RESEARCH ARTICLE

Head Trauma in Refugees and Asylum Seekers

A Systematic Review

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Abstract

Background and Objectives

Refugees and asylum seekers are at risk of head trauma. They endure blows to the head due to exigent circumstances necessitating resettlement (e.g., torture, war, interpersonal violence) and during their dangerous journeys to refuge. Our objective was to assess the global prevalence of head trauma in refugees and asylum seekers and describe its clinical characteristics in this population.

Methods

The protocol was registered in the PROSPERO International Prospective Register of Systematic Reviews (CRD42020173534). PubMed/MEDLINE, PsycInfo, Web of Science, Embase, and Google Scholar databases were searched for relevant studies. We included all studies in English that comprised refugees or asylum seekers of any age and examined the prevalence or characteristics of head trauma. We excluded studies that were not peer-reviewed original research. Information was recorded on the prevalence of head trauma, method of ascertaining head trauma, severity, mechanism of injury, other trauma exposures, and comorbidities. Descriptive analyses and narrative syntheses were performed.

Results

A total of 22 studies were included, of which 13 with 6,038 refugees and asylum seekers reported head trauma prevalence. Prevalence estimates ranged from 9% to 78%. Heterogeneity among studies precluded meta-analysis. Most studies were US based (n = 9, 41%), followed by the Middle East (n = 5, 23%). Most refugees or asylum seekers were from the Middle East (n = 9, 41%), with those from Latin America least represented (n = 3, 14%). Studies disproportionately involved younger (pooled mean age = 29 years) adult samples composed of men. Recruitment settings were predominantly hospitals/clinics (n = 14, 64%), followed by refugee camps (n = 3, 14%). The most common mechanism of injury was direct impact through a beating or blow to the head. Studies varied greatly in how head trauma was defined and ascertained; no study used a validated traumatic brain injury (TBI)–specific screening tool. Similarly, TBI severity was not uniformly assessed, although hospital-based samples captured more moderate-to-severe head injuries. Mental health comorbidities were more frequently documented rather than physical health ones. Only 2 studies included a comparison with local populations.

Discussion

Refugees and asylum seekers are vulnerable to head trauma, but studies using systematic approaches to screening are lacking. Increased attention to head trauma in displaced populations will allow for optimizing equitable care for this growing vulnerable population.

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Glossary

IPV = intimate partner violence; **LOC** = loss of consciousness; **PTA** = posttraumatic amnesia; **PTSD** = posttraumatic stress disorder; **TBI** = traumatic brain injury.

The United Nations Refugee Agency estimates a worldwide population of 26.4 million refugees and 4.1 million asylum seekers, a subgroup of migrants fleeing their home countries and seeking protection from persecution.[1] The distinction between them is a legal one, with refugees having their status already determined and asylum seekers awaiting adjudication of their asylum claim. Clinically, refugees and asylum seekers experience poorer health outcomes than the general population including posttraumatic stress disorder (PTSD), depression, and cardiovascular disease.[2,3] Head trauma is one common neurologic condition among refugees and asylum seekers.[4] These individuals are at particular risk of head trauma because they are both more likely to endure blows to the head due to the exigent circumstances in their home countries necessitating resettlement (e.g., torture, war, and interpersonal violence) and the circumstances of their dangerous journeys to refuge.[4,5] These traumatic exposures also lead to additional physical, psychological, and psychosocial problems. The combination of these problems makes for more complex presentations than in the general population, including perpetuating head injury–related neurobehavioral symptoms, hindering recovery, and portending worse outcomes.[6] Single studies have suggested an elevated risk of traumatic brain injury (TBI) in this population.[7] Still, empirical evidence is scarce, and no systematic literature review has been conducted on this topic.

TBI is associated with numerous adverse health consequences including psychiatric disorders,[8] cognitive impairment,[9] later-life dementia,[10] and neurodegenerative disease. Beyond individual-level ramifications, TBI affects the life of an affected individual's family and carries a societal and economic toll.[11,12] For asylum seekers and refugees, there are also significant legal ramifications such as credibility assessments in immigration court proceedings derailed due to an individual's cognitive impairment after head injury.[6,13] Recognizing the prevalence of head trauma, its common characteristics, and the associated health consequences is critical to understanding and serving the unique needs of this vulnerable and growing population.

The primary aim of this study was to conduct a systematic literature review to determine the global prevalence of head trauma among refugees and asylum seekers and to describe its common clinical characteristics in this population. We used head trauma rather than TBI to avoid the challenge of definition differing across studies and to provide as expansive a review of the extant literature as possible. We use TBI when criteria are specified. We subsequently synthesized the findings of these studies and proposed areas for future study.

Methods

Standard Protocol Approvals and Registrations

We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines and the Meta-analysis of Observational Studies in Epidemiology for this systematic review.[14,15] The protocol was registered on the PROSPERO (CRD42020173534). Institutional ethics review was not sought because the current review relied on secondary use of group-level data.

Eligibility

Studies were included in the systematic review if they comprised individuals of any age who were refugees or asylum seekers and if they examined the characteristics or prevalence of head trauma in this population. We did not apply any internal criteria for defining refugees or asylum seekers. Articles were included if they reported on the population of interest; however, it was defined in the original article. There were no limitations regarding the dates of data collection or TBI severity. Exclusion criteria included studies that were not peer reviewed, not published in English, not original research studies with unique observational data (i.e., reviews, editorials, or commentaries), case reports and case series, and depiction of ethnic background or immigrants only without an explicit mention of refugee or asylum status or focus on subpopulations such as imprisoned individuals. For articles that we were unable to access, we contacted authors of the studies to obtain the article and assess study eligibility.

