Evaluating Effectiveness of Somatic Experiencing® in Treating PTSD

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Abstract

This Capstone research project focuses on evaluating the effectiveness of Somatic Experiencing, a body-based approach, to treating post traumatic stress disorder. I used a systematic review method, a scientific and rigorous approach, in establishing and evaluating the evidence regarding the effectiveness of somatic experiencing with the aim to add to the evidence-based decision-making research in health care. I discussed a variety of treatment approaches to treatment of PTSD and how each of them works neuroscientifically and the advantages and drawbacks of the two established approaches. Finally, I used a systematic review approach to collect information, synthesize it, and analyze to establish evidence on whether somatic experiencing is effective in treating post traumatic stress disorder among diverse populations, located in various settings.

Keywords: *somatic experiencing, treatment approaches, post traumatic stress disorder, evidence, systematic review, diverse populations.*

Dedication

"Listen to the mustn'ts, child. Listen to the don'ts. Listen to the shouldn'ts, the impossibles, the won'ts. Listen to the never haves, then listen close to me… Anything can happen, child. Anything can be." — Shel Silverstein, American poet and writer.

To my mother who has been an unyielding source of support and strength for me.

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Chapter 1: Introduction

As a child, my mother was accidentally locked in a dark closet for a few minutes. She has no memory of the event, but she remembers she was crying and how it felt being in the dark with a little keyhole for light. She was soon rescued and comforted by my grandmother. To this day, my mother cannot get into a narrow elevator. If she does, she breaks into a sweat, goes dry in the mouth, and feels sick. All her rational thoughts and knowledge that elevators are secure has no effect on her body reactions.

My aunt, going through an extremely stressful time, being overwhelmed by her personal life, work and battling her own depression started becoming blind in one eye. At first, she went to see the doctor, but they had no answer for why my aunt was becoming blind in her one eye. It was a hard and worrying time for my aunt. She went to see a psychiatrist who prescribed antidepressants and counseling services. With yoga and meditation, and actively destressing, she started gaining vision back into her eye.

Personally, when experiencing grief and loss, I shutdown, go numb and my chest ribs tighten as I engage in shallow breathing. Through the grieving process, I find that my body becomes immensely tight as it tries to contain all the emotions within. Through yoga and meditation, I can start processing the loss and slowly start to heal using my body as a vessel. These experiences are personal and from my family, but I have found that they are not unique to us but like many others who experience trauma. Trauma not only effects our mind but our body as well.

Purpose Statement

"The paradox of trauma is that it has both the power to destroy and the power to transform and resurrect." Peter A. Levine, In an Unspoken Voice: How the Body Releases Trauma and Restores Goodness

The purpose and focus of my capstone are establishing the effectiveness of somatic experiencing- a body-based approach in treating post-traumatic stress disorder (hereafter referred to as 'PTSD') among diverse populations. PTSD is not just a psychological illness but a disorder with tangible somatic components (Payne et al., 2015; Levine, 2015). Therefore body-based therapies may be better and effective for clients who are unable to get any relief from pharmaceutical drugs or clients whose cognitive capacities are compromised due to PTSD (Levine, 1994; Levine, 2015; van der Kolk, 2015). Though a recent development in western psychology, body-based therapies have emerged as an alternative to cognitive and pharmacological approaches in treating PTSD (Kuhfuß et al., 2021). Somatic Experiencing® is now increasingly used as a stand-alone approach in treating PTSD, especially in populations with complex trauma (Vagnini, 2023). Despite interest and use of Somatic Experiencing® techniques there is limited research on the effectiveness of Somatic Experiencing® as a stand-alone approach in treating PTSD (Brom et al., 2017; Kuhfuß et al., 2021). My approach is to establish the importance of body-based approaches in the treatment of PTSD and to undertake a systematic review of the Somatic Experiencing® model- a body-based model for understanding and treating PTSD to evaluate the effectiveness of the Somatic Experiencing® model in treating PTSD symptoms in diverse populations.

Research Questions

The success of any treatment can be assessed by metrics such as remission and recovery from the disease; changes in baseline psychopathology for the better; improvement in health and social functioning of the client; improving client motivation to adopt and complete the treatment; and providing the client with tools to self- manage and understand their condition (Hunter et al., 2013, p. 589-597).

To examine the effective of Somatic Experiencing® method in treating PTSD among diverse populations, the capstone poses three questions of interest: (i) is somatic experiencing, a bottom-up body-based therapy is effective in treating PTSD among diverse populations? PTSD treatment includes removal of PTSD diagnosis, recovery from PTSD, and remission of PTSD symptoms; (ii) is Somatic Experiencing® effective in treating comorbidities associated with PTSD? These comorbidities may be cognitive, affective, or somatic; (iii) is Somatic Experiencing® effective in providing clients with tools to self manage? These include, introspection, resilience, reduction in avoidance, and coping skills.

Contribution to the Field

As far as I know, my capstone would be the first systematic review that provides rigorous levels of evidence on the effectiveness of Somatic Experiencing®. Only studies that used either an experimental or observational design with a control are included in my systematic review. RCTs, quasi-experimental studies, and case- control studies rank on the top three levels of hierarchy evidence (Cook, 1997).

My research differs significantly from the most recent systematic review of Kuhfuß et al. (2021) on Somatic Experiencing®, who include sixteen studies with varying research designs

ranging from experimental, case-control, uncontrolled studies, and purely qualitative studies. Uncontrolled studies and qualitative studies are not found on the evidence hierarchy and not recommended as evidence for an intervention effectiveness assessment (Cook, 1997; Burns et al., 2011).

The higher the level of evidence, the lower the risk of bias and the risk of systematic errors and the more reliable the evidence (Schlosser, 2006). In the world of health care, when decisions about a treatment must be made for vulnerable clients, it is important for both and health care practitioners, patients, and policymakers to have the highest level of evidence to base their decisions upon. Therefore, I believe my study will provide the highest level of evidence available to date to assess and determine the effectiveness of Somatic Experiencing® in treating PTSD among diverse populations.

Overview of Post Traumatic Stress Disorder (PTSD)

Post Traumatic Stress Disorder (PTSD) is a diagnosable mental health condition triggered by either experiencing or witnessing a traumatic event (s). PTSD can be triggered by any event that reminds the person of their trauma. For example, a police officer may hear a car backfire and relive her riot experiences, or a cancer patient may smell something that reminds her of an intense chemotherapy session. Trauma involves terrible events that pose significant threat to the physical, emotional, and psychological health of the victim or survivor. Childhood abuse, accidents, physical violence, sexual assault, military combat experiences, the unexpected loss of a loved one, sudden onset of illness, persistent discrimination, racism, and poverty are common traumatic events. Those exposed to traumatic events experience post traumatic and psychological reactions that they undermine a person's sense of safety in the world. The survivor of trauma operates with a foreboding

sense that catastrophe could strike at any time continually triggering them beyond their limits of mental, emotional, and physical capacity (van der Kolk, 2000). In most cases, these reactions go into remission on their own within one month of the event occurrence (Nugent et al., 2009). If they persist, they may meet the criteria for PTSD.

PTSD may occur within one month of the traumatic event or several years later. PTSD comprises of four clusters of symptoms, namely intrusive and recurrent memories of the event, avoidance of reminders of the trauma related event, negative changes in thinking and mood, and changes in reactivity and arousal symptoms- physical and emotional reactions y over time may vary from person to person (DSM-V-R, 2022) and long after the event has occurred (Almeida et al., 2009). PTSD symptoms can be mild to moderate or debilitating and can trigger an intense physical and psychological stress response that leads to serious physical illness including increased fibromyalgia, blood pressure, severe pain in the chest and back, chronic backpain, autoimmune disease, headaches, and nausea (López-Martínez, 2018) and psychological response such as revictimization and further traumatization leading to co-morbidities such as depression, anxiety, substance abuse, violence, and self harm. The damage continues with psychosocial impacts of poverty, broken homes, homelessness, and incarceration (López-Martínez, 2018). Therefore, PTSD has high persistence and low spontaneous remission levels with clients reporting high levels of suffering (Brady et al., 2000). This is why it is important for PTSD treatment to engage the body, mind, and brain of the survivor.

Prevalence of PTSD in Canada

With in their lifetime, 75% of Canadians are exposed to one or more traumatic events. While the ratio of trauma patients developing PTSD is low- only 8% of adults in Canada have moderate to severe symptoms of PTSD with only 5% of adults report having a diagnosis of PTSD (Statistics

Canada, 2021). The low rate of diagnosed adults is not surprising. Stigma, lack of awareness, inaccessibility to services, privacy around personal information sharing may underestimate the prevalence of PTSD. The Federal Framework on PTSD (Public Health Agency of Canada, 2019) highlighted the populations most at risk of PTSD are the Canadian Armed Forces, public safety personnel, health care providers, First Nations, and refugees and immigrants. What was important is that the report found that in Canada, PTSD is twice as common in women compared to men; women report symptoms of numbing, avoidance, and mood disorders; men report symptoms of irritability, violence, impulsiveness, and concurrent substance use disorders.

COVID-19 increased the proportion of adults with mental health problems from 21% in fall 2020 to 25% in spring 2021 (Public Health Agency of Canada, 2021). Recognizing that the proportion of mental illness was on the rise among young adults, the Government of Canada in the 2021 budget committed $50 million to support PTSD and trauma in frontline workers, essential workers, and others most affected by the pandemic (Public Health Agency of Canada, 2021).

Imprint of Trauma on Body, Brain, and Mind

Trauma is unbearable and intolerable and affects us in entirety- body, brain, and mind. In PTSD, the survivor continues to defend against a threat that has occurred in the past. Therefore, the treatment must terminate stress response mobilization and restore the body, brain, mind to safety (van der Kolk, 2015; van er Kolk, 2000; van der Kolk, 1994). Though we are a resilient species, our primal brain also called the reptilian brain is not good at denying or forgetting trauma. This is simply because the reptilian brain is tailored for our survival and has four adaptive responses to any threat stressor: fight, flight, freeze/ flop, and fawn (van der Kolk, 2015; Levine, 1994). I have laid out four case examples that better demonstrate what these responses look like and the

associated PTSD symptoms to gain a better understanding of the impact of trauma on the brain, body, and mind.

1. Fight: Victor is diagnosed with Post Traumatic Stress Disorder (PTSD). Victor is a 27-year-old Iraq war veteran. He admits to experiencing several traumatic events during the war but cannot recall specific details. As he is constantly irritable and angry with people, he has become distanced from his family, friends, and colleagues. He sleeps with one eye open or has nightmares. He does not visit his army unit friends as they remind him of horrific incidents he does not want to recall. He is constantly on the web looking for threats where none exist. He has been accused of physical assault by his colleagues who find that he is easily startled and hypervigilant to the noise and motion. Victor walks all tensed up, his jaw clamped, and shoulders set.

   Symptoms: Hypervigilance, intrusive thoughts, irritability, nightmares, inability to recall traumatic events in detail.
2. Flight: Jack is diagnosed with PTSD. Jack was a bright student and studying law at an Ivy League school. Though not often, he hung out with a group of influential and rich boys. He and his friends were involved in a bad accident that caused the death of a mother and her child. But it was hushed up by the parents and lawyers of the influential boys. Over the years, Jack got married and had a baby. After the birth, Jack became a workaholic, spending all his time at the law firm. He was known as a perfectionist at his job. To overcome his anxiety and panic at failing at his job, he began imbibing alcohol and drugs. His relationship with his family deteriorated and his wife left him. Eventually, Jack became addicted to drugs and porn and was fired from his job at the law firm. Jack walks shaking and averting his gaze and hiding his face in his chest.

