accompanied refugee minors changed from 1.92 to 2.14, though confidence intervals were wide (95% CI 0.87–5.27) and

results not significant at the 0.05 level (*p*-value for Wald test of equal odds = 0.1, not shown in table).

Discussion

The objective of the present study was to assess nationwide, representative prevalence estimates for symptom-defined PTSD within populations of refugee minors from Afghanistan, Syria and Iraq resettled in Sweden. We hypothesized that symptom-defined PTSD prevalences for unaccompanied minors would be significantly higher compared to accompanied minors, and PTSD prevalences were expected to vary by country, with minors from Afghanistan reporting the highest prevalences. We also hypothesized that PTSD prevalences among unaccompanied girls would be significantly higher, compared to boys. Overall, our findings revealed a notably high number of "at risk" minors with prevalences rates of PTSD above 40%, with refugee minors from Afghanistan presenting the highest estimates, indicating the presence of PTSD in over half (56%) of these children.

With approximately 4 out of 10 refugee minors presenting symptoms indicating PTSD, a far greater, multifold burden was reflected in the present study, compared to available epidemiological evidence pertaining to prevalence of PTSD in high-income countries [39, 40]. This also holds true when comparing our estimates

Solberg *et al. Conflict and Health*   (2020) 14:67

Page 8 of 12

Table 2 Prevalences of symptom-defined posttraumatic stress disorder (PTSD) and 95% confidence intervals (95% CI), by total and country of birth among participating resettled refugee minors in Sweden

	Symptom-defined PTSD prevalence							
	Total sample[2] (*n* = 1057)		Syria (*n* = 551)		Iraq (*n* = 132)		Afghanistan (*n* = 374)	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Unweighted	42.0	(39.1–45.0)	33.6	(29.7–37.6)	37.1	(29.3–45.7)	56.1	(51.1–61.1)
Weighted[3]	42.0	(38.9–45.1)	33.4	(29.4–37.6)	36.8	(28.9–45.4)	56.9	(51.5–62.2)
Gender								
Boys	43.3	(39.3–47.4)	32.8	(27.4–38.8)	32.8	(22.5–45.1)	57.7	(51.4–63.9)
Girls	40.5	(36.2–44.9)	34.3	(29.0–39.9)	41.5	(30.1–54.0)	53.3	(44.8–61.6)
Age								
16	38.7	(33.4–44.3)	30.1	(23.9–37.1)	42.2	(28.5–57.2)	57.0	(45.8–67.5)
17	42.5	(37.5–47.7)	33.0	(26.9–39.8)	39.5	(25.1–55.9)	59.7	(50.6–68.1)
18	44.2	(39.3–49.2)	38.3	(31.1–46.0)	30.6	(19.2–45.0)	53.4	(46.0–60.7)
Total								
Migratory status on arrival								
Accompanied	37.1	(33.7–40.6)	33.8	(29.7–38.1)	37.2	(29.0–46.2)	48.9	(40.4–57.4)
Unaccompanied	53.7	(48.1–59.1)	31.7	(21.4–44.3)	a		60.2	(53.8–66.2)
Living situation								
With mother and/or father or relatives	37.2	(33.9–40.7)	a		a		53.0	(44.5–61.3)
Family home or with unrelated adults	56.4	(46.9–65.4)	a		a		60.6	(50.4–70.0)
HVB home	56.9	(47.4–65.9)	a		a		57.3	(47.5–66.5)

[1] A PTSD case was defined as a total score ≥ 17 on the CRIES-8 questionnaire
[2] There were 72 individuals with missing for the PTSD variable: 23 from Syria; 19 from Iraq; and 30 for Afghanistan
[3] Prevalence for total sample was weighted using direct standardization – i.e. strata-specific sample prevalences were weighted according to the distribution of the source population across strata. There were six strata in total, defined by all possible combinations of gender and country of origin
[a] Not calculated because there were less than 5 individuals in individual cells when PTSD was stratified by living situation

to reported prevalence estimates for trauma exposed children and adolescents [41]. Still, in a recent study conducted with refugee minors in a German context, a greater proportion of participants than in the current study were deemed to present post-traumatic stress symptoms above the determined cut-off (56.1% in comparison with 42% in the present study) [42]. Notably, these findings are equivalent to those for the subset of the present study's population of minors from Afghanistan (56% prevalence for symptom-defined PTSD), a population highly represented in the German study cited. These results are also comparable

Table 3 Logistic regression analyses with crude and adjusted odds ratios (ORs) with 95% confidence intervals (95% CI) for the association between migratory status on arrival (unaccompanied vs. accompanied) and symptom-defined posttraumatic stress disorder (PTSD)

	Syria and Iraq (*n* = 683)			Afghanistan (*n* = 374)		
	OR	(95% CI)	*p*-value[1]	OR	(95% CI)	*p*-value[1]
Unadjusted model:						
Migratory status: unaccompanied	0.91	(0.55–1.53)	0.73	1.58	(1.03–2.42)	0.036
Adjusted model						
Migratory status: unaccompanied	0.93	(0.55–1.56)	0.78	1.92	(1.08–3.40)	0.026
Gender: girl	1.11	(0.81–1.53)	0.52	1.25	(0.71–2.20)	0.44
Age (vs 16): 17	1.07	(0.73–1.57)	0.74	1.06	(0.59–1.91)	0.84
18	1.18	(0.80–1.75)	0.41	0.77	(0.44–1.33)	0.34

[1] *p*-value from Wald test of equal odds

with a similar study which also used a sample of refugee minors primarily from Afghanistan, resettled in Norway (58.7% prevalence of symptom defined PTSD) [43].

Still, exposure to war- and conflict-related trauma may present a particularly complex case. Indeed, the prevalence estimates previously reported for children in proximity of war have been shown to be markedly high [44], close to the rates detected in the present study. In fact, war- and conflict-related experiences may be particularly detrimental to children's mental health due to the concurrent erosion of supportive resources and networks, such as those provided by parents and family [45, 46]. Following this line of thought, the estimated high prevalences of PTSD in the present study may reflect the pronounced likelihood of exposure to war and conflict and the concurrent detrimental effects that follow, leaving unaccompanied minors at particular risk.

In this regard, the significantly higher prevalence of PTSD presented by minors from Afghanistan, compared to those from Syria and Iraq, stands out. Since the situations in Afghanistan, Syria and Iraq are characterized by severe and long lasting conflicts and war, and given that the eastern Mediterranean migration route has been the most important pathway for refugees from the Greater Middle East, including minors from Afghanistan, it is not obvious that we can ascribe the observed differences to mere specificities of the pre-migratory factors [47]. The main differences in the distribution of risk and protective factors in our study sample, however, seem to be related to the minors' migratory status and current living situation. Refugee minors from Afghanistan were to a larger extent unaccompanied and most live without a parent or relative. Living without a parent or relative post arrival in host-country has previously been shown to significantly increase the risk for the development of psychopathology [48]. From our available data, thus, the post-migratory living conditions may provide an explanation for the heightened PTSD prevalence among this group of refugee minors. Furthermore, going beyond the legal definition of "unaccompanied", which only denotes if a legal guardian was present at arrival or not, unaccompanied minors from Afghanistan currently living without a parent or relative, in this sense, might more fully represents respondents who actually traveled alone, i.e. unaccompanied in the non-legal meaning of the word, hence reporting the highest symptom burden. In other words, minors who traveled unaccompanied in the legal sense could still have been traveling with several members of their family or friends (but not legal guardians) and be reunited with their guardians in Sweden under the laws of family reunification. These children are classified as unaccompanied either way by the Swedish authorities. On the other hand, unaccompanied respondents currently living alone in family homes/HVB-

homes would be more likely to truly have traveled alone and unprotected. Children put in HVB-homes, do not have a legal guardian or are still waiting to be reunited with their guardians. Most of them probably also traveled without close family and friends who could provide for them after arrival in Sweden. In this sense they were and are more alone/less protected both during their flight and after arrival in Sweden, compared to those living with family or friends, and thus expected to report higher symptom levels.

It is also worth emphasizing that participants in the present study were granted residency between the years of 2014 and 2018. This implies that these children may well have been living in Sweden for up to 5 years at the time of our data collection. The high rates of "at risk" children presented are therefore particularly concerning, as they raise questions regarding whether the PTSD prevalences have declined over time, remained stable or even increased post arrival. Prior longitudinal studies exploring the mental health of unaccompanied refugee minors have found sustained levels of PTSD symptoms over time, even while other measures of mental disorders declined [8, 49]. While the present study did not collect longitudinal data, the findings herein might be consistent with these cited studies.

Finally, somewhat surprisingly, our hypothesis stating that PTSD prevalences among unaccompanied girls would be significantly higher, compared to boys, was not confirmed. The present study did not find any evidence that symptom-defined PTSD prevalence varied by gender, neither in the sample overall nor within subsamples from Afghanistan, Syria or Iraq. As mentioned in the introduction, findings related to gender differences among unaccompanied refugee minors have thus far been largely inconclusive and a lack of representative studies and relevant data for male refugees calls for caution when interpreting previous findings [28, 29]. A possible explanation for the lack of PTSD differences between genders may be attributed to the fact that all minors, regardless of gender, are at the heightened risk of being exposed to extreme adversities, trauma and human right violations during their flight to Europe. In other words, within the context of flight, war and conflict, these children's main vulnerability might lie in the compounding of exposures to extreme adversities and their young age, not their gender. The gendered pattern of risk and vulnerability factors among refugee minors within this specific context, thus, warrants future investigation, taking pre-, peri-, and post-migratory exposures and conditions into account.

Limitations
As less than a quarter of invited refugee minors decided to participate in the present study, there is an obvious

Solberg *et al. Conflict and Health*   (2020) 14:67

Page 10 of 12

possibility that selection bias may have influenced results, in particular the study's prevalence estimates. Using weighted analyses may partly correct for selection bias issues, however, it will not correct for problems with representativeness *within* strata. For example, if non-participation in the study was positively associated with poorer mental health as some evidence suggests [50], the study may underestimate PTSD prevalence even in weighted analyses. Selection bias may also have affected the association between migratory status and PTSD, although exposure-outcome associations are generally considered to be quite robust to nonresponse [51, 52].

Another limitation is the use of self-reported data and the short-form version of the Impact of Event Scale (CRIES-8). This short-form version was chosen in order to ease the response burden of the participating children. However, CRIES-8 is a brief, child-friendly measure designed to screen children/youth at risk for PTSD. The scale therefore does not incorporate the DSM-IV A-criterion, i.e. it does not anchor the questions asked to a specific potentially traumatic event. The referenced "event" is instead "flight in general" (before, during and after flight) and all the potentially traumatic events such forced migration might entail. CRIES-8 also lack items measuring hyper-arousal, the third cluster of PTSD symptoms, as defined in DSM-IV. Together, this calls for caution when interpreting the prevalences presented in this study. However, CRIES-8 is a tool frequently used to screen for posttraumatic stress symptoms in children and has been validated for use with refugee children [21, 22]. Findings on PTSD from the present study will therefore be readily comparable to other relevant studies on refugee minors in the literature.

Finally, as discussed above, the categorization of refugee minors as unaccompanied vs. accompanied in the present study was based on a pre-existing variable obtained from Statistics Sweden and the following definition: "... a refugee under 18 years of age who arrived in Sweden without a parent or other legal guardian." In other words, being unaccompanied in the present study did not necessarily mean that a refugee minor travelled alone. She/he could have travelled with family other than mother and father, and/or with friends. It is also worth noting that even though 63 refugee minors from Syria were categorized as unaccompanied, only 14 stated *not* to live with their mother and/or father or relatives. This contrasts with refugee minors from Afghanistan, where 203 of 249 unaccompanied refugee minors stated *not* to live with their mother and/or father or relative (i.e. a much higher proportion). Considering this, future research should explore our findings further within a longitudinal, mixed methods design in order to identify factors that exacerbate or alleviate PTSD symptoms over time within these subsamples. We also would like to note that our study only focused on minors who already had received a residence permit in Sweden. By doing so, the present study overlooks the vulnerable and distressing period of the asylum-seeking process itself and longitudinal data, incorporating this period, could have added additional clarity to our results. Regrettably, a longitudinal study including non-registered asylum-seeking children at the time of data collection was not logistically possible. It also needs to be highlighted that the present study incorporates a limited number of possible confounders and/or predictors of PTSD. A more thorough investigation of the links between pre-, peri- and post-migratory stress exposure, mental health, quality of life, integration, social inclusion, school- and work-participation, incorporating registry data per country of origin, would have been preferable in order to broaden the scope.

Conclusions

To our knowledge, this is one of the first studies to report weighted PTSD prevalence estimates by country within a nation-wide, large, random sample, encompassing both unaccompanied and accompanied refugee minors from Afghanistan, Syria and Iraq within a high-income, EU country. Thus, our findings can provide the field with more robust estimates for PTSD prevalences among refugee minors in Europe. Unaccompanied minors from Afghanistan presented the highest PTSD prevalence and, according to Eurostat, are still the largest group of unaccompanied refugee minors in the EU [53]. Together, these findings call for continued efforts to support this especially "at risk" group, changes in immigration policies and the utilization of readily available interventions that specifically targets mental ill health. Furthermore, the overall high symptom defined prevalences of PTSD among minors reported in the present study, paints a harrowing picture of a group of children that are truly at risk and in need of international protection and care.

Availability of data and materials
In line with the Conflict and Health regulations and guidelines on data sharing, as well as Swedish law and ethical approval, the data from this study cannot be shared on an individual data level. Sharing this data would compromise the confidentiality of participants due to the small number of observations in individual cells and the sociodemographic characteristics in the results. Therefore, the used data is viewed as back-traceable and identifiable. Further, in addition to participants being part of a vulnerable group who shared personal and sensitive data, they did not consent to data being shared. Individual data sharing would breach the terms of consent. Therefore, the datasets generated and analysed during the current study are not publicly available, but aggregated data are available from the corresponding author on upon reasonable request.

Ethics approval and consent to participate
The study was approved by the Stockholm Regional Ethical Review Board (*Approval number: 2018/456–31/5*). Statistics Sweden was responsible for conducting the survey. Enclosed with the questionnaire was an informed consent form where it was explicitly stated that participation was voluntary and that submission of the questionnaire implied consent for both participation and publication. Consent for children (under 16 years) was obtained from their parents/guardian. Data was analyzed anonymously.

Consent for publication
NA

Competing interests
On behalf of all authors, the corresponding author states that there is no conflict of interest/competing interests.

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Paper II

II

II

BMJ Open

Cohort profile: Resettlement in Uprooted Groups Explored (REFUGE)—a longitudinal study of mental health and integration in adult refugees from Syria resettled in Norway between 2015 and 2017

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ABSTRACT

Purpose In the field of forced migration and mental health research, longitudinal studies with large sample sizes and rigorous methodology are lacking. Therefore, the Resettlement in Uprooted Groups Explored (REFUGE)-study was initiated in order to enhance current knowledge on mental health, quality of life and integration among adult refugees from Syria resettled in Norway. The main aims of the study are to investigate risk and protective factors for mental ill health in a longitudinal perspective; to trace mental health trajectories and investigate important modifiers of these trajectories and to explore the association between mental health and integration in the years following resettlement. The aims will be pursued by combining data from a longitudinal, three-wave questionnaire survey with data from population-based registries on education; work participation and sick-leave; healthcare utilisation and drug prescription. The goal is to incorporate the data in an internationally shared database, the REFUGE-database, where collaborating researchers may access and use data from the study as well as deposit data from similar studies.

Participants Adult (≥18 years), Syrian citizens who arrived in Norway as quota refugees, asylum seekers or through Norway's family reunion programme between 1 January 2015 and 31 December 2017. Of the initial 9990 sampled individuals for the first wave of the study (REFUGE-I), 8752 were reached by post or telephone and 902 responded (response rate=10.3%).

Findings to date None published.

Future plans The REFUGE-cohort study will conduct two additional data collections (2020 and 2021). Furthermore, questionnaire data will be linked to population-based registries after all three waves of data collection have been completed. Registry data will be obtained for time-periods both prior to and after the survey data collection points. Finally, pending ethics approval, we will begin the process of merging the Norwegian REFUGE-cohort with existing datasets in Sweden, establishing the extended REFUGE-database.

Strengths and limitations of this study

► The study features a large sample of both male and female adult refugees from Syria who were resettled in a high-income country between 2015 and 2017.
► Study participants were selected through random sampling from a population-based source population identified using Norway's National Registry—that is, all refugees from Syria residing in Norway who met inclusion criteria had equal probability of selection.
► The study will use a three-wave survey design which will enable longitudinal tracking of self-reported mental health and other key measures.
► The study will link data from the three-wave, questionnaire survey to data in Norway's large, population-based registries on education, work participation and sick-leave, healthcare utilisation and drug prescription; as well as to other datasets/data sources within the European Union.
► Initial data collection yielded a low-response rate, despite extensive recruitment efforts.

INTRODUCTION

The adversities of forced migration make the current population of more than 70 million forcibly displaced people especially vulnerable.[1] Here, the concept of 'vulnerability' refers to refugees' heightened exposure to potentially traumatic events (PTEs) such as torture, war and/or violence-related traumas prior to or during forced migration, as well as experiences of post-migration socioeconomic hardships and social isolation. Together, these risk factors create a vulnerability that

constitutes a profound risk for mental ill health and reduced quality of life with potential long-lasting effects.[2–4]

Given the aforementioned high burden of mental ill health in refugee populations and the centrality of functional impairment in the diagnostic frameworks for posttraumatic stress disorder (PTSD), anxiety and depression in the main diagnostic manuals,[5 6] few studies have looked at integration in relation to mental health within refugee populations. The studies available show that general health problems, as well as symptoms of PTSD and depression, are adversely associated with economic and social integration,[7 8] with one study finding mental health to be a mediator between post-migration stressors and integration.[9] Still, longitudinal studies with large sample sizes and rigorous methodology are lacking and the sociopolitical controversy that is linked to the topic of refugee health often influences the measures and investigative methods used.[10] Therefore, studies that bridge these gaps are warranted in order to better understand the resettlement stressors and the mental health burden of refugees resettled in a host country in order to inform policy and practice.

Accordingly, the Resettlement in Uprooted Groups Explored (REFUGE)-study was initiated in order to enhance current knowledge on mental health and quality of life among adult refugees from Syria resettled in Norway following the 2011 outbreak of the civil war in Syria. The main aims of the study are to investigate risk and protective factors for mental ill health in a longitudinal perspective; to trace mental health trajectories and investigate important modifiers of these trajectories and to explore the association between mental health and integration in the years following resettlement. This will be done through a planned longitudinal, three-wave survey design linked to population-based registries in Norway on education; work participation and sick-leave; healthcare utilisation and drug prescription.

A broader, secondary aim is to extend the REFUGE-study beyond Norway's borders, through collaboration between the REFUGE-study group in Norway and partner institutions in Sweden and the UK, forming the REFUGE-consortium. This work, pending ethics approval, will include setting up and servicing a shared database in order to harness the research potential that lies within the existing datasets on resettled refugees from Syria in Norway and Sweden (N>4500).

A tertiary, long-term goal is to further expand the REFUGE-database by encouraging researchers in other countries to complete similar, nation-wide data-collections that can be added to the existing database. In turn, given the extensive number of included participants, the REFUGE-database will have ample opportunities to provide unique cross-country, intersectional, comparative analyses that can provide robust explanatory models of refugees' health and social outcomes, in turn informing social policy and practice.

At the time of writing this cohort profile, the first wave of the three-wave survey design has been completed.

COHORT DESCRIPTION
Setting
The study is set in Norway, a high-income country, with a population of 5.3 million people.[11] Approximately 4.5% of the Norwegian population has a refugee background.[12] The Directorate of Immigration (UDI) is the central agency in the Norwegian immigration administration. UDI facilitates lawful immigration and administrates applications for residency and citizenship, including asylum applications.[13] Since its onset in 2011, the civil war in Syria has forced more than 6.5 million Syrian citizens to flee the country as refugees, of which an estimated 1 million have reached Europe, excluding Turkey.[14 15] At the time of primary data collection, forced migrants from Syria therefore constituted the largest group of newly resettled refugees and asylum-seekers in Norway.

Eligibility
The source population for the REFUGE-study cohort was defined by the following three criteria: potential participants had to be (1) Syrian citizens who arrived in Norway as either a resettlement refugee (quota refugee), an asylum seeker, or through Norway's family reunion programme, (2) granted permanent or temporary residency and registered with an address in Norway between 1 January 2015 and 31 December 2017 and finally (3) 18 years of age or older at the time the sample was drawn from the source population.

These criteria were sent to the Norwegian National Registry (NNR) who generated a list of potential participants (N=14 350) from their database consisting of all individuals residing in Norway at that time. A simple, random, equal probability sample of 9990 Syrian citizens was then drawn in August 2018.

Study preparation and promotion
In initial stages of development, approximately a year before the commencement of the data collection, an early version of the questionnaire was tested in a reception centre. Arabic speaking asylum seekers filled out the survey and participated in focus groups with the aim of testing and tailoring the questionnaire for length, comprehension and cultural sensitivity. Several amendments to the questionnaire then followed as a result of the feedback obtained in these focus groups. Findings from this preliminary stage also prompted the creation of a user reference-group, consisting of six Syrians living in Norway. This user reference-group served as an advisory board throughout the planning, development and implementation of the study.

Additionally, prior to data collection, a number of strategies were employed in order to inform potential participants about the study and boost participation. Key persons within the community were identified and contacted in order to discuss ways to explain and promote the study through social media and other channels. Based on input from these sources, several short, animated movies were made in Arabic in order to explain why the

study was being undertaken, what participation entailed and how key issues in research, such as informed consent, confidentiality, data handling and privacy rights, would be handled. REFUGE web and Facebook pages were also created in both Arabic and Norwegian, conveying the same information as the movies, in more detail. The Facebook page, with Q&A, was continuously supervised and moderated by a native Arabic speaker.

In order to reach a wider range of potential participants, in-person and paper-based dissemination of information also took place. Information and Q&A sessions at Adult Education centres in Norway's larger cities were held by the REFUGE team members, including an Arabic interpreter from Syria who was involved in the study from the beginning. Information about the study was also sent to local community refugee centres throughout Norway. These centres work with refugees on a daily basis, assisting and counselling them on various matters related to the integration process into Norway.

Sampling

The first wave of the REFUGE-study (REFUGE-I) was launched at the end of November 2018. Each of the 9990 sampled Syrian refugees were sent an envelope containing the study questionnaire, a cover letter in Arabic and a prepaid return envelope. The cover letter explained the purpose and voluntary nature of the study, what participation entailed and issues surrounding confidentiality and data handling. It also included a space for willing participants to provide written informed consent in the form of a signature. Moreover, due to the sensitive nature of some parts of the questionnaire, the cover letter explicitly stated that 'some questions in the questionnaire might be difficult to answer, cause slight discomfort or might bring up difficult memories from your past or flight to Norway'. It also included contact details to clinical back-up in the form of a psychiatrist at Norwegian Centre for Violence and Traumatic Stress Studies, stating that participants could contact this person in order to receive information and support in accessing professional medical help in Norway. Out of hours and emergency service contact details were also included.

The address list provided by the NNR included 1235 addresses where the addressee was either not found or could not be reached. These potential participants were never found and therefore excluded from the study. Current rules for conducting research surveys in Norway prohibit more than one reminder being sent out to non-responders to encourage participation. Based on a small pilot project testing the use of telephone reminders with Arabic speaking personnel conducted on 530 non-responders in the sample, it was decided that telephone reminders would be used for all non-responders with an available telephone number (N=5675). Telephone contact was made with less than half of this group (N=2087). Online supplementary table S1 summarises the answers given by this group when asked to participate. The telephone reminders were conducted in late March

and early April 2019. A postal reminder which included the questionnaire, the cover letter with informed consent and a prepaid return envelope was also sent out to non-responders who were not reached via telephone (N=5000). The postal reminder was sent out in early June 2019. Figure 1 summarises the flow of participants through REFUGE-I, and table 1 provides comparative statistics on participants in REFUGE-I vs the source and sample population. Of the initial 9990 sampled individuals, 8752 were reached either by post or telephone and 902 returned the questionnaire (response rate=10.3% if non-contacts are excluded). Of the 902 responders, 665 (73.2%) were willing to take part in later waves of the study.

According to the original plan registered at ClinicalTrials.gov, data collection was planned to run for about 6–8 weeks. However, due to a very low-response rate at the time of the planned closing date in mid-January 2019, the study was extended and the final closing date was in early September 2019.

The administration and logistics of the survey was handled by the research and consulting firm, Ipsos, which has extensive experience with and infrastructure for these types of surveys. Ipsos is also responsible for securely storing participants' Norwegian identity numbers so that longitudinal tracking of individuals and linking to registry data is possible. The identity numbers are unknown to all researchers involved.

METHODS
Quantitative measures

Three waves of questionnaire surveys are planned for the REFUGE-study (REFUGE-I, II and III). Collection for REFUGE-I has already been completed as described above. REFUGE-II and III are scheduled to be carried out roughly 1 and 2 years after REFUGE-I, respectively. The questionnaire used will be very similar for all three waves of the study. Key variables are highlighted in table 2.