Search Strategy, Study Selection, Risk of Bias, and Quality Assessment

All articles included in this review were identified through a systematic search on the following databases: PubMed/MEDLINE (Inception–March 2021), PsycInfo (1988–March 2021), Web of Science (Inception–March 2021), Embase (Inception–March 2021), and Google Scholar (Inception–March 2021). The search strategy was piloted in PubMed/MEDLINE by using MeSH terms and iteratively adding and refining relevant search terms and by ensuring that the included search terms returned studies we knew to exist on this topic. Searches were performed in March 2021 with a combination of key words and subject headings consistent across all databases (eTable 1, links.lww.com/WNL/C741). To reduce the risk of publication bias, we conducted forward and backward citation searches on included studies and reviews on this topic.

Two authors independently screened titles, abstracts, and full articles for eligibility, extracted data from the included articles,

and assessed the methodological quality of selected studies. Discrepancies were resolved by discussion. Interrater reliability for both the title and abstract and full-text screening was calculated using Cohen kappa (>90%).

Methodological quality was assessed using NIH National Heart, Lungs and Blood Institute Study Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (*Study Quality Assessment Tools*). Each domain was judged according to specific criteria and scored as "good," "fair," or "poor" by 2 independent reviewers.

Data Extraction and Analysis

The following items were extracted from each study: study authors, year of publication, study design, sample size, study site and setting, study sample country of origin, sex, age, head trauma prevalence, head trauma severity, head trauma ascertainment method, mechanism of injury, physical and mental health comorbidities, and other trauma exposure. The brain injury was "mild" if loss of consciousness (LOC) was 30 minutes or less and posttraumatic amnesia (PTA) was 24 hours or less; the brain injury was "moderate or severe" if any LOC or PTA was greater than these thresholds. Mechanism of injury included direct impact (head strike or fall), penetrating injury, sudden or rapid acceleration and deceleration, and blast injury. Head trauma ascertainment method included clinical interview, voluntary self-disclosure, survey instrument with self-report of head trauma, medical record review, and neuroimaging. The form was piloted and refined on 5 studies selected for inclusion. Ultimately, because many studies used variable definitions or classifications for head trauma severity and mechanism of injury, we retained original language used by study authors and outlined differences from these a priori classifications in the narrative synthesis.

We decided not to conduct a meta-analysis after the systematic literature search was completed because of the heterogeneity of studies. The heterogeneity of test results was considered quantitatively (Higgin I^2 statistic, wherein I^2 values of 25%, 50%, and 75% were considered low, moderate, and high heterogeneity, respectively; in this study, I^2 = 99) alongside a qualitative assessment of the combinability of studies in the systematic review. Therefore, results reflect qualitative and descriptive analyses and narrative synthesis of the studies.

Data Availability

Data that support the findings of this statement are available in tables and figures. Other materials in the review are available on request from the corresponding author, A.S.

Results

Study and Population Characteristics

Our database searches identified a total of 877 potentially eligible studies. After removing duplicate records, 425 were screened for eligibility. We contacted 4 authors for articles we did not have access to; 2 responded and the articles were not deemed eligible for the study. We assessed 77 full-text articles for eligibility, of which 22 full-text articles were ultimately included in the review (Figure 1).

The included studies were published between 1988 and 2021. Most of the studies were conducted in the United States (n = 9, 41%), followed by the Middle East (n = 5, 23%) and Europe (n = 4, 18%) (Figure 2). Most studies included refugees or asylum seekers from the Middle East (n = 9, 41%), with refugees or asylum seekers from Latin America least represented (n = 3, 14%) (Figure 2). The predominant recruitment settings were hospitals/clinics (n = 14, 64%), followed by refugee camps (n = 3, 14%), forensic medical-legal partnerships (n = 3, 14%), and civic/service organizations (n = 2, 9%).

Among the 22 studies, the sample size of refugees and asylum seekers ranged from 18 to 1,735 (median = 175, mean = 466). Two pairs of studies involved overlapping samples.[16-19] The age of participants ranged from 2 months to 90 years. The mean age was reported in 15 studies, of which the pooled mean age was 29 years. Most of the studies (n = 14, 64%) included adults only. Of the 22 studies, most of the studies included more men than women (n = 10, 45%), with 3 studies not specifying participant sex or gender and 3 comprising men-only samples. Table 1 represents the study characteristics and summary of findings.