Symptoms: needing to stay busy all time, panic, constant fear, perfectionism.

3. Freeze/ Flop: Mary is diagnosed with PTSD. Mary's father was an alcoholic who beat her mother every night. If Mary was quiet as a mouse, he ignored her, thinking she was asleep. Occasionally, if Mary moved slightly or gasped at her mother's pain, he would pull her out of her bed and beat her. Mary's boyfriend, though not an alcoholic, was prone to serious rage and he beat her often. Though advised by her friends to drop him or report him to the authorities, Mary just put up with it. Whenever she had to go into the ER, Mary would lie and cover up for her boyfriend. Mary was convinced that she deserved what she got. Mary walks with a sad face and tears flowing down her cheek alternating with a trembling and frozen look.

Symptoms: Disassociation, zoning out, difficulty making decisions, fear of acting, perceived laziness.

4. Fawn: Hillary is diagnosed with PTSD. Hillary's mother remarried and she sent Hillary, 6 years old to live on a farm with her grandmother. Hillary did not see her parents for the next 10 years. She was a good student. When she turned 16 years, her mother took her back to New York saying that there were better schools for Hillary to attend. Hillary was happy to be back with her parents and her 3 stepsisters. She said yes, even though she wanted to look after her old grandmother. Once in New York, Hillary's mother said she could not afford to send her to school and Hillary had to look after the home and earn her own living. Hillary sympathized with her mother who now had to work and look after three small children. Over time, her stepsisters looked upon Hillary as their mother. She went beyond her job to help her employer and customers. She did not see a raise or promotion. Hillary

never married. She is 50 years old looking after her stepdad and mother and working at the same job. She constantly lives with the fear of losing her parents, losing her job, and stepping outside her neighborhood. Hillary walks with a sad and tired face and narrates sad events with a trembling and wobbly smile.

Symptoms: people- pleasing, lack of boundaries, self-neglect, codependency, and emotional exhaustion.

We need to understand how the brain-body are intricately connected to understand the trauma survivor response even after the traumatic events have passed.

Neuroscience Models on Relationship between Brain, Body, and Mind

"The crossed eyebrows, the clenched fists, the hunched shoulders, and the unsmiling lips told me the story in the room even before hearing a word of it." P.K. Sinha about a Staff Meeting at Work.

Human beings are good at picking up signals. Neurological advancements show that the brain scans of the children who were holocaust survivors are different from those of normal children (Fňašková M, Říha P, 2021). The holocaust survivors had reduced grey matter, an indication that they were exposed to extreme stress. As a result, these survivors had higher incidence of PTSD and depression symptoms. Physically, they were unable to relax, and their bodies remained on high alert. What is worse, the children born of holocaust parents showed similar brain scans to their parents with high frequency of anxiety, depression, and post traumatic stress. The children were tensed up and on high alert for the slightest change in their environment and often prone to bullying (Yehuda & Lehrner, 2018). There are two neuropsychological models to explain why, where, and how response to stress and trauma occur.

Triune Brain Model

A popular theory used to conceptualize brain functioning is the triune brain theory. We have three functional layers of brain that not only impacts each other but also has control over our physical body and our emotions (Levine, 2008). The primal brain or the basal ganglia controls regulatory systems such as sleep, hunger, breathing, chemical balance, sex and is responsible for primal instincts of survival (Berman et al., 2023). All our impulsive and instinctual behaviours involved in aggression, dominance, territoriality, and ritual display emanate from the primitive part of the brain (Berman et al., 2023). The limbic brain is responsible for motivation and regulates the emotions such as fear, flight, anger, and perception and controls the primitive instincts (Berman et al., 2023)). The cerebral cortex (neo cortex), the most developed and recent regulates impulse control, abstraction, planning, decision making, and sense of time and context (Berman et al., 2023).

The reptilian brain is the first to develop with the singular function of survival. It develops in the utero and governs our heart rate, breath, and essential biological functions for homeostasis in the body (Levine, 2008). It governs the nervous system to the extent of developing the perception of our body and the environment around it, based solely on sensation. The reptilian brain stores the sensory memory from our previous experiences so that it can repeat the past response that helped the person survive (Butler, 2009). For example, newborns cry when hungry (eat to) to survive. The sensation memory of what hunger feels like is stored in our body and this triggers our impulsive actions of fight, flight, freeze mechanisms to ensure our survival.

The limbic system that includes the hypothalamus, amygdala, and hippocampus connects the reptilian brain (lower functioning) with the neocortex (higher functioning) and regulates the

nervous system's response to emotional stimulation (Henley, 2021). Here we store our memories, emotions, and motivation. The neocortex, involved in higher-order brain functions separates humans from animals. It is why humans are capable of executive functions (Berman et al., 2023).

The model proposes that interactions between the reptilian and limbic brain are competitive (Berman, 2021; Butler, 2009). For example, the limbic system may curb the primitive behaviours associated with food and sex. Also, the interactions between the neocortex and the reptilian brain are competitive and conflicting (Butler, 2009). For example, the neocortex responsible for conscious thought can suppress the primitive thoughts generated by the reptilian brain (Butler, 2009).

What our brain on trauma looks like is now clear. Neuroimaging studies of the brain on trauma show heightened activation in the right limbic brain (emotional brain) and the neo cortex, which is responsible for processing visual information (Bremner, 2006). Simultaneously there is decreased activation in the Broca's area responsible for speech. In contrast, the visual cortex lights up showing that the images associated with trauma are lastingly stamped in memory (Bremner, 2006).

Autonomous Nervous System in Stress Response

This section draws heavily from a standard textbook on neuroscience (Henley, 2021) in summarizing the structure and functions of ANS. The pathway to identifying and responding to threat is two-fold. Our senses gather environmental information, and these sensations converge in the thalamus, the body's information relay station. These sensations or experiences are passed into the amygdala (limbic) and to the frontal lobes (neocortex). If the amygdala with the help of the hippocampus interprets the mixture of sensations as life threatening, it activates the autonomic

nervous system (ANS) and triggers stress hormones and neural impulses causing increased heart rate, secretions of cortisol and adrenaline, increased blood pressure and fast breathing – thus preparing the body for survival by activating fear and flight responses to danger.

The autonomic nervous system regulates involuntary body functions including heart rate, blood pressure, respiration, digestion, and sexual arousal. These physiological processes behave differently in response to stress and manifest as uncomfortable and often unbearable body distress. The sympathetic nervous system, a part of the autonomous nervous system, responsible for fight/ flight/ freeze/ fawn responses switches on to survival mode, providing the body with energy, causing uncomfortable body sensations to respond to stress (Henley, 2021).

This is the fastest neural pathway to response. Once the stressor is eliminated, the parasympathetic system of the ANS, responsible for 'rest and digest' becomes activated thus returning the body to homeostasis (van der Kolk, 2000; Rothschild, 2000). The slower pathway of response is when the information flows from the thalamus via the hippocampus and anterior cingulate to the prefrontal cortex of the brain, where the frontal lobes are located. This pathway results in a calm and refined interpretation of the threat and a better control over the ANS (van der Kolk, 2015; Rothschild, 2000).

There are two ways in which individuals with PTSD trigger dysfunctional reactions (Gray & McNaughton, 1996). One is the misinterpretation of the danger. The amygdala relies on the frontal lobe to assess the danger. If the frontal lobes are compromised, as in the case of PTSD, the person is unable to process the information in the frontal lobes. The response is hijacked by the amygdala which pushes the body into conditioned responses of fight and flight (Gray & McNaughton, 1996). The second is the breakdown in the inhibitory responses of the frontal lobes.

The neocortex is unable to override the base responses of the reptilian and limbic brain thus compromising the threat detection system (Gray & McNaughton, 1996). Van der Kolk (2015, p.63-65) proposes two ways of changing the threat detection system that is compromised in individuals with PTSD, either by regulating the top-down approach involving and strengthening the pathway of emotions through the medial prefrontal cortex or regulating bottom up through the reptilian brain by recalibrating the ANS.

Recalibration of ANS becomes pertinent in PTSD treatment because at a cognitive level, we may not be aware of a threat (Porges, 2022). However, at a neurophysiological level, via neuroception, our body may be putting in place neural processes that would facilitate behaviors such as fight, flight, or freeze (Porges, 2022). It is significant that neuroception is an unconscious, primitive process. For instance, a child exposed to abuse may cognitively not recognize the abuse as a threat, but the body's nervous system may be signaling danger. Thus, in PTSD cases, the unconscious mind may conflict with the conscious mind (Porges, 1995).

Neuroception brings together interoception, exteroception, and proprioception signals and messages for the brain to make sense of our experience (Pinna & Edwards, 2020). Interoception refers to the internal signals of our body like heartbeat and nervous system, vital to maintaining homeostasis. If a hungry child is picked up and fed, the child's interoception develops in a health way- hunger- crying- being fed in that order. On the other hand, if the child receives a smack for being hungry, the child will cut off itself from hunger and not express its hunger (crying) so that it can remain safe. Maladaptation is the result, and this may be with pleasurable feelings as well if they threaten the safety of the person (Rothschild, 2000).

Interoception is informed by exteroception and proprioception (Pinna & Edwards, 2020). Exteroception is how we view the world around us like auditory and visual information. To a child, the arrival of the mother can signal food and safety. Proprioception refers to information about the position and movements of the body. When a child sees the mother, it quickly moves towards the mother because it is safe (Rothschild, 2000). Research on emotions shows that emotions are a body's interpretation of sensation resulting from an interoceptive sensation (increased heartbeat, shortness of breath) then integrating with exteroception and proprioceptive information for context to name the emotion experienced (Barrett, 2013). For this capstone, five conclusions are pertinent.

a) The reptilian brain responsible for survival operates solely on sensation and repetition. These sensory memories are stored in our body.
b) The brain integrates the facts gathered from neuroception with previous experiences to distinguish between safe and dangerous situations. This information is primarily provided by body changes (homeostasis) governed by the sympathetic nervous system.
c) Dysregulated nervous system causes emotional dysregulation. That is, inability to feel body sensations causes inability to process emotions causing the person to relive the past.
d) A person with trauma is unable to switch off the survival mode and the accompanying uncomfortable body sensations.
e) The dysfunctional threat detection system can be changed either thorough regulating the top-down approach from the prefrontal cortex or through the bottom-up approach from the brain stem.

PTSD Treatment Approaches

The capstone focuses on three treatment avenues to treating PTSD: (a) Pharmacotherapy- taking medications that correct the chemical imbalances and shutting down incongruous reactions in the brain caused by trauma and stress hormones. (b) Top-down approaches- include talking psychotherapy interventions that target inappropriate cognitions and perceptions surrounding trauma and understanding what they are and why they exist. (c) Bottom-up approaches- include mind-body, somatic or body-based interventions that encourage and utilize the physical sensations and activities that seek to heal the unresolved trauma and emotions trapped in the body.

