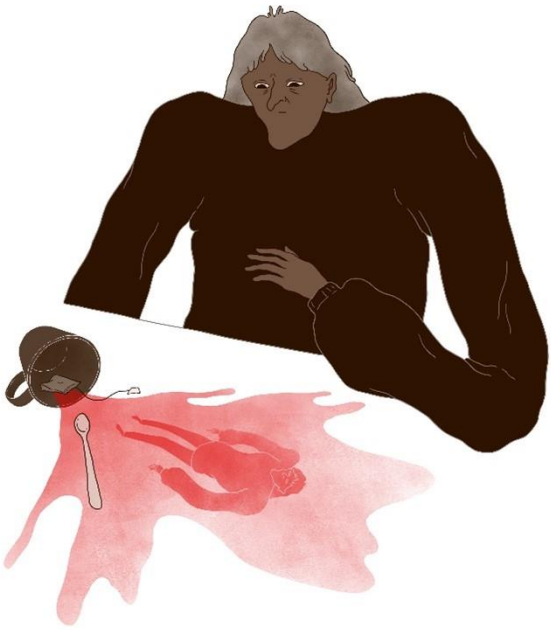
Swedish Red Cross Competence Center for Rehabilitation of Torture and War Trauma
Report 2025:01



The Effect of Torture on Executive Functions

Consequences of PTSD and traumatic brain injury on the asylum process, treatment, and integration of torture survivors.

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ISBN: 978-91-983684-6-8
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The report can be downloaded at www.rkh.se

Working group's contributions:
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Preface

Those who have survived torture are at an increased risk of experiencing life-threatening events later in life. Why?

Torture is violent, protracted and varied. No other type of event leads to post-traumatic stress disorder (PTSD) as frequently. The torturer's deliberate infliction of harm changes everything: the world will never feel safe again, the danger comes from other people, and each time you recall what happened, you relive it. A significant proportion of torture survivors also suffer from traumatic brain injury (TBI).

Both PTSD and TBI lead to challenges with concentration, memory, planning, decision making, impulse control as well as adapting to new situations. Even after successful trauma treatment, difficulties with executive functions persist in torture survivors.

The Swedish Red Cross Competence Center aims to contribute to knowledge that enhances treatment for survivors of torture and war. Our hope is that identifying comorbidities will lead to complementary interventions for torture victims undergoing trauma treatment. We also believe that this review will be of interest for those who encounter tortured asylum seekers and refugees in their work, including employees at social services, employment services, teaching institutions and authorities working with migration.

The asylum process is particularly challenging for individuals with executive dysfunction. Data in this report suggests that remembering is a goal-directed behavior. PTSD is characterized by efforts to avoid think about torture, as avoidance constitutes one of the symptom clusters within the diagnosis. Retelling a traumatic event, as required in the asylum process, demands both the ability to remember chronologically and in detail, as well as the capacity to resist the impulse to avoid the distressing memory.

For those who have experienced extensive and repeated abuse, individual events often merge while the experience of victimization remains rigid. The more torture a person has been endured, the

higher the risk of PTSD and the greater the difficulty in narrating events in an organized manner. Consequently, those most severely affected by trauma are at higher risk of being judged as untrustworthy. However, it is not the person who lacks credibility, but rather the memory that is unreliable.

And while memories can be painful, forgetfulness can be equally distressing. For those who have received asylum and residence permits, living in a new country requires the ability to adapt. Individuals with impaired executive function learn slowly and forget quickly. Executive difficulties also hinder integration by reducing the effectiveness of PTSD treatment, as most trauma therapies require learning skills.

Even though many have fled as far from their country of origin as possible, a torturers' touch can continue to cause harm. Traumatized individuals are at higher risk than others of ending up in life-threatening situations. A person who is constantly caught off guard by trauma memories tries to suppress the brain's warning signals and is therefore more likely to react too late when the danger arises. Many who has come to regard violence as an everyday occurrence find it more difficult to set boundaries for physical contact, thereby increasing their risk of sexual assault. Intrusive memories cause disorientation, heightening the risk for accidents, and making the traumatized person a more likely target of crimes such as robbery. Traumatic events increase the likelihood of developing PTSD, and PTSD increases the likelihood of future traumatic events.

Those who have survived traumatizing situations are at risk of experiencing furthermore tragic events throughout their lives. Protecting survivors of torture, including ensuring their right to safety and health, is therefore a crucial preventive measure.

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Summary

Abstract in English

A high percentage of persons seeking asylum have been exposed to torture. Extensive ill-treatment (mental and physical), which torture often consists of, can result in changes in the brain's structure and function. Torture often leads to mental illness such as post-traumatic stress disorder (PTSD). As a result of various types of violence, the risk of brain damage also increases. This literature review focuses on the neurobiological changes to brain structures that can occur as a result of torture, especially traumatic brain injury (TBI). Both PTSD and TBI can affect the so-called executive functions, resulting in difficulties remembering, planning, executing plans, regulating emotions, and solving problems. This can have significant negative consequences in everyday life, work performance, and social interactions. The evidence reviewed in this report highlights the issues that arise during the asylum process when torture survivors are expected to remember and recount details of traumatizing events. Knowledge of the effect of torture on executive functions can result in a more qualitative asylum process and more efficient integration policies.

Abstract in Swedish

En hög andel av de personer som söker asyl har varit utsatta för tortyr. Omfattande illabehandling, psykisk och fysisk, som tortyr ofta innebär medför en ökad risk för att hjärnans struktur och funktion förändras. Tortyr leder i mycket hög utsträckning till psykisk ohälsa som posttraumatisk stress (PTSD). Till följd av olika typer av våld ökar också risken för hjärnskada. Litteraturstudien fokuserar på de neurobiologiska förändringarna av hjärnstrukturer som kan uppstå till följd av tortyr, framför allt traumatisk hjärnskada (traumatic brain injury, TBI). Både PTSD och TBI kan påverka de så kallade exekutiva funktionerna så att en person får svårigheter att minnas, planera, verkställa planer, reglera sina känslor och överväga olika alternativ för att lösa problem. Detta kan få betydande negativa konsekvenser i vardagen, i arbetsprestationer och sociala interaktioner. Litteraturen uppmärksammar specifikt risker i asylprocessen då tortyrskadade förväntas kunna minnas och återberätta detaljer om traumatiserande händelser. Kunskap om tortyrens effekt på exekutiva funktioner kan vara avgörande för en kvalitativ asylprocess och verksamma integrationsinsatser.