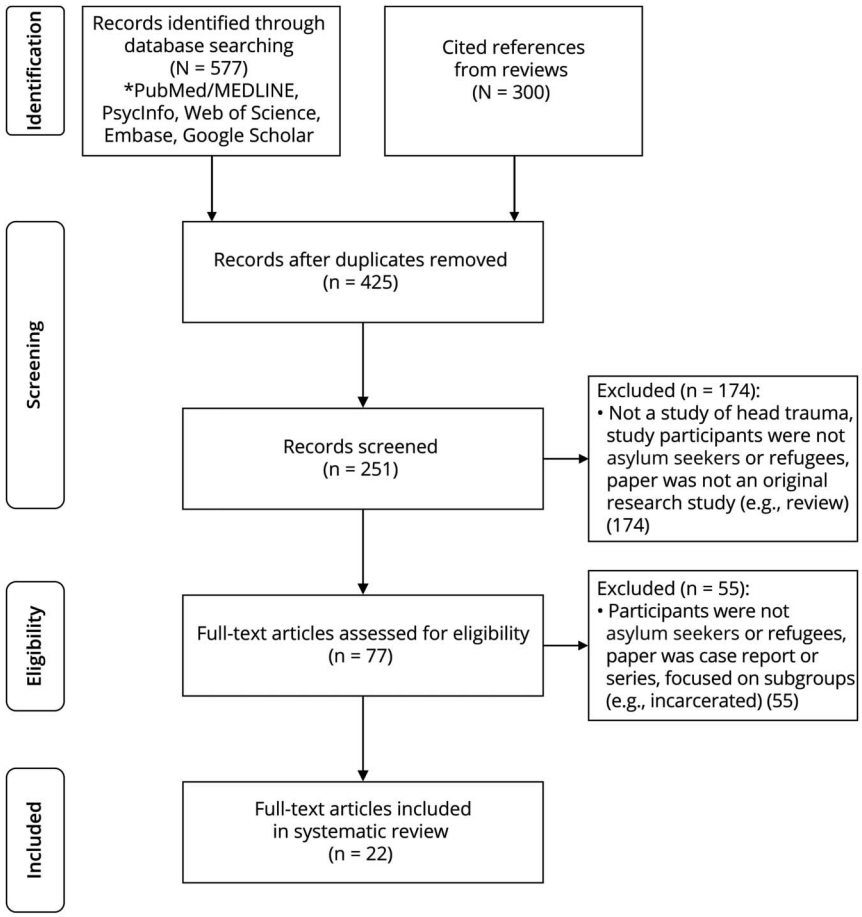
Head Trauma Characteristics

Thirteen studies (n = 6,038) reported prevalence rates of head trauma, in sample sizes of >25 participants with nonoverlapping study cohorts. Prevalence estimates of head trauma ranged from 9% to 78%. Studies varied greatly in how they defined and ascertained cases with head trauma. The methods of head trauma ascertainment for the included studies ranged from self-reporting (either through individual disclosure or using a screening questionnaire) to neuroimaging for moderate-to-severe brain injuries. No validated TBI-specific screening tools were used in any of these studies.

Ten studies mentioned the use of neuroimaging, with 7 of those comprising retrospective medical record reviews in hospital-based settings. Only 5 studies explicitly specified head trauma severity,[19-23] although this definition also varied among studies. For example, Goh et al.[21] used the Glasgow coma scale (scores of ≥13), whereas Keatley et al.[19] used duration of LOC (> or <30 minutes) as an index of severity. However, due to the hospital-based/clinic-based sampling, most of the studies comprised moderate-to-severe head injuries even without an explicit mention of severity, for example, McKenzie et al.[24] discussed referral for head trauma including bullet wounds. Strangulation or asphyxiation was reported in this population in conjunction with head trauma (n = 8) but not specified as to whether this contributed to any brain injury.

The most documented mechanism of injury was direct impact or head strike through a beating or blow against the head

Figure 1 PRISMA Flow Diagram

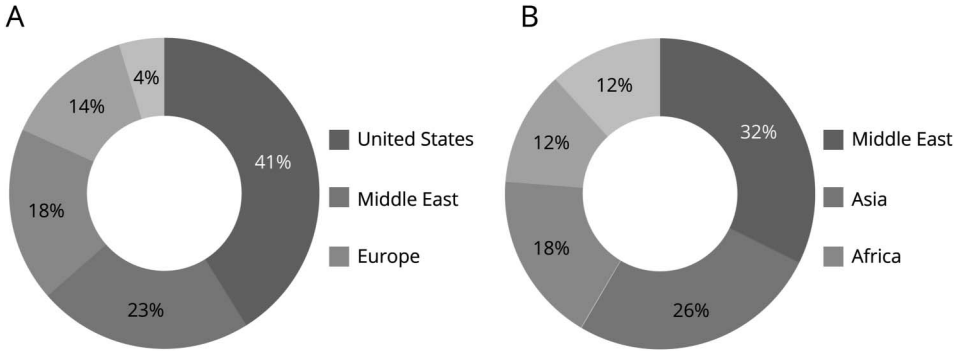


PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-analyses.

(n = 9, 41%).[13,18,20,25-30] Three additional studies reported that blunt trauma was the leading mechanism of head trauma in their sample but did not specify the percentage that this represented.[16,19,31] Two studies cited blast-induced head trauma as the predominant mechanism of injury in their study population.[17,32] Another 2 studies, comprising Vietnamese refugee adult and pediatric samples, listed falls (e.g., falls from beds for the pediatric group) as the predominant mechanism of injury, attributed to the poor living conditions in refugee camps.[21,22]

Head trauma was comorbid with a range of physical and mental health conditions, although more studies documented mental health comorbidities (n = 12, 55%) than physical ones (n = 9, 41%). Among mental health

Figure 2 Study Settings



(A) Study sites. (B) Refugee region of origin.

Table 1 Summary of Included Studies

Study	Country	Study design	Study setting	Sample size (N)	Age, y, mean ± SD (range)	Women, n/N (%)	ASR country of origin, n/N (%)	Diagnosis or method of ascertainment	Prevalence, n/N (%)	Severity	Mechanism of injury n/N (%)
Studies focusing on adult populations (n = 20)											
Al-Nuaimi et al., 2018[34]	Turkey	Cross-sectional	Rehabilitation Hospital	40	NR ± NR (8–50)	7/40 (17.5%)	40/40 (100%) Syria	Clinical interview	9/40 (22.5%) TBI	NR	NR
Baranowski et al., 2019[25]	United States	Retrospective Chart review Cross-sectional	Forensic Human Rights Program, New York City	70	29.4 ± 6.5 (18–55)	70/70 (100%)	24/70 (34%) El Salvador 15/70 (21%) Guatemala 31/70 (44%) Honduras	Voluntary self-disclosure	27/70 (39%) Blunt trauma to head	NR	27/27 (100%) Blunt trauma to head
Doherty et al., 2016[20]	United Kingdom	Cross-sectional	NHS Psychological Trauma Service, Greater Glasgow and Clyde	115	36 ± 9 (18–71)	68/115 (59%)	49/115 (43%) Africa 37/115 (32%) Middle East 14/115 (12%) South Asia 12/115 (10%) North Asia 3/115 (3%) Eastern Europe	Survey instrument including self-report of head trauma, LOC, and duration; LOC and duration (>30 min) as index of severity	53/103 (51%) HI	11/53 (21%) Mild 20/53 (38%) Mod–severe 22/53 (41%) Unsure	17/53 (33%) Accidental 9/17 (53%) Falls 8/17 (47%) Traffic accidents 34/53 (67%) Assault 18/34 (53%) Torture 6/34 (18%) Domestic violence 4/34 (12%) Human trafficking 6/34 (18%) Not specified
Duzkoylu et al., 2017[7]	Turkey	Retrospective Chart review Cohort	Emergency Department, State Hospital	3,863 (1,735 refugees)	19.06 ± NR for Refugee patients, 27.01 ± NR for nonrefugee patients	573/1,735 (33.0%) Refugee patients 620/2,128 (29.1%) nonrefugee patients	NR, Syria and Iraq	Medical records	329/1735 (18.9%) Refugee patients HI, 281/2128 (13.2%) Turkish patients HI	NR	NR specifically, include fracture, bleeding, hematoma, closed head injury, superficial skin tear, and additional nose, mouth, and orbital injuries
Ferrada-Noli et al., 1998[49]	Sweden	Cross-sectional	Centre for Diagnosis and Rehabilitation of Torture and Trauma Victims, Psychiatric clinic of teaching hospital, Stockholm	65	NR	9/65 (13.8%)	69% Middle East and Africa 31% Yugoslavia, East, Europe, and Latin America	Clinical interview	18/65 (28%) Head and body beatings (head and body trauma combined)	NR	18/18 (100%) beatings 6/65 (9%) Water torture
Goh et al., 1996[21]	China	Retrospective chart review cross-sectional	Neurologic Division Hospital	1,223	21 ± NR (0.17–42)	NR	1,223/1,223 (100%) Vietnam	Medical records	NA (entire sample has HI)	90%–92% Pediatric and 97%–99% Adult–minor H; 8%–10% Pediatric and 0.3%–1.3% Adult–moderate HI, defined by GCS ≥13	429/601 (57%–75%) Pediatrics and 289/622 (40%–51%) Adults–fall from bed NR—assault a slips