In talk therapy, the therapist works with the neocortex, responsible for attention, thought, perception and episodic memory to change the thinking which in turn positively affects emotions (van der Kolk, 2000). This change in thinking results in positive emotions in the limbic/ mammalian part of the brain positively affects the body- which is governed by the reptilian brain (van der Kolk, 2000; Levine, 2015; Kuhfuß et al., 2021).

Talk therapy is a great tool as it can help with various steps in the process of reframing and reintegrating our memories (Sharpless & Barber, 2011). But it has a risk to cause dissociation, depersonalization or retraumatization in individuals with PTSD (van der Kolk, 2015; Rothschild, 2000). This is reflected in the dropout rates from cognitive based treatments varying from 54% (Hays, 2014), 39% (Kehle-Forbes et al, 2016), 36% (Goetter et al., 2015), and 25% (Steenkamp et al., 2015).

Bottom-up approach or somatic therapies drive the attention towards selfhood and agency of the individual- both concepts derived from polyvagal theory and the somatic marker hypothesis (van der Kolk, 2015; van der Kolk, 2000). The aim of somatic therapies is to draw

out the sensory information form trauma that is stored in the body (van der Kolk, 2015). Somatic experiencing, the most researched of bottom-up approaches also aims to help individuals befriend the energies released; and complete the self-preserving physical actions that were left incomplete when they were experiencing trauma (van der Kolk, 2000; van der Kolk, 2015; Levine, 1994).

Systematic Review Framework Methodology

Systematic reviews are a rigorous and structured approach to synthesizing research evidence, using a predefined search strategy, aimed at minimizing bias and providing a comprehensive overview of all relevant studies on a particular research question (Siddaway & Hedges, 2019). A systematic review is a meticulous summary of all available primary research in response to a research question, providing the most reliable source of evidence to guide clinical practice (Clarke, 2011). Systematic reviews are a key element of evidence-based healthcare that identifies relevant studies, appraises their quality, and summarizes the evidence using explicit methodology (Caldwell & Bennett, 2020). Systematic reviews involve a comprehensive and replicable methodology, including a thorough search for all relevant literature, systematic integration and critique of evidence, and synthesis of findings to draw broad conclusions (Tsafnat et al., 2014). Systematic reviews are essential for evidence-based practice and policy, incorporating both quantitative (meta-analysis) and qualitative (narrative review, meta-synthesis) research, with qualitative research traditionally excluded due to methodological challenges (Dixon-Woods et al., 2006). The process of systematic review includes several steps: problem formulation, development of a protocol, comprehensive literature search, study selection, data extraction, quality and bias assessment, evidence rating, and synthesis of results (Siddaway & Hedges, 2019).

It is important that researchers must typically include the following seven steps in conducting a systematic review for it to be rigorous, reliable, and valuable for decision-making in healthcare and research (Higgins et al., 2023; Gopalakrishnan and Ganeshkumar, 2013; Opheim, 2019).

1. **Define the Research Question**: Clearly define the research question or objective that the systematic review aims to address. This step is crucial as all subsequent steps will be based on this question.
2. **Literature Search**: Conduct a comprehensive and systematic search of the literature using various sources such as electronic databases, clinical trial registers, biomedical databases, grey literature, references from primary sources, and unpublished sources known to experts in the field.
3. **Study Selection**: Screen and select studies based on pre-defined inclusion and exclusion criteria. This process involves reviewing titles, abstracts, and full texts of potentially relevant studies to determine their eligibility for inclusion in the review.
4. **Data Extraction**: Extract relevant data from the selected studies like recording key information such as study characteristics, methods, results, and conclusions.
5. **Quality Assessment**: Assess the quality of included studies to evaluate their risk of bias and methodological rigor. This step helps in determining the overall strength of the evidence presented in the systematic review.
6. **Data Synthesis**: Synthesize the findings from individual studies to provide an overall summary of the evidence. This may involve qualitative synthesis, quantitative synthesis (meta-analysis), or both, depending on the nature of the included studies.

7. **Interpretation and Reporting**: Interpret the results of the systematic review considering the research question and the quality of the included studies. Report the findings following established guidelines such as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to ensure transparency and completeness.

Researchers can provide a broader assessment of the effectiveness of an intervention, if it has been used multiple times and tested on a variety of population groups and in multiple settings (Hunter, 2021). Systematic reviews of existing studies are the recommended framework to evaluate intervention efficacy (Hunter, 2021). There are two ways of doing this- one approach is through meta-analysis, which is to develop a common set of metrics to assess the intervention's impact. Another way is to use a narrative approach- assess common findings and factors across the studies to assess the intervention's impact (Siddaway & Hedges, 2021; Caldwell & Bennett, 2020).

Reflectivity and Positionality Statement

In the spirit of self-reflexivity, I acknowledge my standpoint as an educated brown male who has personally experienced PTSD and seen PTSD symptoms in my family. I am well- versed with the debilitating impacts of PTSD on health, quality of life, interpersonal relationships, and status in community and society. In my work as a crisis counsellor, I have seen the devastating impacts of trauma long after the traumatic events have occurred. I believe in evidence-based decision making especially about treatments for vulnerable clients.

While I believe that cognitive and exposure therapies have an important role in treating PTSD, I am increasingly drawn to body- based therapies. My belief is that PTSD is not just a psychological condition, it has important somatic components. As a mixed martial arts practitioner, yoga practitioner, and undergoing Hakomi training, I am aware of my bias towards body-based

therapy such as Somatic Experiencing® in treating PTSD. My bias, that we hold trauma in our bodies, will I believe help me in becoming a better trauma therapist with ability to serve diverse populations.

Chapter 2: Literature Review

PTSD Treatment Modalities

"Being trauma informed must include respecting and honouring the fact that what is learned from the experience of trauma is a kind of knowledge, in the same way that what we learn about trauma is knowledge. In both cases, what is known is contextual and deeply nuanced." Linde Zingaro, Speaking Out: Storytelling for Social Change.

The purpose of this chapter is to review the literature on modalities to treat PTSD in a variety of populations ranging from refugees, combat veterans, and civilians and examine the effectiveness of these approaches. Simplistically, there are three broad groups of PTSD treatment modalities available to health care professionals- pharmacotherapy, psychotherapy- top-down approaches and psychotherapy- bottom-up approaches. The plan of the chapter is as follows. It begins with a summary on the complex and multifaceted connection between PTSD, the body, brain, emotions, and mind and thus the treatment goals. The next section of the chapter focuses on review of pharmacological approach to treat PTSD and its efficacy and drawbacks followed by a section on the review of different types and efficacy of top-down approaches and the disadvantages. The third section of the chapter provides a brief introduction to bottom down approaches, with the supporting theoretical model. The final section is devoted to the theoretical framework of somatic/ body therapies, specifically Somatic Experiencing® (SE), the focus of the systematic review.

Another way of looking at the brain on trauma is how the primitive part of the brain hijacks the logical and analytical (Pessoa et al., 2019). According to the triune model, neurological

responses emanate from different parts of the brain- reptilian, limbic, and neocortex (Pessoa et al., 2019; Levine, 2020). In short, the processing of sensations and experiences is more nuanced and rational in the higher parts of the brain and more instinctive and conditioned in the emotional part of the brain (reptilian and limbic) and the latter triumphs over the former when responses are unjustified to the threat, as is with PTSD patients (Pessoa et al., 2019; van der Kolk, 2015). What is in a name? Called shell shock in World War 1 and battle fatigue in World War 2, and PTSD in Vietnam war, trauma has always been the same but approaches and diagnosis to treat it has progressed over time. Earlier treatments were insensitive to say the least. They included isolating the patient, heavily medicating patients, and viewing war neurosis as patient's weakness and moral failing. It was only in 1980, that Vietnam war veterans succeeded in lobbying the American Psychiatric Association (APA) to create PTSD as a separate diagnosis/ disorder (van der Kolk, 2015). With the advancement of neuroscience, neurobiology, and neuropsychology in 1960s and 1970s, a better understanding of the brain, behaviour, and emotions and the interlinkages began to emerge. The brain research revelated that trauma and stress cause chemical imbalances in the brain and alter brain's physiological structure (Solomon, 1980; Raleigh et al., 1984). These studies also found that the stress caused by trauma fundamentally reorganizes how the mind and brain alters perceptions and the view of the world. Traumatized individuals are always on high alert and hypervigilant because they perceive their environment as unsafe, dangerous, and life threatening (van der Kolk, 2000). However, all was not lost as research showed that brain was neuroplastic, meaning that the neural pathways in the brain could rewire and make new connections and organize themselves in different ways (Henley, 2021). Effectively, if the treatment method could utilize the neuroplasticity of the brain, then the trauma could be treated, and the patient could regain abilities lost following a trauma and return to a fulfilling life (Cross et al., 2017).

At a basic level, any trauma treatment must stabilize the individual; help the patient build interpersonal relationships; set the past trauma and triggers to rest; and develop skills to deal with traumatic stress (Rothschild, 2000). As mentioned above, we will focus on three treatment avenues to treating PTSD:

i) Pharmacotherapy- taking medications that correct the chemical imbalances and shutting down incongruous reactions in the brain caused by trauma and stress hormones (Sharpless & Barber, 2011).

ii) Top-down approaches- include talking psychotherapy interventions that target inappropriate cognitions and perceptions surrounding trauma and understanding what they are and why they exist (Sharpless & Barber, 2011).

iii) Bottom-up approaches- include mind-body, somatic or body-based interventions that encourage and utilize the physical sensations and activities that seek to heal the unresolved trauma and emotions trapped in the body (Sharpless & Barber, 2011).

Pharmacotherapy in Treating Trauma and Related Disorders

Pharmacotherapy is informed by theories and studies about treating the chemical imbalances in the brain by administering appropriate chemicals to cure the disorder. These theories and experiments informed the development of pharmacotherapy for mental disorders. Stress hormones secreted during disorders such as PTSD caused abnormal changes in hormones and neurotransmitters, norepinephrine, dopamine, and serotonin in the brain (Hoskins et al., 2015). Pavlovian like experiments on dogs showed that dogs after receiving an inescapable shock, necessarily did not run out of their cages when set free (Seligman & Altenor, 1980). They called this learned helplessness, a behaviour shown by traumatized patients.

Richard Solomon (1980) put forth a psychological theory that explains the paradox of how pleasures can turn to painful addictions and painful stress can turn into pleasurable thrilling experiences in his seminal paper, "The Opponent-Process Theory of Acquired Motivation: The Costs of Pleasure and the Benefits of Pain". Solomon's theory was verified experimentally with animals and humans and reflects the physiology of the nervous system and how the body eventually learns to adjust to all types of stimuli. This theory provides a framework to explain diverse behaviours of addiction, thrill-seeking, job satisfaction, and cravings for food or exercise (Solomon, 1980). For example, people retiring from positions of power exhibit poor health status and depression. Alternately, marathon runners enjoy a profusion of endorphins when they push their bodies to the limit. Therefore, like drug addiction, PTSD may cause the survivors to crave the very trauma and the pain that accompanies it, i.e., the brain generates morphine like chemicals in response to stress (van der Kolk, 2015).