Introduction

Swedish Red Cross runs five treatment centers (RCCs) for refugees affected by war and torture. In addition to trauma treatment, the RCCs conduct documentation of torture according to the Istanbul Protocol, usually by request of the Migration Agency as part of the asylum process. Torture practices such as physical violence, suffocation, food deprivation, injection of chemicals, and extended periods of extreme stress, as well as lack of medical treatment, increase the risk for permanent brain injuries.

In our clinical work, we frequently meet individuals where cognitive difficulties run deeper than the consequences of post-traumatic stress disorder (PTSD) and post-migration stressors. It is important to correctly assess the functioning of the patient for several reasons. For patients and their loved ones, gaining insight into strengths and difficulties can be a great relief and ameliorate symptoms of guilt and stress. For health care clinicians, the assessment is crucial in formulating an effective treatment plan and adjusting treatment and expected outcome accordingly. In the documentation of torture according to the Istanbul Protocol, within the context of the asylum process, it is equally important to accurately evaluate and describe the difficulties and general functioning of the survivor, in assessing torture claims as well as the ability to provide a coherent narrative. In general, accurate evaluations help authorities make informed decisions and provide appropriate support.

Within the RCCs, we are constantly aspiring to improve our ability to make accurate assessments of our patients. In the past years, we have seen a growing interest in complementing clinical interview and observation with neuropsychological testing in complex cases, well aware of the many inherent problems; a very diverse patient group, lack of relevant test batteries, lack of norm groups, lack of research specifically targeting torture survivors, language, and cultural

barriers, to name a few. As part of this effort, in June 2021 we initiated a project with the aim to survey the research base regarding torture and its effects on executive functions, i.e., the cognitive processes enabling the ability to organize and regulate behavior, including memory, planning, adapting, and monitoring actions, and problem solving. The purpose of this project is, through a literature review, to summarize the body of research concerning the effects of torture on executive functions.

This literature review is one part of that project, contributing to a long-term increase of the RCC clinical competency regarding torture and executive functions, and the implications for trauma treatment. We also see that such knowledge can contribute to laying a foundation for a future study on neuropsychological testing within the context of the RCCs and to increased quality of the documentation of torture according to the Istanbul Protocol.

This report is funded by Swedish Red Cross Competence Center for Rehabilitation of Torture and War Trauma. Researchers from Swedish Red Cross University have been recruited to conduct the literature study.

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Consequences of Torture

Torture is a gross violation against human rights defined as any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person with the consent or acquiescence of a public official for such purposes of obtaining information, a confession, or punishing them for an act they have committed or are suspected of having committed (United Nations, 1984). Many refugees have been tortured. In a study by the Swedish Red Cross University, Syrian asylum seekers, Syrians recently approved for residency, and Eritrean and Somalian asylum seekers were compared. The prevalence of experiences of torture was found to be 25,2%, 30,6% and 87,1%, respectively (Tinghög et al., 2016). In this narrative review, we aimed to illustrate the effects of torture on executive functions with focus on posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI).

Biological signatures of stress

Situations that are physically and emotionally draining and in which there is a lacking sense of control – such as torture – lead to the secretion of adrenaline and cortisol (McEwen & Gianaros, 2010). These hormones prepare the body to deal with physical and emotional emergencies. Adrenaline and cortisol, also known as “stress hormones”, are the product of the hypothalamus-pituitary-adrenal (HPA) axis. Both the hypothalamus and the pituitary regulate most of the physiological processes that are beyond cognitive control. Examples of such processes include sleep rhythms, growth, digestion, reproduction, blood pressure, and temperature regulation (Tsigos & Chrousos, 2002).

Fight or flight

Once secreted in the blood, stress hormones initiate a series of reactions that make the body better equipped to deal with

emergencies. Nutrients are mobilized from their stores inside the body and directed to the skeletal muscles where they are needed to produce energy. This requires an increase in heart rate, respiratory rate, and blood pressure. Memory and the processing of sensory information are temporarily improved. Mood changes towards the negative spectrum where one easily experiences irritability, anxiety, and fear. These physiological changes are commonly referred to as the “fight-or-flight” response and aim to provide readily available energy so one can react accordingly to the threats of the environment (McEwen & Gianaros, 2010). All the physiological changes mentioned above have a critical adaptive advantage. It would be impossible to deal with emergencies, or stressful conditions if not by the support given by stress hormones. This is clearly seen in patients with Addison’s disease who are not able to produce cortisol and as a result cannot be exposed to stressful situations without medical supervision (Gorman, 2013; Michels & Michels, 2014).

The critical role of cortisol

Given the pivotal role of cortisol in regulating the stress response, variations in its daily rhythm have been used as a tool to understand the impact of trauma in refugees and asylum seekers. Altered diurnal rhythms in the secretion of cortisol are commonly seen in patients with anxiety disorders, depression, obsessive compulsive disorder, and PTSD and are considered an important factor in the development of pathology (Staufenbiel et al., 2013). Higher levels of cortisol, for instance, were reported in recently fled immigrants from Africa and the Middle East who had been living in Germany for about seven months when compared to already settled immigrants from Türkiye or German citizens. The authors attributed this difference to the uncertain living conditions and legal status of recently fled asylum seekers (Mewes et al., 2017). Similar results were found in camps for internally displaced people in Northern Uganda. The individuals in this study were diagnosed with PTSD after being abducted by militias in Uganda and submitted to war atrocities such

as the threat of being killed, sexual violence and being forced to eat human flesh. When compared to displaced individuals without a PTSD diagnosis, the former group showed higher levels of cortisol, and a positive correlation between cortisol and the cumulative exposure of traumatic events (Steudte et al., 2011). On the other hand, cortisol levels have been inversely associated with the number of traumatic experiences and different types of traumas, while positively associated with self-reported emotional problems in 142 young unaccompanied Afghan and Syrian refugees who had been living in sheltered accommodations in Germany for approximately 19 months. It is generally accepted that cortisol levels rise during the initial phases of trauma and significantly decrease if external conditions do not change or help is not received (Sierau et al., 2019). The initial increase in the concentration of cortisol in response to traumatic events as well as the subsequent drop beyond pre-traumatic levels are putative factors in the development of anxiety, PTSD, and depression, respectively (Mewes et al., 2017; Miller et al., 2007; Steudte-Schmiedgen et al., 2016).

The absence of a clear relationship between cortisol levels and psychiatric conditions is likely influenced by a broad spectrum of factors, including genetic makeup, resilience, prior experiences, and nutritional status. Nonetheless, a significant body of evidence supports the notion that long-term exposure to high levels of cortisol has the potential to rewire brain circuitry in a way that predisposes for disease (Komoltsev & Gulyaeva, 2022; Mikulska et al., 2021; Murphy et al., 2022; Zajkowska et al., 2022).