Continued

Table 1 Summary of Included Studies *(continued)*

Study	Country	Study design	Study setting	Sample size (N)	Age, y, mean ± SD (range)	Women, n/N (%)	ASR country of origin, n/N (%)	Diagnosis or method of ascertainment	Prevalence, n/N (%)	Severity	Mechanism of injury n/N (%)
Hougen, 1988[30]	Denmark	Cross-sectional	Clinic	24	NR ± NR (18–51)	0%	24/24 (100%) Lebanon	Survey instrument with self-reported head trauma, Clinical interview	12/24 (50%) Blow Against the Head Also reported 4/24 (16.7%) Asphyxiation	NR	12/12 Blow Against the Head
Keatley et al., 2015[19]	United States	Retrospective chart review Cohort	Program for Survivors of Torture, New York City	157 (sample overlaps with Keatley et al., 2013)	33.26 ± 9.31 Control 34.18 ± 9.11 Moderate/severe TBI	39/72 (54%) Control 26/85 (30.6%) Moderate/severe TBI	TBI cohort (similar to control) 32/85 (37.7%) West Africa 18/85 (21.2%) Central Africa 12/85 (14.1%) Central Asia 9/85 (10.6%) East Asia 7/85 (8.2%) Eastern Europe 7/85 (8.82%) Other/missing	Clinical interview, including self-reported head injury and LOC; LOC as index of TBI severity	NA (entire sample has HI)	85/85 (100%) Moderate/severe Of those with moderate/severe TBI, 58 (68.2%) experienced duration of LOC between 31 min and 6 h, 18 (21.2%) between 6 h and 1 d, and 9 (10.6%) greater than 1 d.	NR specifically; many experience abuses at the hands of their persecutors that include being kicked, punched, or struck with a weapon about the head.
Keatley et al., 2013[18]	United States	Cross-sectional	Program for Survivors of Torture, New York City	488	35.7 ± 12.9	184/488 (37.7%)	146/488 (29.9%) West Africa 94/488 (19.3%) East Asia 84/488 (17.2%) Central Africa 64/488 (13.1%) Eastern and Western Europe 57/488 (12%) South Asia 18/488 (3.7%) Americas 11/488 (2.3%) Middle East, 11/488 (2.3%) Africa 3/488 (0.1%) Other	Clinical interview, including self-reported head injury and LOC; LOC as index of TBI severity	335/488 (69%) patients reported sustaining a blow to the head	NR	335/488 (69%) patients reported sustaining a blow to the head; 185/335 (55%) reported LOC after a blow to the head
McKenzie et al., 2015[24]	United States	Retrospective cohort	UNHCR referrals for exceptional or emergency care	223	NR *Median = 35 y (first quartile 12 y, third quartile 55 y)	89/223 (40%)	128/223 (57%) Syria 80/223 (36%) Iraq 15/223 (7%) Sudan, Somalia, Egypt and Yemen collectively	Medical record, neuroimaging (MRI)	NA (sample reflects referral patterns not prevalence) 17/223 (7.6%) referrals for head trauma	NR, but presumed severe due to need for referral	NR specifically; mention conflict related e.g., bullet wounds and unintentional injuries e.g., falls in the elderly individuals