A second development was the role of serotonin in PTSD (Cusack et al., 2016). The amygdala, the emotional regulatory system in the brain largely depends on the neurotransmitter, serotonin. Raleigh et al. (1984) in their study on serotonin levels in male monkeys found that dominant male monkeys had higher serotonin levels. The low-ranking monkeys on the other hand had compromised social responses to potential threats and were hyperactive like individuals with PTSD. By pumping up the serotonin levels of low-ranking monkeys, their dominance and leadership could be elevated in the monkey hierarchy (Raleigh et al.,1984).

In 1988, the drug Prozac or Fluoxetine was prescribed for treatment of trauma and related conditions (Hoskins et al., 2015). Other psychoactive drugs used to treat trauma include Zoloft, Cymbalta, Paxil, Lexapro, and Sertraline- all commonly known as Selective serotonin reuptake

inhibitors (SSRIs) class of drugs and norepinephrine reuptake inhibitors (SNRIs) (Hoskins et al., 2015). Selective serotonin reuptake inhibitors (SSRIs) class of drugs are universally accepted as the first line pharmacological treatment of PTSD in clinical guidelines (Martin et al., 2021) with strongest evidence of efficacy for fluoxetine and paroxetine (Hoskins et al., 2015). Venlafaxine, a Serotonin-norepinephrine reuptake inhibitor (SNRIs) is also commonly recommended as a first line pharmacological treatment of PTSD in clinical guidelines (Martin et al., 2021).

A positive effect of pharmacotherapy, specifically anti-psychotic drugs, is the significant impact it had in reducing the number of people living in mental health facilities in the USA- a welcome change from housing patients in horrible, unsanitary conditions compared to treating them at home or in the community (Torrey, 1997). A systematic review and meta-analysis of pharmacological treatment for PTSD found statistically significant improvements but small effect sizes in PTSD severity when treated with SSRIs and SNRIs compared to placebo (Hoskins et al., 2015). Cipriani et al. (2018) found that patients on SSRIs showed significant improvement in sleep, improved coping skills, and lower preoccupation with the trauma event and the past. In contrast, Puetz et al. (2015) in their meta-analysis of comparing psychotherapy and pharmaceutical treatment for combat related PTSD found statistically significant greater effect size for psychotherapy compared to pharmaceutical methods for treating combat related PTSD. Sullivan & Neria (2009) reviewed the efficacy of drugs in PTSD treatment based on outcome data available from RCTs of drugs. The study found that drugs have limited efficacy and small effect sizes coupled with huge drop out over the longer treatment period of 12 weeks. They also found that only the civilian population (excluding seniors and children) who were on pharmacological treatment had positive effects when compared to placebo control group. Jonas et al. (2013) in a head-to-head comparison of psychotherapy with pharmacotherapy had mixed results. A

comparison of EMDR and Paroxetine in treating PTSD was unable to draw any conclusions on which was better. On the other hand, a comparison of EMDR and Fluoxetine treated subjects found that both had similar improvements in PTSD symptoms, rates of remission, and loss of PTSD diagnosis at the end of treatment.

There are several drawbacks to relying on pharmaceuticals to treat trauma and PTSD. Neurological advances and brain imaging studies show that PTSD is not merely chemical imbalances in the brain (Cross et al., 2017). Recent research has found that, drugs increasingly mask the problem and do not actually treat PTSD (Kishi et al., 2023). The markers used in evaluating the drugs often do not identify the side effects (low curiosity, low motivation, drowsiness) or secondary conditions (obesity and diabetes) that may develop because of using psychoactive drugs (Hall et al., 2008; Kishi et al., 2023). Policy makers are finding that pharmacotherapy is neither a long- term solution nor cost-effective (CBC, 2021) A study on anti-depressants in Canada find that the number of people using anti-depressants is increasing while not showing any decrease in the number of individuals showing up with depression (CBC, 2021). For example, in Canada, depression is the leading mental disorder with insurance claims for SSRIs up by 17% in 2019 led by increase in the number of new patients diagnosed with depression (CBC, 2021). Financially, this means that increasing amounts of constrained mental health budgets (public and private) are spent on anti-depressants (CBC, 2021). Amongst the OECD countries, Canada is the fourth largest in consumption of anti-depressants- 133 DDD per 1,000 population (Statistica, 2022). Other issues that go beyond effectiveness of pharmacotherapy are the problem of generic formulations arriving with delay in the market due to the lobbying by pharmaceutical companies, often patients are not part of their care, and several non-pharmaceutical interventions are marginalized, and their practitioners are not funded adequately (van der Kolk, 2015, p.38).

A systematic review with trial sequential analysis (Jakobsen et al., 2017) found that pharmaceutical companies undertook or funded researchers to conduct Randomized Controlled Trials (RCTs)- the gold standard for evaluating the effectiveness of an intervention and outcome of trials for drugs but none of the RCTs followed the patients' progress over time. The study also found that SSRIs' small potential benefits were significantly outweighed by the risk of both serious and non-serious adverse effects on the patient's health. Finally, all PTSD treatment clinical guidelines published during 2004-2020, recommend psychotherapy- top-down interventions as the first line of treatment for PTSD (Jericho et al., 2022; Martin et al., 2021; Merz et al., 2019). Only, if pharmacological treatment was indicated, an SSRI was recommended as the first line of treatment for PTSD (Martin et al., 2021).

Top-Down Treatment in Treating Trauma and Related Disorders

The top-down approach is the most prevalent approach today in psychotherapy in America reflected in the treatment guidelines for PTSD by US Veteran Affairs and Defence Department, American Psychiatry Association, International Society for Traumatic Studies, and National Institute for Health and Care Excellence (Sonya et al., 2023). All strongly recommend CPT, PE, and EMDR for PTSD (Sonya et al., 2023; Schrader & Ross, 2021).

Top-down treatment of PTSD engages the upper part of the brain, the prefrontal cortex, associated with cognitive thinking, thought patterns, communication, management, and decision making, and present-day emotional awareness (Cusack et al., 2016; Watkins et al., 2018). In top-down therapy, clinicians work on activating the cognitive controls of the brain affected by PTSD through talk therapy and adjust the emotional centres of the brain to positively change emotions and behaviours- such as how we think and our capacity to think about the past, present, and future

(Reisman, 2016; Watkins et al., 2018). Top-down therapy seeks to alter the relevance of current environmental stimuli such as perceived versus actual threat, trauma triggers, and memories thus reshaping the emotional and physiological responses to those experiences in the present (Reisman, 2016; Watkins et al., 2018). There are broadly two kinds of top-down therapies or commonly known as talk therapies to treat PTSD. One, is therapy where the client talks about the traumatic event and the therapist provides non- judgemental acknowledgement (Schnurr, 2017). The second, is trauma focused talk therapy (TFT) that uses cognitive, emotional, and behavioural techniques to process trauma reminders and alter unhelpful trauma beliefs about self and the world (Schnurr, 2017). Top-down psychotherapies for PTSD have the following commonalities- psychoeducation; facilitating intervention; optimizing patient cooperation; and preventing relapse (Schnyder, 2015). But they differ from each other in terms of intervention and number of sessions; strategies for processing trauma- verbal, written, imagery, narrative (Schnyder, 2015; Schnyder & Cloitre, 2015).

Top-down approaches are the most studied- especially trauma focused therapies (TFTs) that combine components of exposure and/or cognitive restructuring (Lewis et al., 2020; Barawi, 2020). These include PE (Schnurr, 2017), CPT, CT-PTSD (Ehlers & Clark, 2008), and EMDR (Schnurr, 2017). In terms of effectiveness and efficacy in treating PTSD among diverse populations, cognitive behavioural approaches such as Cognitive Behavior Therapy (CBT), Cognitive Processing Therapy (CPT); exposure-based interventions- Prolonged Exposure Therapy (PE) and Narrative Therapy (NT); and Eye-Movement Desensitization Reprocessing (EMDR) Therapy with significant trauma focus are considered the gold standard for treating PTSD in terms of their effectiveness (Alshahrani et al., 2022; Jericho et al., 2022; Martin et al., 2021; Watts et al., 2018). Guideline recommended treatments for PTSD are supported by the highest evidence (RCTs) in aiding PTSD recovery and remission of trauma symptoms (Martin et al., 2021).

Recent systematic reviews and meta- analysis of first-line psychotherapies for treating PTSD in adults and veterans report that trauma focused- CBT-T, PE and CPT that focus on the traumatic event are effective when compared to non- trauma focused CBT and pharmacotherapy (Sonya et al., 2023; Lewis et al., 2020; Steenkamp et al., 2020; Barawi, 2020). However, earlier systematic reviews and meta-analysis of effectiveness of top down or psychotherapy treatments for PTSD are mixed. Ehlers et al. (2010) establish that top-down approaches are very effective in treating PTSD. While others (Bisson et al., 2013; Phelps & Le Doux, 2005) found significant limitations to cognitive- behavioural and exposure therapy in treating PTSD clients especially when the client is required to have a substantial amount of cognitive processing that is typically impaired due to negative affect of PTSD symptoms.

The evidence on EMDR therapy is mixed. EMDR is unique in being a cognitive approach with strong somatic elements (Shapiro, 2014). EMDR shows improved PTSD diagnosis, reduced PTSD symptoms, and other trauma-related symptoms (Wilson et al., 2018; Opheim et al., 2019). However, the evidence is based on small sample sizes and provides limited follow-up data (Wilson et al., 2018). Further, EMDR has some elements of cognitive behavior therapy such as strengthening adaptive cognitions to stress and some elements of Somatic Experiencing® such as not challenging beliefs instead, using eye movements to reduce affective distress (Shapiro, 2014).

As a baseline, I summarize the meta-analysis (studies and trials) of Jonas et al. (2013) because systematic reviews of RCTs constitute the highest level of evidence and meta-analysis metrics allow to extrapolate the results to a general population (Moosapour et al., 2021). The authors determine whether psychotherapeutic and pharmacological treatments are effective for adults with PTSD; whether evidence supported the efficacy of each psychotherapy intervention;

determine the comparative effectiveness of the intervention by comparing head-to-head evidence on psychological treatments for PTSD (Jonas et al., 2013). Among psychological treatments for PTSD, they include (1) cognitive behavioral therapy (CBT)-cognitive therapy; (2) CBT-coping skills; (3) CBT-exposure; (4) CBT-mixed therapies; (5) eye movement desensitization and reprocessing (EMDR); and (6) other psychotherapies (imagery rehearsal therapy, narrative exposure therapy, brief eclectic psychotherapy). Some interesting and relevant conclusions are reported here.

- The strength of evidence (SOE) or efficacy with high effect sizes for improving PTSD symptoms and moderate effect sizes for achieving loss of PTSD diagnosis is strongest for **exposure-based therapies**.
- Moderate efficacy and high effect sizes for improving PTSD symptoms and moderate effect sizes for achieving loss of PTSD diagnosis was found with **cognitive processing therapy, cognitive therapy, CBT-mixed interventions, EMDR, and narrative exposure therapy**.
- Head-to-head comparative evidence of psychotherapy interventions was **inconclusive** on whether one therapy was better than other.
- **CBT-mixed interventions** result in greater improvements in PTSD symptoms than relaxation interventions.
- Moderate SOE exists for efficacy of fluoxetine, paroxetine, sertraline, topiramate, and venlafaxine for improving PTSD symptoms.
- **Inadequate evidence** to determine if a combination(s) of psychotherapy treatments and pharmacological treatments are better than either one alone for PTSD treatment.