Other important measures in the questionnaire include an item regarding the re-experiencing of traumatic events or intrusive memories, which asks whether the participant experiences this, how often and how distressing it is. Another item asks about the daily effects of chronic physical illness, disability, infirmity or mental health problem(s). Finally, as an addition to the ENRICHD Social Support nventory Inventory (ESSI), three items have been included to assess how easily the respondent can get help from neighbours, how many people the participant can count on when serious problems occur and how much concern people show in what the respondent is doing.

Background and sociodemographic variables

Important background and demographic variables include: gender, age, marital status, number of children, refugee status on arrival (ie, asylum seeker, quota refugee, family reunion or other), whether the participant fled Syria alone or with a partner, family and/or friends,
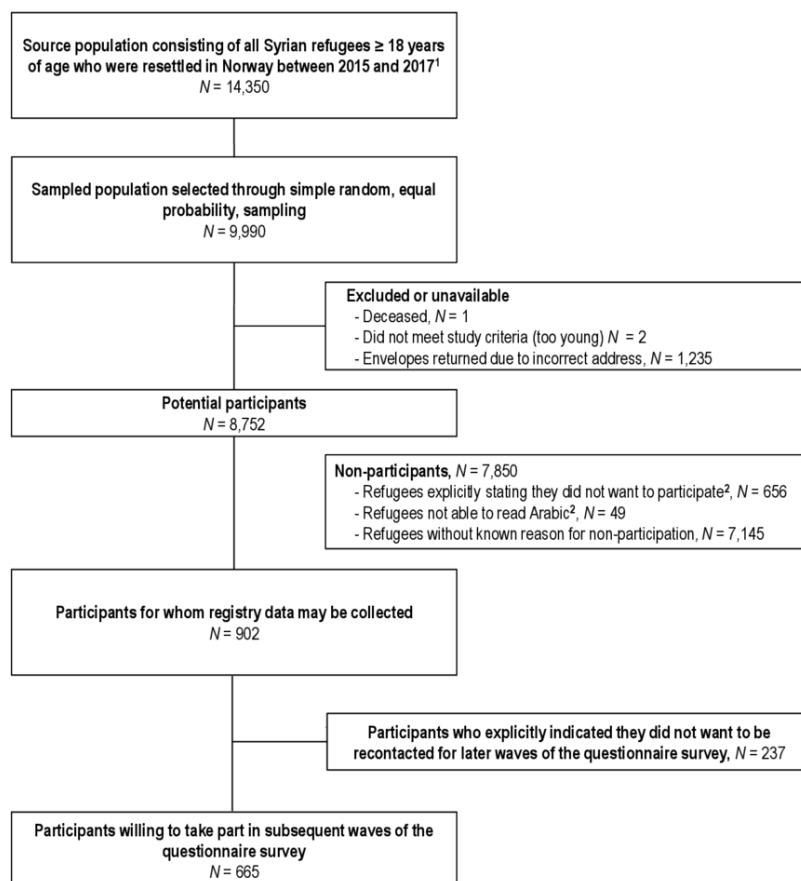
Figure 1 Flowchart of participants through the study. [1]Refugees were either resettlement/quota refugees; asylum seekers who were granted asylum in Norway; or individuals coming through the programme 'family immigration with a person who has protection (asylum) in Norway'. The source population was identified through the Norwegian National Registry. [2]Information was obtained when non-responders were contacted during the telephone reminder.

whether other family members had already settled in Norway prior to refugee's arrival in the country, time elapsed between when a participant fled Syria and arrived in Norway and time in Norway prior to participating in the study. Tables 3 and 4 provide descriptive statistics on participants on the aforementioned variables from the first wave of data collection. The number of participants with missing values across variables can be interpreted from the table (applies for all tables). Additional sociodemographic data collected include: smoking; alcohol and drug use; employment status (Do you currently hold paid employment in Norway? Yes/No); job satisfaction; self-reported competence in English and Norwegian language and years of education completed (How many years of schooling do you have? No education/1–5 years/6–9 years/10–12 years/more than 12 years). Further details on the scales used, their psychometric properties and how variables will be handled in analyses can be found in the ClinicalTrials.gov database.

Integration
Previous research has highlighted that active participation in social contexts promotes mental health, quality of life and beneficial health behaviours.[16–18] The REFUGE-study approaches integration in agreement with the primary domains suggested by Ager and Strang,[19] which are: employment and labour market, school and education attainments, housing, and health and healthcare. Furthermore, and in line with suggestions by Castles *et al*[20] and Niemi *et al*,[21] we consider civic and social participation/social exclusion to be central indicators of refugees' access to and active involvement in important spheres of the host societies, and these markers thus indicate a central component of social capital.[22]

Congruent with the domains of integration suggested by Ager and Strang, the study will use data from the Norwegian national registries in order to measure integration for consenting participants. Specifically, the study plans to obtain data from the National Education Database which contains data on educational participation and achievements; the Norwegian registries on employment and sick-leave which contain data on employment and doctor-certified sick-leave; the Norwegian Patient Registry and the Norwegian Registry for Primary Health Care which contain data on the utilisation of the healthcare system and, finally, the Norwegian Prescription Database which contains data about dispensed drugs. All of

Table 1 Demographic characteristics of participants vs the source and sample populations

	Source population	Sample population	Participants	Participants willing to take part in subsequent surveys
	N=14 350	N=9990	N=902	N=665
	n (%)	n (%)	n (%)	n (%)
Gender				
Female	5117 (35.7)	3552 (35.5)	320 (35.5)	236 (35.5)
Male	9233 (64.3)	6446 (64.5)	582 (64.5)	429 (64.5)
Age*				
18–29	6135 (42.8)	4265 (42.7)	197 (21.8)	148 (22.2)
30–39	4769 (33.2)	3315 (33.1)	310 (34.4)	218 (32.8)
40–49	2263 (15.8)	1604 (16.0)	230 (25.5)	173 (26.0)
50–64	1034 (7.2)	721 (7.2)	145 (16.1)	112 (16.9)
>64	149 (1.0)	95 (1.0)	20 (2.2)	14 (2.1)
Civil status*				
Unmarried	5879 (41.0)	4047 (40.5)	236 (26.1)	176 (26.5)
Married	7873 (54.8)	5545 (55.5)	595 (66.0)	433 (65.1)
Other†	598 (4.2)	398 (4.0)	71 (7.9)	56 (8.4)
Year granted residency in Norway				
2015	2993 (20.8)	2081 (20.8)	N/A‡	N/A‡
2016	7513 (52.4)	5267 (52.7)		

*Age and civil status for the two participating groups was based on participants' answers in the questionnaire.
†Includes widow(er), separated, divorced.
‡Individual-level data on the year residency was granted was not provided by the Norwegian National Registry.

the registries contain individual-level data, and the study intends to merge a participant's longitudinal survey data with that participant's registry data at in order to investigate how mental health is associated with these measures of integration.

Integration will also be investigated through the questionnaire data. Social integration is explored through measures of post migratory stress (eg, 'often felt excluded or isolated in the Norwegian society', 'often being unable to buy necessities'), social support (ESSI) and quality of life. Furthermore, the questions on how easily the participant can get help from neighbours; how many people the participant can count on when serious problems occur and how much concern people show in what the participant is doing will also be used as measures of integration. In the coming data collection waves, a scale measuring social participation will also be included. This scale will be incorporated both in the quantitative part of the study and as a specific topic within the planned qualitative interviews and focus groups.

Analysis
The study's registration in the ClinicalTrials.gov database presents detailed analytic plans for the first phase of the REFUGE-study (REFUGE-I). Broad analytic questions to be investigated in the later phases of the REFUGE-study include: (1) what are important risk and protective factors for mental ill health; (2) what are the mental health trajectories and which factors appear to impact these trajectories; (3) how is mental health associated with the measures of integration used in the present study and what are important mediators and modifiers in the relationship between mental health and integration.

Qualitative measures
In addition to the quantitative aspect of the REFUGE-study, qualitative analyses are also planned for future waves of the study, comprising interviews and focus group sessions. Questions regarding participation and non-participation will be included in interview guides. Further themes for the interview and focus group guides are in development, and directions will be refined as further findings emerge from the existing quantitative dataset.

Patient and public involvement
The REFUGE-study was supported throughout the development process by members of the community. Focus groups were held in the early stages of development in order to tailor the questionnaire, and a user reference group was created in order to act as an advisory group, providing insight during the planning, development and implementation stages. Community members were also involved in the recruitment process, providing insight

Table 2 Summary of key measures used in the longitudinal, three-wave, questionnaire survey

	Measure used*	Comments
Symptoms of posttraumatic stress disorder (PTSD)	Harvard Trauma Questionnaire	The first 16 items on trauma symptoms in section IV will be used
Symptoms of anxiety and depression	Hopkins Symptom Checklist	The first 10 of the total 25 items will be used to measure symptoms of anxiety and the last 15 to measure symptoms of depression
Quality of life	WHO Quality of Life Assessment	The scale consists of 26 items and all will be included
Somatic pain	Questions adapted from the Tromsø Study	10 questions will be used, 5 concerning muscle/joint pain and 5 concerning more general somatic pain
Perceived general health	European Social Survey	Two items from the scale will be included
Sleep difficulties	The Bergen Insomnia Scale	The scale consists of six items and all will be included
Potentially traumatic events before the flight from Syria (pre-migratory PTEs)	The Refugee Trauma History Checklist (RTHC)	The scale consists of eight items and all will be included
Potentially traumatic events during the flight from Syria (peri-migratory PTEs)	RTHC	The scale consists of eight items and all will be included
Post-migration stressful experiences	Post-Migration Stress Scale	The scale consists of 24 items and all will be included
Social support	Enhancing Recovery in Coronary Heart Disease (ENRICHD) Social Support Inventory (ESSI)	The first six items of the scale will be included

*Further information on the measures used can be found in the ClinicalTrial.gov database where the study is registered (NCT03742128).

and advice on the dissemination of information about the study through social media.

Findings to date

The first wave of data collection in Norway has been completed. At the time of writing, no findings have been published.

Strengths and limitations

The REFUGE-study has several important strengths, both in terms of methodology, and in value of the resulting data. First, the study population was randomly selected from a large source population consisting of all adult refugees from Syria residing in Norway who met the study's eligibility criteria, obtained from the NNR. In comparison, many of the previous studies on mental health in refugee populations rely on convenience sampling. Further, the use of a three-wave longitudinal survey design will allow for better exploration of cause–effect relationships between variables in the study, than purely cross-sectional data. In addition, research on the association between refugee mental health and integration is scarce. By linking longitudinal questionnaire data to registry data on education-related, work-related and health-related parameters, the study could make important contributions to the dearth of evidence on this topic. Also, combining self-report data with registry data from well-established national registries may reduce common method bias. Research on refugee mental health to date relies heavily on self-report data. A further strength of the study is that most of the key

variables are measured using well-documented and validated scales. Review articles on refugee mental health frequently highlight the large degree of variance in terms of methods used and call for increased focus on methodological issues. Finally, the close collaboration between the REFUGE-study group in Norway and its main collaborating partner, the Red Cross University College in Sweden, will offer ample opportunities to compare Syrian refugee populations in two different countries, as both projects use similar measures and have agreed to collaborate on and combine datasets.

An important potential weakness of REFUGE-I is that less than 11% of the sampled population participated in the study. This could lead to selection bias problems. As can be seen from table 1, participants are very similar to the source and sample population in terms of gender, though the proportion of young and unmarried refugees are notably smaller in the participating group. Online supplementary table S2 shows that the geographical distribution across Norway's 18 counties was very similar for participants and the sample population. In terms of residency status, participants had the same proportional breakdown as the sample population: 95% had temporary residency in Norway at the time of the survey and 5% had permanent residency (result not shown in tables). In order to further explore selection bias, we investigated whether there were any trends across demographic and background variables in terms of when the surveys were filled out and returned. Given that the survey was open

Table 3 Descriptive statistics on participating refugees from Syria

	Participants, N=902	Participants willing to take part in longitudinal questionnaire survey, N=665
	n (%)	n (%)
Number of children		
I do not have children	271 (31.6)	213 (33.5)
1	63 (7.4)	44 (6.9)
2	125 (14.6)	86 (13.5)
3	139 (16.2)	103 (16.2)
4	101 (11.8)	78 (12.3)
5	77 (9.0)	53 (8.3)
6 or more	81 (9.5)	59 (9.3)
Total	857 (100.0)	636 (100.0)
Education		
9 years or less	394 (44.7)	281 (43.0)
10–12 years	158 (17.9)	116 (17.8)
More than 12 years	330 (37.4)	256 (39.2)
Total	882 (100.0)	653 (100.0)
Refugee status on arrival		
Asylum seeker	454 (52.5)	325 (51.0)
Quota refugee	273 (31.6)	209 (32.8)
Family reunion	133 (15.4)	100 (15.7)
Other	4 (0.5)	3 (0.5)
Total	864 (100.0)	637 (100.0)
Arrived in Norway …		
… alone	247 (28.1)	182 (28.0)
… with friends, but no family	56 (6.4)	43 (6.6)
… with family	576 (65.5)	425 (65.4)
Total	879 (100.0)	650 (100.0)
Family member previously settled in Norway		
No	594 (68.3)	440 (68.4)
Yes	276 (31.7)	203 (31.6)
Total	870 (100.0)	643 (100.0)
Length of flight*		
Less than 3 months	165 (33.7)	124 (33.9)
3–12 months	61 (12.4)	42 (11.5)
1–2 years	59 (12.0)	43 (11.7)
t2–3 years	77 (15.7)	56 (15.3)
More than 3 years	128 (26.1)	101 (27.6)
Total	490 (100.0)	366 (100.0)
Residency time in Norway†		
Less than 2 years	104 (16.8)	83 (17.9)
Between 2 and 3 years	151 (24.4)	120 (25.9)
Between 3 and 4 years	289 (46.7)	209 (45.1)

Continued

Table 3 Continued

	Participants, N=902	Participants willing to take part in longitudinal questionnaire survey, N=665
	n (%)	n (%)
More than 4 years	75 (12.1)	51 (11.0)
Total	619 (100.0)	463 (100.0)

*Estimated through the number of days elapsed between a refugee reportedly left Syria and arrived in Norway.
†Estimated through the number of days elapsed between a refugee reportedly arrived in Norway and the date he/she returned the questionnaire.

for 9 months, exploring the timing of participation may give some indication of different groups' willingness to participate, and, by extension, suggest which groups may be over-represented and under-represented among participants. While the most common reason for non-participation was unwillingness, a potentially significant contributing factor to the low participation rate may be the presence of low literacy rates within the sampled population. As shown in figure 1, 49 participants stated an inability to read Arabic to explain non-participation, and it is conceivable that this was the case for a number of sampled individuals who failed to return the survey. Regrettably, current ethical laws in Norway do not allow for an online-based questionnaire where Arabic voice-over could be used. Therefore, potential participants with low reading and writing proficiency regrettably were effectively excluded.

Online supplementary table S3 shows the distribution of demographic variables across four different time-periods of participation (ie, the 9-month period the survey was open was divided into four shorter periods), and online supplementary table S4 shows the distribution across background characteristics related to refugee status and history. Differences in distributions across time-periods were tested with χ^2 test of equal proportion. As can be seen from the tables, there was weak or no evidence that the timing of participation was related to demographic and/or background variables with three exceptions. First, there was very clear evidence that residency time in Norway was negatively associated with early participation—that is, the longer a refugee's residency time in Norway, the less likely (s)he was to participate in the first time-periods following study launch (p<0.001), relatively speaking. There was also very strong statistical evidence (p<0.001) that pre-migratory stress was associated with the timing of participation, though the underlying trend was not easily interpretable. Refugees with the highest number of pre-flight potentially traumatic events were more likely to participate in the early periods after study launch (relatively speaking). This was not true, however, for the refugee group with the second to most

Table 4 Potentially traumatic experiences prior to and during the flight from Syria among participants

		Participants	Participants willing to take part in longitudinal survey
		N=902*	N=665*
		n (%)	n (%)
Before you left your home, have you personally faced any of the following situations or events			
War at close quarters	No	41 (4.7)	31 (4.8)
	Yes	840 (95.3)	618 (95.2)
Forced separation from family or close friends	No	324 (40.3)	235 (39.8)
	Yes	480 (59.7)	355 (60.2)
Loss or disappearance of family member(s) or loved one(s)	No	287 (35.3)	213 (35.5)
	Yes	526 (64.7)	387 (64.5)
Physical violence or assault	No	554 (70.5)	400 (69.3)
	Yes	232 (29.5)	177 (30.7)
Witnessing physical violence or assault	No	304 (36.9)	203 (33.5)
	Yes	520 (63.1)	403 (66.5)
Torture	No	567 (72.8)	410 (71.6)
	Yes	212 (27.2)	163 (28.4)
Sexual violence	No	710 (93.3)	518 (92.7)
	Yes	51 (6.7)	41 (7.3)
Other frightening situation(s) where you felt your life was in danger	No	103 (12.0)	74 (11.7)
	Yes	754 (88.0)	561 (88.3)
After you left your home, during your flight, have you personally faced any of the following situations or events			
War at close quarters	No	408 (49.3)	310 (50.7)
	Yes	420 (50.7)	302 (49.3)
Forced separation from family or close friends	No	412 (52.5)	298 (51.5)
	Yes	373 (47.5)	281 (48.5)
Loss or disappearance of family member(s) or loved one(s)	No	422 (53.8)	312 (53.6)
	Yes	362 (46.2)	270 (46.4)
Physical violence or assault	No	638 (83.6)	467 (83.5)
	Yes	125 (16.4)	92 (16.5)
Witnessing physical violence or assault	No	566 (72.6)	405 (70.7)
	Yes	214 (27.4)	168 (29.3)
Torture	No	657 (86.8)	481 (87.1)
	Yes	100 (13.2)	71 (12.9)
Sexual violence	No	722 (97.3)	529 (97.2)
	Yes	20 (2.7)	15 (2.8)
Other frightening situation(s) where you felt your life was in danger	No	350 (42.8)	258 (42.9)
	Yes	468 (57.2)	344 (57.1)

*Not all participants answered all items, therefore, the total number of answers for a given item may be less than 902 and 665 for the two groups, respectively.

pre-flight potentially traumatic events. Finally, there was moderate evidence that refugee status on arrival was association with the timing of participation (p=0.01), though no clear underlying pattern was evident.

Another limitation of the present study is the survey design used to attain prevalences of depression, anxiety and PTSD symptoms. Short-form questionnaires, while efficient, do not capture all aspects of the measured

constructs. Additionally, recent studies have suggested that when self-report measures are used, resulting prevalences tend to be higher than when using diagnostic interviews.[23][24] However, the questionnaires used in the current study to measure PTSD, anxiety and depression have been validated for use within the studied population and their use allows for many more participants to be reached, improving the generalisability of the findings.

Perhaps the most significant learning opportunity provided by the present study thus far has been the challenging recruitment process. Although extensive recruitment efforts were employed, the participation rate for REFUGE-I was just above 10%. As noted previously, methods to boost recruitment involved the utilisation of contacts within the community, dedicated Facebook and web pages in Arabic, and Q&A sessions held at Adult Education centres in Norway's major cities, as well as the dissemination of information about the project online through purpose-built, animated videos and newsletters. Researchers aiming to gather data from similar populations would do well to ensure that sufficient time and resources are dedicated to the recruitment phase of the study.

Future plans

The REFUGE-cohort study will conduct a second wave of data collection in 2020. A third wave of data collection is planned in 2021, pending funding. Furthermore, we plan to link questionnaire data to Norwegian registry data after all three waves of data collection have been completed. Registry data will be obtained for time-periods both prior to and after the three-wave survey. Primary and secondary objectives with detailed plans for analyses for studies involving registry data will be registered at ClinicalTrials.gov prior to obtaining the registry data, so that true hypothesis-testing studies from the REFUGE-cohort are distinguishable from more exploratory and data-driven studies. Finally, pending ethics approval, we will begin the process of merging the Norwegian REFUGE-cohort with existing datasets in Sweden, creating the REFUGE-database.

Parallel to completing the survey data collection, data-merging and registry data obtainment, we aim to publish papers in accordance with our pre-registered publication plan at ClinicalTrials.gov.

COLLABORATION

We welcome potential collaboration with other research groups. Interested researchers should contact the REFUGE research group for collaboration and knowledge-sharing. Locally collected data can then be added to the REFUGE-database. Reference estimates (eg, prevalence, incidence and associations) can then be continuously updated and made available to researchers abiding by the European Union's General Data Protection Regulation laws and regulations. In addition, the REFUGE-database will also include data obtained through Scandinavian social and health registries.

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Paper III

III

III

Mental health in adult refugees from Syria resettled in Norway between 2015 and 2017: a nationwide, questionnaire-based, cross-sectional prevalence study

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Mental health in adult refugees from Syria resettled in Norway between 2015 and 2017: a nationwide, questionnaire-based, cross-sectional prevalence study

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ABSTRACT

Background: The number of forcibly displaced people globally has never been higher, with refugees from Syria constituting the largest displaced population worldwide. Many studies have documented elevated levels of mental health problems in refugee populations, though prevalence estimates of common mental disorders vary considerably between studies, explained both by methodological and contextual factors.

Objective: Using questionnaire-based screening checklists to approximate the prevalence of and investigate risk factors for post-traumatic stress disorder (PTSD), anxiety and depression among adult refugees from Syria resettled in Norway and to compare estimates with a sister-study in Sweden.

Method: Cross-sectional survey of a randomly selected sample from the National Population Register in Norway of adult refugees from Syria who were granted residency rights in Norway between 2015 and 2017 (N_{sample} = 9,990; $n_{respondents}$ = 902). Above-threshold scores on the Harvard Trauma Questionnaire (HTQ) and Hopkins Symptoms Checklist (HSCL-25) defined caseness for PTSD (HTQ>2.06); anxiety ($HSCL_{anxitey}$>1.75); and depression ($HSCL_{depression}$>1.80).

Results: Weighted, checklist-positive prevalence estimates for PTSD, anxiety and depression were 29.7% (25.4%-34.4%), 30.1% (25.7%-34.9%), and 45.2% (40.6%-49.8%), respectively. Cumulative exposure to potentially traumatic experiences before or during flight was a clear risk factor for all outcomes, and female gender was a risk factor for anxiety and depression, though only in adjusted analyses. The choice of HTQ cut-off to define PTSD caseness (2.5 vs. 2.06) had a notable effect on prevalence estimates.

Conclusion: In line with prior evidence, the present study suggests adult refugees from Syria resettled in Norway have higher rates of anxiety and depression and markedly higher rates of PTSD compared to general, non-refugee populations, and that this is clearly linked to past traumatic experiences. Prevalence estimates were highly consistent with estimates from the sister-study in Sweden, which used almost identical methodology. Findings underline the importance of screening for and intervening on mental health problems in newly arrived refugees.

Salud mental en adultos refugiados de Siria reinstalados en Noruega entre 2015 y 2017: un estudio de prevalencia transaccional a nivel nacional basado en cuestionarios

Antecedentes: El número de personas desplazadas forzosamente a nivel global nunca ha sido más alto, con los refugiados de Siria constituyendo la mayor población desplazada del mundo. Muchos estudios han documentado elevados niveles de problemas de salud mental en poblaciones refugiadas, aunque las estimaciones de prevalencia de trastornos de salud mental comunes varían considerablemente entre estudios, explicadas tanto por factores metodológicos y contextuales.

Objetivo: Utilizar listas de tamizaje en formato de cuestionarios para estimar la prevalencia e investigar factores de riesgo para el trastorno de estrés postraumático (TEPT), la ansiedad y la depresión entre adultos refugiados de Siria reinstalados en Noruega, y para comparar estimaciones con un estudio hermano en Suecia.

Método: Encuesta transaccional en una muestra seleccionada aleatoriamente del Registro de Población Nacional en Noruega de adultos refugiados de Siria que obtuvieron derechos de residencia entre 2015 y 2017 (N muestral = 9990, n de encuestados = 902). Puntajes por sobre el puntaje de corte del Cuestionario de Trauma de Harvard (HTQ en su sigla en inglés) y la Lista de chequeo de síntomas de Hopkins (HSCL-25 en su sigla en inglés) definió como caso clínico para el TEPT (HTQ>2.06); ansiedad (HSCL ansiedad > 1.75); y depresión (HSCL depresión> 1.80).

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🄱 Supplemental data for this article can be accessed here.

Resultados: Las estimaciones ponderadas de prevalencia de positivos en lista de chequeo para TEPT, ansiedad y depresión fueron 29.7% (25.4%–34.4%), 30.1% (25.7%–34.9%), and 45.2% (40.6%- 49.8%), respectivamente. La exposición acumulativa a experiencias potencialmente traumáticas antes o durante el vuelo fue un claro factor de riesgo para todos los resultados, y el género femenino fue un factor de riesgo para ansiedad y depresión, aunque solo en análisis ajustados. La elección del puntaje de corte del HTQ para definir caso clínico de TEPT (2.5 versus 2.06) tuvo un efecto notable en las estimaciones de prevalencia.
Conclusión: En línea con evidencia previa, el presente estudio sugirió que los adultos de Siria refugiados y reinstalados en Noruega tienen tasas más altas de ansiedad y depresión, y tasas marcadamente más altas de TEPT comparadas con poblaciones generales no refugiadas, y esto está ligado directamente a experiencias traumáticas anteriores. Las estimaciones de prevalencia fueron altamente consistentes con las estimaciones del estudio hermano en Suecia, el cual utilizó metodología casi idéntica. Los hallazgos subrayan la importancia de tamizar e intervenir en problemas de salud mental en refugiados recién llegados.