Continued

Table 1 Summary of Included Studies *(continued)*

Study	Country	Study design	Study setting	Sample size (N)	Age, y, mean ± SD (range)	Women, n/N (%)	ASR country of origin, n/N (%)	Diagnosis or method of ascertainment	Prevalence, n/N (%)	Severity	Mechanism of injury n/N (%)
McMurry et al., 2020[27]	United States	Retrospective cross-sectional	Forensic Human Rights Clinic, Miami	139	27.4 + 12.1	79/139 (56.8%)	49/139 (35.3%) Honduras, 24/139 (17.3%) Guatemala, 22/139 (15.8%) Haiti 13/139 (9.4%) El Salvador, 7/139 (5%) Nicaragua 4/139 (2.9%) Mexico 20/139 (14.4%) Other	Voluntary self-disclosure	59/139 (42.9%) Head injury	NR	41/139 (69.5%) Repeated beatings, 13/139 (22%) >3 beatings with hard object, 14/139 (23.7%) >1 beating with hard object, 19/139 (32.2%) Head laceration, 5/139 (8.5%) Facial fracture.
Mollica, 1993[28]	Thailand	Cross-sectional	Refugee camp on Thailand-Cambodia border	993	56.6% (±1.6) Age 18–34 40.7% (±1.6) Age 35–64 2.7% (±0.5) Age ±65	605/993 (60.9%)	993/993 (100%) Cambodia	Survey instrument with self-report of head trauma	228/993 (23%) Head trauma Also reported 32.3% Near drowning, 23.1% LOC, 16.1% Near suffocation	NR	228/228 Beatings to head
Mollica et al., 2014[17]	United States	Cross-sectional	Civic organization, greater Boston area	419	60.5 ± 7.4 refugees who were formerly detained in Vietnam, 62.4 ± 11.2 Comparison	0%	419/419 (100%) Vietnam	Survey instrument with self-report head trauma, post-concussive symptom scale, neuroimaging	263/337 (78%) with traumatic head injury (THI), 183/263 (69.8%) with LOC associated with THI. Of those with THI, 167/263 (63.5%) with 3+ injuries	NR	158/337 (46.88%) Explosion, 68/337 (20.18%) Beaten on head, 58/337 (17.21%) Shrapnel, 55/337 (16.32%) Fall for other reason, 47/337 (13.95%) Suffocation, 40/337 (11.87%) Fall out of vehicle, 36/337 (10.68%) Fall from fatigue, 19/337 (5.64%) Hit head against dashboard, 15/337 (4.45%) Work accident, 9/337 (2.67%) Drowning, 9/337 (2.67%) Whiplash, 7/337 (2.08%) Shot in head, 6/337 (1.78%) Strangulation, 5/337 (1.48%) Other head injury, 3/337 (0.89%) Hit by vehicle, 2/337 (0.59%) Hit head while trying to escape from camp
Mollica et al., 2009[16]	United States	Cross-sectional	Academic medical center hospital, Boston	58 (Subsample of Mollica et al., 2014)	62.9 ± 8 Detainees 62.6 ± 9.6 Comparison	0%	58/58 (100%) Vietnam	Survey instrument with self-report head trauma (including LOC, posttraumatic amnesia, and neurologic deficit), Neuroimaging (MRI)	16/42 (38%) THI	NR	NR specifically, but mentioned that most prevalent is blunt trauma from beating to head and explosion

Continued

Table 1 Summary of Included Studies *(continued)*

Study	Country	Study design	Study setting	Sample size (N)	Age, y, mean ± SD (range)	Women, n/N (%)	ASR country of origin, n/N (%)	Diagnosis or method of ascertainment	Prevalence, n/N (%)	Severity	Mechanism of injury n/N (%)
Mollica et al., 2002[31]	United States	Cross-sectional	Refugee camps	967	NR ± NR (18–90)	593/967 (61.3%)	967/967 (100%) Cambodia	Survey instrument with self-report head trauma	567/967 (58.6%) Brain injury	NR	Beatings to the head, near-drowning, near-suffocation with a plastic bag
Qasaimeh et al., 2017[32]	Jordan	Retrospective cohort	Academic medical center hospital	90	NR ± NR (6–64)	4/90 (4.4%)	90/90 (100%) Syria	Medical record	21/90 (23.3%) Brain injury	NR	43/90 (47.8%) Head and neck injury 49/90 (54.4%) Explosives *most common cause of injury to the head and extremities 45/90 (50%) Gunshots *more frequent in chest and abdomen 4/90 (4.4%) Both explosives and gunshots 4/90 (4.4%) Flame burns affecting head and extremities and were associated with explosives.
Saadi et al., 2021[13]	United States	Retrospective Cross-sectional	Forensic Physicians for Human Rights Asylum Network	193	32.5 ± 12.4 (7–75)	104/193 (53.9%)	24/193 (13%) Guatemala, 15/193 (8%) Honduras, 11/193 (6%) El Salvador There were RetrospectiveC9 or fewer applicants from any other country	Voluntary self-disclosure	58/193 (30.1%) Head trauma	NR	119/193 (63%) Pushed/punched/kicked/slapped, 96/193 (50.8%) Hit with weapon
Simsek, 2017[23]	Turkey	Retrospective Cohort	Public Hospital Department of Surgery	707	25.8 ± 12.7 (1–67)	48/707 (6.8%)	707/707 (100%) Syria	Medical records	NR	707/707 (100%) Severe	373/707 (52.7%) Injured head-neck area
Taha, 2015[29]	Iraq	Cross-sectional	Refugee camps	1,642 (820 refugees)	33.6 ± 10.8 (18–78) Refugees	506/820 (61.7%) Refugees	820/820 (100%) Syria	Clinical interview, Survey instrument	71/820 (8.7%) Beating to the head	NR	71/820 (8.7%) Beating to head 6/820 (0.7%) Suffocation or strangulation 8/820 (1%) Head submerged i n water near drowning