Torture and PTSD

Traumatic experiences like witnessing or experiencing violence – as in the case of torture – put a person at greater risk for a variety of psychological impairments and disability, among which PTSD is the most common (Steel et al., 2009). PTSD is characterized by re-experiencing a traumatic event in the present, avoidance of traumatic

reminders and a sense of current threat (Cloitre, 2020).

POST-TRAUMATIC STRESS DISORDER (PTSD)
PTSD is diagnosed in an individual who has been exposed to potential traumatic events and has experienced clinically significant distress for longer than a month. According to the 5th version of the Diagnostic and Statistical Manual of Mental Disorders the symptoms develop after being threatened with death, serious injury, or sexual violence, and include recurrent, involuntary, and intrusive memories or dreams of the traumatic event, persistent avoidance of stimuli associated with the traumatic event, and negative alterations in cognitions and mood associated with the traumatic event (American Psychiatric Association, 2013).

Traumatic events can be divided into assaultive and non-assaultive, while assaultive trauma can be further divided into sexual and non-sexual trauma (Kessler et al., 2005; Resnick et al., 1993). Individuals who are exposed to assaultive trauma are more likely to develop PTSD (Kessler et al., 2005). Since assaultive trauma is often used as a form of torture (Burnett & Peel, 2001; Pollanen, 2018), it is not surprising that the prevalence of PTSD among torture survivors is high (Abu Suhaiban et al., 2019).

Complex PTSD

A new diagnosis in the International Classification of Diseases, 11th Edition (ICD-11), is complex PTSD (C-PTSD) (World Health Organization, 2022). The condition might develop following exposure to an event or series of events of an extremely threatening or horrific nature. These events are prolonged and repetitive in nature and from which escape is difficult or impossible. They include torture, slavery, genocide campaigns, prolonged domestic violence, and repeated sexual or physical abuse. Additionally, C-PTSD also includes symptoms of disturbances in three key domains: 1) problems in affect regulation, such as in calming down; 2) beliefs about oneself as diminished, defeated, or worthless, accompanied by feelings of

shame, guilt, or failure related to the traumatic event; and 3) difficulties in sustaining relationships, and in feeling close to others (Cloitre, 2020; World Health Organization, 2022). Previous research on C-PTSD has mostly focused on repeated interpersonal trauma during childhood or adolescence and therefore, the cause to C-PTSD has been assumed to be developmental. However, adults who have experienced prolonged interpersonal trauma in adulthood, such as torture, present symptoms of C-PTSD despite no history of childhood trauma. Therefore, it has been suggested that prolonged adult trauma can result in symptoms associated with C-PTSD in survivors of torture and war (McDonnell et al., 2013). Asylum seekers and refugees are often considered to be at higher risk to develop C-PTSD.

Inflammation and PTSD

There seems to be a strong link between inflammation and PTSD. Previous studies indicate that inflammation processes also contribute to reduced cognitive function in patients with PTSD. Levels of biomarkers of inflammation, such as proinflammatory cytokines are significantly higher in patients with PTSD when compared to non-PTSD trauma-exposed, or healthy individuals. The underlying mechanism in PTSD-related inflammatory dysregulation is coupled with stress reactions. Consequently, PTSD can be seen as a state of chronic stress or hyperarousal, accompanied by high levels of proinflammatory cytokines. PTSD is characterized by persistent and intense fear reactions when one is exposed to situations associated with a previous traumatic event, or that are contextually inappropriate as interpreting threat despite a safe context. Dysregulation of the HPA axis can lead to lower levels of cortisol, which compromises immunity and promotes inflammation. Thus, dysregulation of the HPA axis can contribute to chronic low-grade inflammation in PTSD. Given that evidence suggests that inflammation is a key component of PTSD that affects fear-learning and extinction-related neural

pathways, it is possible that inflammation contributes to reduced cognitive function in patients with PTSD (Quinones et al., 2020).

Torture and TBI

Blows to the head can lead to TBI, a common condition that results in physical, mental, and emotional disabling injuries (McPherson, 2019). Several reports suggest a considerably high prevalence of TBI in survivors of torture, refugees, and asylum seekers. Studies carried out in Europe, including Sweden, have reported that between 48–64%of these individuals suffered from blows to the head that led to momentary loss of consciousness, chronic headaches, dizziness, balance problems, sleep issues, memory loss, and concentration deficits (Doherty et al., 2016; Keatley et al., 2013; Moisander & Edston, 2003).

TRAUMATIC BRAIN INJURY (TBI)
TBI is defined as an alteration in brain structure or function caused by an external force (Menon et al., 2010). The most common causes of TBI are physical assault, traffic accidents, sports injuries, and falls. TBI can have a significant negative impact on quality of life and ability to work due to long-lasting cognitive, emotional, and behavioral changes. It has been reported that only 36%of patients who have suffered severe TBI have been able to return to work and live an independent life (Jourdan et al., 2016). The pathophysiology behind TBI involves shear injury of axons and further disconnection of cortical and subcortical brain areas, hypoxia, and inflammation (Azouvi et al., 2017). Deficits in working memory, for instance, have been associated with altered activation patterns in the dorsolateral prefrontal cortex and Broca's area in patients with moderate and severe TBI (Perlstein et al., 2004).

TBI is characterized by a period of confusion, disorientation, and post-traumatic amnesia (Rabinowitz & Levin, 2014). Whereas mild TBI can occur with or without loss of consciousness, moderate and severe TBI are diagnosed based on loss of consciousness that lasts longer than 30 minutes and post-traumatic amnesia lasting longer

than 24 hours (Azouvi et al., 2017; Rabinowitz & Levin, 2014). It is estimated that up to 60% of patients recover from mild TBI within six months. 85% patients recover successfully (given the right treatment) from mild TBI between 1–3 years after injury. However, about 15% of patients experience more persistent emotional and cognitive complaints (Benedictus et al., 2010). Recovery might be attributed to the nature and severity of the injury (sport injury vs. blows to head during physical assault, for example), and factors such as age and comorbidity. Unlike mild TBI, moderate and severe TBI are distinguished by long-lasting impairments in self-awareness, reasoning, language, and visuospatial processing. In the most extreme cases, patients are not able to return to work and have significant difficulties performing daily tasks such as driving, cooking, and handling money (Rabinowitz & Levin, 2014).