2015 年至 2017 年在挪威重新定居的叙利亚成年难民的心理健康:一项全国性, 基于问卷的横断面患病率研究

背景:全球被迫流离失所的人数从未如此之多, 来自叙利亚的难民构成了全球最大的流离失所人口。许多研究记录了难民人群中精神健康问题的水平升高, 尽管不同研究之间对常见精神障碍的患病率估计差异很大, 这可以通过方法学和背景因素来解释。
目的:使用基于问卷的筛查检查表来估计在挪威重新安置的叙利亚成年难民中创伤后应激障碍 (PTSD), 焦虑和抑郁的患病率和风险因素, 并与在瑞典进行的姊妹研究进行比较。
方法:对一个从挪威国家人口登记册中随机抽取的2015 年至 2017 年期间获得挪威居住权的叙利亚成年难民样本 (Nsample = 9,990; nrespondents = 902) 进行横断面调查。哈佛创伤问卷 (HTQ) 和霍普金斯症状检查表 (HSCL-25) 的阈值以上定义了 PTSD (HTQ>2.06), 焦虑 (HSCLanxitey>1.75) 和抑郁 (HSCLdepression>1.80) 的病例。
结果: PTSD, 焦虑和抑郁的加权检查表阳性患病率估计分别为 29.7% (25.4%-34.4%), 30.1% (25.7%-34.9%) 和 45.2% (40.6%-49.8%)。在逃离前或期间累积潜在创伤经历暴露是所有结果的一个明确风险因素, 女性是焦虑和抑郁的风险因素, 尽管仅在调节分析中有这一结果。选择 HTQ 临界值来定义 PTSD 病例 (2.5 对 2.06) 对患病率估计有显著影响。
结论:与先前证据一致, 本研究表明, 与一般非难民人群相比, 在挪威重新定居的叙利亚成年难民有更高的焦虑和抑郁患病率和显著更高的PTSD 患病率, 这显然与过去的创伤经历有关。患病率估计与使用几乎完全相同方法的瑞典姊妹研究的估计高度一致。结果强调了筛查和干预新抵达难民心理健康问题的重要性。

1. Introduction

At the start of 2020, there were close to 80 million forcibly displaced people globally, which is the highest number on record (UNHCR, 2019). Syrians constitute, by far, the largest forcibly displaced population worldwide with more than six million internally displaced people (IDP) and approximately 6.6 million refugees following the outbreak of the 2011 civil war. An estimated 25,000 refugees from Syria have arrived in Norway since 2011, of which roughly half were asylum seekers, a quarter resettlement refugees and a little under a quarter family reunification refugees (Dzamarija, 2018).

While a substantial number of studies have explored mental health in refugee and conflict affected populations, there has historically been broad variation in the findings of these studies (Turrini et al., 2017). The variation is thought to be caused both by contextual factors and methodological ones, where a debated issue has been whether standardized symptom checklists are valid in measuring mental health across very heterogeneous settings and populations (Rasmussen, Verkuilen, Ho, & Fan, 2015; Rodin & Van Ommeren, 2009; Wind, van der Aa, de la Rie, & Knipscheer, 2017). Recent major reviews have gone

some way towards disentangling and quantifying the effects of key contextual and methodological factors (e.g. 7,8). Still, adjusted prevalence estimates for post-traumatic stress disorder (PTSD) and depression do not converge across reviews, ranging from about 10% in the lower end to over 30% in the upper end for both disorders (Blackmore et al., 2020; Bogic, Njoku, & Priebe, 2015; Charlson et al., 2016, 2019; Steel et al., 2009). Crucially, estimates unequivocally point towards a disease burden of mental disorders in refugee populations that is markedly higher than that found in general, non-refugee populations, especially for PTSD (Kessler et al., 2009; Koenen et al., 2017). Reviews have called for further methodologically rigorous and context-specific studies.

A 2020 review of studies specifically on refugees from Syria has estimated notably higher prevalences of mental disorders: 43.0% for PTSD; 40.9% for depression, and 26.6% for anxiety (Peconga & Høgh Thøgersen, 2020). Similar to previous reviews, high between-study variance was found, despite the population in question being constant in the sense that all were refugees from Syria. This highlights again that methodological factors may play an important role in explaining diverging results. As a point of illustration,

of the six studies in the Peconga et al. review that estimated PTSD prevalence through the Harvard Trauma Questionnaire (HTQ), PTSD caseness was defined in three different ways. Two studies used PTSD symptom cluster criteria (Chung, AlQarni, Al Muhairi, & Mitchell, 2017; Chung et al., 2018); three studies used a HTQ cut-off score of 2.5 (Chung et al., 2018; Ibrahim & Hassan, 2017; Kéri, 2015); and one study used a cut-off score of 2.06 (Tinghög et al., 2017). In addition, there are also many potential non-methodological explanations for the high variability between studies relating to refugees' pre-, peri-, and post-migration experiences and obvious differences between host-countries and their policies towards refugees (Gleeson et al., 2020; Li, Liddell, & Nickerson, 2016). Further methodologically sound studies within different host-country settings may help clarify this complex picture.

Given the inherent characteristics of the refugee experience and the known negative and cumulative effects of traumatic experiences on the risk of PTSD in non-refugee populations, a central topic of investigation in refugee studies has been how potentially traumatic experiences (PTEs) impact upon mental health. This effort has to some extent been hampered by the absence of established standards in the field on how PTEs should be measured in refugee populations (Scoglio & Salhi, 2020; Sigvardsdotter, Malm, Tinghög, Vaez, & Saboonchi, 2016). Nonetheless, most reviews have found clear associations between PTEs and mental disorders (e.g. 7,11), even if some have not (Charlson et al., 2016, 2019). Importantly, though, the latter two reviews investigated conflict-affected populations rather than refugees per se, and focused on traumatic events directly related to war experiences. Prior studies on Syrian refugees have documented strong positive associations between traumatic experiences and mental disorders (e.g. Acarturk et al., 2018; Alpak et al., 2015; Tinghög et al., 2017). In terms of sociodemographic factors, there is inconsistent evidence on whether gender is associated with mental health problems in refugees and conflict-affected populations, with some reviews concluding there is an association (Blackmore et al., 2020; Charlson et al., 2016, 2019; Porter & Haslam, 2005; Roberts & Browne, 2011), whereas others not (Bogic et al., 2015; Peconga & Høgh Thøgersen, 2020; Steel et al., 2009). More recent research has begun to address nuances in gender as a risk factor, suggesting that exploring only cross-sectional associations between gender and mental health may misrepresent this complex relationship (Wu et al., 2021). Furthermore, duration of stay in host country has been found to be adversely linked to mental health (Gleeson et al., 2020), though the explanation behind this link remains to be fully understood.

The present study is modelled upon a prior study in Sweden (Tinghög et al., 2017), and the two studies share many methodological features – e.g. eligibility criteria, the use of random sampling from total population registries and identical instruments and translations to measure mental health. These similarities provide a strong opportunity for cross-country comparison.

The overarching aim of the current study is to contribute to the field of refugee mental health with important context- and population-specific findings on the burden of and risk factors for mental health problems in a refugee population recently resettled in a Western European country. Using survey data from a randomly selected nationwide sample of adult refugees from Syria granted residency rights in Norway between 2015 and 2017, the primary objectives are to:

(1) Approximate the prevalence of PTSD, anxiety and depression based on standardized symptom checklists (i.e. the HTQ for PTSD and the Hopkins Symptom Checklist, HSCL-25, for anxiety and depression) and compare findings with the sister-study in Sweden (Tinghög et al., 2017).
(2) Explore risk factors for the above mental disorders with a particular focus on refugees' experience of potentially traumatic events prior to arrival in Norway.

The first objective is described in detail in the study's pre-registration in the ClinicalTrials.gov database, whereas parts of the analytic strategies to address the second objective are less clearly outlined in the pre-registration (e.g. how certain variables were categorized and multivariate models built). A secondary post hoc objective is to compare and contrast findings on PTSD in relation to whether caseness was defined by the study's pre-registered HTQ cut-off value of 2.06 versus by the more commonly used cut-off of 2.5.

2. Methods

2.1. Design and participants

Methodological details and descriptive statistics can be found in the study's pre-registration in ClinicalTrial. gov (NCT03742128) and published cohort profile (Nissen, Cauley, Saboonchi, Andersen, & Solberg, 2020).

The present study used a cross-sectional survey design. Eligible participants included all registered refugees from Syria >18 years of age who were granted temporary or permanent residency in Norway between January 2015 and December 2017. Refugees were either UNHCR quota refugees (resettlement refugees), refugees entering Norway through family reunification programmes, or asylum seekers whose asylum application had been approved. A complete list of eligible

participants was obtained from the Norwegian National Registry (N = 14,350) and a simple, random, sample of 9,990 individuals was drawn in August 2018. The study launched in November 2018, when all sampled individuals were sent a study invitation letter, the survey and a prepaid return envelope. The letter explained key elements of the study and outlined consent procedures and withdrawal options. A consent form had to be signed and returned with the questionnaire for a person to be included as by the approved study protocol. After several extensions, the study closed in September 2019. One reminder request for non-responders was delivered via postal mail or telephone in the spring of 2019. The Regional Committees for Medical and Health Research Ethics (REC) – Region Southeast (A) in Norway was responsible for ethical oversight of the project (reference number 2017/1252). The research and consulting firm, Ipsos, was contracted to handle all logistical aspects of data collection.

2.2. Variables and measurements

The three outcome variables in the present study were checklist-positive posttraumatic stress disorder (PTSD), anxiety and depression, defined by mean scores above predetermined thresholds on relevant symptom scales. We apply the terms checklist-positive (cp) to emphasize that caseness is based on symptom checklists and not a clinical interview which is the diagnostic gold-standard. Thus, for example, the term *cp-PTSD* designates a person who scores above the cut-off for PTSD. The term *cp-mental disorders*, abbreviated *cp-MD*, is used as an umbrella term for all three outcomes.

2.2.1. Posttraumatic stress disorder

Symptoms of PTSD were measured using the first 16 items of section IV of the Harvard Trauma Questionnaire (HTQ), each scored on a 4-point Likert scale ranging from 1 = Not at all to 4 = Very much (Mollica et al., 1992). The 16 items are based on the criteria for PTSD in the American Psychiatric Association's Diagnostic and Statistical Manual of mental disorders, version IV (DSM-IV). The HTQ scale is the most widely used scale for studies on PTSD in refugee populations (e.g. 23), though evidence from studies on construct validity across different populations and cultures is somewhat conflicting (Darzi, 2017; Rasmussen et al., 2015; Wind et al., 2017). The most frequently used cut-off to estimate probable PTSD is a mean score ≥2.5, established in a population of Indochinese refugees (Mollica et al., 1992). A later study on primary care patients in Bosnia and Herzegovina, however, found that a mean score >2.06 was optimal for identifying probable PTSD (Oruc et al., 2008), and this cut-off was applied by the sister-study in Sweden (Tinghög et al.,

2017). To facilitate comparison with both the Swedish sister-study and other relevant studies, the present study reports PTSD findings using both the study's pre-registered cut-off value of 2.06 and the more commonly used 2.5 cut-off value. Caseness based on the two cut-offs is denoted cp-PTSD$^{>2.06}$ and cp-PTSD$^{≥2.5}$, respectively. A mean score was not calculated for participants with three or more missing values on the HTQ scale. Cronbach's alpha for the 16 items was 0.92.

2.2.2. Anxiety and depression

Symptoms of anxiety and depression were measured using the Hopkins Symptom Checklist (HSCL-25), with the first 10 items measuring anxiety and the latter 15 depression (Mollica, Wyshak, De Marneffe, Khuon, & Lavelle, 1987). All items are scored on a 4-point Likert-scale ranging from 1 = Not at all to 4 = Extremely. Studies on construct validity and reliability from different settings and populations, including among refugees, broadly support the psychometric properties of the checklist (Hollifield et al., 2002; Tinghög et al., 2017; Wind et al., 2017). The recommended cut-off mean score is 1.75 for both anxiety and depression. In the present study, a mean score >1.75 was used to define cp-Anxiety, however, the study used a cut-off of >1.80 to define cp-Depression based on the abovementioned study in Bosnia (Oruc et al., 2008) which found that this cut-off maximized sensitivity and specificity for detecting major depressive disorder. This was also the chosen cut-off in the sister-study in Sweden. A mean score was not calculated for participants with three or more missing on a given subscale. Cronbach's alphas for the anxiety and depression subscales were 0.93 and 0.94, respectively.

2.2.3. Potentially traumatic experiences (PTEs)

Potentially traumatic experiences (PTEs) were measured with the Refugee Trauma History Checklist (RTHC), which has been validated in refugee populations (Sigvardsdotter et al., 2016, 2017). The RTHC asks about eight PTEs both pre-flight and during flight. All 16 items are answered with Yes/No. To facilitate comparisons with existing evidence, an overall measure of exposure to PTEs was constructed using the concept of adversity ratio introduced by Steel et al. in 2009 (Steel et al., 2009). Specifically, a PTE-adversity ratio (PTE-AR) was obtained by dividing the total number of PTEs experienced before and during flight by the total number asked about (16 in the present study). The PTE-AR was then divided into the following four groups: <0.2; 0.2–0.29; 0.3–0.39; and ≥0.4 in line with the review by Steel et al. This categorization of the PTE variable was not pre-registered.

The Arabic translation of all scales was done by our collaborating partners in Sweden using standard

double-blind translation and back-translation unless complete translations already existed. The questionnaire was piloted through interviews with Arabic-speaking patients in a rehabilitation centre for war and torture trauma in Sweden (for details, please see 20).

2.2.4. Flight-related measurements and background

Length of flight was estimated using self-reported date of leaving home country and self-reported date of arriving in Norway, and categorized into: <3 months; 3 months-2 years; 2–4 years; and >4 years. *Time in Norway* was estimated using self-reported date of arriving in Norway and the date the questionnaire was returned, categorized into: <2 years; 2–3 years; 3–4 years; and >4 years. These variables were not pre-registered, thus the categories were chosen based on the variables' distributions, with the aim of having comparable numbers in categories and each end of the spectrum represented in a theoretically meaningful way. For example, for *Length of flight*, we wanted to capture those with a very short flight (<3 months) as well as those with a protracted flight (>4 years). *Refugee status* upon arrival had the answer choices: asylum seeker; quota refugee; family reunion; and other, though the latter category was dropped as there were <5 refugees in this category. The variable *Arrived with . . .* asked whether a participant arrived alone, with friends but no family/spouse, or with family and/or spouse. The variable *Prior family Norway* asked whether any family members had previously resettled in Norway (Yes/No).

Self-report sociodemographic data included education and marital status. Education was split into: ≤9 years; 10–12 years; and >12 years; and marital status into married; unmarried; and divorced/separated/widow(er) to be consistent with the study's pre-registration and facilitate comparison with the sister-study in Sweden. Age and gender were based on registry data, with age split into the same age groups as the sister study in Sweden (18–29 years; 30–39 years; 40–49 years; 50–64 years; and ≥65 years).

2.3. Statistical analysis

Frequency distributions and simple cross-tabulations were used to create descriptive tables and check variables for errors, outliers and missing. Approximated prevalence with 95% confidence intervals (95% CI) were obtained using the *proportion* command in Stata. Given marked distributional differences for age and civil status between participants and the source populations (Nissen et al., 2020), weighted approximated prevalences for participants were calculated using post-stratification weights with age and civil

status defining the strata used for weight estimation (Royal, 2019).

Logistic regression was used to estimate adjusted odds ratios (ORs) for all mental health outcomes for each pre- and peri-flight PTE. Multicollinearity was checked before adding all PTEs to the same logistic model. Logistic regression was also used to build the final multivariable models exploring the full set of predictors. Crude estimates are included to highlight potential confounding patterns when covariates were added to models. Only participants with data for all variables included in a given regression model were included in that model (listwise deletion). The number of participants contributing data to models are indicated in the respective models in the tables. Because of the high number of participants with missing on the variables Length of flight and Time in Norway, these two variables were added in the final step (models 3), so that models exploring the other predictors could be estimated with the maximum available data (models 2). As a sensitivity analysis, fully adjusted regression models were rerun with imputed data obtained from multiple imputation by chained equations, MICE (White, Royston, & Wood, 2011). The imputation model included all variables in the final analysis models (except *Arrived with. . .* which was discarded due to perfect prediction). As a second sensitivity analysis included in supplementary material, the final regression models of PTSD, anxiety and depression were repeated using linear regression with the mean-item score of the respective scales as the outcome. This was done in order to focus on symptom severity rather than a disease/no-disease dichotomy. Likelihood ratio test (LRT) was used to evaluate whether multi-categorical variables could be modelled linearly without a significant worsening of model fit. Internal consistency of the main questionnaires (HTQ and HSCL) was tested using Cronbach's alpha. All analyses were performed with Stata version 16 (STATA Corporation, College Station, TX, USA). Please see Supplementary file S2 for analytic codes.

3. Results

Table 1 in Methods gives descriptive statistics on the study population. Overall mean symptom scores with standard deviations (SD) on mental health outcomes were: 1.86 (SD = 0.61, $n = 877$) for PTSD; 1.61 (SD = 0.62, $n = 886$) for anxiety; and 1.77 (SD = 0.67, $n = 877$) for depression.

Table 2 shows the prevalence estimates with 95% CIs for all checklist-positive mental disorders (cp-MDs), with the prevalence for PTSD presented for both the 2.06 and the 2.5 cut-off values on the HTQ. The overall cp-PTSD prevalence in weighted analysis was 29.7% (95% CI 25.4%-34.4%) using the 2.06 threshold and 13.1% (95% CI 10.0%-16.9%) using

Table 1. Descriptive statistics on participating adult refugees from Syria resettled in Norway between 2015 and 2017.

	n	(%)
Gender (n=902)		
Male	582	(64.5)
Female	320	(35.5)
Age (n=902)		
18–29 yrs	197	(21.8)
30–39 yrs	310	(34.4)
40–49 yrs	230	(25.5)
50–64 yrs	145	(16.1)
≥65 yrs	20	(2.2)
Education (n=882)		
≤ 9 yrs	394	(44.7)
10–12 yrs	158	(17.9)
>12 yrs	330	(37.4)
Marital status (n=902)		
Married/partner	595	(66.0)
Divorced/widow(er)a	71	(7.9)
Unmarried	236	(26.1)
Refugee status (n=860)		
Asylum seeker	454	(52.8)
Quota refugee	273	(31.7)
Family reunion	133	(15.5)
Arrived with … (n=879)		
… family/spouse	576	(65.5)
… friends only	56	(6.4)
… alone	247	(28.1)
Prior fam Norway (n=870)		
Yes	276	(31.7)
No	594	(68.3)
Length of flighta (n=644)		
<3 months	248	(38.5)
3 months – 2 yrs	158	(24.5)
2–4 yrs	162	(25.2)
>4 yrs	76	(11.8)
Time Norwayb (n=755)		
<2 yrs	126	(16.7)
2–3 yrs	164	(21.7)
3–4 yrs	385	(51.0)
>4 yrs	80	(10.6)
PTE-AR (n=819)		
<0.20	163	(19.9)
0.20–0.29	79	(9.7)
0.30–0.39	158	(19.3)
≥0.40	419	(51.2)

aThe full category included: widow(er), surviving partner, separated/separated partner, divorced/divorced partner.

the 2.5 threshold. Weighted cp-Anxiety prevalence was estimated at 30.1% (95% CI 25.7%-34.9%) and weighted cp-Depression at 45.2% (95% CI 40.6%-49.8%). There were clear dose-response relationships between increasing trauma exposure as measured through the PTE-AR and the prevalence of all cp-MDs. Comparing the most exposed refugees (PTE-AR ≥0.40) to those least exposed (PTE-AR <0.20), the former group had two- to threefold higher estimated prevalence for cp-Anxiety and cp-Depression and about five times higher estimated prevalence for cp-PTSD, regardless of cut-off used.

Table 3 shows the frequencies of experienced PTEs, the estimated prevalence of cp-MDs by each PTE, and adjusted measures of associations (ORs) between individual PTEs and cp-MDs. Overall, a high proportion of participants reported PTEs and all PTEs were more frequently reported before flight than during flight. In terms of cumulative PTE exposure, the majority of participants (51.2%) ranked in the highest category for PTE-AR – i.e. answering affirmatively on more

than 40% of all PTEs inquired about. Looking at the estimated prevalence of cp-MDs in relation to individual PTEs, there was a fairly clear pattern of markedly higher prevalences in participants who had experienced physical violence or assault; torture; or sexual violence. This was true for all mental disorders and for PTEs experienced both prior to and during flight. In particular, for participants exposed to sexual violence, the estimated prevalence of cp-PTSD$^{>2.06}$, cp-Anxiety and cp-Depression was around or over 70%. There was strong to very strong evidence that almost all PTEs were individually associated with markedly higher odds of cp-MDs after adjusting for demographic and flight-related variables (OR[1]). After adjusting for the other seven PTEs in each respective RTHC scale (OR[2]), the strength of evidence for individual PTEs weakened and the ORs were lower. Nonetheless, there was still evidence of associations between several individual PTEs and cp-MDs.

Tables 4–5 show the crude and adjusted multivariable models for cp-MDs. In terms of PTSD, there was very strong evidence in adjusted models that cumulative PTE was associated with markedly higher odds of cp-PTSD, regardless of cut-off. Specifically, compared to participants in the lowest cumulative PTE group (PTE-AR <0.20), those in the highest group (PTE-AR ≥ 0.40) had over 8 times the odds of cp-PTSD$^{>2.06}$ in adjusted analysis (OR = 8,38, 95% CI 4.56–15.4, $p < .001$). There was also strong evidence of an association between cumulative PTE and cp-PTSD if the 2.5 cut-off was used, though the ORs were somewhat lower. Furthermore, there was strong to very strong evidence that cumulative PTE was associated with markedly higher odds of both cp-Anxiety and cp-Depression, with the most exposed group (PTE-AR ≥0.40) having over four times the odds of cp-Anxiety compared to the least exposed group (OR = 4.43, 95% CI 2.60–7.54, $p < .001$) and almost five times the odds of cp-Depression (OR = 4.91, 95% CI 2.98–8.09, $p < .001$). There was very strong evidence in adjusted models that females had higher odds of both cp-Anxiety and cp-Depression compared to males (though not in crude models), and moderate evidence that older age, being unmarried and longer length of stay in Norway were associated with increased odds for both disorders.