Continued

Table 1 Summary of Included Studies *(continued)*

Study	Country	Study design	Study setting	Sample size (N)	Age, y, mean ± SD (range)	Women, n/N (%)	ASR country of origin, n/N (%)	Diagnosis or method of ascertainment	Prevalence, n/N (%)	Severity	Mechanism of injury n/N (%)
Veliu and Leathem, 2017[33]	New Zealand	Cross-sectional	Service Organization, Refugee as Survivors offices	18	(25–60)	6/18 (33.3%)	7/18 (38.8%) Burna 2/18 (11%) Iraq 2/18 (11%) Afghanistan 1/18 (5.5%) Sri Lanka 1/18 (5.5%) Eritria 1/18 (5.5%) Ethiopia 1/18 (5.5%) Somalia 1/18 (5.5%) Iran 2/18 (11%) Palestine	Clinical interview, Medical record: duration of posttraumatic amnesia, duration of LOC, neuroimaging; formal neuropsychological testing	7/18 (38.9%) Brain injury	NR	Torture, assault while held captive, beatings, suffocation, electric shock, and bomb blast
Studies focusing on pediatric populations (n = 2)											
Friedl and Muensterer, 2019[35]	Germany	Retrospective Cohort	Pediatric Surgical Department, Academic Medical Center Hospital	25,046 (63 refugees)	5.6 ± 4.7 Refugee children 7.5 ± 0.4 Nonrefugee children	35/63 (55%) Refugee children, 14,490/ 24,983 (58%) Nonrefugee children	Refugee children: (11%) Syria, (11%) Albania, (8%) Eritrea, (6%) Afghanistan	Medical record	Minor closed head injury 49% nonrefugee vs 14% refugee, $p < 0.01$ Open head trauma 11% nonrefugee vs 14% refugee, nonsignificant difference	NR	Minor closed head injury and open head trauma
Goh and Poon, 1995[22]	China	Retrospective Cohort	Neurosurgical Unit of Hospital	1,206	6 ± NR (0.17–12)	NR	1206/1206 (100%) Vietnam	Medical record, Neuroimaging (skull x-ray, CT scan), severity determined by GCS	NA (entire sample has HI)	89%–93% Minor 7%–10.6% Moderate 0.5%–2.8% Severe	Fall from bed most common (67%–73%) Other causes: falling from stairs, from hammocks, from the arms of their minders, or while running or playing

Abbreviations: ASR = asylum seekers and refugees; GCS = Glasgow coma scale; LOC = loss of consciousness; NA = not applicable; NR = not reported; TBI = traumatic brain injury.

conditions, depression (n = 9)[13,16,17,25,27,28,30,31,33] and PTSD (n = 9)[13,16,17,19,26,27,31,33,34] were cited most frequently, followed by anxiety disorder (n = 4)[25,27,30,34] and suicidal ideation (n = 4).[25,26,28,30] Physical health conditions cited included the following: headaches (n = 6),[18,24,25,27,28,30] dizziness (n = 3),[25,28,30] sleep disturbance (n = 2),[18,34] impaired memory (n = 2), spinal injuries (n = 2),[24,34] and chronic pain (n = 1).[18] Notably, there was significant co-occurring trauma, above and beyond physical trauma, faced alongside head trauma in this population. This included sexual violence,[13,14,18,19,25,27-30] burns,[7,13,23,25,26,29,30,32,35] kidnapping,[13,28,31] imprisonment,[28,29,31] electrical torture,[26,30,33] deprivation of food and water,[28,30,31] verbal abuse,[13,25,27] brainwashing,[28,31] and childhood abuse.[19]

Finally, only 2 studies compared refugee with nonrefugee populations.[7,35] One comprised a pediatric-only sample, not finding a higher prevalence of head trauma among refugee children compared with that among nonrefugee children[35]; the other comprised an adult-only sample, finding a higher prevalence of head trauma among refugees compared with that among nonrefugees.[7] We did not conduct a meta-analysis of these 2 studies to determine relative risk ratios because the combination of only 2 studies with very different characteristics would make any statistical determination highly uncertain.

Methodologic Quality Assessment

The risk of bias assessments for all included studies is reported in Table 2. Only 6 studies (27%) received a score deemed "good" quality, among which there were 4 unique samples (in other words, 2 studies were subsamples of a previously published study). All studies were cross-sectional.

Discussion

The results of our systematic review suggest that the prevalence of head trauma among refugees and asylum seekers ranged from 9% to 78%. Previous national estimates of the prevalence of head injury in the United States have ranged from 7% to 60%.[36]

Among studies rated "good" quality in our systematic review, the prevalence range was 23%–78%, suggesting a trend toward higher prevalence of head injury in this population. However, even among these, definitions of head trauma or TBI were varied: Mollica[28] defined head trauma as "beatings to the head" only; Mollica et al.[31] documented TBI as comprising "three events: beatings to the head, near-drowning, near-suffocation with a plastic bag"; Mollica et al.[16,17] defined TBI as an event with 1 or more occasions during which LOC, posttraumatic transient amnesia, and any neurologic deficits occurred; and Keatley et al.[18,19] defined head injury as sustaining a blow to the head without LOC directly after the injury. Notably in the study by Keatley et al., 106 refugees were excluded from analysis because they were unable to recall whether they received a blow to the head and/or if they lost consciousness. These studies demonstrate how heterogeneity across studies limited our ability to establish the true prevalence of head trauma in this population, particularly TBI, because no studies relied on the systematic appraisal of TBI history using validated tools such as the Ohio State University TBI Identification Method[37] or other validated screening instruments.[38] In fact, the systematic review we conducted generally revealed lack of studies with high methodological rigor.

Only 2 studies compared refugee and asylum seekers with their nonrefugee counterparts. While these 2 studies suggest a trend toward a higher risk of head trauma in refugee and asylum seeker adult populations relative to their nonrefugee counterparts,[7,35] they reflect most a paucity of studies that included comparison groups with nonrefugee immigrants.

Our findings also identified direct impact or head strike as the most common documented mechanism of injury in this population, relative to the general population that also sustains head trauma from motor vehicle accidents, falls, and sport activities. Furthermore, although the presence of head trauma was generally reported, we found that clinical characteristics such as severity or mechanism of injury and comorbid conditions were often unclear and neuroimaging infrequently used. These represent gaps in the literature that can be improved in future robust epidemiologic studies focused on this topic alongside systemic appraisal of head trauma and TBI that could address the potential underestimation of this phenomenon in the existing literature.