Evidence of the effects of torture and TBI on cognitive functions is not particularly new

Evidence of the effects of torture and TBI on cognitive functions is not particularly new. Already in the 70s and 80s, some reports were published describing anatomical and functional changes in the brain as a result of blows to the head in about 65% of torture survivors (Jensen et al., 1982; Thygesen et al., 1970). In addition to psychological testing and clinical interviews, over the last couple of decades, the diagnosis of cognitive and emotional deficits in survivors of torture after TBI has also been possible by modern diagnostic imaging techniques. A significant body of evidence supports a cause-effect association between TBI and neurological and psychiatric illness. Inner-cranial wave physics and the presence of bone protuberances inside of the skull due to blows to the head have been shown to cause significant damage to the orbital and anterior temporal lobes of the brain (Perry et al., 2016). A large body of evidence has proven that TBI is characterized by damage to, and significant loss of grey matter in one or several brain regions

including the frontal and temporal lobes, as well as subcortical structures such as the thalamus, hypothalamus, amygdala, hippocampus, midbrain, and locus coeruleus (Shetty et al., 2016). Because of their location, the hippocampal-amygdala complex and the ventromedial prefrontal cortex are particularly vulnerable to damage by blows to the head (Depue et al., 2014).

The prefrontal cortex is the structure of the brain mostly in charge of planning, reasoning, postponing of pleasure, and behavioral control. These structural changes are coupled with a vast array of neurological and psychiatric conditions such as mood alterations, memory loss, decreased motivation and initiative, language deficits, depression, bipolar disorder, paranoia, Alzheimer's, and Parkinson's disease (Perry et al., 2016). Interview studies in survivors of torture aiming to diagnose the consequences of TBI have also allowed for associations between physical trauma and the development of neurological and psychiatric conditions. In some of these cases, however, it has been known that individuals describe fewer symptoms associated with the injury than those identified by their caregivers. In survivors who suffered particularly severe injuries, gross impairments in cognitive reasoning and self-awareness compromise the understanding and recognition of their own symptoms (Doherty et al., 2016).

PTSD and TBI combined

In a sample of 42 Vietnamese ex-political detainees who had been tortured in Vietnamese re-education camps and resettled in the United States, a detailed history of TBI was obtained through the Harvard Trauma Questionnaire. The questionnaire includes different types of events such as traffic accidents, accidental falls, physical assault, torture and combat induced TBI. Further, depression and PTSD symptoms were determined by interviews and the Hopkins Symptom Checklist-25. Finally, cortical thickness and subcortical volume were assessed by magnetic resonance imaging. Here, TBI

was associated with cortical thinning in the frontal and temporal lobes, which in turn correlated with higher symptoms of depression. The authors of the study argue that TBI plays a role in the development of psychiatric conditions (Mollica et al., 2009), which is in line with previous data associating lesions in the prefrontal and temporal cortex with depression, anxiety, and mood disorders (Arulsamy et al., 2018; Pope et al., 2019; Silverberg & Panenka, 2019; Vanderploeg et al., 2005). It is important to note that mood disorders such as anxiety, depression, and PTSD can arise because of TBI even in populations who had not experience psychological trauma before the head injury. Similar cases of thinning of the cerebral cortex as a result of TBI have been reported in subjects involved in traffic and sport accidents (McKee et al., 2013). Torture can on its own lead to anxiety, depression, and PTSD. This means that in addition to playing a role in the development of mood disorders, TBI can significantly exacerbate pre-existing psychological disorders in torture survivors.

Rewired brain circuitry

Traumatic events, even in the absence of TBI, have the potential to rewire brain circuitry leading to long-term anatomical changes which makes recovering much more difficult. The prefrontal cortex and hippocampus are brain structures in direct contact with the amygdala and together play an important role in behavior (Depue et al., 2014).

The hippocampus is a brain structure in charge of forming new memories. The amygdala, on the other hand, is a set of nuclei in the brain linked to impulsivity, aggression as well as fear conditioning and extinction. Constant secretion of adrenaline and cortisol (amongst other factors) in response to stressful situations leads to changes in the size of these brain structures and the re-wiring on neurological networks. Dysregulation in the secretion of cortisol due to high, long-lasting levels of stress for example, has been

associated with atrophy of the hippocampus and the amygdala (McEwen & Gianaros, 2010). A study conducted in 21 combat veterans from the United States with mild TBI and comorbid PTSD from active duty, but no history of neurological disease prior to deployment, showed that reductions in the size of the amygdala, leads to overprocessing of sensory input related to fear conditioning, which translates into anxiety and impulsive behavior (Depue et al., 2014). Decreases in the size of the amygdala were also related to higher scores in symptoms of PTSD. When compared to controls without TBI or PTSD, these individuals had lowers scores on attention, perseverance, and self-control in the Barratt Impulsivity Scale. The Trauma Symptom Inventory revealed higher scores within the categories Intrusive Experiences, Defensive Avoidance as well as dissociation. It is worth noting that in this study, only individuals with mild TBI were included and as such, a worsening of symptoms for cognitive and behavioral impairment is to be expected in those patients with moderate and severe TBI.

Even mild TBI constitutes a risk factor for the development of PTSD

Perhaps not surprisingly, a large body of evidence consistently indicates that subjects with PTSD exhibit anatomical and functional abnormalities in the same brain structures even in the absence of TBI (Hedges & Woon, 2010; Karl & Werner, 2010). Brain scans of torture survivors with PTSD, for example, have shown cortical thinning, reduced hippocampal volume, and hypometabolism in the caudate nucleus when compared to healthy controls (Liddell et al., 2022). Expressed in terms of functionality, this means memory loss, and constant feelings of fear and insecurity. As such, even mild TBI constitutes a risk factor for the development of PTSD (Depue et al., 2014; Elder & Cristian, 2009).

Torture and executive functions

Executive functions is an umbrella term that encompasses higher cognitive abilities. Executive functions include memory, inhibitory control, cognitive flexibility, planning, reasoning, and problem solving. These functions are necessary to set and achieve a goal, and they enable the understanding of complex and abstract concepts. Executive functions are critical to regulate and adapt our behavior in relation to conditions in the environment. Neurologically speaking, executive functions are a product mainly of the prefrontal cortex of the brain (Cristofori et al., 2019).

Torture exposure has been associated with altered functioning of the central executive network as well as the default mode network. While the central executive network exerts top-down executive control over emotional processing (Depue et al., 2014), the default mode network translates emotional responses into appropriate behavior (Liddell et al., 2022). Altered functioning between these networks seems to be responsible for withdrawal and dissociative behavior, problems with self-regulation, and difficulties in recognizing safety signals from the environment (Teicher et al., 2016). Aupperle and colleagues (2012) found evidence that subtle impairments in response inhibition and attention regulation are associated to the severity of PTSD symptoms and as such, are risk factors for its development (Aupperle et al., 2012).