- **Remission of PTSD** symptoms was not reported as an outcome in any of the studies/ trials.
- Both **EMDR and fluoxetine** were equally effective on their own to treat PTSD. However, on a 6 month follow up, depression scores were lower for EMDR treated patients than those on fluoxetine.

Whatever the treatment, its effectiveness is directly correlated with the client completing the treatment and not dropping out from the treatment (Burns et al., 2011). Knowing why a client drops out of treatment helps the clinician/ therapist in determining the appropriate treatment and its format to help the client in continuing and completing the treatment (Imel et al., 2015; Varker et al., 2021). A significant problem with guideline recommended treatments for PTSD is the high dropout rates from treatment reported by clinicians. Dropout rates mean failure to complete the pre-specified treatment (Imel et al., 2015) or post-treatment assessment (Lewis, 2020) or a combination of not completing the prespecified treatment protocol and agreed upon goals (Varker, 2021) from guideline recommended treatments. The conclusions on the gold standard PTSD therapies-cognitive based and exposure therapies are mixed. Najavitis (2015) reports several studies that show the problem of drop out and low retention is significantly lower with the gold standard PTSD therapies- in the real world compared to RCT trials. In contrast, Goetter et al. (2015) observed higher drop out rate in clinical care settings than in clinical trials.

Some studies (Humbree et al., 2003; Imel et al., 2013) found no significant difference in dropout rates in head- to- head comparison of active treatments for PTSD- PE (20.5%), cognitive therapy- CT (22.5%), and EMDR (20%). A meta-analysis of psychological therapies found a lower dropout rate of 16% but these included a wide array of individual and group-based treatment, with interventions delivered via internet and virtual reality (Lewis et al., 2020). Dropout rates from cognitive based treatments varied from 54% (Hays, 2014), 39% (Kehle-Forbes et al.,

2016), 36% (Goetter et al., 2015), and 25% (Steenkamp et al., 2015). Varker et al. (2021) in their meta-analysis studies and 85 trials comprising of 6804 participants found that the mean dropout rate was 20.9%. In a head-to-head comparison, the Varker et al. (2021) found dropouts from recommended trauma focused intervention was highest at 30.4% for Cognitive Processing Therapy (CPT), 28.7% from prolonged exposure (PE), and 7% from Narrative Therapy (NT). Dropout rates were not predicted by age, employment status, relationship status, baseline trauma severity (Varker et al., 2021; Humbree et al., 2003). Instead, the number of treatment sessions, their format delivery was positively related with dropout sessions (Varker et al., 2021; Humbree et al., 2003; Imel et al., 2013). This is seen in controls on waitlist, who were receiving supportive counselling and relaxation had the lowest drop out rate of 11.4% (Bradley, 2005). A systematic review of qualitative studies of trauma focused therapies (TFTs) as first line of treatment found TFTs are underutilized as they create motivation for drop out as the clients consider them harmful (Gjerstad & Nordin, 2024). In fact, in those with most severe PTSD symptoms received less benefit from treatment (Barawi, 2020).

Military population had higher dropout rates from treatment compared to civilian population. Military population had higher dropout rates from trauma focused treatments compared to non-trauma focused treatments (Hundt et al., 2020). In fact, Garcia et al. (2014) concluded that military groups did not initiate treatment for PTSD when it was trauma focused as they feared that their symptoms would get worse and overwhelm their capacity to cope. Lewis et al. (2018) also found a similar result that exposure therapy and to a certain extent cognitive behaviour interventions result in low retention rates and high dropout rates from the programs due to the aversive effect of exposing oneself to trauma.

In addition to drop out rates, there is some research on non-response rates to guideline recommended PTSD interventions. The implications of non-response rates vary across studies. High non-response rates of 50% results in an inability to maintain treatment's long-term effect (Hays, 2014). The non-response rates are due to the client having to relive and walk through the memory which is incredibly charged is a very emotionally and mentally vulnerable thing to have to walk through (Payne et al., 2015).

Currently, the top- down therapies are the most prevalent in USA and Canada and PTSD guidelines prescribe cognitive behaviour therapy and trauma focused cognitive based therapies as first line intervention (Martin et al., 2021; Sonya et al., 2023). Public and private insurance companies pay for talk therapies and medications, encouraging clinicians and patients to increasingly opt for these treatment avenues (Martin et al., 2021; Sonya et al., 2023). However, dropout rates are significantly high from guideline recommended therapies as first line of treatment for PTSD thus reducing the efficacy of the treatment (Varker et al., 2021; Gjerstad & Nordin, 2024; Imel et al., 2013). As a result, the effectiveness of the interventions may be overstated by not including dropout rates and non-response rates to the intervention (Gjerstad & Nordin, 2024). The adverse effects of the treatment and secondary health effects may be understated due to the interventions triggering reminders of trauma and the associated ill effects such as hyperarousal or disassociation (Kehle-Forbes et al., 2016). Finally, the very nature of top-down therapy- its focus on talking about trauma, exposure to traumatic memories and triggers and emphasis on changing cognitions and thinking about trauma may be extremely challenging and overwhelming for PTSD clients thus dissuading them from submitting to any top-down therapy (van der Kolk, 2015; Levine, 2020).

Therefore, following conclusions emerge. First, top-down therapies are most researched and studied for their effectiveness and efficacy in treating PTSD and trauma focused therapies that combine exposure and cognitive restructuring are most effective. Second, guidelines for PTSD treatment recommend top-down therapies as first line of treatment. Third, there is inconclusive evidence on which of the therapies are most effective when therapies are compared head-to-head. This arises from the difficulty that effects of trauma are heterogenous and cannot be captured as a variable and there are innumerable symptom profiles of PTSD reducing their formulation profile for research (Cloitre et al., 2009). Finally, while number of RCTs- the gold standard for evidence is increasing on top-down therapies, the evidence on their effectiveness is unclear. A common problem is that the structure of trials varies and there is minimal follow up of clients to study remission and relapse.

Bottom-up Techniques

PTSD is associated with decreased top-down emotion modulation and increased bottom-up connectivity from the amygdala to the prefrontal cortex, suggesting the importance of bottom-up processes or somatic therapies in PTSD symptomatology (Nicholson et al., 2017). Bottom-up approaches increase connectivity between amygdala to the prefrontal cortex through a defensive and reactive processing of the trauma (Schnyder, 2015). Bottom-up treatment for PTSD refers to therapeutic approaches that focus on the body and sensory experiences to address the symptoms of PTSD (Kearney, 2022). This contrasts with top-down methods that emphasize cognitive processes.

When trauma symptoms activate, the 4Fs kick in the limbic brain even before the cognitive brain understands what is happening. Hyperarousal, sadness, anger, disassociation, and depersonalization occur accompanied by physical symptoms such as muscle tension, nausea, dry

throat, racing heartbeat, and going numb, all body reactions (Engel-Yeger, 2013). Many traumatized individuals are either hypervigilant or numb leading to inaccurate sensing of threats and responding inappropriately (Engel-Yeger, 2013).

Somatic therapy is described as a “bottom-up” approach in which patterns are changed through the body’s movements (Brom et al., 2017). The concept of "bottom-up" approaches, known as body-oriented or somatic psychotherapy interventions, is gaining attention as an alternative to traditional "top-down" cognitive therapies in trauma therapy (Kuhfuß et al., 2021; van der Kolk, 2015). This approach focuses on the body's sensory experiences and the regulation of emotions through somatic awareness to treat trauma (van der Kolk & Fisler, 1995). Body-based approaches explore how the body holds trauma at a cellular level, how it expresses trauma and emphasizes the importance of somatic awareness and the body's role in emotion regulation and trauma processing (Grabbe, 2017; Salamon, 2023).

Somatic therapy includes interventions such as grounding, boundary development, movement and process, titration, and self-regulation as well as complementary and alternative movement modalities such as tai chi, therapeutic touch, massage, and yoga (Almeida et al., 2019). Though the approaches differ SE, sensorimotor psychotherapy and Hakomi method directly address traumatic memories. Of these methods, only SE is most researched in terms of treatment effectiveness (Almeida et al., 2019; Kuhfub et al., 2021).

Although the manifestation of trauma in the body is a phenomenon well-endorsed by clinicians and traumatized individuals, the neurobiological underpinnings of this manifestation remain unclear (Almeida et al., 2019; Kearney, 2022). For now, body-based approaches are supported by the polyvagal theory and somatic marker hypothesis understanding of trauma and

how it informs Bottom-up/ somatic approaches to trauma care through the lens of the autonomic nervous system and somatic marker deficits, leading to more effective clinical techniques (van der Kolk, 1994; van der Kolk, 2015).

Theoretical Framework

Polyvagal Theory (PVT)

The peripheral nervous system is divided into two: a) somatic nervous system, popularly known as the voluntary nervous system, allows muscles and spinal cord and brain to interact. This pathway controls mainly voluntary muscle movements such as walking, blinking but also some involuntary muscle responses (reflexes). Simplistically, the somatic nervous system collects and processes information through sensory neurons from touch, muscle, and controls movement through somatic neurons. b) Autonomic Nervous system (ANS), controls glands, internal organs and is popularly known as the involuntary nervous system as it regulates functions necessary for survival- heart rate, blood pressure, digestion, reproductive and immune system. At the same time, the ANS is also scanning for danger and threats in the environment and responding through the sympathetic nervous system and the parasympathetic nervous system (Quillman, 2013; Hanazawa, 2022).

The sympathetic nervous system prepares the body for stressful or emergency situations—by activating the adrenal glands for fight or flight by increasing heart rate and dilating the airways to make breathing easier. It causes the body to release stored energy and increase muscular strength. It causes palms to sweat, pupils to dilate, and hair to stand on end. Simultaneously, it slows less important body processes such as digestion and urination when facing threats (Quillman, 2013; Hanazawa, 2022).

The parasympathetic nervous system does the opposite. It is a rest and digest system. In daily regular and non-threatening situations, it slows the heart rate, decreases blood pressure, and regulates digestion. It stimulates the digestive tract to process food and generates energy for repair and building of tissues (Quillman, 2013; Hanazawa, 2022).

A simple way to think about the two systems is that the sympathetic nervous system acts like an accelerator in face of danger cues and the parasympathetic nervous acts as the brake when individual is safe and trusts others. That is the two systems balance one another.

Porges formulated polyvagal theory (PVT) in 1993, proposes that there are a hierarchy of responses built into the ANS through the Vagus nerve. According to Porges (2001) the Vagus nerve is part of the parasympathetic nervous system. It is a long nerve that begins at the lower part of the brain and goes all the way to the intestine. The vagus nerve is multi-functional and is involved in sensory functions of the throat, heart, abdomen and carries these signals to the brain; motor control of the neck, swallowing and speech; and parasympathetic such as digestion and heart rate regulation (Porges, 2001). According to PVT, the vagus structure has two distinct branches or functions through two independent pathways- ventral vagal pathway (myelinated)- newly developed in mammals and dorsal vagal pathway (unmyelinated)- phylogenetically primitive. Each supports different adaptive behavioural strategies (Porges, 2003). The ventral vagal complex regulates the social engagement system by inhibiting sympathetic influences and promoting calm and safety, and connectedness. The dorsal side of the vagus nerve responds to cues of danger. When there is extreme danger, an individual experiences immobilization- such as shutting down and freezing, inherited from our reptilian ancestors (Porges, 2009).