Several factors contribute to the prevalence of head trauma reported in these studies being an underestimate. First, beyond differences in defining head trauma, the manner used to assess for head trauma also varied, sometimes even relying on individual self-disclosure, albeit universal screening for all types of trauma considered best practice.[39] Factors such as stigma, shame, or lack of knowledge could contribute to not disclosing brain injury. Therefore, rates are underestimated both because of potential nondisclosure and because of exclusion of people who do not meet arbitrarily set diagnostic criteria due to lack of standardized validated screening tools. Although self-reported head injury may be subject to recall bias, self-reported definitions have been validated,[37] and prior studies have shown that systematically asking about TBI rather than relying on patient disclosure elicits a higher prevalence of TBI over the lifespan.[38] Studies have also found that self-report questions relying on a single question rather than a series of questions are less reliable for assessing TBI.[40] Furthermore, some individuals may have sustained fatal head injury and therefore not captured in existing studies, further underestimating the prevalence of head trauma in this population.

Second, disproportionate recruitment from hospital or clinic settings may have further underestimated the true prevalence of head trauma. This is because many individuals are not aware that they should seek care or they may not be able to seek immediate care due to systemic barriers, especially in

Table 2 Quality Assessment for Included Studies Using NHLBI Quality Assessment Tool for Observational Cohort and Cross-sectional Studies

Study	Clearly stated objective/ research question	Clearly specified and defined population	Participation rate of eligible persons at least 50%	Participants recruited from the similar populations, with specified inclusion/ exclusion criteria	Sample size distribution, power description, or variance and effect estimates provided	Exposure(s) of interest measured before the outcome(s) being measured	Sufficient time frame to see an effect	Examined levels of exposure(s)	Clearly defined, valid, reliable, and consistently implemented exposure measures	Exposure(s) assessed more than once over time	Clearly defined, valid, reliable, and consistently implemented outcome measures	Outcome assessors blinded to the exposure status of participants	Loss of follow-up after baseline 20% or less	Confounders measured and adjusted for in analyses	Score
Al-Nuaimi et al., 2018[34]	Y	Y	Y	Y	N	N	N	NA	NA	NA	N	NA	NA	NA	4/8 (50%) Fair
Baranowski et al., 2019[25]	Y	Y	NA	Y	N	N	N	NA	NA	NA	NA	NA	NA	NA	3/6 (50%) Fair
Doherty et al., 2016[20]	Y	Y	NA	Y	N	N	N	NA	NA	N	Y	NA	NA	NA	5/8 (63%) Fair
Duzkoylu et al., 2017[7]	Y	Y	NA	N	N	N	N	NA	N	NA	N	NR	NA	N	2/10 (20%) Poor
Ferrada-Noli et al., 1998[49]	Y	Y	NR	N	N	N	N	NA	NA	N	N	NA	NA	N	2/9 (22%) Poor
Goh et al., 1996[21]	Y	Y	NA	Y	N	N	N	NA	NA	NA	N	NA	NA	N	3/8 (38%) Poor
Hougen, 1988[30]	Y	Y	NR	N	N	N	N	NA	NA	N	Y	NR	NA	N	3/11 (27%) Poor
Keatley et al., 2013[18]	Y	Y	Y	Y	Y	N	N	NA	NA	NA	Y	NA	NA	N	6/9 (67%) Good
McKenzie et al., 2015[24]	Y	Y	NA	Y	Y	N	N	NA	NA	NA	Y	NA	NA	N	5/8 (63%) Fair
McMurry et al., 2020[27]	Y	Y	NA	Y	Y	N	N	NA	NA	NA	N	NA	NA	Y	5/8 (63%) Fair
Mollica, 1993[28]	Y	Y	Y	Y	Y	N	N	NA	Y	NA	Y	NA	NA	NA	7/9 (78%) Good
Mollica et al., 2014[17]	Y	Y	Y	Y	Y	N	N	NA	Y	NA	Y	NR	NA	Y	8/11 (73%) Good

Continued

Table 2 Quality Assessment for Included Studies Using NHLBI Quality Assessment Tool for Observational Cohort and Cross-sectional Studies *(continued)*

Study	Clearly stated objective/ research question	Clearly specified and defined population	Participation rate of eligible persons at least 50%	Participants recruited from the similar populations, with specified inclusion/ exclusion criteria	Sample size distribution, power description, or variance and effect estimates provided	Exposure(s) of interest measured before the outcome(s) being measured	Sufficient time frame to see an effect	Examined levels of exposure(s)	Clearly defined, valid, reliable, and consistently implemented exposure measures	Exposure(s) assessed more than once over time	Clearly defined, valid, reliable, and consistently implemented outcome measures	Outcome assessors blinded to the exposure status of participants	Loss of follow-up after baseline 20% or less	Confounders measured and adjusted for in analyses	Score
Mollica et al., 2009[16]	Y	Y	Y	Y	Y	N	N	NA	Y	NA	Y	NR	NA	Y	8/11 (73%) Good
Mollica et al., 2002[31]	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	NA	NA	NA	9/11 (82%) Good
Qasaimeh et al., 2017[32]	Y	Y	NA	N	N	N	N	NA	NA	NA	N	NA	NA	N	2/8 (25%) Poor
Saadi et al., 2021[13]	Y	Y	NA	Y	Y	N	N	NA	NA	NA	N	NA	NA	Y	5/8 (63%) Fair
Simsek, 2017[23]	Y	Y	NA	Y	N	N	N	NA	NA	NA	N	NA	NA	N	3/8 (38%) Fair
Taha, 2015[29]	Y	Y	NR	Y	N	N	N	NA	NA	NA	Y	NR	NA	N	4/10 (40%) Fair
Veliu and Leathem, 2017[33]	Y	N	NR	N	N	N	N	NA	NA	NA	Y	NA	NA	NA	2/8 (25%) Poor
Friedl and Muensterer, 2019[35]	Y	Y	NA	Y	Y	N	N	N	Y	N	Y	NR	NA	N	5/12 (42%) Fair
Goh and Poon, 1995[22]	Y	Y	NA	Y	N	N	N	NA	NA	NA	N	NA	NA	N	3/8 (38%) Poor
Keatley et al., 2015[19]	Y	Y	Y	Y	Y	N	N	NA	NA	NA	Y	NA	NA	Y	6/9 (67%) Good

Abbreviations: N = no; NA = not available; NHLBI = National Heart, Lungs and Blood Institute; Y = yes.

circumstances necessitating fleeing persecution. For instance, Aras et al.[41] discussed how patients who experienced cranial gunshot wounds during the war in Syria had delays in transport because of having to wait for a safe time to cross the border to Turkey. For mild injuries, patients who are undiagnosed may be at a higher risk of prolonged recovery because they are not provided with psychoeducation regarding possible consequences or early treatment for associated symptoms.