PTSD and executive functions

A Norwegian study aimed to investigate whether exposure to political violence had any effect on executive functions (Kanagaratnam & Asbjørnsen, 2007). The study group consisted of 45 immigrants/refugees aged 18–55 who had been exposed to political violence and war. In the group, 22 individuals had a self-reported diagnosis of PTSD and 23 had no psychiatric diagnosis. Three cognitive components of executive functions, intentionality, inhibition,

and executive memory were assessed by the neuropsychological tests Tower of London, Stroop Color Word Test, and Wisconsin Card Sorting Test.

Kanagaratnam & Asbjørnsen (2007) found impaired performance on tests of executive memory, and problems in automatic processing in the war-exposed PTSD group compared to the war-exposed group with no PTSD diagnosis. However, there were no group differences found in the executive component of inhibition and intentionality. Further analysis revealed that the individuals who scored higher on posttraumatic symptoms had more profound impairment on executive memory. The authors concluded that posttraumatic symptoms are associated with automatic processing problems and impairment on executive memory. Furthermore, dysfunction in mental flexibility could have a negative impact on cognitive processing of traumatic memory, and thus make recovery more difficult (Kanagaratnam & Asbjørnsen, 2007).

Individuals who scored higher on posttraumatic symptoms had more profound impairment on executive memory

In a quantitative meta-analysis based on 60 studies, including 1,779 participants with PTSD, 1,446 trauma-exposed, and 895 healthy controls, neurocognitive functioning was examined (Scott et al., 2015). The researchers focused on nine cognitive domains: attention/working memory, executive functions, language, verbal memory, visual learning, visual memory, language, speed of information processing speed, and visuospatial abilities. These nine domains were compared between the groups using effect size as a measure. The aim was to examine the profile and magnitude of effect size or cognitive deficits associated with PTSD across these domains. In addition, the researchers aimed to examine aspects of study design and subject characteristics that may influence cognitive dysfunction in PTSD. The findings from the meta-analysis indicate

that PTSD is associated with neurocognitive deficits of medium magnitude in verbal learning and memory, attention/working memory, and processing speed. Smaller effect sizes were seen in executive functions, language, visual learning, memory, and visuospatial abilities. These findings are consistent with dysfunction in the fronto-limbic network underlying the pathophysiology of PTSD. According to the researchers in this study, neuropsychological functioning in attention, verbal memory, and speed of information processing are key aspects in clinical treatment of persons with PTSD (Scott et al., 2015).

TBI and executive functions

TBI can lead to a rather broad spectrum of cognitive and emotional issues, amongst which executive dysfunction is one of the most common (Brenner, 2011). The ability to sustain attention for long periods of time is essential for goal-directed behavior. The default mode network is composed of the posterior cingular cortex, precuneus and the ventromedial prefrontal cortex. Activity and communication amongst these structures is thought to be central for the ability to sustain attention and directed mental activity. Using a simple choice reaction time task, Bonelle and colleagues (2011) assessed 30 patients with TBI secondary to assault, traffic accidents, falls and sport injuries, and compared their performance against age-matched healthy controls. They found that impaired attention is common in patients with TBI, and that poor performance over time in tasks that require sustained attention and goal-directed behavior are associated with abnormal patterns of activity in the default mode network of the brain. Sustained attention during cognitive demanding tasks requires regulation and de-activation of the default mode network. Less activity in these areas is most likely correlated to higher efficiency and thus, better performance. In other words, overactivity in the default mode network implies a higher cognitive load which eventually leads to mental fatigue. Further, mind

wandering and increased internally focused attention have been coupled with higher activity in both the precuneus and posterior cingular cortex. Patients with TBI fail not only to de-activate the default mode network during tasks that require sustained attention, but also show an abnormal pattern of recruitment of such areas, which leads to decreased performance over time (Bonnelle et al., 2011).

Changing strategies based on new information

Loss of conceptualization and the ability to change strategies are also common complaints in patients with TBI. The Wisconsin Card Sorting Test is a neuropsychological test used to measure attention, perseverance, abstract thinking and set shifting. In short, the test is used to measure perseverance and insistence on wrong behaviors. Patients are asked to sort different items according to arbitrary criteria and then change their arrangement according to new rules. Several studies have reported a higher number of errors after moderate and severe TBI in such test (Ferland et al., 1998; Nelson, 1976; Rapoport et al., 2006). No significant differences were observed between patients with mild TBI and healthy controls. Speed of processing, mental flexibility and planning have also been previously studied in patients with TBI. These functions have been examined by means of the Tower of London test, in which patients must organize colored beads on three vertical rods according to instructions using a restricted number of moves. Patients with TBI performed similarly on this task as healthy controls but they take significantly longer to complete it (Azouvi et al., 2017; Ponsford & Kinsella, 1992; Spikman et al., 2000). Longer times to complete the test imply poor planning, as well as greater caution in making decisions. The Stroop Colour and Word Test measures the ability to inhibit cognitive interference. Patients are required to name the ink color of color names under non-congruent conditions. Recent studies have reported significant effects of moderate and severe TBI on

inhibition in which more errors during the test correlate with the severity the injury (Cantin et al., 2007; Fortin et al., 2003).

Measuring cognitive and executive dysfunction as a result of TBI in survivors of torture is particularly difficult since in most cases no pre-injury data exists and thus, performance on cognitive and executive tests cannot be compared and attributed to the injury. Since survivors of torture who have suffered TBI vary greatly in age, health status (comorbidity), educational level, cultural background, and degree of injury, appropriate control groups are difficult to establish in scientific studies. Some studies rely on self-reports of mental health and cognitive ability post-injury. However, one of the hallmarks of moderate and severe TBI is that memory becomes impaired, and survivors lack self-awareness. Hence, individuals are known to under-report the number and severity of their own symptoms (Jamora et al., 2012; Sbordone et al., 1998).