Porges (2003) suggests that between these two extreme behavioural strategies in evolutionary hierarchy, is mobilization (fight or flight) through the sympathetic nervous system in

face of danger. All the three responses- immobilization; mobilization; and social engagement are organized in evolutionary hierarchy of three biological pathways with an individual moving between ventral vagal, sympathetic nervous system, and dorsal vagal states in response to experiences and environmental cues (Porges, 2023).

Porges (2009) put forth that individuals did not exist in one state. Instead, the individual went through a hierarchy of states where one moved from one to the next (Porges, 2009). According to the theory, the vagus nerve plays a crucial role in regulating physiological responses to environmental cues, particularly in situations of threat or stress (Porges, 2003).

1. **Evolutionary Perspective:** Porges (2003) proposes that the vagus nerve in mammals is "polyvagal" because it contains two distinct efferent pathways originating from different brainstem areas - the dorsal motor nucleus of the vagus and the nucleus ambiguus. This dual pathway system evolved from ancestral vertebrates and culminated in the ventral vagal complex, which is essential for coordinating vagal regulation of the heart with behaviors such as swallowing, breathing, and vocalizing. This complex forms the basis of a social engagement system that promotes calm states and homeostatic function.
2. **Functional Perspective:** PVT suggests that the autonomic nervous system is not just reactive but also adaptive, responding to environmental cues to optimize survival. In situations of threat or stress, the nervous system evaluates the level of safety and triggers appropriate physiological responses without conscious awareness, a process known as neuroception. This reflexive mechanism allows mammals to react instantaneously to danger and cues of safety, promoting social ability and well-being (Porges, 2003).
3. **Clinical Implications:** Porges (2003) provides insights into how disruptions in autonomic regulation can lead to maladaptive responses to stressors, contributing to conditions such as

anxiety, depression, and trauma. By recognizing the interplay between the ANS and social behavior, interventions can be designed to promote feelings of safety, trust, and social connection, thereby supporting optimal health and well-being.

PVT has profound implications for contemporary strategies for health and well-being. By emphasizing the role of the autonomic nervous system in regulating feelings of safety and social engagement, it offers a unique perspective that can inform various aspects of health interventions (van der Kolk, 2015: Porges, 2009). Here are some key implications:

1. **Focus on Safety and Regulation:** PVT underscores the importance of creating environments that promote feelings of safety and regulation. Interventions that prioritize safety can help individuals regulate their autonomic nervous system responses, leading to improved emotional well-being and stress management (Porges, 2009).

2. **Neurophysiological Understanding:** By recognizing the neurophysiological basis of feelings of safety, interventions can be designed to target specific neural circuits that support positive emotional states and social connections. This understanding allows for more targeted and effective interventions aimed at enhancing well-being (Porges, 2009).

3. **Social Engagement and Connection:** PVT highlights the role of the social engagement system in promoting feelings of safety and connection. Health strategies that foster positive social interactions and relationships can support individuals in feeling safe, connected, and emotionally regulated (Porges, 2009).

4. **Impact on Mental Health:** By considering the autonomic state as an intervening variable, PVT helps us assess how any threat affects mental health and well-being. For example, it highlights how

public health strategies like social distancing and self-quarantining can exacerbate the negative impact of the crisis on our nervous system (Porges, 2023).

5. **Trauma and Autonomic Regulation**: The theory also alerts us to the influence of past trauma on autonomic regulation and responses to a crisis such as the pandemic. Individuals with a history of trauma may be more vulnerable to dysregulation and heightened threat responses of arousal, hypervigilance, and difficulty in regulating emotions and responses (Porges, 2023).

6. **Resilience Building:** Understanding how feelings of safety contribute to resilience can guide interventions aimed at building adaptive coping mechanisms and recovery from stressors. By promoting a sense of safety and social support, individuals can develop greater resilience to navigate challenges and setbacks (Porges, 2023).

7. **Individualized Interventions:** The hierarchical model of self-regulation proposed by PVT can inform personalized interventions tailored to individuals' neurophysiological and emotional needs. By considering individual differences in autonomic responses, interventions can be customized to support optimal health and well-being outcomes (Porges, 2023).

Individuals process their environment and pick up danger cues through perception- conscious information processing and neuroception- autonomic processing of sensory information. PVT explains why an individual may respond the way they do by breaking down the stages of response. Further, with neuroception, an individual may themselves be unaware of what they are picking up. Combined, the theory is powerful in explaining the response stage at which an individual is getting struck.

Somatic Marker Hypothesis

The Somatic Marker Hypothesis provides a framework for understanding how emotions and bodily sensations influence decision-making and behavior. SMH, developed by Damasio in early 1990s, proposes that emotional processes guide or bias decision-making behaviour. It proposes that somatic markers, feelings in the body, are associated with emotions- like rapid heartbeat is associated with anxiety and are vital to help individuals make decisions, especially in complex and uncertain situations (Kearney, 2022). Within the brain, somatic markers are processed in the ventromedial prefrontal cortex (vmPFC) and the amygdala (Kearney, 2022; Engel-Yeger, 2013). It is particularly relevant in understanding individuals with PTSD who exhibit dysfunctions of somatic sensory processing at the brainstem level, affecting physiological arousal, affect regulation, and higher-order functions (Kearney, 2022). The somatosensory system is comprised of the skin, muscles, and joints which detect touch, pressure, pain, temperature, and proprioceptive input (Engel-Yeger, 2013). Due to its perception of stimuli originating inside and outside of the body, the somatosensory system contributes toward both interoceptive and exteroceptive processing of the physiological body and the external environment (Engel-Yeger, 2013).

When a person relives fragmented negative emotions, these are accompanied by changes in somatic markers such as muscle, gut, and skin and based on these somatic signals, the brain regulates bodily functions. Each type of emotion such as sadness, anger, fear produced a characteristic pattern different from the others (van der Kolk, 2015). However, we acknowledge these strong emotions as somatic markers in the body- “you make me sick (van der Kolk, 2015).” When an individual is bombarded by visceral signs, they learn to not to trust their gut feelings thus losing the power of self-regulating their own body (van der Kolk, 2015).

The following conclusions are pertinent for the capstone:

- The natural state of mammals is to be on guard and only by lowering the guard can they engage socially with others. People with PTSD feel unsafe and exist in a state of paralyzing fear or blind rage.
- Neuroception, an unconscious perception of safety or danger, influences physiological and behavioral responses to traumatic events without involving cognitive processing (Quillman, 2013).
- Dysregulation of the autonomic nervous system, as explained by polyvagal theory, is linked to various health outcomes, including emotion dysregulation and gut and abdominal disorders (Kolacz, 2019).
- The autonomic nervous system can exacerbate or dampen threat reactions to a stressor. Previous trauma can compound this risk (Porges, 2023).
- Polyvagal theory emphasizes the significance of fostering social connections and creating a sense of safety for trauma recovery.
- Polyvagal Theory enhances trauma treatment by promoting safety and connection, improving emotional regulation and communication, and providing insights into autonomic nervous system responses and their role in trauma and attachment.
- The somatic marker hypothesis explains selfhood and agency. Negative emotions are accompanied by visceral sensations. In the case of traumatized individuals, whose mind and body are in a state of arousal, they feel threatened and attempt to shut these down by disassociation.

- Interoception determines agency- that is awareness of sensory body-based feelings. When an individual ignores these gut feelings, they are unable to self-regulate and lose the ability to know what they are feeling and why they are feeling that way.

The theoretical framework, particularly PVT has important implications for therapists who are engaged in supporting the client to get out of their fight-flight-freeze-fawn stages (Kolacz, 2019). These include therapist **provide context** to the client such as what and why they are doing, and how it may impact the client (Kolacz, 2019); therapist **provide choice** around proximity and focus of the session, modality, and pace of therapy (Kolacz, 2019); therapist **connect with the client**, track disconnection, and explicitly make the client aware of these connections (Kolacz, 2019).

Before moving on to the next section- Somatic Experiencing® that is of interest to the author, a few words about why SE is chosen over other body-based approaches. First, SE is the most researched of all body-based therapies (Almeida et al, 2019). Second, SE is used as stand-alone intervention for PTSD thus enabling us to evaluate its effectiveness (Kuhfub et al., 2021).

Somatic Experiencing®

"We live in a world that has a cognitive bias and assumes that our actions are voluntary. We are confronted with questions related to motivation and outcome. We are asked about costs, risks, and benefits." Stephen W. Porges, The Pocket Guide to the Polyvagal Theory: The Transformative Power of Feeling Safe.

Somatic Experiencing® is a body-focused therapy used for treating people suffering from PTSD that integrates body awareness into the psychotherapeutic process, taking a unique approach not used by other PTSD treatment methods (Levine, 1997). Body-oriented psychotherapy

interventions use body techniques to strengthen the means of communication and exploration between the therapist and the client (Andersen, 2011).

What it Entails

The Somatic Experiencing® (SE) practice has roots from other cultures that have mindful based practices. It takes learning and knowledge from Yoga, Tai- Chi, Qigong and other practices when utilizing the bottom- up approach in addressing PTSD (Payne et al., 2015). Trauma not only affects the mental and emotional state of people but is held in the body and can have adverse effects physically (van der Kolk, 2000; van der Kolk, 2015) underpins the development of SE.

SE practice was developed by Peter Levine in 1970s. The description of SE is drawn from Levine (1997, 2008, 2015, 2023). SE directs client's attention to internal sensations both visceral (introspection) and musculoskeletal (proprioception and kinesthesis). The focus of the therapy is on creating awareness of inner physical sensations, which are seen as the carriers of traumatic memory. In the theory behind SE, posttraumatic stress symptoms are considered an expression of stress activation and an incomplete defensive reaction to a traumatic event. From this theoretical perspective, the goal of the therapy is to release the traumatic activation through an increased tolerance of bodily sensations and related emotions, inviting a discharge process to let the activation dissipate (Levine, 2008).

With exposure to abuse and violence, the body fosters the development of a hyperactive alarm system and molds a body that gets stuck in fight/ flight or freeze. Trauma interferes with the brain circuit that plays a role in focusing, emotional flexibility, and being able to stay in emotional control. The constant state of being in fight/ flight causes secretion of stress hormones, which wreaks havoc with the immune system and functioning of body's organs (Levine, 1997). SE is used

to discharge tension stored in the body following a traumatic event. The therapist directs the client to revisit the memory in small doses, while focusing on body sensations and guiding the client to shift back and forth between the traumatic memory and an image of comfort and safety. As fears dissipate throughout the client's body, gentle touch or movement is used to help ground the person in the present moment (Levine, 1997).

By making it safe for trauma victims to inhabit their bodies, to tolerate their feeling, and knowing what they know can help lead to lasting healthy relationships. Therefore, to overcome trauma, one must befriend and be in touch with themselves (van der Kolk, 2015). This is where somatic based therapy including SE can provide a lot of utility in allowing the person to become comfortable in one's body and becoming more aware and comfortable with feelings and sensation going on in one's body. Through this process, the parasympathetic nervous system can be reactivated and increases their inner bodily sense of control safety and flexibility. Thus, the practice of SE is considered effective in trauma recovery especially because unless the physical dimension is directly addressed, healing cannot be effective (Dayton, 2012).