Third, the lack of women participants across studies likely underestimates the prevalence of head trauma among this population because many are survivors of intimate partner violence (IPV). Researchers have found a high prevalence of head trauma among IPV survivors.[42] At least 40% of women experiencing IPV had at least 1 TBI resulting in LOC, while up to 92% reported a blow to the head.[43] More recent research has found that refugee status is associated with a higher number of IPV-related brain injuries.[44] This relative lack of representation of women is also significant clinically because there may be differences in brain injury symptomatology and recovery among men vs women. Thus, more studies investigating how brain injury may manifest differently among women refugees, including symptoms and recovery trajectories, are needed.

Furthermore, although several studies mentioned strangulation or asphyxiation, which can lead to brain injury through oxygen deprivation, they did not document this connection. Focusing on head trauma from blows to the head or head strikes, rather than anoxic brain injury, that is, inclusive of strangulation-related brain injury, may be further underestimating the burden of brain injury in this population. Therefore, screening instruments for this population may require adaptation to include assessment of brain injury from strangulation. This has been performed for brain injury screening among survivors of IPV who similarly experience brain injury from both head strikes and strangulation.[45]

We also found that most studies reported mental health comorbidities rather than physical health comorbidities. Among mental health conditions, suicidality was least documented, although there are studies linking brain injury and suicidality and an increased suicidality among displaced populations.[46,47] There is a need for expanding research assessing associations with physical health conditions, which may be overlooked when the focus is disproportionately on mental health, despite the interplay between physical and mental health conditions. For example, antecedent or mental illness concurrent with TBI increases the likelihood of persistent postconcussive symptoms.

Notably, multiple studies were excluded for this systematic review because it was unknown whether participants were refugees or asylum seekers; that is, they were referred to as immigrants broadly, which can include, but is not exclusive of, refugees and asylum seekers. This points to the added challenges of studying this population, particularly when the label "refugee" or "asylum seeker" may not be applied until after one has interfaced with a United Nations or other government agency to adjudicate their legal claim for refuge. For example, Ramey et al.[5] determined the clinical consequences of neuro-trauma because of jumping over the US-Mexico border wall; however, this article was excluded because the study participants were not clearly labeled as refugees or asylum seekers and may not have had that status determined while jumping the border wall. In other words, focusing solely on individuals with the labels of "refugee" or "asylum seeker" may not fully capture the prevalence of head trauma and/or risk of TBI associated with the migration experience because injuries may occur alongside the trajectory of an individual's experiences before refugee or asylum seeker status has been determined. In this way, specific definitions of refugees and asylum seekers exclude populations of similar situations and therefore underestimate the prevalence of head trauma. This may have also contributed to the underrepresentation of people fleeing persecution from Latin America.

Finally, the studies in this review focused predominantly on adults and were all cross-sectional and/or retrospective, which does not allow for the interpretation of causality or bidirectionality of relationships noted with physical and psychological conditions. Future studies should include prospective longitudinal data with this population to better assess causality with associated psychiatric or physical health issues and include children who may experience later-life consequences of head injury.

Moving forward, comprehensive screening of head trauma in this population would be critical in not only capturing the true burden of disease but also helping to mitigate the impacts of brain injury, such as multidisciplinary referrals to vestibular therapy or cognitive rehabilitation depending on individual needs. For asylum seekers, documenting prior head trauma and associated symptoms may also be influential to the legal process that involves credibility assessment as part of asylum adjudication. For example, credibility assessments could be a potential incentive for asylum seekers and refugees to report head trauma, delay application, and/or affect the ability to provide a thorough testimony because of cognitive deficits.[6]

Our study also highlights the need to consider head trauma as one component of multiple types of traumas faced by this population. Studies in our review highlighted sexual abuse, burns, kidnapping, imprisonment, brainwashing, electrical torture, lack of food and water, verbal abuse, and childhood abuse as occurring preceding, concurrently, or after head trauma. These exposures in conjunction with associated psychiatric conditions can contribute to worsening symptoms and prolonged recovery.[13] This also suggests that trauma-informed care principles should be integrated in head trauma and TBI identification efforts targeting this population. Of importance, racial and ethnic disparities span the TBI continuum of care, including acute care and diagnosis, recovery and adjustment, and long-term outcomes.[48] Therefore, even if head trauma and TBI are increasingly screened for and recognized in this

population, we would need to consider the ways in which service disparities may be perpetuated after diagnosis.

Head trauma among refugees and asylum seekers is common and complex due to both mental and physical health comorbidities. Prior research is limited by challenges with TBI diagnosis due to absence of standardized screening methods and missed opportunities for assessment of comorbid physical and mental health concerns. Systematic approaches for assessing both head trauma and TBI are required for improved understanding because they cannot be interchanged based on their respective definitions, and head trauma may not necessarily result in brain pathology. Furthermore, studies comparing this population with nonrefugee and asylum seeker immigrants and nonimmigrants are needed. Beyond clinicians, public health officials, legal practitioners, and policymakers having an increased awareness of the prevalence of head trauma in this population, policy changes include using a comprehensive, universal head injury screening tool, providing safe living and working conditions to reduce the risk of head injuries and expanding medical assistance programs for refugees and asylum seekers worldwide. The knowledge gained from this study should be integrated in efforts to develop and deliver interventions to optimize equitable care for this growing and vulnerable population.

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