Military personnel who suffered TBI (this can also be said to be the case for PTSD) because of torture or armed conflicts are one of the few groups that provides reliable data since pre-injury scores on both cognitive and executive function tests usually exists and parameters such as age, educational level, cultural background, and health status are standardized amongst individuals. Some studies aiming to elucidate the effects of both closed and penetrating TBI on cognitive and executive functions in war veterans have been previously conducted (for an in-depth review of such studies the reader is referred Dikmen et al., 2009). For example, The Vietnam Head Injury Study was a multidisciplinary revaluation of more than 600 head-injured veterans from the Vietnam war and uninjured controls. Subjects were tested in the Army General Classification Test upon enrolment and up to 15 years after injury. They authors found that in penetrating brain injury,

The hallmark of moderate and severe TBI is that memory becomes impaired

total brain volume loss strongly predicted performance in subtests composed of vocabulary knowledge, arithmetic word problems, object-function matching, as well as mental imagery construction of boxes. Perhaps not surprisingly, the more total brain volume loss the worse individuals scored on such tests even 15 years after injury. Poor performance was particularly coupled to lesions on the left temporal and occipital lobes. Interestingly, higher scores pre-injury were associated with a slower cognitive decline and a better recovery up to five years after injury (Grafman et al., 1988).

TBI can have significant and negative consequences in daily activities, work performance and social interactions that are present even decades after the original injury. Executive dysfunction is one of the most problematic sequalae of TBI. When individuals are unable to change their behavior in response to clues from the environment, following new rules and instructions proves difficult. This leads to risk-taking or rule-breaking behavior even in the face of negative consequences. Individuals do not necessarily choose to behave against norms and regulations, but they are unable to adapt to new information and internally process actions and responses (McDonald et al., 2002).

Consequences of stress, PTSD, and TBI on the asylum process, trauma treatment, and integration of torture victims

PTSD and TBI are difficult to treat and often lead to long-term effects. Recovering from trauma requires learning new strategies to deal with problems as well as acquiring new perspectives to look at oneself and the world. Successfully integrating in a new country often requires learning a new language and new social norms. Both PTSD and TBI can result in executive dysfunction, which makes learning more difficult thus, perpetuating the torture-induced trauma and its cognitive sequalae.

Therefore, a comprehensive approach is needed by healthcare professionals when meeting traumatized people. If learning a new language when suffering from PTSD or TBI proves difficult, entry of the patient into the labor market in their new country is delayed. Other expressions of executive dysfunction such as having difficulty taking initiative and multi-step planning, translate into problems getting to meetings on time, remembering what the meetings are about, and remembering afterwards what it was discussed. Misunderstandings and conflicts can naturally occur between patients and healthcare professionals, language teachers, work colleagues, and migration authorities. Not being able to perform can result in anxiety and everyday life easily becomes frustrating and confusing for these patients. Unfortunately, the asylum process, as well as some efforts to integrate patients in their new countries, take little account of their needs and capabilities after the events that made them seek for asylum. In the next section, we summarize the scientific literature on how stress, PTSD, and TBI affect the asylum process of torture victims. A better understanding of the cognitive difficulties that torture victims experience during the asylum process due to these conditions can hopefully lead to programs that better

tend to the patients' needs not only during the asylum process itself, but also during trauma treatment, and integration in the host country.

Executive dysfunction's impact on the asylum process

In most countries in Europe, the asylum-seeking process is based on oral interviews in which subjects need to provide a detailed and coherent description of the events that made them leave their country of origin and apply for refugee status. Moreover, migration authorities often focus on the legal aspects of the asylum-seeking process (Arts et al., 2009), and the neurological consequences of torture are rarely considered during such interviews (Aarts et al., 2019; van Willigen, 2008). The lack of knowledge regarding the effects of torture on brain function causes a variety of problems for torture survivors. Amongst the more common are reluctance in migration authorities to attach credibility to asylum seekers' narratives.

Remembering traumatic experiences

Coherence while accounting for events is often used as a proxy for credibility by migration officials since direct and independent evidence is often missing or difficult to obtain. Sometimes, discrepancies in the asylum seeker's accounts are considered an indication of false and exaggerated claims. Both the number and depth of details in a story play a central role in how credible the story is. Discrepancy in the account of details tend to be considered as possible reconstruction of events instead of recollection (Herlihy & Turner, 2007). A few misconceptions exist regarding remembering traumatic experiences. On one hand, it is generally believed that all traumatic experiences would be remembered clearly since high levels of stress increase arousal and attention. On the other hand, some argue that dissociation during a possibly traumatic event and consequently, the inability to remember it, offers a protective

mechanism against trauma. However, robust, and mounting evidence suggests that the formation and recollection of memories is much more nuanced and depending on multiple factors.

The effect of stress on memory

Stress does not always improve memory. Morgan Iii and colleagues (2004) studied 509 young (25 ± 5 years of age) military personal in active duty enrolled in military survival school training in the United States. The training consisted of wilderness evasion and simulations of prison during war. Training is designed to test the ability of the soldiers to withstand exploitation by the enemy during various types of interrogation. Military survival school is highly stressful, realistic and one of the most challenging experiences in the military. Here, individuals were interrogated after 48 hours of uniform food and sleep deprivation. The interrogation consisted of two sessions of 40 minutes each separated by four hours. Their study revealed that only 66% of the soldiers were able to identify pictures with the face of their interrogators 24 hours after being interrogated.

Morgan Iii and colleagues (2004) argue that memory formation during situations that are highly stressful and personally relevant is subject to significant error. The poor performance in facial recognition in this study is attributed to the inverted U-shaped relationship between stress hormones and memory where moderate levels of stress improve memory but both low and high levels might disrupt it. Secondly, it is known that sleep, and in particular REM sleep, is necessary for the formation of memories. Perhaps the soldiers had performed better if given longer time and appropriate recovery from training. Lastly, the effects of stress on neural circuits involved in face recognition cannot be discarded. It is not known how catecholamines and cortisol affects these circuits during short and intense periods of stress (Morgan Iii et al., 2004).

Stress does not always improve memory

All these variables are highly relevant when interviewing survivors of torture. Suffocation and drowning are often used as methods of torture and these might cause cerebral hypoxia, which depending on the severity, might lead to persistent disorientation, confusion, and memory impairment (Cohen, 2001). In addition to the extreme suffering and uncertainty, lack of sleep, and further damage to the brain due to blows to the head, it is not surprising that memory formation and recollection is significantly impaired in survivors of torture.

These findings are in line with previous studies that show that the gist of a story but not the details about it, is more easily recalled after events with a high emotional component, such as armed robbery (Herlihy et al., 2002). Moreover, details are more susceptible to disruption and change upon recollection than the central elements of the story. Taken together, these findings indicate that moderate levels of stress might improve attention and the formation of memories during an emotionally intense experience. However, the recollection of details about the experience might be compromised.