4. Discussion

The present study, based on a randomly selected nationwide sample of adult refugees from Syria who were resettled in Norway between 2015 and 2017, found high levels of exposure to potentially traumatic experiences (PTEs) both before and during the flight to Norway, and a high burden of mental health problems. Weighted approximated prevalence of mental disorders based on symptom checklist scores were around 30% for PTSD and anxiety and over 40% for

Table 2. Prevalence of checklist-positive (cp) mental disorders with 95% confidence intervals (95% CI) in participating adult refugees from Syria.

		cp-PTSD>2.06			cp-PTSD≥2.5			cp-Anxiety			cp-Depression		
		Prev.	(95% CI)	X^2	Prev.	(95% CI)	X^2	Prev.	(95% CI)	X^2	Prev.	(95% CI)	X^2
Overall	Unweighted	34.7	(31.5–37.9)		14.9	(12.6–17.5)		31.7	(28.7–34.9)		40.0	(36.8–43.4)	
	Weighted	29.7	(25.4–34.4)		13.1	(10.0–16.9)		30.1	(25.7–34.9)		45.2	(40.6–49.8)	
Gender	Male	36.0	(32.0–40.1)	0.27	16.3	(13.4–19.6)	0.13	29.7	(26.0–33.6)	0.08	39.8	(35.7–43.9)	0.83
	Female	32.3	(27.1–37.8)		12.5	(9.0–16.6)		35.5	(30.2–41.0)		40.5	(35.0–46.3)	
Age	18–29 yrs	31.8	(25.3–38.9)	0.02	11.5	(7.3–16.8)	0.07	31.1	(24.6–38.1)	0.02	37.2	(30.3–44.4)	0.10
	30–39 yrs	31.9	(26.7–37.5)		15.3	(11.4–19.9)		30.3	(25.2–35.8)		38.6	(33.1–44.4)	
	40–49 yrs	33.3	(27.2–40.0)		13.1	(8.9–18.2)		27.1	(21.4–33.4)		38.2	(31.8–44.9)	
	50–64 yrs	45.5	(37.1–54.0)		19.6	(13.4–27.0)		41.8	(33.6–50.4)		47.9	(39.3–56.5)	
	>65 yrs	42.1	(20.3–66.5)		31.6	(12.6–56.6)		40.0	(19.1–63.9)		55.6	(30.8–78.5)	
Education	≤9 yrs	32.6	(28.0–37.6)	0.31	13.2	(10.0–17.0)	0.31	29.7	(25.2–34.5)	0.64	36.7	(31.9–41.8)	0.18
	10–12 yrs	32.0	(24.6–40.1)		13.3	(8.3–19.8)		32.5	(25.2–40.5)		39.0	(31.2–47.1)	
	>12 yrs	37.6	(32.3–43.1)		17.1	(13.1–21.6)		32.8	(27.7–38.2)		43.5	(38.0–49.1)	
Marital status	Married/partner	31.4	(27.7–35.4)	0.01	13.1	(10.4–16.1)	0.04	28.9	(25.3–32.8)	0.02	35.2	(31.3–39.3)	<0.001
	Divorced/widow(er)	47.1	(34.8–59.6)		23.5	(14.1–35.4)		43.5	(31.6–56.0)		55.9	(43.3–67.9)	
	Unmarried	39.2	(32.8–45.9)		17.2	(12.5–22.7)		35.4	(29.2–41.9)		47.6	(40.9–54.3)	
Refugee status	Asylum seeker	36.7	(32.2–41.4)	0.35	17.1	(13.7–20.9)	0.24	32.4	(28.1–37.0)	0.54	44.0	(39.4–48.8)	0.03
	Quota refugee	31.3	(25.8–37.3)		14.0	(10.0–18.7)		29.0	(23.6–34.8)		35.5	(29.7–41.6)	
	Family reunion	34.9	(26.7–43.8)		11.6	(6.7–18.5)		33.6	(25.6–42.4)		33.8	(25.8–42.7)	
Arrived with …	…family/spouse	31.4	(27.6–35.4)	0.01	11.9	(9.4–14.9)	0.001	29.3	(25.6–33.3)	0.08	36.5	(32.5–40.6)	0.01
	…friends only	35.8	(23.1–50.2)		13.2	(5.5–25.3)		31.5	(19.5–45.6)		38.2	(25.4–52.3)	
	…alone	42.1	(35.9–48.6)		21.9	(16.9–27.6)		37.3	(31.2–43.8)		48.8	(42.3–55.2)	
Prior fam Norway	Yes	33.9	(28.3–39.9)	0.81	13.7	(9.8–18.3)	0.55	35.2	(29.5–41.2)	0.16	38.6	(32.8–44.7)	0.54
	No	34.8	(30.9–38.8)		15.2	(12.4–18.4)		30.4	(26.7–34.3)		40.8	(36.8–45.0)	
Length of flight	<3 months	32.0	(26.1–38.2)	0.16	12.4	(8.6–17.3)	0.53	30.6	(24.9–36.8)	0.24	37.7	(31.6–44.1)	0.05
	3 months – 2 yrs	40.6	(32.8–48.8)		15.5	(10.2–22.2)		38.5	(30.8–46.6)		46.2	(38.2–54.3)	
	2–4 yrs	29.8	(22.9–37.5)		9.9	(5.8–15.6)		30.4	(23.4–38.2)		37.7	(30.2–45.8)	
	>4 yrs	30.3	(20.2–41.9)		13.2	(6.5–22.9)		27.0	(17.4–38.6)		27.4	(17.6–39.1)	
Time Norway	<2 yrs	20.8	(14.1–29.0)	0.001	3.2	(0.9–8.0)	0.001	22.0	(15.0–30.3)	0.02	22.8	(15.7–31.2)	<0.001
	2–3 yrs	37.3	(29.8–45.2)		14.9	(9.8–21.4)		37.2	(29.8–45.1)		38.8	(31.2–46.8)	
	3–4 yrs	35.4	(30.6–40.5)		15.3	(11.9–19.4)		31.1	(26.5–36.1)		42.6	(37.6–47.8)	
	>4 yrs	41.1	(29.7–53.2)		20.5	(12.0–31.6)		40.3	(29.2–52.1)		48.1	(36.5–59.7)	
PTE-AR	< 0.20	10.0	(5.8–15.7)	<0.001	3.8	(1.4–8.0)	<0.001	15.4	(10.2–21.9)	<0.001	20.6	(14.6–27.7)	<0.001
	0.20–0.29	23.4	(14.5–34.4)		10.4	(4.6–19.4)		21.5	(13.1–32.2)		23.4	(14.5–34.4)	
	0.30–0.39	30.3	(23.2–38.2)		12.3	(7.5–18.5)		27.8	(21.0–35.5)		38.5	(30.8–46.6)	
	≥0.40	48.2	(43.3–53.1)		21.9	(18.0–26.2)		41.7	(36.9–46.7)		52.5	(47.5–57.4)	

Total number of participants with data on outcome variables: n = 877 (cp-PTSD $^{>2.06}$); n = 877 (cp-PTSD$^{≥2.5}$); n = 886 (cp-Anxiety); n = 877 (cp-Depression).

Table 3. Prevalence estimates (95% CIs) and odds ratios, ORs, of checklist-positive (cp) mental disorders by potentially traumatic experiences (PTEs).

		n	cp-PTSD >2.06			cp-PTSD ≥2.5			cp-Anxiety			cp-Depression		
			Prev	95% CI	OR¹/OR²	Prev	95% CI	OR¹/OR²	Prev	95% CI	OR¹/OR²	Prev	95% CI	OR¹/OR²
Before flight (premigratory PTEs)														
War at close quarter	-	41	10.0	(2.8–23.7)		5.0	(0.6–16.9)	3.1/1.3	14.6	(5.6–29.2)	2.4b/1.1	24.4	(12.4–40.3)	2.0/0.8
	+	840	35.7	(32.4–39.1)	4.7b/1.5	15.2	(12.8–17.8)		32.3	(29.1–35.6)		40.9	(37.5–44.3)	
Forced separation from fam/friends	-	324	22.1	(17.6–27.1)		9.1	(6.2–12.9)	2.2b/1.2	22.4	(17.9–27.3)	2.4c/1.6a	28.9	(23.9–34.2)	2.5c/1.7b
	+	480	43.3	(38.8–47.9)	2.8c/1.6a	18.7	(15.3–22.5)		38.2	(33.8–42.7)		47.9	(43.3–52.5)	
Loss/disappearance of family/friends	-	287	21.9	(17.2–27.2)		9.2	(6.1–13.2)	2.2b/1.3	23.5	(18.7–28.9)	2.0c/1.2	31.3	(26.0–37.1)	1.9c/1.2
	+	526	41.5	(37.2–45.9)	2.6c/1.5	17.9	(14.7–21.5)		36.6	(32.5–40.9)		44.2	(39.8–48.6)	
Physical violence or assault	-	554	25.3	(21.7–29.1)		9.2	(6.9–11.9)	3.7c/1.8	25.0	(21.4–28.8)	3.5c/2.7c	32.3	(28.4–36.4)	3.4b/2.0b
	+	232	56.6	(49.9–63.2)	4.3c/2.4b	28.3	(22.5–34.7)		48.0	(41.4–54.7)		58.7	(52.0–65.3)	
Witnessing physical violence/assault	-	304	18.1	(13.9–23.0)		6.7	(4.1–10.2)	2.8c/1.6	21.5	(17.0–26.5)	2.4c/1.4	25.8	(20.9–31.1)	3.0c/2.0b
	+	520	44.9	(40.5–49.3)	3.4c/1.7a	20.4	(17.0–24.2)		37.8	(33.6–42.2)		49.1	(44.7–53.6)	
Torture	-	567	27.0	(23.4–30.9)		9.5	(7.2–12.2)	3.8c/1.7	27.3	(23.7–31.2)	2.4c/0.9	34.5	(30.6–38.6)	2.8c/0.9
	+	212	55.8	(48.8–62.7)	3.4c/1.4	29.1	(23.0–35.8)		43.5	(36.6–50.5)		57.4	(50.3–64.2)	
Sexual violence	-	710	31.4	(28.0–35.0)		12.2	(9.9–14.9)	5.1c/1.9	29.1	(25.7–32.6)	5.6c/2.6a	37.0	(33.4–40.7)	5.8c/2.8a
	+	51	71.4	(56.7–83.4)	4.9c/1.7	44.9	(30.7–59.8)		68.0	(53.3–80.5)		77.1	(62.7–88.0)	
Other perceived life-threat. situations	-	103	8.9	(4.2–16.2)		5.0	(1.6–11.2)	3.4b/1.4	15.7	(9.2–24.2)	3.1b/1.4	21.8	(14.2–31.1)	3.1c/1.4
	+	754	38.6	(35.1–42.3)	6.4c/2.3	16.3	(13.7–19.2)		33.8	(30.4–37.4)		43.1	(39.5–46.7)	
During flight (perimigratory PTEs)														
War at close quarter	-	408	33.9	(29.3–38.8)		14.4	(11.1–18.2)	1.0/0.6	29.0	(24.6–33.7)	1.4/0.6a	37.3	(32.5–42.2)	1.4a/0.7
	+	420	34.2	(29.6–39.1)	1.0/0.5a	13.6	(10.4–17.4)		33.6	(29.0–38.3)		43.1	(38.2–48.1)	
Forced separation from fam/friends	-	412	25.2	(21.0–29.7)		10.4	(7.6–13.8)	2.1b/1.5	24.6	(20.5–29.1)	2.0c/1.2	31.2	(26.7–36.0)	2.4c/1.7b
	+	373	44.8	(39.6–50.1)	2.4c/1.8b	19.7	(15.7–24.1)		39.4	(34.4–44.6)		50.1	(44.9–55.4)	
Loss/disappearance of family/friends	-	422	25.4	(21.3–29.9)		10.6	(7.8–13.9)	2.3c/1.5	23.8	(19.8–28.1)	2.5c/1.8a	30.8	(26.4–35.5)	2.5c/1.8b
	+	362	45.5	(40.2–50.8)	2.4c/1.7a	20.5	(16.4–25.1)		40.9	(35.8–46.2)		51.1	(45.8–56.5)	
Physical violence or assault	-	638	29.6	(26.1–33.4)		11.5	(9.1–14.2)	3.8c/1.8	28.1	(24.6–31.7)	3.3c/1.3	36.8	(33.1–40.8)	2.9c/1.1
	+	125	57.7	(48.5–66.6)	4.0c/2.0a	30.9	(22.9–39.9)		49.2	(40.0–58.4)		56.7	(47.3–65.7)	
Witnessing physical violence/assault	-	566	28.6	(24.9–32.6)		11.7	(9.2–14.7)	2.2b/0.6	26.0	(22.4–29.8)	2.8c/1.3	35.1	(31.2–39.3)	2.4c/1.1
	+	214	50.0	(43.0–57.0)	2.5c/1.2	23.3	(17.8–29.6)		46.5	(39.6–53.4)		54.6	(47.5–61.5)	
Torture	-	657	29.8	(26.3–33.5)		11.6	(9.2–14.3)	3.8c/2.5a	27.1	(23.7–30.7)	4.3c/2.4a	35.9	(32.2–39.7)	4.1c/2.8b
	+	100	63.3	(52.9–72.8)	4.3c/3.7c	34.7	(25.4–45.0)		59.6	(49.3–69.3)		67.4	(57.0–76.6)	
Sexual violence	-	722	32.7	(29.3–36.3)		13.0	(10.6–15.7)	8.6c/3.8a	29.6	(26.2–33.1)	9.1c/3.5	38.1	(34.5–41.8)	7.7b/2.8
	+	20	65.0	(40.8–84.6)	4.1b/1.0	50.0	(27.2–72.8)		70.0	(45.7–88.1)		77.8	(52.4–93.6)	
Other perceived life-threat. situations	-	350	27.2	(22.5–32.2)		9.6	(6.7–13.3)	2.3b/1.8	23.7	(19.3–28.5)	2.2c/1.6	33.5	(28.5–38.8)	1.7b/1.1
	+	468	40.2	(35.7–44.8)	1.8b/1.2	19.0	(15.5–22.9)		37.4	(32.9–41.9)		46.0	(41.3–50.6)	

OR¹ adjusted for gender, age, education, marital status, refugee status, arrived with fam/friends/alone, and prior family in Norway.
OR² adjusted for same as OR¹ plus other PTEs *within* scale (i.e. OR for a given *pre*-flight PTE is adjusted for other PTEs in *pre*-flight scale).

depression, though a low participation rate could affect generalizability. There was very strong evidence that higher levels of exposure to PTEs before or during flight were associated with markedly higher odds of all three mental disorders, with a clear underlying dose-response relationship. The approximated prevalence for PTSD was sensitive to the choice of cut-off in the Harvard Trauma Questionnaire, with the prevalence more than halved if the 2.5 cut-off was used rather than the study's pre-registered value of 2.06. The choice of cut-off point, however, had limited impact on risk factor findings. Approximated prevalences were highly consistent with the sister-study in Sweden (Tinghög et al., 2017).

The present study's approximated PTSD prevalence of about 30% is in line with summary estimates from several major reviews on general refugee populations (Blackmore et al., 2020; Bogic et al., 2015; Steel et al., 2009), though somewhat higher than Charlson et al.'s estimates for conflict-affected populations (Charlson et al., 2016, 2019). Compared to the sister-study in Sweden (Tinghög et al., 2017), which had roughly identical inclusion criteria, followed the same nationwide recruitment strategy with random sampling from total population registers, and used an identical Arabic translation of the HTQ with the same cut-off value for PTSD (>2.06), the approximated PTSD prevalences were very consistent: 34.7% vs. 30.6% in unweighted analysis and 29.7% vs. 29.9% in weighted analysis in Norway and Sweden, respectively. If the 2.5 cut-off was used, the unweighted PTSD prevalences estimates in the two countries were 14.9% in Norway and 15.2% in Sweden (obtained through email correspondence with F. Saboonchi, Prof. [sabf@rkh.se] in April 2021). In a recent review by Peconga et al. on refugees from Syria, PTSD prevalence estimates ranged from 25% to 83% in included studies (Peconga & Høgh Thøgersen, 2020). Three of these studies used the 2.5 cut-off value on the HTQ to define PTSD caseness (Chung et al., 2017; Ibrahim & Hassan, 2017; Kéri, 2015) and their estimated PTSD prevalence ranged from 35% to 65%, which is significantly higher than the 13.1% found in weighted analysis in the present study if applying the 2.5 cut-off. Potential explanations for the notably lower estimate in the present study could be related to sampling and recruitment strategy, sample size, and response rate, all shown to be associated with prevalence estimates (Charlson et al., 2016; Steel et al., 2009). A further important difference is that participants in the present study had all been granted permanent or temporary residency as opposed to the participants in the other three studies, many of whom were awaiting asylum decisions with the associated risks for mental ill health that confers (Solberg, Vaez, Johnson-Singh, & Saboonchi, 2020). A more conservative PTSD prevalence estimate of 7% was reported in another recent Norwegian study on refugees from Syria which used the 2.5 cut-off (Strømme et al., 2020), though the study population had less exposure to traumatic events compared to the present study and population-based random sampling was not used. Overall, the discussion above highlights the well-known heterogeneity of evidence on PTSD in refugee populations, further highlighting the need for comparisons of estimates between studies of similar design, methodological rigorousness and host-country context. The very consistent estimates found in Norway and Sweden support this argument and the reliability of the methods used and findings in these studies. However, it does not imply that the chosen cut-off value of 2.06 is more valid than the 2.5 cut-off in identifying true PTSD cases among adult refugees from Syria. Considering the sensitivity of prevalence estimates to the choice of cut-off demonstrated in the present study, validation studies exploring optimal HTQ cut-off values in this population are warranted. Furthermore, the field of refugee research should aim towards using the gold standard clinical interview to estimate prevalences with more accuracy in the future.

Despite being the most widely used and validated screening instrument to measure PTSD symptoms in refugee populations, the HTQ scale used in the present study is based on version 4 of the DSM (DSM-IV), which was replaced by version 5 in 2013 (DSM-V). Given that the diagnostic criteria for PTSD changed somewhat in the DSM-V version (e.g. the symptom cluster *Negative alterations in cognition and mood* was added), a limitation of the study's approximated PTSD prevalence is that it may not accurately estimate PTSD prevalence according to the most recent DSM criteria. A new and updated HTQ-5 version using the DSM-V criteria was introduced in 2018, though this version is in the early phases of validity and reliability testing (Megan Berthold et al., 2019). Moreover, the World Health Organization introduced a somewhat different and simplified diagnostic framework for PTSD in the 11th version of the International Classification of Diseases, ICD-11, with a reduction in the number of symptoms required for the PTSD diagnosis compared to the DSM-V (6 vs. 20, respectively), and the introduction of Complex PTSD, CPTSD (Maercker et al., 2013). Validation studies in several non-refugee populations have supported this simplified model (Hansen, Hyland, Armour, Shevlin, & Elklit, 2015), and evidence is also emerging supporting the validity and use of the ICD-11 to estimate PTSD in refugee populations (Barbieri et al., 2019; Vallières et al., 2018; Vang, Nielsen, Auning-Hansen, & Elklit, 2019). Although there are several overlapping diagnostic criteria for PTSD/CPTSD in the DSM and ICD-11 diagnostic frameworks (Hansen et al., 2015), there is some evidence to suggest that they will estimate somewhat

different prevalence in refugee populations (Barbieri et al., 2019). Therefore, the present study's approximated PTSD prevalence must be interpreted in light of the HTQ's reliance on the now outdated DSM-IV criteria in addition to the uncertainty regarding optimal cut-off to define PTSD caseness among adult refugees from Syria. Table S1 in the supplementary material shows the result of fully adjusted *linear* regression analysis of PTSD symptom severity (i.e. HTQ mean-item score) regressed on relevant predictors. As can be seen from the table, the overall findings are fairly consistent with the fully adjusted logistic models in Table 4 in terms of which predictors associate with PTSD, though the statistical evidence in the linear models is generally stronger. Additionally, *Time in Norway* crosses the 0.05 significance level in the linear model.

The study's approximated prevalence of around 40% for depression and 30% for anxiety are somewhat higher than estimates in prior major reviews on general refugee populations (Blackmore et al., 2020; Bogic et al., 2015; Steel et al., 2009) and notably higher than those in recent reviews by Charlson et al. on conflict-affected populations (Charlson et al., 2016, 2019). They are nonetheless well within the range of estimates in these reviews. If the more conventional cut-off of 1.75 was used for depression (instead of 1.80), the estimated prevalence was 43.7%. The overall high degree of exposure to PTEs among study participants in the present study, taken together with the documented positive association between PTE exposure level and depression (Steel et al., 2009), may explain part of why at least depression estimates in the present study are comparatively high. When comparing depression and anxiety estimates to other studies on adult refugees from Syria only, findings are more congruent, with most studies reporting depression prevalences around 30% to 40% and anxiety prevalences around 20% to 35% (Peconga & Høgh Thøgersen, 2020; Strømme et al., 2020). The measures used for depression in these studies were quite diverse: six different measures or versions of scales were used across the eight reported studies; suggesting a certain robustness of findings to the measurement method applied. Again, when the present study is compared to its sister-study in Sweden, depression and anxiety estimates are highly comparable. Weighted depression prevalence in the Swedish study was estimated at 40.2% vs. 45.2% in the present study, and weighted anxiety prevalences were estimated at 31.8% and 30.1% in Sweden and Norway, respectively. As highlighted in the discussion on PTSD above, the consistency in estimates across the two studies, given their many similarities, is reassuring from the point of view of reliability of results. Comparing the logistic models to the linear models of symptom severity of anxiety and depression in the supplementary

material (Table S1), findings are again quite similar in terms of the patterns of associations. However, there was some evidence in the linear models that divorced/widowed refugees had more symptoms of both anxiety and depression compared to married ones and weak evidence that refugees arriving alone had more symptoms of depression compared to refugees who came with family/spouse (none of these was above the 0.05 threshold in logistic regression).

For all outcomes in the present study – checklist-positive PTSD, anxiety and depression – it is of course important to stress that mental ill health does not fit neatly into dichotomized, disease/no-disease categories. Refugees whose symptoms scores fall below population-derived thresholds may nonetheless suffer psychological distress that adversely impacts their lives and functioning and that could warrant clinical attention. Screening instruments are just that, and cannot replace more in-depth face-to-face interviews where nuances, subtleties and individualities may be detected and explored in further details whenever necessary.

The findings of clear dose-response associations between cumulative traumatic exposure (PTE-AR) and all three mental disorders are in line with prior evidence (Bogic et al., 2015; Steel et al., 2009), and congruent with studies in non-refugee populations (Kessler et al., 2009; Koenen et al., 2017). Specifically, the study's approximated prevalence across PTE-AR categories and the meta regression estimates from Steel et al. are surprisingly similar for both $PTSD^{>2.06}$ and depression. The exception is that refugees in the highest PTE-AR category in the present study had higher estimated prevalences for both disorders, which could be related to the overall high cumulative PTE burden in the study population with potentially more participants having PTE-ARs closer to 1.0, pushing estimates upwards. The adjusted ORs in multivariable models tell a similar story of markedly increased odds of all cp-MDs with increasing PTE-ARs. The changes in ORs between crude and adjusted models were generally small (except for cp-$PTSD^{\geq 2.5}$), indicating limited confounding by covariates in the models. When the fully adjusted models were repeated with imputed data using MICE, the statistical evidence for a dose-response association was even stronger, and, for $PTSD^{>2.06}$, the ORs were pushed further from the null value of 1.00 (results not shown in tables).

There was weak evidence in the fully adjusted model that female gender was associated with higher odds of $PTSD^{>2.06}$. In sensitivity analyses, the results were mixed, with a clear positive association between female gender and higher PTSD symptom levels in linear regression, though no association when the fully adjusted logistic model was rerun on imputed

Table 4. Crude and adjusted logistic regression models with odds ratios, ORs, and 95% CIs for checklist-positive PTSD using both the 2.06 and 2.5 cut-off on the Harvard Trauma Questionnaire to define PTSD caseness.

| | | cp-PTSD >2.06 | | | | | | cp-PTSD ≥2.5 | | | | | |
| | | Model 1 (crude) | | Model 2 (n=710) | | Model 3 (n=508) | | Model 1 (crude) | | Model 2 (n=710) | | Model 3 (n=508) | |
		OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Gender	Female	0.85	(0.63–1.14)	1.46	(0.96–2.22)	1.73[a]	(1.04–2.88)	0.73	(0.49–1.09)	1.21	(0.70–2.08)	1.68	(0.84–3.35)
Age	30–39 yrs	1.01	(0.68–1.48)	1.06	(0.63–1.78)	1.58	(0.82–3.02)	1.39	(0.81–2.40)	1.44	(0.72–2.89)	2.43	(0.95–6.22)
	40–49 yrs	1.07	(0.71–1.62)	1.24	(0.70–2.22)	1.68	(0.82–3.44)	1.16	(0.64–2.10)	1.40	(0.64–3.09)	1.94	(0.68–5.55)
	≥50 yrs	1.76[a]	(1.14–2.72)	2.79[b]	(1.47–5.28)	3.50[b]	(1.57–7.81)	2.05[a]	(1.15–3.68)	2.38[a]	(1.04–5.43)	3.65[a]	(1.19–11.2)
Education	10–12 yrs	0.97	(0.65–1.45)	1.01	(0.62–1.62)	1.05	(0.59–1.86)	1.01	(0.58–1.76)	0.89	(0.47–1.68)	1.03	(0.46–2.32)
	>12 yrs	1.24	(0.91–1.69)	1.07	(0.72–1.61)	1.26	(0.77–2.07)	1.35	(0.89–2.05)	1.16	(0.70–1.93)	1.42	(0.73–2.75)
Marital status	Div./widow	1.94[a]	(1.17–3.22)	1.78	(0.91–3.48)	1.59	(0.65–3.88)	2.05[a]	(1.11–3.77)	1.62	(0.78–3.37)	2.08	(0.79–5.46)
	Unmarrie[d]	1.41[a]	(1.02–1.93)	1.84[a]	(1.10–3.07)	2.18[a]	(1.16–4.11)	1.38	(0.91–2.10)	1.30	(0.67–2.51)	1.47	(0.63–3.45)
Ref. status	Quota ref	0.79	(0.57–1.09)	0.84	(0.53–1.35)	1.20	(0.60–2.39)	0.79	(0.51–1.20)	1.08	(0.59–1.97)	2.10	(0.87–5.04)
	Fam reunion	0.92	(0.61–1.39)	1.21	(0.66–2.20)	1.32	(0.63–2.79)	0.64	(0.35–1.15)	0.81	(0.36–1.84)	0.94	(0.33–2.62)
Arrived with …	… friends only	1.22	(0.68–2.20)	1.26	(0.59–2.73)	0.85	(0.31–2.30)	1.12	(0.49–2.59)	1.22	(0.44–3.35)	0.92	(0.22–3.81)
	… alone	1.59[b]	(1.17–2.18)	1.47	(0.93–2.33)	1.54	(0.86–2.74)	2.07[c]	(1.39–3.08)	1.99[a]	(1.12–3.52)	1.77	(0.80–3.89)
Prior fam Norway	No	1.04	(0.77–1.41)	1.06	(0.68–1.66)	0.73	(0.43–1.25)	1.14	(0.75–1.72)	0.91	(0.52–1.61)	0.77	(0.38–1.54)
PTE-AR	0.20–0.29	2.75[b]	(1.31–5.75)	2.51[a]	(1.12–5.62)	2.08	(0.83–5.25)	2.98	(0.99–8.90)	1.82	(0.53–6.24)	1.75	(0.44–6.98)
	0.30–0.39	3.92[c]	(2.11–7.28)	3.61[c]	(1.84–7.11)	2.35[a]	(1.08–5.10)	3.59[b]	(1.39–9.24)	2.84[a]	(1.07–7.51)	1.74	(0.56–5.43)
	≥0.40	8.37[c]	(4.82–14.5)	8.38[c]	(4.56–15.4)	7.74[c]	(3.90–15.3)	7.20[c]	(3.08–16.8)	5.95[c]	(2.50–14.2)	4.34[b]	(1.63–11.6)
Length flight	per category	0.96	(0.82–1.12)			1.04	(0.83–1.31)	0.96	(0.77–1.20)			0.92	(0.66–1.26)
Time Norway	per category	1.29[b]	(1.08–1.55)			1.30	(0.96–1.75)	1.60[c]	(1.23–2.08)			1.48[a]	(1.00–2.19)

Significant results (p > 0.05) highlighted in bold: [a] p < 0.05 [b] p < 0.01 [c] p < 0.001.
Model 1: unadjusted/univariable logistic regression (i.e. separate logistic models for each predictor, with each model containing only the outcome and one predictor in question).
Model 2: adjusted for all variables in table except *Length of flight* and *Time Norway*.
Model 3: adjusted for all variables in table.
For models 2 and 3, the number of participants contributing data is indicated at the top of the respective columns.
Ref.groups: male (Gender); 18–29 (Age); ≤9 yrs (Edu); married (Mar. status); asylum seeker (Ref. status); family/spouse (Arrived with); Yes (Prior fam Norway); <0.20 (PTE-AR).