SE differs from cognitive based and exposure therapy methods used for treating PTSD in that it does not require extensive nor full retelling of traumatic events (Brom et al., 2017). Therefore, it does require the client to engage with traumatic memories that cause high arousal. The client learns to monitor the arousal and downregulate it in an early phase by using body awareness and applying self-regulatory mechanisms like engagement in pleasant sensations, positive memories, or other experiences that help regulate arousal (Levine, 2008; Payne et al., 2015; Levine, 2015).

SE Technique

In the first few sessions, somatic therapists start by building client- therapist rapport, and introducing somatic concepts including healing through the body, the trauma and healing vortices, experiencing the "felt sense," titration (how to keep arousal at a low level during the processing of traumatic triggers), pendulation (balancing between regulated parts in the body and dysregulated parts), and discharge (how to make arousal dissipate). Then, the client is taught in helping lower arousal of the body. Once an ability to stabilize oneself is created, the client starts working through their traumatic story to trigger low level autonomic nervous system activation, track bodily reactions and guide its discharge. Throughout the sessions the client and therapist track sensations, images, behavior, affect, and meaning. They get in tune with their mind and body. In the latter part of the sessions, the therapist is focused on how to maintain therapy successes, manage stress levels, and look at future directions in life in the aftermath of trauma (Levine, 2008; Levine, 2020).

Because SE therapy approaches memories indirectly and gradually and facilitates generation of new corrective interoceptive experiences that physically contradict those of overwhelm and helplessness, it can assist in client retention and responsiveness to therapy (Payne et al., 2015). The Simon’s case study shows a client that has not had success in conventional talk therapy, finds success in SE therapy (Payne et al., 2015; Levine, & Crane-Godreau, 2015). In the case study, the client finds it a lot easier to navigate the traumatic memories and can do so from a stronger standpoint than from CBT (Payne et al., 2015).

To conclude, SE is a body-centred approach that addresses PTSD through a body-based lens with a gentle approach compared to the top- down therapies. Though, there are case studies

and two RCTs that demonstrate that SE has efficacy in treating trauma and client retention, it is still a much under researched modality.

Chapter 3: Systematic Review of Somatic Experiencing® (SE)

In health care, evidence-based decision making by clinicians, patients, and policymakers is the norm (Hardi & Fowler, 2014; Schlosser, 2006). The past methods of evidence based on experience of clinicians, findings of academicians, and habitual practices have increasingly been replaced by systematic reviews (Hardi & Fowler, 2014; Schlosser, 2006). Systematic reviews are designed to synthesize information from the most recent research evidence and follow a transparent approach of collecting, analysing, and presenting findings (Moosapour et al., 2021). There are three aspects that render systematic reviews as effective methods as effective tool for evaluating the effectiveness, validity, efficacy of an intervention/ treatment (Hardi & Fowler, 2014).

Schlosser (2006) summarizes the role of systematic reviews in Evidence based practice as follows. First, clinicians must use the best evidence that is out there in deciding the best patient care treatments. Second, policy makers use the evidence on the treatment for educating the relevant stakeholders; funding additional research; funding the treatment; and providing support for treatment target groups. Third, researchers can build on the current evidence- a far more cost-effective and time saving approach and instead focus on new questions for research. Fourth, all decision-makers can use the evidence from systematic reviews, as they are structured, rigorous, transparent processes that involve exhaustive research, allowing for substantial evidence on the effectiveness of an intervention.

The plan of the section is as follows. The first section is devoted to the aims of the systematic review followed by the steps in systematic review including identifying relevant research studies, assessing the quality of the studies, summarizing, and analyzing the evidence, and

interpreting the findings. Finally, the section is concluded by describing the limitations of the systematic review.

Aim and Hypotheses

H1: Somatic Experiencing® intervention for individuals with PTSD will be significantly more effective in decreasing the post-traumatic stress levels of experimental group than that of the control (placebo) group.

H2: Somatic Experiencing® intervention for individuals with PTSD will be significantly more effective in decreasing the comorbidities associated with post-traumatic stress levels of experimental group than that of the control (placebo) group.

H3: Individuals with PTSD who have successfully completed Somatic Experiencing® therapy would have improved resilience than those of the control (placebo) group who have not received Somatic Experiencing® therapy.

Materials and Methods

Search Strategy

Step 1: Framing the research questions for the systematic review

The researcher must formulate clearly and unambiguously the research question/ issue of interest before beginning the systematic review (Khan et al., 2003). The purpose of the capstone is to evaluate the effectiveness and evidence available on the effectiveness of Somatic Experiencing® a body-based treatment for PTSD, among diverse populations.

Is Somatic Experiencing® (SE) effective in treating PTSD symptoms in diverse populations?

The study design is formulated using the PICO format. It is a useful tool in comparative studies where an intervention is compared with a control group, placebo, or approach (Eldawlatly et al., 2018). A study that uses the PICO approach is considered robust and dependable, helping the researcher find high quality evidence (Sackett et al., 1996). Cohort studies, cross sectional and longitudinal studies, case control and randomized controlled studies (RCTs) follow the PICO approach (Sackett et al., 1996). I used the PICO framework to frame my research question.

P	Population of Interest	Populations with PTSD
I	Intervention	Somatic experience therapy applied in treating PTSD
C	Control/ Comparator	Participants who are on waitlist or received treatment as usual (TAU)
O	Outcome	Remission of PTSD symptoms and management of PTSD symptoms in the short term and recovery from PTSD in the long term, and general well-being.

For systematic reviews to be informative, the studies included in the review must be relevant, of high quality, and add to already existing systematic reviews (Khan et al., 2003; Schlosser, 2006). The search strategy included relevant studies in the following databases: PubMed, EMBASE- PsycINFO, APA PsycARTICLES, Psychiatry online, MEDLINE, Science Direct, and Google Scholar. The studies were identified using the general search terms: (Somatic Experiencing® OR SE) AND (Trauma OR Body Trauma Therapy). The search was further narrowed down to evidence-based studies using the search string: (Somatic Experiencing® OR SE) AND (Trials OR Pilot OR Control OR Longitudinal OR Field OR Qualitative).

Additionally, I used the citation lists of systematic reviews and study trials of SE and sensorimotor therapy to cross check my search results and identify any that were missing.

Given RCTs, experimental design studies, case control studies, field, and longitudinal studies have extremely high citations as they are the gold standard for evidence on the intervention (Schlosser, 2006), I can say with confidence that I have captured the existing studies that evaluate the effectiveness of the SE intervention for treatment of trauma in the search.

Selection Criteria and Screening

Step 2: Identifying relevant publications

I restricted the search duration to studies published Jan 1, 2007-March 15, 2024- a seventeen-year period for Somatic Experiencing®. Typically, systematic reviews date back to 10 years to include the most recent studies (Shaheen et al., 2023). Given the paucity of studies on SE, I extended the study period back to 2007. The search was kept tight in terms of search terms. This was to restrict the results relevant to the research question.

For my search on Somatic Experiencing® between Jan 1, 2007- August 2020, I relied on the first and exhaustive scoping literature review on effectiveness of SE by Kuhfuß et al. (2021). The authors identified sixteen studies that provided evidence on the effectiveness of SE in treating PTSD symptoms. These studies contain quantitative and qualitative evidence on the effectiveness of SE in treating trauma and include samples of N>1. Using my search strategy, I had thirty results including the sixteen studies reviewed by Kuhfuß et al. (2021) to assess the effectiveness of SE.

Data from the search was saved in a word document- including the author's name and publication title. By sorting on the author's name duplicate records were identified and eliminated. (See Appendix A for Search Results).

Step 3: First Screening of Search Results

Titles/ abstracts of the thirty studies were reviewed and assessed for relevance against the inclusion criteria already set before the search.

A. Inclusion criteria:

- Published articles in English in peer reviewed journals and grey literature are included.
- Articles published in the last seventeen years- Jan 1, 2007- March 15, 2024.
- Studies with RCTs, case control studies, and quasi-experimental designs are included as they are the highest quality evidence available on the effectiveness of SE in treating PTSD.
- Qualitative evidence included in the above studies is reviewed.
- Studies that have the principles of SE as the primary treatment method are included (example, SE with TRM).
- Studies with a sample of N>=10 are included.

B. Exclusion criteria:

The following were excluded from the review:

- The theoretical therapeutic approach of the intervention- SE studies that explained theoretical application of SE are excluded.
- Studies that focused on SE as intervention to treat conditions other than PTSD are excluded.

- Articles that combine SE with dance or art therapy to formulate a novel approach are excluded as it is difficult to isolate the effectiveness of the interventions on PTSD.
- Authored books by Levine and Ogden, and information on 'Somatic Experiencing® International: Transforming Lives Through Healing Trauma' (https://traumahealing.org/) and 'Sensorimotor Psychotherapy Institute' (https://sensorimotorpsychotherapy.org/) are excluded from the review.
- Articles with uncontrolled study design, qualitative/ narrative evidence of practitioners and clients, isolated case studies are excluded.
- Studies with qualitative research design are excluded.

Among the thirty studies, I screened out studies that were qualitative. Qualitative studies including in-depth interviews, focus groups, and observation are intense and time-consuming, therefore making them costly to conduct on a large scale (Mays & Pope, 1995). Though useful in describing a situation or behaviour, which is useful for formulating a hypothesis, they cannot establish a cause-and-effect relationship (Verhoef & Casebeer, 1997). While extremely useful in understanding perspectives at individual level, qualitative studies require intense vetting of the study design and its valence (Mays & Pope, 1995). All is not lost. When a qualitative measure is included in quantitative studies, it may ensure the validity and reliability of the findings from the qualitative data (Dzurec, 1993; Mays & Pope, 1995) and these findings are reviewed in the discussion section. Fifteen studies using a quantitative approach in the study design were included for the next round of screening.

Step 4: Second Screening of Search Results

In terms of evidence, quantitative studies have better scientific rigour, and are well- suited to establish cause and effect relationships and test hypothesis on the effectiveness of an intervention in health care (Verhoef & Casebeer, 1997; Steckler, 1992). Quantitative studies are assigned levels of evidence based on the research design, quality of the study, and applicability to patient care. The higher the level of evidence, the less the risk bias and more the increase in the validity of the study (Cook, 1997). According to hierarchy of evidence (Burns, 2011; Higgins, 2023) of quantitative research, experimental studies- RCTs occupies the highest level at level I, followed by Quasi-experimental design studies at level II, and observational studies such as well- designed cohort or case-control studies at level III. The hierarchy of evidence does not include uncontrolled studies, or it includes them at the bottom with the category of opinions (Burns, 2011; Higgins, 2023). Though cost-effective, the missing control group in uncontrolled field/ longitudinal studies, these studies overestimate the effectiveness of an intervention and underestimate the risk factors (Sackett, 1996). Using the above criteria, eight quantitative studies were selected for the systematic review. (See Appendix B for Included Studies).

PRISMA

PRISMA stands for Preferred Reporting Items for Systematic reviews and Meta-Analyses. A good systematic review must report PRISMA- a set of items (Clarke, 2011). It is the minimum evidence required that should be reported on systematic reviews focusing on evaluating the effects of interventions (Moher et al., 2009). These are reported in *Figure 1. PRISMA flow diagram*.