Time affects memory recollection

In a sample of 27 Kosovan Albanians and 16 Bosnians with refugee status in the United Kingdom discrepancies were found between the accounts of traumatic events given on two different interviews separated by up to seven months (Herlihy et al., 2002). All the individuals in this study were given permission to remain in the United Kingdom under the United Nations High Commissioner for Refugees group, which means that they did not have to provide accounts of previous experiences to be granted asylum. The study was not associated to any clinical examination or migratory process. As such, it is difficult to see why the individuals investigated would provide false claims or exaggerate them on purpose. Since the discrepancies observed were about “peripheral details” (not central to the story), the authors suggest that there was no intent on

fabricating information by the individuals. Interestingly, the authors found that subjects with PTSD became more inconsistent in their accounts the longer they waited between interviews (Herlihy et al., 2002).

The interview situation itself

Remembering is not an unequivocal process. Both the formation and recollection of memories can be influenced by emotions (McNally et al., 1994). It has been demonstrated that subjects with depression tend to focus on the negative aspects of previous events. Likewise, subjects suffering from anxiety will remember better and have a bias for situations they consider to be threatening. The recollection of events can also be influenced by the way questions are formed in an interview. The answer given varies depending on how a question is worded even when the interviewee means to tell the truth (Herlihy & Turner, 2007). Previous studies in asylum-seekers carried out by the United Nations demonstrate that inconsistency in the accounts given is highly dependent on the type and manner that questions are asked (Herlihy et al., 2002).

Dissociation and memory gaps after traumatic events

Torture is characterized by hideous suffering and humiliation. A universal coping mechanism against it is dissociation in which the survivors both actively and passively separate themselves from that happening to them (Sarkar, 2009). Not surprisingly, dissociation during a traumatic experience leads to poor memory formation and recall. Time, ideas, and emotions are distorted and can easily lead to inconsistencies while accounting for these events. Saadi and colleagues (2021) randomly reviewed 200 medico-legal affidavits from asylum seekers in the United States collected between 1987 and 2017 and described the most common memory complaints reported in them. They found that memory gaps of the traumatic event, difficulty stablishing a timeline of the traumatic experience,

dissociation (and subsequent memory loss) as a coping strategy, and persistent memory loss interfering with daily activities were the most discussed by clinicians in the affidavits. Gaps in memory were particularly common as a result of physical and sexual trauma. Dissociation was reported in these individuals as the main cause of memory gaps both during the traumatic experience as well as the interview with the physicians while applying for asylum (Saadi et al., 2021). The authors underline the difficulty of individuals in answering questions related to threats to their children, for example, and how recalling such events triggered dissociative behavior in the individuals at several times during the interview. Avoidance of memories about traumatic experiences is a common coping mechanism, and a symptom category in the PTSD diagnosis. According to the affidavits some individuals consistently avoided both listening to the threats to their family as well as talking about it since it made dealing with emotional pain much easier (Saadi et al., 2021).

Discrepancies in the recollection of events is common and should not be used as a proxy for lack of credibility

Lastly, the study highlights how traumatic events can lead to memory gaps and concentration deficits which affect performance in daily activities. The individuals are described to be easily distracted and to forget what they are doing mid-chore. The more concentration the task at hand required or the more stressful it was, the higher the probability that the individuals will be affected by their previous trauma (Saadi et al., 2021). Guidelines on how to interview survivors of torture are beyond the scope of this report. However, a significant body of evidence suggests that discrepancies in the recollection of events, especially in survivors of torture and subjects with PTSD, is common and should not be used as a proxy for lack of credibility by asylum officials.

TBI and difficulties with autobiographical memory

Problems with memory are the most common amongst patients with TBI. Memory problems are difficult to treat and persist in 67.5% of patients with moderate and severe TBI even decades after injury. These problems involve all three phases of memory formation, which are encoding, consolidation, and retrieval of information. Vanderploeg and colleagues (2014) studied 105 male US army veterans with moderate and severe TBI enrolled in the Defense and Veterans' Brain Injury Center in the United States. The individuals performed the California Verbal Learning Test right after TBI as well as six months and one year after injury.

The California Verbal Learning test measures episodic memory, i.e., contextual information about events, such as time, location, and associated emotions. The authors found that impairments in memory are mostly due to visual and verbal consolidation deficits up to a year after injury. Patients with TBI take longer to learn new things while forget things faster when compared to healthy controls. Learning new information might also lead to retroactive interference, which means that encoding new information makes it difficult to retrieve similar memories. For example, memorizing a new phone number makes it difficult to remember an old phone number (Vanderploeg et al., 2014). Deficits in episodic memory significantly affect memories about one's personal history (autobiographical memory). This issue is particularly delicate since autobiographical memory guarantees a sense of identity and the continuity of the self.

Deficits in autobiographical memory can considerably impair social adjustment in everyday activities (Piolino et al., 2007). Patients who suffered a severe TBI score lower on autobiographical memory tests when compared to healthy controls irrespective of the period tested i.e., impairment is not related to the time elapsed between the injury and the event being recalled. Although patients who suffered a mild TBI experience post-traumatic amnesia about events just before and

after the injury, patients with severe TBI present with memory deficits about events that took place decades before the injury. Such impairment in autobiographical memory is also independent from the common cognitive decline seen with age. Even when strongly prompted with details, patients with severe TBI are not able to provide a rich account of autobiographical memories. Visual, spatial, and temporal memory in these patients is notably poor, which leads to account of previous events from an "observer" perspective. Patients display an impoverished self-consciousness and are unable to see themselves as part of the story being recalled. Thus, the information recalled becomes impersonal and unrelated to one's own past. Also, patients lack the context such memory belongs to and as such attribute it to the wrong source. For example, patients believed they obtained a piece of information from a doctor when in fact it came from their partners. They are known to confuse appointments as well. A doctor's appointment is confused with a hairdresser's appointment, for example (Piolino et al., 2007).

The information recalled becomes impersonal and unrelated to one's own past

Remembering is a goal-directed behavior

Memory recollection requires well-preserved executive functioning. In most cases, the retrieval of information is intentional and based on strategic, elaborative, and evaluative processes, which are mediated by the prefrontal lobe. Goal-directed behavior and motivation drive retrieval of information about oneself. Patients who suffered severe TBI often present with changes in behavior associated with diminished motivation, apathy, and lack of attention. It has been proposed that problems with autobiographical memory are related to the inability to initiate and organize recall as well as difficulties travelling back in subjective time and re-experiencing certain events at will (Piolino et al., 2007). Considering the pivotal role of the

prefrontal lobe in both storing information and initiating recall at will, it is not surprising that patients with severe TBI show notable problems in accounting for autobiographical events.