Table 5. Crude and adjusted logistic regression models with odds ratios, ORs, and 95% CIs for checklist-positive anxiety and depression.

| | | cp-Anxiety | | | | | | cp-Depression | | | | | |
| | | Model 1 (crude) | | Model 2 (n=718) | | Model 3 (n=512) | | Model 1 (crude) | | Model 2 (n=708) | | Model 3 (n=505) | |
		OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Gender	Female	1.30	(0.97–1.75)	2.30[c]	(1.51–3.50)	2.73[c]	(1.65–4.53)	1.03	(0.78–1.37)	2.14[c]	(1.41–3.23)	2.38[b]	(1.44–3.94)
Age	30–39 yrs	0.96	(0.65–1.42)	1.09	(0.66–1.80)	1.14	(0.62–2.11)	1.06	(0.73–1.54)	1.28	(0.78–2.12)	1.43	(0.77–2.68)
	40–49 yrs	0.82	(0.54–1.26)	1.03	(0.58–1.84)	0.98	(0.49–1.97)	1.05	(0.70–1.56)	1.83[a]	(1.05–3.21)	2.11[a]	(1.06–4.22)
	≥50 yrs	1.58[a]	(1.02–2.45)	2.82[b]	(1.50–5.30)	2.83[b]	(1.30–6.17)	1.61[a]	(1.05–2.47)	3.08[b]	(1.63–5.82)	3.63[b]	(1.64–8.00)
Education	10–12 yrs	1.14	(0.76–1.70)	1.24	(0.78–1.98)	1.34	(0.77–2.32)	1.10	(0.75–1.61)	1.13	(0.71–1.79)	1.44	(0.83–2.50)
	>12 yrs	1.16	(0.84–1.59)	1.09	(0.73–1.62)	1.18	(0.72–1.93)	1.33	(0.98–1.80)	1.08	(0.73–1.59)	1.24	(0.76–2.01)
Marital status	Div./widow	1.89[a]	(1.14–3.14)	1.34	(0.69–2.59)	1.29	(0.54–3.09)	2.33[b]	(1.40–3.87)	2.06[a]	(1.05–4.02)	1.68	(0.69–4.08)
	Unmarried[d]	1.35	(0.97–1.86)	1.96[b]	(1.18–3.25)	2.02[a]	(1.09–3.73)	1.67[b]	(1.22–2.28)	2.90[c]	(1.76–4.78)	2.98[c]	(1.62–5.50)
Ref. status	Quota ref	0.85	(0.61–1.18)	0.91	(0.57–1.45)	1.78	(0.91–3.49)	0.70[a]	(0.51–0.96)	0.61[a]	(0.39–0.97)	1.35	(0.69–2.65)
Arrived with ...	Fam reunion	1.05	(0.70–1.59)	1.03	(0.57–1.88)	1.28	(0.62–2.65)	0.65[a]	(0.43–0.98)	0.65	(0.36–1.16)	0.95	(0.46–1.98)
	friends only	1.11	(0.61–2.02)	1.46	(0.69–3.10)	1.52	(0.61–3.77)	1.07	(0.61–1.90)	0.79	(0.37–1.66)	1.09	(0.44–2.71)
	alone	1.43[a]	(1.04–1.97)	1.39	(0.87–2.20)	1.27	(0.72–2.26)	1.66[b]	(1.22–2.25)	1.33	(0.85–2.07)	1.46	(0.83–2.56)
Prior fam Norway	No	0.80	(0.59–1.09)	0.91	(0.59–1.41)	0.74	(0.45–1.24)	1.10	(0.82–1.47)	1.04	(0.67–1.60)	0.77	(0.46–1.29)
PTE-AR	0.20–0.29	1.50	(0.76–2.98)	1.36	(0.63–2.91)	1.80	(0.78–4.15)	1.17	(0.61–2.25)	1.13	(0.54–2.36)	1.09	(0.45–2.61)
	0.30–0.39	2.12[b]	(1.22–3.67)	2.12[a]	(1.15–3.91)	1.61	(0.79–3.29)	2.41[b]	(1.46–3.97)	2.51[b]	(1.42–4.41)	2.25[a]	(1.14–4.41)
	≥ 0.40	3.93[c]	(2.46–6.28)	4.43[c]	(2.60–7.54)	4.21[c]	(2.28–7.78)	4.25[c]	(2.76–6.53)	4.91[c]	(2.98–8.09)	4.85[c]	(2.67–8.83)
Length flight	per category	0.96	(0.82–1.12)			0.98	(0.78–1.23)	0.91	(0.78–1.06)			0.94	(0.75–1.18)
Time Norway	per category	1.20[a]	(1.00–1.43)			1.52[b]	(1.14–2.04)	1.42[c]	(1.20–1.69)			1.52[b]	(1.13–2.05)

Significant results (p > 0.05) highlighted in bold: [a] p < 0.05 [b] p < 0.01 [c] p < 0.001.
Model 1: unadjusted/univariable logistic regression (i.e. separate logistic models for each predictor, with each model containing only the outcome and one predictor in question).
Model 2: adjusted for all variables in table except *Length of flight* and *Time Norway*.
Model 3: adjusted for all variables in table.
For models 2 and 3, the number of participants contributing data is indicated at the top of the respective columns.
Ref.groups: male (Gender); 18–29 yrs (Age); ≤9 yrs (Edu); married (Mar. status); asylum seeker (Ref. status); family/spouse (Arrived with); Yes (Prior fam Norway); <0.20 (PTE-AR).

data. This may reflect the mixed results in prior reviews (e.g. 7,10,11,14) although several studies looking only at refugees from Syria have found that female gender is a risk-factor for PTSD (Acarturk et al., 2018; Alpak et al., 2015; Javanbakht et al., 2019). Interestingly, in unadjusted analysis, it appeared that females had equal, or even lower risk of PTSD compared to men, though this was likely due to strong confounding by other variables, especially PTE exposure (i.e. men reported significantly more exposure to PTEs than women). When testing if the association between gender and PTSD varied across strata of PTE-AR, that is, whether gender and PTE-AR interacted, we did not find any evidence of this. The strong associations between female gender and both cp-Anxiety and cp-Depression in fully adjusted models is somewhat discordant with the bulk of evidence on refugees at large, which tend to report weaker or no associations (Bogic et al., 2015; Peconga & Høgh Thøgersen, 2020; Porter & Haslam, 2005; Steel et al., 2009), though consistent with several studies on Syrian refugees (Acarturk et al., 2018; Javanbakht et al., 2019). Again, there was strong confounding by covariates causing marked differences between crude ORs showing no associations, and adjusted ORs with very strong evidence of associations. Studies to date have not reached consensus on the link between gender and mental ill health in refugee populations, in part due to nuances and complexities that may be missed in cross-sectional studies. A recent, large, 4-wave longitudinal study exploring the relationships between pre- and post-migratory stressors and mental health outcomes in resettled refugees in Australia observed marked differences between genders, and patterns of associations which fluctuated over time (Wu et al., 2021). This research encourages careful consideration of the way gender and mental health interact in this population. Future studies exploring gender in relation to mental health in refugee populations are needed – e.g. are the mental health effects of post-resettlement stressors such as financial and social strain, discrimination and language difficulties gendered or gender-neutral; are the mental health trajectories different for males and females after resettlement in a host country and what are risk and protective factors for healthy trajectories across gender. The finding that time in Norway was positively associated with both cp-Anxiety and cp-Depression is consistent with some prior research in the field (e.g. Heeren et al., 2014), however, there is no consensus in this finding (for an overview, please see 21). There are, of course, a multitude of factors that may interact with length of stay and contribute to mental health outcomes, many of which relate to the conditions in the host country around asylum processes, economic support, integration policy, and social support. Nonetheless, one way to interpret this finding could also be that the adverse consequences on

mental health conferred by the many adversities refugees typically experience prior to resettlement do not necessarily go away by themselves just by removing refugees from the context of trauma/war and placing them in safer environments. This supports the importance of actively screening for and intervening against psychological distress and mental disorders in this vulnerable group by host countries.

The present study has one obvious and potentially serious limitation in that less than 10% of invited participants returned the questionnaire. If participants are not representative of the source population, the study's validity could be compromised. Applying post-stratification weights may partly correct for biased prevalence estimates due to selection bias, however, this procedure assumes that participants in weight-defining strata are representative of all members of that strata in the source populations. Comparing early-responders who returned the questionnaire within the first month of study launch ($n = 433$) to late-responders (returned after the first month; $n = 464$), there was slight evidence that early-responders had higher odds of cp-PTSD$^{>2.06}$ (but not cp-PTSD$^{>2.5}$), though no evidence of a difference in the odds for cp-Anxiety or cp-Depression was found. The consistency in findings between the present study and the sister-study in Sweden where the participation rate was above 30% also gives some reassurance that selection bias has not grossly skewed findings. Nonetheless, we cannot rule out issues with selection bias due to the low response rate. Another potential limitation concerns how missing data was handled for pre- and peri-migratory PTEs. Sensitivity analysis showed that allowing for more missing when calculating the PTE-AR somewhat increased prevalence estimates in the lowest PTE-AR group, and consequently pushed ORs downwards for the other PTE-AR groups in multivariable models for all mental disorders, though not substantially. On a more general level, there is marked variability in how different studies measure PTEs (e.g. the number and types of PTEs inquired about), which should be kept in mind when interpreting findings related to the PTE-AR. The cross-sectional design of the study places clear constraints on the ability to draw causal conclusions from findings, even if most of the study's predictor variables are objective in nature and many have a temporal order. Lastly, given that a fairly large number of statistical tests were conducted and some of them were not pre-registered in detail (e.g. Table 3), there is a risk that some findings are chance-findings (i.e. type-I error). Given the consistency with theory and prior evidence, and the clear dose-response relationship, we believe it is unlikely that the associations between PTE-ARs and mental ill health are due to chance even if the analytic handling of the PTE-AR variable was not pre-registered.

4. Conclusion

Congruent with a large and growing body of literature on mental health in refugee populations, the present study suggests a clearly elevated burden of PTSD, anxiety and depression in adult refugees from Syria recently resettled in Norway compared to general, non-refugee populations (Kessler et al., 2009; Koenen et al., 2017). The study also found strong evidence in support of the established adverse links between pre- and periflight traumatic experiences and mental health. The consistency of prevalence estimates for the above mental disorders in the present study and sister-study in Sweden, given the high degree of methodological overlap between the studies, lends credibility to the methods used and the robustness and accuracy of findings. The study underlines the importance of screening for and intervening on mental health problems in newly arrived refugees.

Data availability statement

Data are available upon reasonable request. Deidentified participant data will be made available for reuse upon reasonable request pending ethics approval, compliance with the General Data Protection Regulation (GDPR), and discretion of the research group with regard to the prospective research project proposals. Requests should be sent to the corresponding author: a.f.w.nissen@nkvts.no.

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Paper IV

IV

IV

BMC Psychiatry

Chronic pain, mental health and functional impairment in adult refugees from Syria resettled in Norway: a cross-sectional study

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Abstract

Background: Limited research exists on pain and especially the co-occurrence of pain and mental ill health in general refugee populations. The present study aimed to approximate the prevalence of chronic pain (CP) among adult refugees from Syria resettled in Norway; investigate the association between CP and mental ill health; and explore how CP and mental ill health associate with both perceived general health and functional impairment. Gender as potential effect modifier in these associations was also examined.

Methods: Cross-sectional, postal survey questionnaire. Inclusion criteria: ≥ 18 years old; refugee from Syria; and arrived in Norway between 2015 and 2017. Study sample was randomly drawn from full population registries, and $n = 902$ participated (participation rate ≈10%). CP was measured with 10 items on pain lasting for ≥ 3 consecutive months last year. Symptoms of anxiety, depression and PTSD were measured with the HSCL and HTQ scales, respectively. Ordered and binomial logistic regressions were used in analyses. Gender was tested as effect modifier with Wald test for interaction.

Results: In the sample overall, the proportion of participants who reported severe CP was 43.1%. There was strong evidence that anxiety, depression and PTSD were associated with higher levels of CP. In fully adjusted regression models, including both CP and mental health variables, CP was strongly associated with poor perceived general health whereas mental health showed much weaker associations. The association between mental health (anxiety and PTSD) and functional impairment was highly gender specific, with strong associations in men but not in women. CP was strongly associated with functional impairment with no difference across gender.

Conclusion: The study shows a high burden of CP in a general population of adult refugees from Syria with likely substantial adverse consequences for daily functioning**.** The strong association between CP and mental ill health suggests personnel working with refugees' health should be attuned to their co-occurrence as both problems may need to be addressed for either to be effectively mitigated. A clear mismatch exists between the burden on health caused by pain in general refugee populations and the amount of available evidence to guide mitigating strategies.

Trial registration: NCT03742128.

Keywords: Refugees, Syria, Mental health, Pain, Anxiety, Depression, PTSD, Functional impairment

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Background

A substantial body of evidence across various settings and populations has documented the close interconnectedness of psychological distress and somatic symptoms in general [1–3], and pain in particular [4–7]. The

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 2 of 16

underlying mechanisms behind the frequent co-occurrence of psychological distress and pain are complex, likely bidirectional and involve both genetic and environmental factors [7, 8]. For traumatized individuals with post-traumatic stress symptoms, the experience of elevated levels of pain is thought to be linked to disturbances in the processing of pain stimuli (pain sensitization); hypermnesia or overconsolidation of traumatic memories (imprinting); and synergistic physiological effects between trauma-related anxiety and pain perception. Transcultural psychiatric approaches stress the importance of sociocultural elements when investigating psychological and somatic symptoms across populations and the need to understand local illness models and idioms of distress [9–11]. Within this framework, variations in patterns of co-occurrence across ethnocultural groups documented in some studies are at least partly explained by cultural differences in how distress is experienced, represented and expressed, and relatedly, by fear of stigmatization [12–14].

Refugees are often exposed to a number of potentially traumatic experiences both before and during flight, and many experience post-migration hardships after resettling in a new country. The cumulative load of these stressors increases refugees' risk of mental ill health [15–18]. Elevated rates of post-traumatic stress disorder (PTSD), depression and anxiety have repeatedly been found in refugee populations (e.g., [19, 20]). High levels of pain have also been documented in studies on selected refugee groups – e.g. war-wounded refugees, refugees exposed to torture and refugees in clinical settings [21–26]. However, studies on pain in general refugee populations are scant. One recent, two-wave, longitudinal study on resettled Syrian refugees in Norway found chronic pain to be fairly constant over time at around 30% [27], and pain was found to be frequently reported among refugees from Syria residing in Turkey [28] and among Rohingya refugees in Bangladesh [29].

In a work commissioned by the UNHCR on culture, context and the mental health and psychosocial well-being of Syrians from 2015, Hassan et al. note that "…most Arabic and Syrian idioms of distress do not separate somatic experience and psychological symptoms, because body and soul are interlinked in explanatory models of illness" (p. 22 in [30]). They further note potential stigma against expressing certain negative emotions, especially in men and if emotions are labeled as 'psychological' or 'psychiatric'. The issue of stigma against negative emotions is also pointed out by other researchers working with Arab populations [12]. As a consequence, it has been noted that physical symptoms may be the initial and predominant presenting complaints for people with psychological or mental health issues [30]. With

several studies documenting a high burden of mental ill health among refugees from Syria in recent years (for an overview, please refer to [31]), it seems vital, therefore, to expand knowledge on the co-occurrence and possible relationship of psychological and somatic symptoms in this population. This could be of value to healthcare providers by sensitizing them to the complex manifestations of distress, which in turn could help ensure needs are recognized and addressed adequately. Yet, there is notable shortage of studies addressing this topic, both among refugees from Syria and among other refugee populations.

The present study focuses on pain and the co-occurrence of pain and psychological distress in a general refugee population. Nonetheless, due to the limited number of studies on this topic, relevant evidence from a broader range of somatic symptoms, including the category formerly known as "somatoform disorders" in the DSM diagnostic systems, is at times included. Pain is both a central feature of most instruments used to measure somatic distress/somatization and one of the most frequently reported somatic symptoms in refugee populations (e.g., [28, 32]). Moreover, evidence suggests symptom groups (e.g. musculoskeletal, gastrointestinal) do not show differential association with psychological distress [1]. Importantly, the "somatoform disorders" have been reconceptualized in the most recent versions of both major diagnostic frameworks (DSM-V and ICD-11), partly to remove "medically unexplained symptoms" as a diagnostic criterion, which was thought to be unreliable, stigmatizing to patients and 'perilous in its reliance on mind–body dualism' (p. 233 in [33]). The latter point may be particularly relevant in the context of illness models with a less dichotomous understanding of body and mind. Therefore, evidence from studies on somatic distress/somatization in refugee populations should be interpreted with care. Interpretations must incorporate an understanding of and appreciation for local idioms and explanatory models of distress, and, even if no medical explanation is found for somatic symptoms, that does not mean that none exists [34]. For example, many refugees have been exposed to torture which can have long-term consequences for, and a complex relationship with, pain [35, 36].

We have only identified one study exploring psychological distress and pain in a general refugee population, which was conducted on Syrian refugees resettled in Norway [37]. Interestingly, the study found no associations between pain and mental ill health (i.e. anxiety, depression and PTSD) in the first wave of the study, when refugees were still residing in Lebanon, awaiting resettlement. However, fairly strong associations were found at the follow-up measurement about a year after resettlement. The latter

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 3 of 16

finding is broadly supported by three recent and large cross-sectional studies on refugees and war-displaced persons which found clear associations between anxiety, depression and PTSD and somatic distress, as measured by the Patient Health Questionnaire (PHQ-15), where pain is a core component [28, 38, 39]. Further support comes from a matched control study on Bhutanese torture survivors, which found that somatic complaints were associated with PTSD and depression [40], and from studies on clinical subsamples documenting close links between pain and mental ill health [24, 41–43].

The associations of pain with functional impairment and perceived general health are also understudied in refugee populations. The degree of pain experienced by severely traumatized and tortured refugees and the associated level of functional disability has been shown to be substantial compared to many non-refugee groups suffering from pain conditions [43, 44]. Pain has also been strongly linked to low health-related wellbeing among female Yazidi refugees who experienced extreme violence by the "Islamic state" [32]. Furthermore, in a general population of conflict-affected persons in the Republic of Georgia, somatic distress was strongly associated with increased functional disability, even after controlling for mental ill health [38]. We know of no prior study that has investigated functional impairment in relation to pain and mental ill health (i.e. anxiety, depression and PTSD) in refugees.

An abundance of evidence from both refugee and non-refugee populations has documented that pain conditions and somatic distress are substantially more prevalent in women (e.g., [28, 38, 39, 45, 46]), suggesting studies on this topic should investigate and report gender-specific patterns. This aligns with general recommendations for research on refugees which emphasize the importance of exploring the role of gender across studies, as this has been insufficiently prioritized in the past [20, 47]. Recent evidence suggests gender is a key moderating factor between various migration-related stressors and mental health [48–50].

Using cross-sectional questionnaire data from adult refugees from Syria resettled in Norway, the primary aims of the present study were to assess the burden of chronic pain in this population and to explore the associations of chronic pain with anxiety, depression and PTSD. Secondary aims included to investigate unique and overlapping associations of chronic pain and mental health with perceived general health and functional impairment, and to test gender as an effect modifier in the above associations.

Methods

The primary aims were broadly outlined in the study's pre-registration in ClinicalTrial.gov (NCT03742128, 15/11/2018), though some data-handling decisions were made with data in-house and deviated slightly from the registered plan (these are highlighted in Additional file 1, which also includes the pre-registered analysis plans). All regression models were built with data at hand, and secondary aims were developed post-hoc, meaning these are hypothesis-generating rather than hypothesis-testing even if they are rooted in theory and prior research [51, 52].

Design and participants

The present study used a questionnaire-based cross-sectional design. Eligible participants included all adult ($\geq$ 18 years old) refugees from Syria who were granted temporary or permanent residency in Norway between 2015 and 2017. A complete list of eligible participants was obtained from the population registry in Norway ($N = 14{,}350$), and from this list, 10,000 individuals were randomly sampled for participation. All sampled participants were sent a study invitation letter together with the actual questionnaire and an informed consent form to be signed and returned with the questionnaire, all in formal Arabic. The letter also contained contact information in the event of adverse reactions following participation. The invitations were sent out in November 2018. Due to a low response rate, the study did not close until September 2019. Several efforts were made to boost participation including one postal or telephone reminder to all non-responders. The Regional Committees for Medical and Health Research Ethics (REK) – Region Southeast (A) in Norway granted ethical approval for the study (reference number 2017/1252). All parts of the study were conducted in accordance with the protocol approved by REK and in line with relevant regulations.

Variables and measurements
Chronic pain (CP)

Questions on CP consisted of two parts. The first part concerned musculoskeletal pain- and stiffness and was taken from the Tromsø Study which has been used extensively in the last decades in many large epidemiological studies in Norway (e.g., [53, 54]). Specifically, participants were asked to indicate whether they had been troubled with pain or stiffness in muscle and joints for a minimum of three consecutive months in the last year. The question was asked for five different body regions (neck/shoulders; arms/hands; upper back; lower back; hips/legs/feet), all with the same three answer choices provided: not troubled (= 1); somewhat troubled (= 2); very troubled (= 3).

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 4 of 16

In the second part, participants were asked to indicate whether they had been troubled with pain for more than three consecutive months in the last year in five other body regions (stomach; head; genital area; chest; other), using the same answer choices. These items were also based on the Tromsø study, though slightly adapted. For each of the two parts, participants who answered 1 (not troubled) on all items and had a maximum of one missing, were categorized as "no CP". Participants who answered at least one item with 2 (somewhat troubled) or 3 (very troubled), were categorized as "some CP" or "severe CP", respectively, regardless of the number of missing [53]. The two parts were then combined for an overall CP variable with 3 categories coded as follows: "No CP" = "not troubled" for both parts; "Some CP" = at least one part with "somewhat troubled" (and no part with "very troubled"); and "Severe CP" = at least one part with "very troubled".

Perceived general health (PGH)
Question taken from the European Social Survey 2010 [55]. The question asks "How is your health in general" and provides six answer choices: very bad (=1); bad (=2); fair (=3); good (=4); very good (=5) and don't know (=6). The variable was dichotomized into "Good PGH" (answer choices 4 and 5) and "Poor PGH" (answer choices 1–3). The "don't know" category was recoded as missing.

Functional impairment (FI)
Question taken from the European Social Survey 2010 [56]. The question asks: "Are you hampered in your daily activities in any way by any longstanding illness, or disability, infirmity or mental health problem?". There are four possible answer choices provided: no (=1); yes, to some extent (=2); yes, a lot (=3); and don't know (=4). This variable was dichotomized into "No FI" (answer choice 1) vs. "Some/a lot FI" (answer choices 2 and 3), whereas the "don't know" category was recoded as missing.

Mental ill health
Symptoms of anxiety and depression were measured with the 25 item Hopkins Symptom Checklist, HSCL-25 [57], whereas PTSD symptoms were measured by the Harvard Trauma Questionnaire (HTQ) [58]. The first ten items of HSCL-25 measure anxiety and the last 15 depression. All items are scored on a 4-point scale from 1 ("not at all") to 4 ("extremely"). A mean-item score was estimated for participants with < 3 missing on each subscale, and two dichotomized variables, HSCL-anxiety and HSCL-depression, were created based on cut-offs of 1.75 and 1.80 for anxiety and depression, respectively. The choice of cut-off was made to be consistent with the sister-study

in Sweden [59], and was pre-registered prior to study start. It was also the chosen cut-off in a prior publication assessing the burden of mental ill health in the present study sample [60]. The 16 items used from the HTQ (section IV) are also scored from 1 ("not at all") to 4 ("very much"), and a mean-item score was created for those with < 3 missing. A dichotomized HTQ-PTSD variable was created to indicate those with screen-positive PTSD with a cut-off of 2.06, using the same rationale for the choice of cut-off as above. Both scales have been widely used to measure mental health problems in refugees, and several studies have supported the scales' validity and reliability across different refugee populations (e.g., [61–63]), though recent evidence suggests caution may be warranted before using the depression subscale in Arabic speaking refugees [64]. Cronbach's alpha for the scales in the present sample were 0.96 (HSCL$_{total}$), 0.93 (HSCL$_{anxiety}$), 0.94 (HSCL$_{depression}$), and 0.92 (HTQ$_{total}$).

Potentially traumatic experiences (PTEs)
PTEs prior to- and during flight was measured with the Refugee Trauma History Checklist (RTHC), created and validated by Sigvardsdotter and colleagues [65, 66]. The scale asks about eight PTEs prior to flight (e.g. "War at close quarter", "Torture") and the same PTEs during flight for a total of 16 items. Each item is answered with Yes/No. A new variable named PTE-adversity ratio (PTE-AR) was created based on the work by Steel et al. [15], which equaled the number of endorsed items (i.e. "Yes") divided by 16. The variable was categorized into four groups: < 0.2; 0.2–0.29; 0.3–0.39; and ≥ 0.4.

Sociodemographic and background variables
Age and gender were obtained from Norwegian registry data, with age categorized into 18–29 years; 30–39 years; 40–49 years; 50–64 years; and ≥ 65 years in line with the study's pre-registration. Self-reported data was used for marital status (categorized into: unmarried; married/registered partner; and divorced/separated/widow(er), years of education (categorized into: ≤ 9 years; 10–12 years; and > 12 years), refugee status (asylum seeker; quota refugee; and family reunion), and immigration year (categorized into: 2010–2015; 2016; and 2017).

The items used to measure CP, PGH, FI and sociodemographic/background variables were translated into Arabic using a professional translation bureau. The translation was subsequently checked by two independent translators and discussed with an Arabic speaking reference group from Syria residing in Norway. The translations of the HSCL, HTQ and RTHC scales were obtained from collaborators at the Swedish Red Cross

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 5 of 16

University College in Sweden, who used double-blind and back-translation procedures in addition to interviews with Arabic-speakers to ensure validity [59].

Statistical analysis

Data was first inspected for errors, outliers, missing and distributional properties. Frequency distributions and cross tabulations with chi-square test of equal proportions were used to make descriptive tables and investigate bivariate associations. Ordered and regular logistic regression models were used to investigate the secondary aims of the study. All regression models were built in a forward manner, with sociodemographic/background variables only included in adjusted models if they were associated with the respective outcomes in bivariate analyses (*p*-value < 0.05). Gender, age and PTE-AR were included in adjusted models for a priori reasons regardless of bivariate association given their known association with both pain and mental health. The PTE-AR categories 0.20–0.29 and 0.30–0.39 and the immigration year categories 2016 and 2017 were combined in regression analysis due to few observations in the individual categories. Due to a fairly high number with missing data across variables, the regression analyses were done on imputed data. The imputed values were obtained using multiple imputation by chained equations, MICE [67], with all variables included in the imputation model.

Crude and adjusted ordered logistic regressions were used to investigate the associations of anxiety, depression and PTSD with CP. The odds ratios (ORs) presented indicate the odds of being in the higher category of CP for different predictor levels, regardless of which of the two possible ways CP is dichotomized – i.e. (3 and 2) vs. 1 or 3 vs. (2 and 1). Crude and adjusted logistic regressions were used to investigate the association of mental health variables and CP with perceived general health and functional impairment. Spearman's rank correlation was used to investigate possible multicollinearity between mental health variables and CP (deemed problematic if > 0.7). The Wald test for interaction was used to test whether gender modified the associations of mental ill health with CP, and/or the associations of mental ill health and CP with perceived general health and functional impairment.

Sensitivity analyses

Two sensitivity analyses were done on the fully adjusted regression models. First, all models were repeated with the chronic pain variable split into its two constituent parts: pain/stiffness in muscles and joints (5 items), and pain in other body part (5 items). Furthermore, given the abovementioned evidence questioning the construct validity of the HSCL among certain refugee populations [64], and the known theoretical and empirical overlap

between anxiety, depression and PTSD, regression models were repeated with anxiety, depression and PTSD combined into *one* common-mental-health-problem variable. This dichotomous variable, "Any mental health problem", was coded as "Yes" (= 1) if *any* of anxiety, depression or PTSD were above threshold, and No (= 0) if *all* of them were below threshold. The sensitivity analyses are presented in Additional files 2 and 3. Additional file 2 also contains detailed distributions of the two constituent parts of chronic pain.

Analyses were performed with Stata version 17 (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC).

Results

Of the roughly 10,000 invitations for participation sent out, 1,235 were returned due to incorrect address. Of those who presumably received the invitation, 902 participated, giving a response rate of about 10%. Participants were older and a higher proportion were married compared to the sample population, though there was no difference in gender distribution. For further statistics relating to representativity and possible selection bias problems, we refer to a prior publication [68]. Overall, 64.5% of participants were men, and the mean age was 38.9 (SD = 11.6; min. age = 19; max. age = 83). The degree of exposure to PTEs was high with over 50% in the highest category (affirmative on ≥ 40% of individual PTEs inquired about). Men reported more PTEs than women (Chi-square test of equal PTE-AR across gender: *p*-value = 0.01). The unweighted approximated prevalence of anxiety, depression and PTSD based on screening instruments were 31.7%, 40.0% and 34.7%, respectively, with no statistically significant difference between genders at the *p* = 0.05 threshold. Table 1 gives further descriptive statistics for all participants and stratified by gender.

Table 2 shows the frequency distributions of CP, PGH and FI, and bivariate associations with predictors/covariates of interest. For the total sample, 43.1% reported severe CP, 39.9% poor PGH and 34.9% at least some degree of FI. Being a woman was positively associated with CP and poor PGH, but not FI. There was very strong evidence (*p*-value < 0.001) that anxiety, depression and PTSD were associated with elevated levels of CP, poor PGH and FI in bivariate analyses.

Table 3 presents crude and adjusted ordered logistic regression models of CP. Being a woman was associated with roughly 50% higher odds of CP in both unadjusted and adjusted models (OR$_{fully~adjusted}$ = 1.55; 95% CI 1.13–2.12). There was very strong evidence in both crude and adjusted models that all mental ill health variables (i.e. anxiety, depression and PTSD) were associated

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 6 of 16

Table 1 Descriptive statistics, all respondents and stratified by gender (*n* = 902)

		All respondents		Stratified by gender			
				Men (*n* = 582)		Women (*n* = 320)	
		n	(%)	n	(%)	n	(%)
Age (*n* = 902)	18–29 yrs	197	(21.8)	119	(20.5)	78	(24.4)
	30–39 yrs	310	(34.4)	205	(35.2)	105	(32.8)
	40–49 yrs	230	(25.5)	144	(24.7)	86	(26.9)
	≥ 50	165	(18.3)	114	(19.6)	51	(15.9)
Education (*n* = 882)	≤ 9 yrs	394	(44.7)	244	(43.0)	150	(47.8)
	10–12 yrs	158	(17.9)	91	(16.0)	67	(21.3)
	> 12 yrs	330	(37.4)	233	(41.0)	97	(30.9)
Marital status (*n* = 902)	Unmarried	236	(26.1)	199	(34.2)	37	(11.6)
	Married/partner	595	(66.0)	349	(60.0)	246	(76.9)
	Divorced/wid	71	(7.9)	34	(5.8)	37	(11.6)
Refugee status (*n* = 860)	Asylum seeker	454	(52.8)	366	(65.8)	88	(29.0)
	Quota refugee	273	(31.7)	154	(27.7)	119	(39.1)
	Family reunion	133	(15.5)	36	(6.5)	97	(31.9)
Immigration year (*n* = 856)	2010–2015	509	(59.5)	394	(71.4)	115	(37.8)
	2016	163	(19.0)	72	(13.0)	91	(29.9)
	2017	184	(21.5)	86	(15.6)	98	(32.2)
PTE-AR (*n* = 819)	< 0.20	163	(19.9)	92	(17.4)	71	(24.5)
	0.20–0.29	79	(9.7)	44	(8.3)	35	(12.1)
	0.30–0.39	158	(19.3)	103	(19.5)	55	(19.0)
	≥ 0.40	419	(51.1)	290	(54.8)	129	(44.4)
HSCL-anxiety[a] (*n* = 886)	No	605	(68.3)	403	(70.3)	202	(64.5)
	Yes	281	(31.7)	170	(29.7)	111	(35.5)
HSCL-depression[b] (*n* = 877)	No	526	(60.0)	344	(60.3)	182	(59.5)
	Yes	351	(40.0)	227	(39.7)	124	(40.5)
HTQ-PTSD[c] (*n* = 877)	No	573	(65.3)	361	(64.0)	212	(67.7)
	Yes	304	(34.7)	203	(36.0)	101	(32.3)

PTE-AR Potentially Traumatic Experiences-Adversity Ratio

[a] Mean-item score on HSCL anxiety subscale > 1.75

[b] Mean-item score on HSCL depression subscale > 1.80

[c] Mean-item score on HTQ ≥ 2.06

with increased odds of CP (anxiety: OR$_{fully\ adjusted}$ = 2.42, 95% CI 1.64–3.55; depression: OR$_{fully\ adjusted}$ = 2.28, 95% CI 1.53–3.42; and PTSD: OR$_{fully\ adjusted}$ = 1.97, 95% CI 1.32–2.94). Wald test for interaction between gender and each of mental ill health variables did not reach statistical significance, though there was a tendency for a stronger association of anxiety with CP in women (*p*-value = 0.085). Furthermore, there was very strong evidence (*p* < 0.001) that older age was associated with higher levels of CP, and some evidence that marital status (i.e. widow(er)/separated/divorced vs. unmarried, *p* = 0.021) was associated with higher levels of CP.

The mean score for perceived general health (PGH) was 3.614 (SD = 1.063). Table 4 summarizes logistic regression models of PGH (poor = 1 vs. reference group

good = 0), focusing on the predictors gender, mental ill health and CP. Gender was not associated with PGH in fully adjusted models at the *p* = 0.05 level, though there was weak evidence in unadjusted and partially adjusted models. Anxiety, depression and PTSD were all strongly associated with PGH in crude models and fairly strong associations were also found in partially adjusted models which included background variables and all mental ill health variables (but not CP). However, in the fully adjusted model, there was only moderate evidence of an association for PTSD OR = 1.98 (95% CI 1.19–3.32); weak evidence for depression OR = 1.76 (95% CI 1.05–2.96); and no evidence for anxiety OR = 1.49 (95% CI 0.92–2.41). There was very strong evidence in all models, that both moderate CP (OR = 3.80, 95% CI 1.84–7.86)

Nissen *et al. BMC Psychiatry* (2022) 22:571

Page 7 of 16

Table 2 Frequency distributions of chronic pain[a], perceived overall health and impaired daily functioning due to longstanding illness

		Chronic pain[a] (%)				Perceived general health (%)			Impaired functioning (%)		
		No	Some	Severe	χ2	Very good/good	Fair/poor/very poor	χ2	No	Some/a lot	χ2
Total sample		19.8	37.1	43.1		60.1	39.9		65.1	34.9	
Gender	Men	22.3	37.5	40.2	0.013	63.0	37.0	0.022	65.8	34.2	0.605
	Women	15.2	36.2	48.6		54.9	45.1		64.0	36.0	
Age	18–29 yrs	31.3	37.4	31.3	< 0.001	77.9	22.1	< 0.001	80.6	19.4	< 0.001
	30–39 yrs	22.6	39.5	37.9		67.5	32.5		70.4	29.6	
	40–49 yrs	15.5	37.2	47.3		56.4	43.6		65.4	34.7	
	≥ 50	6.8	31.7	61.5		30.4	69.6		39.1	60.9	
Education	≤ 9 yrs	15.5	37.5	47.0	0.061	54.3	45.7	0.007	60.1	39.9	0.028
	10–12 yrs	22.6	36.8	40.6		61.9	38.1		67.7	32.3	
	> 12 yrs	23.3	37.1	39.6		65.8	34.2		70.0	30.0	
Marital status	Unmarried	28.2	35.9	35.9	< 0.001	70.6	29.4	< 0.001	70.9	29.1	0.005
	Married/partner	18.6	37.9	43.5		58.4	41.6		65.0	35.0	
	Divorced/widowed	2.9	33.3	63.8		38.7	61.3		48.4	51.6	
Refugee status	Asylum seeker	21.6	39.1	39.3	0.211	61.5	38.5	0.806	69.7	30.3	0.098
	Quota refugee	16.7	35.2	48.1		59.2	40.8		61.5	38.5	
	Family reunion	21.1	36.0	42.9		61.9	38.1		67.8	32.2	
Year immigration	2010–2015	20.9	37.3	41.8	0.024	61.6	38.4	0.042	66.8	33.2	0.103
	2016	16.8	28.5	54.7		51.3	48.7		57.8	42.2	
	2017	19.6	41.9	38.5		63.5	36.5		67.9	32.1	
PTE-AR	< 0.20	30.2	39.0	30.8	< 0.001	70.9	29.1	< 0.001	79.9	20.1	< 0.001
	0.20–0.29	25.6	37.2	37.2		70.1	29.9		73.0	27.0	
	0.30–0.39	20.5	40.4	39.1		62.8	37.3		67.7	32.4	
	≥ 0.40	14.9	34.7	50.4		51.9	48.1		55.8	44.2	
HSCL[b]-anxiety	No	26.8	43.0	30.2	< 0.001	71.9	28.1	< 0.001	78.7	21.3	< 0.001
	Yes	5.4	25.1	69.5		34.6	65.4		35.5	64.5	
HSCL[c]-depression	No	28.1	45.1	26.8	< 0.001	75.5	24.5	< 0.001	81.2	18.8	< 0.001
	Yes	8.0	25.2	66.8		36.7	63.3		40.0	60.0	
HTQ[d]-PTSD	No	27.2	43.5	29.3	< 0.001	73.2	26.8	< 0.001	79.7	20.3	< 0.001
	Yes	6.3	25.6	68.1		34.1	65.9		36.3	63.7	

PTE-AR Potentially Traumatic Experiences-Adversity Ratio

[a] Chronic pain (CP) was measured through 10 items answered on a 3-point Likert scale (no/somewhat/very troubled) and categorized into 3 groups: no CP ("no" on all 10 items); some CP ("somewhat troubled" on at least one item and no item as "very troubled"); and severe CP ("very troubled" on at least one item). All items asked about pain lasting for at least 3 months in the last year

[b] Mean-item score on HSCL anxiety subscale > 1.75

[c] Mean-item score on HSCL depression subscale > 1.80

[d] Mean-item score on HTQ ≥ 2.06

and severe CP (OR = 19.1, 95% CI 9.22–39.5) were associated with poor PGH. Gender did not modify the associations of mental health or CP with PGH.

Table 5 shows functional impairment (FI) regressed on gender, mental ill health variables, CP and background variables (not shown in table) using logistic regression. Gender was not associated with FI in any model. Anxiety, depression and PTSD showed very strong associations with FI in crude models and fairly strong associations in partially adjusted models. In fully adjusted models, there was fairly strong evidence of interaction between gender and all mental ill health variables – i.e. the associations of anxiety, depression and PTSD with FI were gender specific. For women, there was no evidence of an association between any of the mental ill health variables and FI (Model 5: Women). In contrast, for men, there was very strong evidence that both anxiety and PTSD were associated with more than

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 8 of 16

Table 3 Crude and adjusted ordered logistic regression models of chronic pain[a]

| | | Unadjusted | | Partially adjusted[d] | | | | | | Fully adjusted | | |
| | | Model 1 | | Model 2[i] | | Model 2[ii] | | Model 2[iii] | | Model 3 | | |
		uOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	Wald[b]
Gender[b]	Women	1.46**	(1.13–1.89)	1.57**	(1.15–2.14)	1.55**	(1.14–2.12)	1.79***	(1.31–2.43)	1.55**	(1.13–2.12)	
HSCL-Anxiety[b]	Yes	5.45***	(4.04–7.35)	5.17***	(3.76–7.11)					2.42***	(1.64–3.55)	0.085
HSCL-Dep[b]	Yes	5.46***	(4.12–7.23)			5.30***	(3.91–7.18)			2.28***	(1.53–3.42)	0.134
HTQ-PTSD[b]	Yes	5.09***	(3.81–6.79)					4.90***	(3.57–6.73)	1.97**	(1.32–2.94)	0.536
Age	30–39 years	1.47*	(1.05–2.05)	1.62*	(1.11–2.37)	1.51*	(1.03–2.22)	1.57*	(1.07–2.30)	1.56*	(1.06–2.29)	
	40–49 years	2.19***	(1.52–3.14)	2.53***	(1.64–3.92)	2.24***	(1.45–3.46)	2.28***	(1.47–3.53)	2.36***	(1.52–3.67)	
	≥ 50 years	3.90***	(2.60–5.85)	3.90***	(2.37–6.41)	3.61***	(2.20–5.94)	3.77***	(2.30–6.19)	3.58***	(2.17–5.91)	
Marital status	Married/partner	1.49**	(1.12–1.97)	0.97	(0.67–1.40)	1.07	(0.74–1.56)	0.98	(0.67–1.42)	1.13	(0.78–1.65)	
	Prev. married[c]	3.73***	(2.19–6.36)	1.92*	(1.03–3.59)	1.90*	(1.02–3.56)	1.92*	(1.03–3.58)	2.12*	(1.12–3.99)	
Immigration year	2016/2017	1.17	(0.90–1.50)	1.06	(0.79–1.42)	1.18	(0.88–1.59)	1.06	(0.79–1.42)	1.17	(0.86–1.58)	
PTE-AR	0.20–0.39	1.44	(1.00–2.07)	1.34	(0.92–1.95)	1.33	(0.91–1.94)	1.21	(0.83–1.76)	1.21	(0.83–1.78)	
	≥ 0.40	2.41***	(1.72–3.38)	1.65**	(1.15–2.36)	1.52*	(1.06–2.19)	1.41	(0.98–2.03)	1.26	(0.87–1.82)	

Reference groups: men (gender); no (mental health variables); 18–29 years (age); unmarried (marital status); 2010–2015 (Immigration. year); < 0.20 (PTE-AR)

[a] Chronic pain (CP) was measured through 10 items answered on a 3-point Likert scale (no/somewhat/very troubled) and categorized into 3 groups: no CP ("no" on all 10 items); some CP ("somewhat troubled" on at least one item and no item as "very troubled"); and severe CP ("very troubled" on at least one item)

[b] Interaction between gender and each of the three mental health variables was tested using Wald test of $H_0 =$ no interaction (ns = $p > 0.10$). Interactions were tested sequentially – i.e., only one interaction term was tested at a time

[c] Category included: divorced/separated/widow(er)

[d] In order to evaluate the association between each individual measure of mental ill health and CP adjusted for background variables and PTE only (but not the other two mental ill health variables), three separate partially adjusted models were run (i.e. Models 2[i], 2[ii] and 2[iii])

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 4 Crude and adjusted logistic regression models of poor perceived general health[a]

| | | Unadjusted | | Partially adjusted[c] | | Partially adjusted[c] | | Fully adjusted[c] | | |
| | | Model 1 | | Model 2 | | Model 3 | | Model 4 | | |
		uOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	Wald[b]
Poor perceived general health										
Gender[b]	Women	1.43*	(1.08–1.90)	1.64*	(1.11–2.41)			1.48	(0.97–2.28)	
HSCL-Anxiety[b]	Yes	4.81***	(3.54–6.54)	2.03**	(1.31–3.17)			1.49	(0.92–2.41)	0.241
HSCL-Depression[b]	Yes	5.21***	(3.89–6.97)	2.43***	(1.53–3.87)			1.76*	(1.05–2.96)	0.224
HTQ-PTSD[b]	Yes	5.18***	(3.80–7.06)	2.37***	(1.49–3.77)			1.98**	(1.19–3.32)	0.192
Chronic pain[b]	Some	5.70***	(2.83–11.5)			4.58***	(2.24–9.40)	3.80***	(1.84–7.86)	0.100
	Severe	42.9***	(21.4–86.1)			32.4***	(15.9–66.2)	19.1***	(9.22–39.5)	0.209

Reference groups: men (gender); no (mental health variables); no (somatic pain)

[a] Perceived general health: fair/poor/very poor vs. good/very good

[b] Interaction between gender and each of the three mental health variables were tested using Wald test of $H_0 =$ no interaction. Interactions were tested sequentially in adjusted models (i.e. one interaction term was tested at a time)

[c] Adjusted models controlled for age, education, marital status, immigration year, PTE-AR and other variables estimated in the model

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 9 of 16

Table 5 Crude and adjusted logistic regression models of functional impairment[a]

		Unadjusted		Partially adjusted[c]		Partially adjusted[c]		Fully adjusted[c]		Gender-specific (fully adjusted[c])				
		Model 1		Model 2		Model 3		Model 4		Model 5				
										Men		Women		
		uOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	Wald[b]
Functional impairment														
Gender[b]	Women	1.09	(0.81–1.48)	1.11	(0.73–1.69)			0.93	(0.59–1.48)	NA		NA		
HSCL-Anxiety[b]	Yes	6.24***	(4.48–8.70)	2.79***	(1.75–4.46)			2.25**	(1.31–3.87)	3.23***	(1.71–6.10)	1.21	(0.56–2.61)	0.027
HSCL-Dep[b]	Yes	5.70***	(4.15–7.85)	1.94**	(1.19–3.16)			1.25	(0.72–2.20)	1.83	(0.95–3.52)	0.66	(0.30–1.46)	0.024
HTQ-PTSD[b]	Yes	6.22***	(4.42–8.76)	2.54***	(1.56–4.13)			2.12**	(1.21–3.71)	3.12***	(1.62–6.02)	1.12	(0.51–2.43)	0.023
Chronic pain[b]	Moderate	3.88**	(1.62–9.3)			3.22*	(1.32–7.9)	2.50	(1.00–6.27)	2.50	(1.00–6.27)	2.50	(1.00–6.27)	0.385
	Severe	44.1***	(19.6–99.0)			35.6***	(15.5–81.5)	20.3***	(8.56–48.0)	20.3***	(8.56–48.0)	20.3[c]	(8.56–48.0)	0.704

Reference groups: men (gender); no (mental health variables); no (somatic pain)

[a] Functional impairment (daily activities): some/a lot vs. no impairment

[b] Interaction between gender and each of the three mental health variables were tested using Wald test of H_0 = no interaction (ns = $p > 0.10$). Interactions were tested sequentially in adjusted models (i.e. one interaction term was tested at a time)

[c] Adjusted models controlled for age, education, marital status, PTE-AR and other variables estimated in the model

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Nissen *et al. BMC Psychiatry* (2022) 22:571

Page 10 of 16

three times higher odds of FI. No association, however, was found between depression and FI in men. Severe CP was strongly associated with FI in all models, though moderate CP was not significantly associated with FI in the fully adjusted model. Finally, gender did not modify the association between CP and FI.

Discussion

Summary of main findings

The present cross-sectional survey of adult refugees from Syria recently resettled in Norway is one of only a few studies investigating the burden of chronic pain (CP) and how it relates to mental ill health in a general refugee population. The study found high levels of CP and clear associations between CP and mental ill health (i.e. anxiety, depression and PTSD). Being a woman was associated with higher odds of CP and there was some evidence that gender acted as an effect modifier in the links between mental ill health and functional impairment (FI). Specifically, findings suggested a strong association of anxiety and PTSD with functional impairment in men, though not in women. Unsurprisingly, there was a strong independent positive association between age and chronic pain.

The burden of chronic pain

The proportion reporting severe CP in the present sample, estimated at 43.1%, is moderately higher than that found by Strømme et al. in their studies on resettled adult refugees from Syria in Norway, where CP was reported by about 30% of participants both at baseline and follow-up one year later [27]. One possible explanation for this difference is that the study by Strømme et. al. measured CP with a single item whereas our measure was more comprehensive. Another possible explanation is the higher degree of exposure to potentially traumatic experiences (PTEs) and elevated levels of mental ill health in our sample compared with the sample in Strømme et. al. Our collaborating project in Sweden, with very similar study population, methodology and prevalence estimates of mental ill health [59, 60], however, also found that close to 30% of participating refugees experienced pain/discomfort at moderate/severe/extreme levels. Though, in the Swedish survey, pain was also measured by a single item from the standardized EQ-5D questionnaire developed by the EuroQol Group [69]. Furthermore, the EQ-5D item does not specify any body region and asks about pain today – i.e. the chronicity of pain is not investigated. Perhaps of some comparative value, another large study on Syrian refugees in Turkey found that almost 40% reported pain causing distress in both "arms, legs or joints" and "back" based the PHQ-15 [28]. However,

the questionnaire-based level of anxiety differed slightly from our sample (34.7% vs. 30.1% respectively), and the levels of depression and PTSD were notably lower (36.5% vs. 45.2% and 19.6% vs. 29.7%, respectively). Our estimate for CP is considerably lower than estimates from studies on clinical or torture-exposed samples of refugees, which typically lie between 60 and 90% [21, 22, 24, 29, 70]. However, the proportion with severe CP among those reporting exposure to torture in our study ($n=231$) was 57.8% (not shown in tables). As pain is a known long-term sequela of torture (e.g. [36]), higher levels of CP among torture-exposed refugees is unsurprising.