Aggravating factors

Previous studies by Sukter and colleagues (1995) have shown deficits in memory, attention, and executive functions such as anticipation, goal selection, planning, and monitoring in prisoners of war survivors from the World War II and Korean conflicts. Such deficits are long lasting, and the result of such traumatic experience can be measured even decades after they took place. Incarceration during war is characterized by physical violence, starvation, extreme conditions, and fear of further punishment and death (Sutker et al., 1995). The authors investigated a sample of 108 survivors of war prison from the World War II and Korean Conflict living in USA (Sutker et al., 1995). The individuals were in prison on average 17 months and lost during that time on average 22 kg of body weight. At the time the study was conducted, decades after the traumatic experiences, the individuals presented with a particularly high prevalence of PTSD and depression. Broadly, their results suggest that both cognitive (memory, attention, and learning), as well as executive functions (anticipation, goal selection, planning, and monitoring) were significantly correlated with PTSD and depression scores. Individuals performed worse on both cognitive and executive tasks with increased severity in PTSD and depression. Further, weight loss, which in the most severe cases accounted for over 35% of the pre-captivity weight, had a negative and significant effect on cognitive function. Survivors of war imprisonment who sustained severe weight loss performed more poorly on different learning and memory tasks than survivors that sustained less weight loss while in captivity as well as healthy war veterans of similar rank and age. A putative thiamine deficiency compromising anterograde and retrograde memory, but not overall intellectual function, is thought to

be responsible for such results. The authors suggest that the aetiology of neuropsychological deficits in survivors of prison during war is multifactorial and as such, it presents different medical implications (Sutker et al., 1995).

Postmigration factors and life in exile

Torture survivors might suffer not only from the trauma induced by torture itself but also from the hardships of ethnical, political, and religious armed conflicts, as well as forced displacement. They might also face relative isolation, financial difficulties, as well as cultural and linguistic barriers in their new countries. Some reports suggest that it might take up to 20 years for asylum seekers to establish themselves in their host countries (Bartlett et al., 2021). As such, it is not difficult to understand how these circumstances can significantly exacerbate the neurological and emotional trauma initially inflicted by torture, which in turn will most likely make treatment even more complicated, while reducing the chances of getting work and socially integrate in the host countries.

Conclusion

A high percentage of asylum seekers are victims of torture. A growing body of evidence confirms both the prevalence and extent of the injuries commonly suffered by torture survivors. The traumatic nature of torture has the potential to rewire brain circuitry. A high percentage of survivors of torture develop PTSD. In many cases, survivors are subject to physical violence, which also results in TBI. Both PTSD and TBI have been associated with thinning of the cerebral cortex as well as structures such as the hippocampus and the amygdala. Some patients recover from mild TBI and PTSD within years after the traumatic event given the appropriate treatment. However, other patients, and those who suffered moderate or severe TBI, might experience long-lasting, or even permanent sequelae. PTSD and TBI have a negative effect on executive functions. Patients suffer from memory problems, have difficulty paying attention, lack initiative and motivation, and cannot appropriately adapt their strategies to deal with daily activities based on changes in their environment. Survivors of torture who suffer from executive dysfunction may confuse details about previous events and have difficulty learning new information. Lack of coherence in their accounts of previous events is common. The hardships of settling abroad while applying for asylum and integrating in the host country might exacerbate the torture-induced executive dysfunction and make recovery even more difficult. Thus, a better understanding of the effects of torture on executive functions is needed to accommodate the needs of torture survivors in their interaction with migration authorities, social insurance agencies, educational institutions, and healthcare providers.

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Appendix

Methods

The present work is a narrative review which aimed to identify the effects of torture on executive functions. Executive performance in survivors of torture is difficult to assess. In most cases, and for obvious reasons, baseline data is not available. At the time of writing, for example, there is only three papers listed in PubMed using the search words “Torture” and “Executive Functions”. To be able to determine how torture can lead to compromised executive functioning, we set out to review the effects of torture on the brain and cognition. Blows to the head is a common method of torture that in some cases lead to traumatic brain injury. Furthermore, and not surprisingly, some survivors of torture develop PTSD. With this in mind, we searched the scientific literature using the databases of PubMed, PsycInfo and PsychArticle. The search included combinations of the following terms: Torture, Executive Functions, Traumatic Brain Injury, Stress, PTSD, Refugee, Asylum Seeker, Memory, Planning, Motivation, as well as relevant Medical Subline Headings (MesH). Citations from relevant articles were also included, particularly in the case of how stressful/traumatic events affect memory formation and consolidation. Articles were excluded if they only reported consequences of torture not related to cognition and executive functions such as pain, musculoskeletal and cardio-pulmonary injuries. The search, review, and writing were conducted by MD and IWL between December 2021 and May 2022 and included articles were published in English and Swedish. No date of publication was settled as criterion of inclusion. Disagreements about inclusion or exclusion of relevant literature were discussed and settled by MD and IWL.

Swedish Red Cross

Swedish Red Cross is part of the world's largest humanitarian network, comprising Red Cross/Red Crescent national societies in 192 countries and 14 million volunteers working to save lives, build community resilience, strengthen localization and promote dignity around the world. In Sweden, we are the largest humanitarian voluntary organization with over 22,000 volunteers in 581 local branches.

One of our priority areas is health. We work for the right to good and equal health and offer healthcare, activities for well-being and psychosocial support for a meaningful everyday life. An important part of our work is our trauma treatment centers – specialized care for the war-wounded and tortured, as well as our clinic for undocumented migrants. The focus of the Swedish Red Cross treatment centers is to assist people exposed to war and torture with support and health care so that they can regain their mental and physical health.

The treatment centers are located in Skellefteå, Uppsala, Stockholm, Skövde, Göteborg and Malmö – the first center originated in Stockholm 1985.

Swedish Red Cross University

With a human and global perspective, we offer leading education and research within nursing and health.

The Swedish Red Cross University has a long tradition of education – ever since 1867 we have trained highly regarded and valued nurses. The university provides a critical service to society and about 160 nurses and 50 specialist nurses in intensive care, infectious care and psychiatric care graduate annually from the Swedish Red Cross University. We also contribute to increasing the competence among clinical supervisors by offering specific training courses. The university conducts research within its research profile "Health sciences in a global perspective".

The university is located at Campus Flemingsberg in Stockholm and has 1,000 students and 70 members of staff.

Swedish Red Cross Competence Center
for Rehabilitation of Torture and War Trauma
The competence center is a collaboration between the Swedish Red Cross and the Swedish Red Cross University with the aim of contributing to better trauma treatment for people injured by torture and war. Based on knowledge from the Swedish Red Cross treatment centers for the war injured and tortured, and the university's scientific competence, we conduct clinical research to contribute to more effective and gentle rehabilitation – in Sweden and globally.

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