Interestingly and importantly, the percentage with severe musculoskeletal pain/complaints (i.e. the first five items of the CP measure) in our study was markedly higher than that found for the Norwegian general population using the "identical" measure: 35.2% vs 15.8% (see Additional file 2—distributions). Since one item, "pain in other regions", was left out in our study, the true difference is likely even larger. Part of the reason for this notable difference may be related to poor transcultural construct validity of the instrument used to measure pain – i.e. "pain" may be understood and communicated differently in different cultures, including in Syrians [71, 72]. Another possible and related reason given local idioms of distress and social pressures against expressing negative feelings, is that the high level of pain reflects a more culturally acceptable expression of distress [12]. Alternatively, it represents a fairly accurate and transculturally valid approximated prevalence of chronic musculoskeletal pain as conceptualized and operationalized in the measure used in the present study. Given the known and strong links between pain and psychopathology (e.g. [4]) and the high levels of mental ill health in the study population as highlighted above, this is likely at least partially true. Furthermore, 38.0% of the sample reported having experienced physical violence, torture and/or sexual violence, which is known to be associated with subsequent pain [35, 36]. Additionally, during the civil war and during their flight to Norway, most refugees will not only have been without adequate access to health care and medicine but also, for many, adequate nourishment and rest. This might increase the risk of a variety of acute and chronic illnesses including musculoskeletal pain. Tying into a greater debate on how traumatic stress, and in particular chronic or continuous traumatic stress (CTS), is linked to pain in more resource poor settings, the high reported frequency of pain in our study may be a consequence of elevated levels of CTS in the study population [73]. That is, as stress caused by pre- and peri-migratory traumatic experiences is compounded by stress from a range of well-known adverse social conditions in the post-migratory environment such as financial hardship, unemployment, discrimination and weak social

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 11 of 16

networks, the overall allostatic load may exceed coping capacities, with resultant consequences for health – e.g. elevated levels of pain [74, 75]. This resonates well with the currently dominating ecological/holistic approach to refugee health. This approach emphasizes the importance of investigating and addressing the full range of factors known to impact health: past trauma history, daily stressors and the disruption of psychosocial systems in the postmigration environment, and the interplay between them [18, 76]. A few recent studies have exploratively used biomarkers (e.g. hair cortisol levels) to assess stress/allostatic load when investigating mental ill health in refugee populations, with promising results [77, 78]. Given some of the inherent limitations of using self-report questionnaire data (e.g. information/recall bias), and that these limitations are likely exacerbated when working across languages, cultures and idioms of distress, the use of biomarkers could represent an interesting option for future research.

The association between chronic pain and mental health

The strong association between mental ill health and CP in the present study is consistent with a large body of prior evidence from non-refugee populations [3–8] and a number of studies on torture-exposed refugees and refugees in treatment [24, 41, 43]. It is also consistent with a biopsychosocial approach to pain in which physical disorders such as pain is seen to result from a dynamic interaction among physiologic, psychological and social factors [79]. Very few prior studies on this topic exist on general refugee populations, adding to the uniqueness of the present study. The only study we are aware of, found relatively strong associations between CP and anxiety/depression and PTSD symptoms among resettled adult Syrian refugees in Norway [37]. If comparative evidence is broadened to also include studies on somatic distress, where pain is a key component, several recent, large studies on refugees and internally displaced people have documented strong links between symptoms of anxiety, depression and PTSD and somatic distress [28, 38, 39]. The clear reductions in the ORs when going from crude to fully adjusted models for all mental ill health variables in Table 3, suggests the associations between these variables and CP are overlapping, which is unsurprising given their known comorbidities. Nonetheless, each mental ill health variable was statistically significantly associated with CP in the fully adjusted model, suggesting a unique association above and beyond shared ones. Methodologically, comparing ORs across models with different predictors is not unproblematic due to scaling effects [80], thus this argument needs to be interpreted with caution. Our finding that being a woman was associated with increased risk of CP is consistent with prior

evidence both in refugee (e.g. [28, 38]) and non-refugee populations (e.g. [45, 46]).

Perceived general health and functional impairment

The mean value for perceived general health (PGH) in this study (3.614, SD = 1.063) was statistically significantly lower (though not necessarily clinically meaningfully lower) than that reported in a large study on general, adult (> 15 years), populations across 26 European countries using the identical instrument ($p < 0.001$), where the mean value was 3.724 (SD = 0.968) [81]. Since refugees in our study were significantly younger that in the European study (mean age 38.9 vs. 48.5 years), and given the strong negative association between age and PGH, the age-standardized difference is likely notably larger. The proportion in our study who reported "fair/poor/very poor" PGH was 39.9%, which is slightly higher than that reported in a longitudinal study on resettled refugees (primarily of Middle eastern origin) in Australia, which found this percentage to be 35.7% at baseline [82]. However, the scoring scale for PGH had six levels vs. five in our study. An interesting finding from the regression analyses on PGH was the weak evidence of association between the mental ill health variables and PGH after controlling for CP. This implies a high degree of overlap between the associations of mental ill health and CP with PGH, even if a moderately strong unique association was found between PTSD and PGH in the fully adjusted model. The strong association between CP and PGH is broadly in line with a study on female Yazidi refugees exposed to violence by the "Islamic State", which found pain to be a strong predictor of overall health-related well-being [32].

The proportion of refugees who reported at least some degree of functional impairment (FI) due to longstanding illness in our study (34.9%) is fairly consistent with another study on resettled adult refugees from Syria in Norway, which found this proportion to be around 30%, both at baseline and one year later [27]. A similar estimate (35.8%) was also found in the aforementioned Australian study [82], though the measurement used also included long term injury/health conditions (i.e. the focus was not on FI per se). Our finding that CP was strongly associated with FI in the fully adjusted model which included mental ill health, is broadly congruent with other studies on refugees [38, 43], though these studies investigated somatic distress and not CP. One important and hitherto unique finding in our study was that the associations between mental ill health and FI were highly gender specific, with a clear association in men, but none in women in fully adjusted models. We are unable to relate this directly to existing literature,

Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 12 of 16

though prior studies have highlighted the importance of taking a gendered perspective when exploring refugee mental health [48–50]. Part of the explanation for this gender specificity may relate to the aforementioned tendency for mental ill health, or, specifically anxiety, to be more strongly linked to CP in women than men in our study. That is, when FI is regressed on both CP and mental ill health for women, any adverse associations of mental ill health may be too overlapping with that of CP to show a unique association. However, the tendency for gender-specific associations was also present in the partially adjusted models (without CP), even if the statistical evidence from Wald test of interaction was weaker. Another possible explanation is that the gendered association may be related to differences in expected and actual daily tasks and demands for men and women given traditional gender roles in Arab culture, with the identity of men more closely tied to work and being able to provide for their families [83–85]. With a relatively low percentage of paid employment among participants based on self-reported data (35% and 12% for men and women, respectively), it could be that unemployment was a driver of both mental ill health and a sense of impaired functioning especially in males given the centrality of work to men's gender role in Arab culture. Alternatively, with almost threefold as many men as women working in the sample, it could be that symptoms of mental ill health were perceived as more impairing to functioning for a higher proportion of men (that is, assuming the link between mental ill health and function impairment was felt in particular in the context of work). Both of these explanations are exploratory in nature, though, and need to be investigated in future studies.

Strengths and limitations

A key and potentially serious limitation with the present study is selection bias. With a response rate of 10%, it is hard to gauge the generalizability of findings. In general, predictor-outcome associations are thought to be more robust to nonresponse than prevalence estimates [86], though we cannot exclude that selection bias has distorted results. In prior publications, we have shown that the proportion of young and unmarried refugees was notably smaller among participants compared to the source population, though there was no difference in the proportion of women [68]. Furthermore, there was no difference in the proportion with anxiety and depression scores above cut-off when participants who returned the questionnaire within a month after study launch ($n = 433$) were compared with those who responded later and after a reminder had been sent out ($n = 464$). There was a tendency, however, that a higher

proportion of early-responders had a PTSD score above cut-off [60]. This provides some evidence that willingness to participate (operationalized through how soon participants returned the questionnaire) was not strongly related to mental ill health. Another limitation concerns the validity of the instruments used in a population of adult refugees from Syria. We have already discussed transcultural construct validity relating to how pain was measured, and the issue of validity is also relevant for the HSCL-25 and HTQ scales, even if both scales have been used extensively with refugee populations and psychometrically tested. Studies are somewhat incongruent as to the cultural appropriateness and validity of the scales across settings and populations [63, 87], with recent evidence suggesting the depression subscale of the HSCL may have poor psychometric properties among Arabic speaking refugees and that the inclusion of purely somatic symptoms in the anxiety subscale may be inappropriate [64]. Moreover, only five items of the 10-item measure for chronic pain were from a previously used scale [53], with the rest composed for the purpose of the present study. As such, the psychometric properties of the full 10-item scale have not been tested. A further limitation concerns the cross-sectional design of the data, which prohibits causal interpretations. It is highly likely that CP and mental ill health are causally related, thus when placing both in the same regression model, there is a chance of overadjustment bias [88]. For example, if anxiety leads to elevated levels of perceived pain because of shared physiological pathways [89], part of the "true" adverse effect of anxiety on PGH may be masked by overadjustment. Moreover, the association between anxiety and FI in men could be because men with FI get anxious if they cannot fulfil their role as breadwinner, rather the other way around. Lastly, since regression models were built with data at hand, without detailed pre-registered plans for data-handling and analyses, findings should be viewed as partly exploratory, with the associated risk of false-positive findings [52, 90].

Strengths of the study include the random sampling from total-population registries; the fairly thorough assessment of CP compared to available evidence, and the use of well-known and frequently used instruments to measure mental ill health (despite the above noted lingering issues of transcultural validity).

Conclusions

The present study shows a high burden of chronic pain in a general population of adult refugees from Syria with likely substantial adverse consequences for their daily functioning. The clear links found between chronic pain and mental ill health suggest

Nissen *et al. BMC Psychiatry* (2022) 22:571

Page 13 of 16

that healthcare providers and others working with this population ought to be aware of, and sensitized to, the fact that pain often goes hand-in-hand with psychological strain (indeed, within the biopsychosocial framework, mental and physical health closely interact and share physiologic pathways and feedback loops, blurring the conceptual boundaries between them). This awareness may be particularly important with Syrian refugees given that illness models and expressions of distress of most Syrians do not clearly distinguish between the mental and physical and the cultural stigma against expressing psychological distress. Addressing the possible co-occurrence of pain and mental ill health may be required for interventions to effectively address either problem. The study further points to potential gender-specific associations between mental ill health and functional impairment, with associations seemingly stronger in men than in women, suggesting initiatives addressing mental ill health, chronic pain or functional impairment in refugee populations should consider gender in tailoring their content and outreach. The present study's low response rate, despite substantial promotional work to boost participation [68], suggests that distributing these types of surveys via postal mail might not be the best strategy to recruit participants. Future studies may want to consider alternative designs (e.g. designs allowing for more face-to-face interaction with potential participants in order to thoroughly explain the purpose and rational of the study in the hope that this may increase participation).

A clear mismatch exists between the burden on health caused by pain in general refugee populations and the amount of available evidence to guide mitigating strategies. The fairly scant number of existing studies are characterized by marked methodological heterogeneity making comparison challenging and knowledge difficult to synthesize. Therefore, future research should aim towards harmonizing and standardizing methodologies for how pain is measured. Moreover, since pain is understood differently across cultures, it will be important for any such effort to take into consideration that pain is an ethnocultural construct in order to enhance transcultural validity.

Abbreviations

CI: Confidence Intervals; CP: Chronic Pain; DSM: Diagnostic and Statistical Manual of Mental Disorders; FI: Functional Impairment; HSCL: Hopkins Symptom Checklist; HTQ: Harvard Trauma Questionnaire; ICD: International Classification of Diseases; PGH: Perceived General Health; PHQ: Patient Health Questionnaire; PTSD: Post-traumatic Stress Disorder; PTE: Potentially Traumatic Experiences; PTE-AR: Potentially Traumatic Experiences Adversity Ratio; RTHC: Refugee Trauma History Checklist; SD: Standard Deviation.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12888-022-04200-x.

Additional file 1.

Additional file 2: a. Detailed distributions for musculoskeletal pain/stiffness and general pain. **b.** Fully adjusted ordered logistic regression models of Musculoskeletal pain/stiffness and General pain (i.e. compare with Table 3 in main manuscript).

Additional file 3: Sensitivity analyses of all fully adjusted regression models (i.e. last models in Tables 3, 4 and 5) with anxiety, depression and PTSD combined into one new variable "Any Mental Health Problem" (0 if *all* of anxiety/depression/PTSD ="No" and 1 if *any* of anxiety/depression/PTSD="Yes").

Availability of data and materials
The datasets generated and/or analyzed during the current study are not publicly available due to agreements made with participants through the informed consent form and outlined procedures for data-handling therein. Anonymized data are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All potential participants were given a detailed information letter and consent form, detailing the study and what participation entailed. The voluntary nature of the study was stressed and procedures for how participants could withdraw were described. All information was given in Arabic. The informed consent form had to be signed and returned together with the questionnaire. The Regional Committees for Medical and Health Research Ethics (REK) – Region Southeast (A) in Norway granted ethical approval for the study (reference number 2017/1252). All parts of the study were conducted in accordance with the protocol approved by REK and in line with relevant regulations.

Consent for publication
NA

Competing interests
None.

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Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 14 of 16

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Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 15 of 16

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Nissen *et al. BMC Psychiatry*   (2022) 22:571

Page 16 of 16

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Paper V

V

V

Post-migration Stressors and Subjective Well-Being in Adult Syrian Refugees Resettled in Sweden: A Gender Perspective

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A number of post-migration stressors have been shown to adversely affect mental health in refugees resettled in high-income countries, including poor social integration, financial difficulties and discrimination, and recent evidence suggests that these effects are gender specific. Social support has been found to buffer against post-migration stress in some studies on refugee populations, though the evidence on this is mixed. The present study used cross-sectional survey data from a nationwide, randomly sampled group of adult refugees from Syria resettled in Sweden between 2008 and 2013 ($N_{sample} = 4,000$, $n_{respondents} = 1,215$, response rate 30.4%) to investigate gender-specific associations between post-migration stressors and subjective well-being (SWB) and whether these associations were modified by social support. SWB was measured with the WHO-5 Well-being Index (scaled 0–100), dichotomized into high (≥ 50) and low (<50) SWB. Main analyses were stratified by gender, and regressed SWB on four domains of post-migration stress (financial strain, social strain, competency strain and discrimination) using logistic regression, adjusting for sociodemographic variables and traumatic experiences. Social support was tested as an effect modifier. In fully adjusted models, main risk factors for low SWB were high financial strain, especially in males ($OR_{high\ vs.\ low\ strain,\ males} = 10.30$ [4.91–21.6], $p < 0.001$ vs. $OR_{high\ vs.\ low\ strain,\ females} = 3.84$ [1.68–8.79], $p = 0.002$), and high social strain, *only* in males ($OR_{high\ vs.\ low\ strain,\ males} = 9.21$ [3.96–21.4], $p < 0.001$ vs. $OR_{high\ vs.\ low\ strain,\ females} = 1.03$ [0.40–2.64], $p = $ ns). There was some evidence that social support buffered the adverse association of financial strain with SWB. In conclusion, the present study found clear support of gender-specific effects of post-migration stressors on SWB. Mitigation strategies and interventions should be aware of and sensitive to these potential gendered effects, and future research exploring mental health in the context of resettlement stress should have a heightened focus on the important role of gender.

Keywords: post-migration stressors, gender, subjective well-being, refugee, social support, WHO-5 well-being index

INTRODUCTION

Due to the rapidly growing number of refugees from 2015 onwards, there is an urgency and considerable debate regarding durable solutions to meet the psychosocial needs of the 26 million refugees worldwide (1, 2). Currently, 15% of the world's refugees are resettled in a high-income host country (3). Refugees from Syria continue to be the largest forcibly displaced population globally with 6.6 million refugees and more than six million internally displaced people (3, 4), and Syrians have accounted for a substantial part of all asylum applications to the European Union in recent years (5). A large number of studies have documented elevated rates of mental health problems in refugee populations (6–8), and the links between mental ill health and pre- and peri-migration potentially traumatic experiences (PTEs) such as sustained conflict, fleeing under life-threatening conditions, separation from family and friends, and prolonged stays in unsafe and overcrowded camps are well-established (6, 9).

Increasing attention has been given to stressors in the post-migration phase and their potential adverse effects on mental health in refugee populations (10–12). Important post-migration stressors include perceived discrimination, lack of economic opportunity, lack of access to resources, social isolation, family concerns and poor language proficiency. These stressors have been shown to not only have strong negative direct effects on mental health, but also to mediate and moderate the adverse effects of other stressors associated with the refugee experience, including pre- and peri-migration PTEs (13–15). Moreover, a recent longitudinal study on refugees in Australia suggests that the effects of post-migration stressors on mental health change over time, and that these time-changing effects follow different trajectories for males and females (16). The review concludes that studies to date have not adequately focused on and explored gender differences when investigating resettlement stress and mental health in refugee populations. This conclusion is supported by an earlier cross-sectional study on Afghan refugees resettled in the United States which explored gender-specific effects of several post-migration stressors on distress (17). Specifically, the study found that strong family ties as well as English proficiency were associated with lower distress in females, but not males; that acculturation dissonance was associated with higher distress in males, but not females; and that gender ideology and distress were gender specific, with traditional women and egalitarian men experiencing less distress. The latter points to the centrality of gender roles when trying to interpret gender-specific effects of resettlement stress on mental health, and the complex and often challenging processes that influence and shape gender roles in migrating populations relocating from societies and cultures with fairly marked gender separation, to societies where this separation is much smaller (18, 19). Further studies with a gender-focused approach are warranted.

The majority of research on mental health in refugee populations have used a deficit model of health (20–22), though a growing number of studies have started to conceptualize and study *positive* mental health using the overlapping concepts of subjective well-being (SWB), life satisfaction and quality of life (QoL) (23–26), with the latter being the most frequently studied concept. Findings from studies on QoL in relation to post-migration stress have yielded mixed results, with some studies failing to find a link between the two (27), whereas others finding QoL to be adversely associated with living difficulties (28, 29), discrimination (28), and unemployment (30, 31). Interestingly, associations between gender and QoL were found in some studies (32–34) but not others (27, 28), and no study that we are aware of have explored gender-specific associations between post-migration stressors and QoL. However, gender was explored as an effect modifier between perceived discrimination and SWB in a study on refugees in Canada, with evidence of an adverse association for men only (24).

Social support has repeatedly been shown to be protective of mental health in refugee populations (23, 35), and part of this may be related to the potential stress buffering effects of social support. Specifically, one study on Iraqi migrants resettled in Sweden found that social participation and trust in others modified the negative effects of discrimination, housing problems, and financial difficulties on mental health (36), and social support was identified as an important moderator of the relationship between resettlement stress and depression in the Canadian Refugee Resettlement Project (37). In contrast, a study on Afghan refugee in the US which tested whether social support modified the association between perceived discrimination and psychological distress, did not find any evidence to support this (38). Refugee women in particular have acknowledged the importance of social support in adapting to their lives in the host country and report that they face barriers to maintaining it in the resettlement phase, both within their own ethnic community and in the host community, often due to language barriers (39, 40).

A weakness in the field of refugee mental health research to date is the limited focus on and reporting of gender specific findings (7, 16, 17, 40, 41). Based on the mounting evidence of the importance of gender in understanding the complex links between pre- and post-migration stressors and mental health (16, 17), there is a clear need for studies with a gender-focused approach. Therefore, the purpose of the present study was to build on previous findings by our group on the adverse association between post-migration stressors and mental health (14, 42) by applying a gender perspective and positive mental health approach. Specifically, the study's main objectives were to explore and report gender-specific associations of post-migration stressors with subjective well-being (SWB) in adult refugees from Syria resettled in Sweden and evaluate the statistical evidence for gendered effects. A secondary objective was to test whether social support modified the associations of post-migration stressors with SWB.

MATERIALS AND METHODS

Participants

Eligible participants for the present study included all refugees from Syria between 18 and 64 years of age who were granted permanent residency in Sweden on grounds of asylum and resettled in a municipality between 2011 and 2013. A sampling

frame of 9,662 eligible individuals was identified through the Swedish Total Population Register (TPR) and a simple random sample of 4,000 individuals was drawn in February 2016. Selected participants were sent a study invitation letter and the Arabic questionnaire *via* postal mail. Of the 4,000 invited individuals, 1,215 returned the questionnaire, giving a response rate of 30.4%. **Supplementary Table 2** compare respondents to non-respondents on key sociodemographic variables. For further details on design, setting and participants, we refer to a prior publication by our group (14).

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

Measures

Subjective Well-Being

Subjective well-being (SWB) was measured using the WHO-5 Well-being Index (WHO-5), one of the most widely used questionnaires assessing subjective SWB. The questionnaire has shown good psychometric properties across various populations and cultures, including refugees (43–45). The WHO-5 consists of the following five items: (1) "I have felt cheerful and in good spirits," (2) 'I have felt calm and relaxed," (3) "I have felt active and vigorous," (4) "I woke up feeling fresh and rested," and (5) "My daily life has been filled with things that interest me." Respondents are asked to rate how well each statement applies to him or her for the last 14 days using a 6-point Likert scale going from 0 = none of the time to 5 = all of the time. Individual items were summed and multiplied by 4 to create an overall score of SWB ranging from 0 (lowest possible SWB) to 100 (highest possible SWB). A cut-off score of 50 was used to create a dichotomous version over SWB, with ≥50 indicating high well-being vs. <50 indicating low well-being (43). Cronbach's alpha for the scale was 0.94.

Post-migration Stress

Four domains from the Refugee Post-Migration Stress Scale, RPMS, focusing on stressors related to the host country, were used to measure post-migration stress: (1) *financial strain*; (2) *social strain*; (3) *competency strain*; and (4) *perceived discrimination.* The RPMS scale was recently developed with the aim of providing an updated instrument for assessing post-migration stress in refugee populations, and the scale has shown good validity when tested among refugees from Syria (42). Please refer to Malm et al. (42) for further details on domain identification and validation. *Financial strain* consists of three items tapping into material and economic hardship potentially threatening integrity, independence, dignity and well-being (example: "Worry about unstable financial situation"). *Social strain* consists of three items relating to social hardship such as feeling isolated or frustrated due to loss of status (example: "Feeling excluded or isolated in the Swedish society"). *Competency strain*, also comprising three items, taps into feelings of inadequacy of host-country specific skills needed to successfully navigate day-to-day living (example: "Bothering difficulties communicating in Swedish"). *Perceived discrimination* consists of four items relating to the experience of unfair treatment in Sweden, either verbally or nonverbally, on the

basis of prejudice (example: "Feeling disrespected due to my national background"). Respondents are requested to indicate how frequently they experience the different items on a scale ranging 1 = never to 5 = very often. Respondents were split into three groups for each domain: low, medium and high strain. The low-strain group consisted of respondents with a maximum score of 2 = seldom for all items within a given domain. The high-strain group consisted of respondents who answered 4 = often or 5 = very often on all items within a given domain, and the medium-strain group consisted of everyone else. Cronbach's alpha for the four domains ranged between 0.80 and 0.84.

Social Support

Social support was assessed using the ENRICHD Social Support Instrument, with Items 4 ("Is there someone available to help with daily chores?") and 7 ("Are you currently married or living with a partner?") excluded (46). The remaining 5 items (e.g., "Is there someone you can count on to listen to you when you need to talk?") measure instrumental and emotional support and are all scored on a 5-point Likert scale going from 1 = none of the time (i.e., low social support) to 5 = all of the time (high social support). The scale has previously been tested among refugees from Syria and found to have adequate psychometric properties in this population (47). Items were summed to create a total score ranging from 5 (lowest possible social support) to 25 (highest possible social support) and a cut-off point of 18 was used to create a dichotomized version of the scale, with ≤18 =low social support vs. >18 = high social support.

Pre- and Peri-Migration Potentially Traumatic Experiences

Potentially traumatic experiences (PTEs) were measured with the Refugee Trauma History Checklist (RTHC), which has been tested and validated in a sample of Syrian asylum seekers in Sweden (48). The scale asks about eight PTEs (e.g., "War at close quarter" and "Forced separation from family or close friends") with reference to the time-periods *before* (pre-flight) or *during* (peri-flight) migration, for a total of 16 PTE items. To enhance comparability with prior evidence, participants were categorized based on a calculated *PTE adversity ratio* (PTE-AR) introduced by Steel et al. in their review in 2009 (6). Specifically, the PTE-AR is estimated as the number of endorsed PTEs divided by the total number of PTEs inquired about (i.e., 16 in the present study), and categorized into: <0.2; 0.2–0.29; 0.3–0.39; and ≥0.4.

Sociodemographic and Background Variables

Gender was an integral part of the study's main objective and based on registry data from the Swedish Total Population Register (TPR). Other sociodemographic variables included: age (18–29, 30–39, 40–49, and ≥50 years); years of education (0–9, 10–12, 13–14, and ≥15); civil status (married, unmarried, and divorced/separated/widowed); and year of immigration (2008–2011, 2012, and 2013). Data for all variables were obtained through the TPR as well.

Psychological Distress

Psychological distress was included in sensitivity analyses in order to evaluate potential confounding by psychological distress of the main associations of interest. Symptoms of anxiety and depression were measured with the Hopkins Symptom Checklist, HSCL-25 (49), and the first 16 items from section Discussion of the Harvard Trauma Questionnaire (HTQ) were used to measure symptoms of PTSD (50). Both scales have been applied extensively in studies on refugee mental health in the last decades (51). All three variables (i.e., anxiety, depression and PTSD) were included in dichotomized form in the sensitivity analyses based on whether mean item scores were above threshold values suggesting checklist-positive disorder. Specifically, mean item scores above 1.75 (first 10 HSCL items) and 1.80 (last 15 HSCL items) were used to define checklist-positive anxiety and depression, respectively, and a mean item score above 2.06 was used to define a checklist-positive PTSD. In order to underline that these mental health variables are based on symptom checklist scores and not the gold standard clinical interview, we use the prefix "checklist-positive" or refer to "symptoms of."

Statistical Analysis

Data were first checked for outliers, errors and missing using simple frequency distributions and cross tabulations. The total number of participants with missing data for a given variable and the total number contributing data to full multivariable models are indicated in the tables. The outcome variable, the WHO-5 well-being index, was summarized across predictors and background variables using both the mean score with standard deviation (SD) and the proportion in the high (≥ 50) and low (< 50) SWB categories.

Associations between SWB and predictors/background variables were tested using chi-square test for categorical variables as well as crude and adjusted logistic regression analysis. The logistic models compared the odds of low vs. high SWB across predictor levels, summarized as odds ratios (ORs) with 95% confidence intervals (95% CIs) against a set reference. Sociodemographic variables were included in the full regression models for a priori reasons based on theory and prior evidence of importance, regardless of whether they showed independent effects. As exposure to potentially traumatic experiences (PTEs) has repeatedly been shown to be closely linked to mental health and well-being, which could subsequently affect the experience of post-migration stressors, PTE-AR was included in the final model to adjust for this potential distortion of the true and direct effects of post-migration stressors on SWB. All four post-migration stressors were included in the final models, though stepwise exploration of each stressor's association with SWB adjusting for demographic variables and PTE-AR was also done. As a sensitivity analysis, we repeated the final regression models with symptoms of psychological distress included in the models (i.e., checklist-positive anxiety, depression and PTSD) to evaluate potential confounding by these variables. Multicollinearity was checked before running full models.

To investigate gender-specific associations between post-migration stressors and SWB, analyses were stratified by gender and gender was tested as an effect modifier by sequentially

fitting interaction terms between gender and each post-migration stressor. That is, interaction between gender and one post-migration stressor was tested at a time, first in crude models, then in fully adjusted models. The presented p-values for interaction are based on Wald test of H_0 = no interaction (i.e., uniform effect across gender). To determine whether interaction was present, the magnitude of strata-specific effects, confidence intervals, sensitivity analysis and p-values from the Wald tests for interaction were evaluated together, with a significance threshold for the latter test not fixed at <0.05 (52). Social support was subsequently tested as an effect modifier between post-migration stressors and SWB for stressors which showed significant associations with SWB. This was done in the same manner as for gender.

Because there was a fairly high number of participants with missing data in the final regression models with complete-case analysis, sensitivity analyses for these models were done with imputed data obtained through multiple imputation by chained equations, MICE (53). The imputation model contained all variables in the final analysis model and imputed males and females separately to account for gender interactions in the models.

All statistical analysis were conducted with Stata, version 16 (STATA Corporation, College Station, TX, USA).

RESULTS

Descriptive statistics on study participants as well as summary statistics on SWB across predictors and background variables are presented in **Tables 1**, **2**. For the total sample, the mean SWB score was 57.7 (standard deviation, SD = 27.1, $n = 1,173$) and 725 (61.8%) of participants were categorized as having high SWB vs. 448 (38.2%) as low. All post-migration stressors, gender, education and potentially traumatic experiences (PTE-AR) were associated with SWB in bivariate analyses.

Unadjusted and adjusted logistic models of SWB regressed on all post-migration stressors are presented in **Table 3**, with the latter two models stratified by gender to investigate gender-specific associations and evidence of interaction. Because there were too few individuals with data in the highest category for discrimination, results for this category were not estimated. There was very strong evidence that financial strain was associated with increased odds of low SWB in the fully adjusted model, and some evidence that this association was stronger in males ($OR_{\text{high vs. low financial strain, males}}$ = 10.30, 95% CI 4.91–21.6, $p < 0.001$) compared to females ($OR_{\text{high vs. low financial strain, females}}$ = 3.84, 95% CI 1.68–8.79, $p = 0.001$). The evidence for interaction was notably stronger in sensitivity analysis done with imputed data (p-value interaction = 0.026) vs. with complete-case data (p-value interaction = 0.156), though the changes in ORs were modest. In females, SWB did not differ between the medium and low strain groups (neither in complete-case analysis nor in sensitivity analysis with imputed data), though there was very strong evidence for a difference between these groups in males ($OR_{\text{medium vs. low financial strain, males}}$ = 3.59, 95% CI 1.95–6.60, p

TABLE 1 | Descriptive statistics on background variables and post-migration stressors; bivariate association with gender.

		All respondents		Stratified by gender				
				Males		Females		χ^2
		n	(%)	n	(%)	n	(%)	
Age								0.13
	18–29	283	(23.29)	161	(21.10)	122	(26.99)	
	30–39	400	(32.92)	257	(33.68)	143	(31.64)	
	40–49	295	(24.28)	193	(25.29)	102	(22.57)	
	≥50	237	(19.51)	152	(19.92)	85	(18.81)	
Education								0.04
	0–9 yrs	453	(38.42)	293	(39.43)	160	(36.70)	
	10–12 yrs	255	(21.63)	169	(22.75)	86	(19.72)	
	13–14 yrs	234	(19.85)	129	(17.36)	105	(24.08)	
	≥15 yrs	237	(20.10)	152	(20.46)	85	(19.50)	
Civil status								<0.001
	Married	771	(63.46)	439	(57.54)	332	(73.45)	
	Unmarried	386	(31.77)	301	(39.45)	85	(18.81)	
	Divorced/wid.	58	(4.77)	23	(3.01)	35	(7.74)	
Immigration year								0.13
	2008–2011	76	(6.27)	54	(7.11)	22	(4.87)	
	2012	334	(27.56)	217	(28.55)	117	(25.88)	
	2013	802	(66.17)	489	(64.34)	313	(69.25)	
PTE-AR								<0.001
	<0.20	279	(24.41)	153	(21.46)	126	(29.30)	
	0.20–0.29	128	(11.20)	72	(10.10)	56	(13.02)	
	0.30–0.39	250	(21.87)	149	(20.90)	101	(23.49)	
	≥0.40	486	(42.52)	339	(47.55)	147	(34.19)	
Financial strain								0.26
	Low	284	(23.83)	189	(25.34)	95	(21.30)	
	Medium	692	(58.05)	427	(57.24)	265	(59.42)	
	High	216	(18.12)	130	(17.43)	86	(19.28)	
Social strain								0.87
	Low	326	(27.82)	202	(27.45)	124	(28.44)	
	Medium	713	(60.84)	452	(61.41)	261	(59.86)	
	High	133	(11.35)	82	(11.14)	51	(11.70)	
Competency strain								0.15
	Low	286	(24.22)	189	(25.47)	97	(22.10)	
	Medium	787	(66.64)	493	(66.44)	294	(66.97)	
	High	108	(9.14)	60	(8.09)	48	(10.93)	
Discrimination								0.70
	Low	748	(63.39)	463	(62.57)	285	(64.77)	
	Medium	425	(36.02)	273	(36.89)	152	(34.55)	
	High	7	(0.59)	4	(0.54)	3	(0.68)	
Social support								0.06
	High	524	(44.37)	313	(42.24)	211	(47.95)	
	Low	657	(55.63)	428	(57.76)	229	(52.05)	

PTE-AR, potentially traumatic experiences adversity ratio; wid, widowed.

< 0.001), which was even more marked in sensitivity analysis on imputed data (OR$_{\text{medium vs. low financial strain, males}}$ = 4.24, 95% CI 2.37–7.57, $p < 0.001$). After adding symptoms of anxiety, depression and PTSD in further sensitivity analysis, SWB was no longer association with financial strain in females, but there was strong evidence for an association in males, albeit with notably reduced ORs (OR$_{\text{high vs. low financial strain, males}}$ = 4.67, 95% CI 2.04–10.7, $p < 0.001$, not shown in tables).

TABLE 2 | Summary of WHO-5 Well-Being Index (0-100), mean (SD) and dichotomized into high vs. low subjective well-being (SWB).

		Mean index score (SD)		High (≥50)		Low (<50)		χ^2
				n	(%)	n	(%)	
Gender								0.008
	Male	59.40	(27.42)	475	(65.52)	259	(57.81)	
	Female	54.82	(26.38)	250	(34.48)	189	(42.19)	
Age								0.177
	18–29	58.78	(26.49)	175	(24.14)	101	(22.54)	
	30–39	59.24	(27.28)	240	(33.10)	145	(32.37)	
	40–49	58.16	(27.40)	185	(25.52)	102	(22.77)	
	≥50	53.08	(26.91)	125	(17.24)	100	(22.32)	
Education								0.031
	0–9 yrs	59.69	(27.88)	281	(40.20)	156	(35.45)	
	10–12 yrs	58.72	(27.75)	162	(23.18)	85	(19.32)	
	13–14 yrs	54.51	(27.12)	122	(17.45)	101	(22.95)	
	≥15 yrs	54.98	(25.16)	134	(19.17)	98	(22.27)	
Civil status								0.139
	Married	58.73	(26.69)	474	(65.38)	272	(60.71)	
	Unmarried	56.93	(27.92)	222	(30.62)	149	(33.26)	
	Divorced/wid.	48.79	(25.97)	29	(4.00)	27	(6.03)	
Immigration year								0.754
	2008–2011	56.45	(28.33)	43	(5.94)	28	(6.28)	
	2012	58.23	(28.59)	206	(28.45)	118	(26.46)	
	2013	57.65	(26.34)	475	(65.61)	300	(67.26)	
PTE-AR								<0.001
	<0.20	65.22	(24.66)	202	(29.40)	73	(17.38)	
	0.20–0.29	59.61	(25.18)	79	(11.50)	45	(10.71)	
	0.30–0.39	58.97	(25.03)	153	(22.27)	87	(20.71)	
	≥0.40	52.27	(28.58)	253	(36.83)	215	(51.19)	
Financial strain								<0.001
	Low	75.14	(19.56)	242	(33.94)	36	(8.13)	
	Medium	56.33	(25.81)	404	(56.66)	267	(60.27)	
	High	38.63	(25.17)	67	(9.40)	140	(31.60)	
Social strain								<0.001
	Low	71.69	(23.92)	266	(37.89)	53	(12.21)	
	Medium	55.19	(24.88)	398	(56.70)	295	(67.97)	
	High	36.71	(27.94)	38	(5.41)	86	(19.82)	
Competency strain								<0.001
	Low	68.27	(24.63)	211	(29.80)	69	(15.86)	
	Medium	55.85	(26.70)	452	(63.84)	309	(71.03)	
	High	45.69	(26.71)	45	(6.36)	57	(13.10)	
Discrimination								<0.001
	Low	61.08	(26.87)	488	(68.64)	239	(55.45)	
	Medium	52.86	(26.01)	221	(31.08)	187	(43.39)	
	High	25.71	(36.06)	2	(0.28)	5	(1.16)	
Social support								<0.001
	High	65.74	(23.61)	389	(54.87)	128	(29.09)	
	Low	50.89	(27.74)	320	(45.13)	312	(70.91)	

SD, standard deviation; PTE-AR, potentially traumatic experiences adversity ratio; wid, widowed.

There was very strong evidence of gender-specific associations between social strain and SWB (Wald *p*-value for interaction <0.001), with fully adjusted models showing clear associations in males, but none in females. These findings were very similar in sensitivity analyses done on imputed data. In males, both the medium and high strain group had

TABLE 3 | Logistic models of low subjective well-being (SWB) regressed on post-migratory stressors.

		Total sample (UOR)		Gender-specific models (UOR)					Gender-specific models (AOR†)				
				Male		Female		Wald‡	Male (n = 609)		Female (n = 362)		Wald‡
		OR	95% CI	OR	95% CI	OR	95% CI		OR	95% CI	OR	95% CI	
Financial strain	Low	Ref		Ref		Ref		0.067	Ref		Ref		0.156
	Medium	4.44c	(3.03–6.51)	6.45c	(3.72–11.2)	2.72c	(1.56–4.73)		3.59c	(1.95–6.60)	1.66	(0.84–3.27)	
	High	14.05c	(8.91–22.1)	21.51c	(11.4–40.6)	7.89c	(4.0–15.6)		10.30c	(4.91–21.6)	3.84b	(1.68–8.79)	
Social strain	Low	Ref		Ref		Ref		<0.001	Ref		Ref		0.001
	Medium	3.72c	(2.67–5.18)	6.78c	(4.03–11.4)	2.12b	(1.34–3.37)		4.25c	(2.31–7.82)	1.06	(0.58–1.92)	
	High	11.36c	(7.01–18.4)	26.04c	(13.0–52.4)	4.53c	(2.23–9.22)		9.21c	(4.91–21.6)	1.03	(0.40–2.64)	
Competency strain	Low	Ref		Ref		Ref		0.452	Ref		Ref		0.325
	Medium	2.09c	(1.54–2.84)	2.27c	(1.52–3.38)	1.81b	(1.11–2.95)		1.32	(0.81–2.17)	0.79	(0.42–1.51)	
	High	3.87c	(2.41–6.24)	4.91c	(2.62–9.20)	2.64b	(1.27–5.50)		2.10	(0.92–4.79)	0.93	(0.36–2.39)	
Discrimination	Low	Ref		Ref		Ref		…	Ref		Ref		…
	Medium	1.73c	(1.35–2.22)	1.90c	(1.38–2.61)	1.53a	(1.02–2.29)		1.39	(0.94–2.07)	1.21	(0.73–2.02)	
	High	…		…		…			…		…		

Low psychological well-being defined as WHO-5 Well-Being Index score <50; UOR, unadjusted odds ratio; AOR, adjusted odds ratio.
†Adjusted for age, education, civil status, year immigration, potentially traumatic experiences (PTE-AR), social support, and other variables in the table.
‡p-values for Wald test of interaction between gender and post-migratory stressors (interaction terms were tested sequentially—i.e., only one interaction term were included in each model).

increased odds of low SWB compared to the low strain group (OR$_{\text{medium vs. low social strain, males}}$ = 4.25, 95% CI 2.31–7.82, $p < 0.001$ and OR$_{\text{high vs. low social strain, males}}$ = 9.21, 95% CI 4.91–21.6, $p < 0.001$), with ORs pushed slightly toward the null (<5%) in sensitivity analysis on imputed data. The statistical evidence remained strong after controlling for symptoms of anxiety, depression and PTSD, even though the ORs were reduced (OR$_{\text{medium vs. low social strain, males}}$ = 3.62, 95% CI 1.84–7.13, $p < 0.001$, OR$_{\text{high vs. low social strain, males}}$ = 6.56, 95% CI 2.58–16.6, $p < 0.001$, not shown in tables).

No associations were found between competency strain and SWB or between discrimination and SWB in fully adjusted models using complete-case analysis, and there was only weak evidence ($p = 0.045$) that the high competency strain group had elevated odds of low SWB compared to the low strain group in sensitivity analysis with imputed data.

There was some evidence (**Table 4**) that social support modified the association between the financial strain and SWB (Wald p-value = 0.08), with a stronger association found in the low social support group (OR$_{\text{high vs. low financial strain, low social support}}$ = 11.30, 95% CI 5.13–24.9, $p < 0.001$) compared to the high social support group (OR$_{\text{high vs. low financial strain, high social support}}$ = 4.33, 95% CI 1.95–9.60, $p < 0.001$). The evidence for interaction was marginally stronger in sensitivity analysis done on imputed data (p-value for interaction = 0.07), but the ORs were more or less unchanged, except for the high strain low support group which was attenuated (from OR = 11.3 to OR = 9.21). When analysis was stratified by gender, no evidence of interaction was found. The test for interaction between social strain and social support is not reported because there were ≤5 participants in individual cells after stratifying by social support, resulting in unstable parameter estimates.

DISCUSSION

Main Findings

To our knowledge, the present study is one of the first to investigate gender-specific associations between post-migration stressors and positive mental health in a population of adult refugees resettled in a high-income country. Our results suggest that post-resettlement social strain in particular, but also financial strain, had clear gendered effects on SWB, with much stronger effects in males than in females. In fact, in fully adjusted analysis, social strain showed no association with SWB in females whereas in males, high social strain was associated with a manifold increase in the odds of low SWB. An important secondary finding was that social support appeared to buffer the adverse effects of financial strain on SWB.

The present study's moderate evidence for gender-specific associations between financial strain and SWB is somewhat contrary to the study by Wu et al. on refugees resettled in Australia (16), which did not find that the adverse associations of economic stressors with mental health varied by gender. A possible explanation for this could be that the gendered effect only comes into play when mental health is framed and

TABLE 4 | Fully adjusted logistic models of low subjective well-being (SWB) regressed on financial strain and testing of social support as effect modifier.

	Total sample (n = 974)						Gender-specific											
	High support		Low support		Wald†		Male (n = 609)						Female (n = 362)				
							High support		Low support		Wald†		High support		Low support		Wald†
	OR	95% CI	OR	95% CI			OR	95% CI	OR	95% CI			OR	95% CI	OR	95% CI	
Financial strain					0.08						0.49						0.36
Low	Ref		Ref				Ref		Ref				Ref		Ref		
Medium	1.59	(0.87–2.91)	4.42[c]	(2.24–8.71)			2.11	(0.83–5.37)	4.34[c]	(1.85–10.1)			1.50	(0.64–3.51)	4.36[a]	(1.26–15.1)	
High	4.33[c]	(1.95–9.60)	11.30[c]	(5.13–24.9)			5.66[b]	(1.71–18.7)	12.6[c]	(4.59–34.8)			4.37[a]	(1.38–13.9)	10.8[c]	(2.67–43.5)	
Social strain*																	

Low psychological well-being defined as WHO-5 Well-Being Index score <50. Models adjusted for age, education, civil status, year immigration, potentially traumatic experiences adversity ratio, and other post-migratory stressors.

†p-values for Wald test of interaction between social support and financial strain.

*Interaction between social strain and social support is not reported because there were ≤5 individuals in individual cells after stratifying by social support, leading to unstable parameter estimates.

measured in terms of positive mental health and not when focusing on mental health as psychological distress as was done by Wu et al. Another possible explanation could be that "financial strain" as operationalized in our study measured a somewhat different and narrower construct than the "economic stressors" variable in the Wu et al. study. Specifically, our study focused exclusively on worries related to personal finances measured with three items answered on a 5-point scale from "not at all" to "always." In the Wu et al. study, on the other hand, economic stress was measured with three yes/no items with a broader focus, incorporating housing and employment stress in addition to "financial status." It is possible that this broader conceptualization of strain could have diluted and rendered undetectable any gender-specific association existing only between personal financial worry/stress and mental health, especially given the somewhat coarse way in which strain was measured.

A surprisingly strong finding in the present study was the clear gender-specific association between social strain and SWB, with no association found in females but a marked association in males. A gendered effect of loneliness on mental health was found in the Wu et al. study, although the adverse effect appeared to be stronger in females, at least at certain phases of resettlement. Comparing these findings is not straight-forward, however, since two of the social strain items in our study focused on frustration due to loss of status in Swedish society and frustration caused by not being able to use personal competency, both conceptually clearly distinct from loneliness. In a more explorative vein, a potential explanation for the apparent stronger negative effect of social strain in males found in the present study, may be related to traditional gender roles and the value placed on patriarchy in Middle Eastern societies, with men's identity closely linked to work and being able to provide for their family (54, 55). This argument is broadly in line with evidence from Syrian refugees in Lebanon where men frequently reported feeling ashamed to ask for help from aid agencies and often sent women to pick up boxed food (56). However, it is important to not try to fit a highly complex gendered reality into stereotypical and overly simplistic gender models (57). More studies are needed to corroborate this interesting and seemingly robust finding.

The notable reduction in the size of the ORs when going from unadjusted to fully adjusted models for financial strain and social strain across all strata was largely explained by the shared variance between these two variables. That is, the association between financial strain and SWB was markedly reduced upon adding social strain to the model, much more so than when adding the other variables included in the full model. Similarly, the association between social strain and SWB was clearly reduced upon adding financial strain to the model. In fact, for women, there was some statistical evidence of an association between social strain and SWB if financial strain was left out of the full model. This association, however, was completely absent when financial strain was included. Considering the three items comprising each of the two post-migration stressors (see **Supplementary Table 1**), a possible explanation could be that part of the adverse effects of social

strain on SWB, particularly for women, is mediated through financial strain—i.e., social strain leads to financial strain, which then impacts SWB. Furthermore, the reduction in the size of the ORs for competency strain when going from crude to fully adjusted models was strongly linked to the shared variance between competency strain and both financial and social strain, with ORs pushed notably toward the H_0 value of 1.00 when either or both were controlled for. Disentangling cause and effect between the post-migration stressors and well-being is complicated by the fact that these factors are likely tightly intertwined, mutually and continuously influencing each other. It is possible that including all stressors in the same model masks true associations because of overadjustment bias (58). For example, if competency strain has an adverse effect on SWB that causally goes through social strain (i.e., high competency strain → high social strain → low SWB), then this effect may be "controlled away" when including both stressors in the same model.

The moderate evidence that social support buffered the adverse effects of financial strain on SWB in the present study is broadly in line with another study from Sweden (36), which found that social support moderated the negative effects of discrimination on mental health. Similarly, the modifying role of social support was a main finding and take-home message in the Canadian Refugee Resettlement Project, which found that the positive association between resettlements stress and depression was only evident for refugees lacking personal and social support (37). Both of these studies, however, focused on psychological distress or disorder, and not on positive mental health as the present study did. The importance of social support in refugees may also depend on where the support comes from, as indicated by one study on refugees from Sudan resettled in Australia which found that social support from family and from within the Sudanese community was associated with mental health, but not support from the wider community (59). The absence of statistical evidence for interaction between social support and financial strain when analyses were stratified by gender was likely because the study was underpowered to detect this two-way interaction.

Strengths and Limitations

The present study has several strengths. First, by approaching mental health with a clear gender perspective, the study mitigates a key limitation in refugee research to date, namely the paucity of gender-specific data and evidence (40, 41). The findings on gender-specific effects of stress in the resettlement phase may be applied in practice to support and promote gender-sensitive resettlement strategies and initiatives, as well as facilitate research focusing on identifying predictors of well-being outcomes. A second strength is the methodological rigorousness of the study, and arguably the focus on positive mental health as opposed to a deficit model of health, given the predominance of the latter approach in current literature. As highlighted in a recent review article (23), one of the limitations of studies on positive mental health in refugee populations relate to weaknesses in methods and design—e.g., the frequent use of

convenience samples. In the present study participants were recruited through random sampling from total population registries and the large number of respondents increased the power to detect smaller associations. Furthermore, validated measurement instruments were used for outcome and key predictor variables, and a broad set of relevant contextual factors were included in analysis, potentially reducing confounding noise and spurious associations distorting the main associations of interest.

The study also has important limitations. Given that just above 30% of invited refugees decided to participate in the study, there is a risk that selection bias may have affected results. **Supplementary Table 2** shows that there were statistical differences between respondents and non-respondents on several sociodemographic variables. However, as shown in a prior publication (14), weighted and unweighted prevalence estimates for SWB and other mental health parameters were similar in the study population, making it less likely that non-response bias has greatly distorted results. When final regression models in the present study were repeated using weighted analysis (poststratification weights), there was only negligible differences in the statistical evidence behind findings and ORs remained mostly unchanged. Moreover, it is not necessarily straightforward, or recommended, to use weighted analyses when exploring causal effects (60).

Since the study focused exclusively on refugees from Syria resettled in Sweden between 2011 and 2013, the findings may not be generalized to other refugee populations, or even to Syrian refugees coming at different time-periods as the profile of refugee cohorts from Syria may vary between time-periods.

Although the refugee post-migration stress scale (RPMS) used in the present study has been piloted and validated in refugee populations, it is possible that some of the questions in the scale rest too heavily on assumptions and expectations found predominantly in gender-equal societies and less in societies with greater gender separation. For example, a Syrian woman may interpret and answer the question "Feeling excluded or isolated in Swedish society" differently than a Syrian man because of gender role expectations rooted in traditional Syrian society and culture.

The cross-sectional design of the study places clear limits on causal interpretations. This point is particularly relevant in light of the recent findings by Wu et al., which suggest that the effects of post-migration stress on mental health are time-varying (16).

Lastly, no pre-registered study protocol with a detailed analysis plan exists, and analytic choices were partly made with data at hand. The study is therefore somewhat exploratory in nature even if hypotheses were based on previous evidence, and relevant theory and were broadly conceptualized prior to approaching the data.

CONCLUSION

Post-resettlement stress related to financial and social hardships appears to have highly gendered effects on SWB

in resettled refugees, with a notably stronger adverse effect in men. Policies and interventions aimed at mitigating psychological distress in refugee populations should be sensitive to this finding and accommodate the potentially gendered reality in order to enhance effectiveness. Given the limited research that has been conducted on this topic and the variations in findings, further research with robust methodology (e.g., randomly selected large samples, validated measurements and longitudinal designs) is clearly needed.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Swedish Ethical Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

NA organized the database, performed the statistical analysis, wrote the statistical analysis, and results section of the manuscript. SM wrote the first draft of the manuscript. All authors contributed to conception, design of the study, manuscript revision, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh. 2021.717353/full#supplementary-material

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