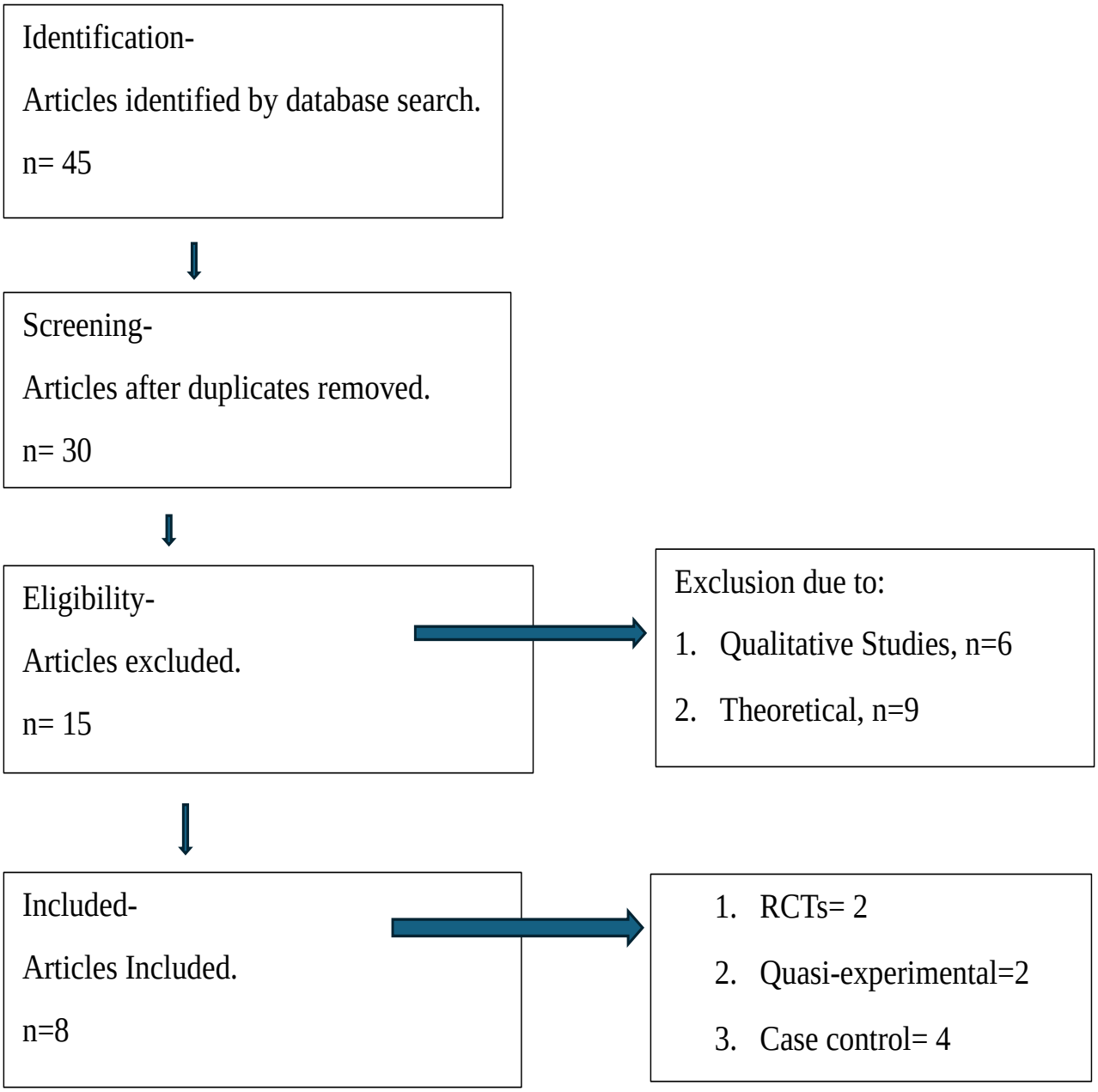

Figure 1. PRISMA flow diagram.

Data Collection and Analysis

Given only studies with the top three levels of evidence are included, there is no attempt to quantitatively assess the quality of evidence as the risk of bias (rob) is correlated with the levels of evidence (Cook, 1997; Schlosser, 2006). Therefore, RCTs and quasi-experimental would have the lowest rob level and case-control studies, a moderate rob. However, when we examine the domains of risk- selection, performance, detection bias, attrition bias, and reporting bias we find that case control studies suffer from significant risk of bias (Tenny et al., 2024). But this is inherent in the case control study as the experimental group may conclude there are positive associations between treatment and outcome, when none exist due to recall bias (Tenny et al., 2024). Kuhfuß et al. (2021) address this issue to find that both the RCTs (Brom et al; 2017; Andersen et al., 2017) have low rob on all the domains of risk. For the case- control studies (Changaris, 2010; Leitch et al., 2009; Gomes, 2014), the authors find unclear rob or serious reporting bias in the post-intervention domain. The same problem applies to the study on Breast cancer survivors by Vagnini et al. (2023) as it is a case-control study. One of the Quasi-experimental studies (Özel, 2023) clearly states that the participants were randomly selected and allocated to the two groups randomly, while the other Quasi-experimental study (Arici Özcan, 2021) used a convenience sampling method to recruit participants causing moderate selection bias. However, there were no dropouts in both the Quasi-experimental studies. (See Appendix C for Quality assessment of included studies).

Results

Study characteristics

Of the thirty studies, 50% of them were quantitative. Of these 53% were either experimental or observational studies. Of these, two are RCTs, two are quasi-experimental design,

and the remaining four are case-control studies. All the studies use SE as the primary stand alone intervention in treating populations with PTSD. The sample size across all the seven studies is 440 but there is considerable variation across study samples. For example, the sample size varies from a low of ten individuals (Gomes, 2014) to a high of 142 individuals (Leitch et al., 2009). All the participants in the study are adults, with five studies having adult male and female participants and three studies with adult female participants. The target population group in each of the study is different, comprising of victims of natural disasters such as hurricanes, homeless people, survivors of breast cancer, women traumatized by domestic violence, persons with PTSD from diverse trauma, persons with low back pain experiencing PTSD, and persons experiencing PTSD from the COVID-19 pandemic. The location of the studies varies with 42% (three studies) of the studies conducted in the USA; two in Turkey; and one study each set in Israel, Denmark, and Italy. Though the intervention was SE in all the studies, the format, frequency, and delivery varied across studies. In two of the studies (Vagnini et al., 2023 and Özel, 2023), the intervention was delivered online as group therapy to the participants. (See Appendix D for Characteristics of the Included Studies).

In terms of outcome measurements, most studies measured not only PTSD levels pre and post treatment, but also measured comorbidities such as pain, depression, anxiety, psychological distress, and well-being, except the study on female refugees with PTSD (Aricia Özcan, 2021). Four studies also measured other effects such as mindfulness and social support (Aricia Özcan, 2021); hope, insight, interpersonal behaviour (Özel, 2023); resilience and coping (Leitch et al., 2009); and coping skills and body image (Vagnini, 2021). (See Appendix E for Measurement Instruments in the Included Studies and Appendix F for Measurement Intervals). The results are grouped under three sections in alignment with the three hypotheses that I am testing. Under each

section, I will present the key findings followed by a discussion of the results. For a quick summary, see Appendix G for a quick summary of Hypothesis Testing Results).

Results for the effectiveness of SE in treating PTSD

The first hypothesis predicted that Somatic Experiencing® intervention for individuals with PTSD will be significantly more effective in decreasing the post-traumatic stress levels of experimental group than that of the control (placebo) group.

In all the eight studies, the effects of SE on PTSD symptoms were investigated. If the study provided the pre-post effect sizes for each data collection instrument, calculated as Cohen's d measure, a standardized metric, was used as an indicator of whether an intervention has an effect greater than zero on the experimental group and if so, how big it is. A general rule, suggested by Cohen, is effect sizes are considered small (d = 0.2), medium (d = 0.5), and large (d = 0.8).

All the eight studies reported significant positive effects of Somatic Experiencing® on PTSD symptoms in the experimental group compared to the control group that did not receive Somatic Experiencing® therapy. The positive effect of the intervention in the treatment group was found in follow- up measurements points up to one year.

Treatment of PTSD Symptoms

In SE, the awareness to monitor the arousal and downregulate it in an early phase by using body awareness, and applying self-regulatory mechanisms that help regulate arousal. The therapeutic goal is to decrease the distress and symptoms caused by the posttraumatic arousal and restore healthy functioning in daily life (Levine, 2010; Payne, Levine & Crane-Godreau, 2015).

The findings on the effectiveness of SE in treating PTSD symptoms show that all the eight studies included in the systematic review show a significant reduction in the PTSD symptoms among the diverse population groups diagnosed with PTSD. All the studies used a control group and showed the effectiveness of SE in experimental- control group comparisons. Though the studies use different measurement scales to measure PTSD levels of the participants, the reduction in PTSD levels among the experimental group due to the intervention is reduced compared to the control group that were either on the waitlist or received treatment as usual. These symptom reductions also measured at pre-intervention and post-intervention for experimental and control groups continued to persist over time during the follow up period for five weeks (Changaris, 2010) to one year (Andersen et al., 2017). Only one study did not have a follow up period for women traumatized by domestic violence, reducing the reliability of the finding (Gomes, 2014). The beneficial effects of SE captured by the pre intervention and post intervention effect size are highest in three studies (Brom et al., 2017; Andersen et al., 2017; Vagnini et al., 2023) and a moderate effect in one study (Leitch et al., 2009). The remaining studies (Changaris, 2010; Gomes, 2014, Arici Özcan, 2021; Özel, 2023) did not report Cohen's d used to measure the effect size. The RCTs report on loss of PTSD diagnosis in the treatment group- 44% lost PTSD diagnosis (Brom et al., 2017) and 38% lost the PTSD diagnosis (Andersen et al., 2017).

These results parallel the results of Kuhfuß et al. (2021) which included uncontrolled and qualitative studies. Because of the inclusion of the latter, Kuhfuß et al. (2021) underestimated the effect sizes of the SE intervention on PTSD symptoms. The authors suggest that SE is a promising therapy for PTSD, as it was originally intended. However, by only including experimental and observational studies, we can conclude that empirically there is a positive and significant

relationship between SE treatment and reduction in PTSD symptoms and this effect is stable for five weeks (Changaris, 2010) - 12 months (Andersen et al., 2017).

Trauma Types and Populations

The more interesting finding of the current systematic review is the adaptability of SE treatment to different types of traumas and to diverse population groups in different settings. All the population groups included in the study face complex trauma from experiencing horrific situations- natural disasters, pandemic, homelessness, domestic violence, cancer, accidents, and terrorist attacks. The studies also covered populations across the globe- Denmark, USA, Italy, Turkey, and Israel. Irrespective of the demographic characteristics such as gender, age, education, and socio-economic conditions, SE was effective in treating the complex trauma sequelae among diverse populations. The effectiveness extends further to other groups. One uncontrolled study (Briggs et al., 2018), not included in the current systematic review finds that SE is effective in reducing PTSD and increasing resilience and coping skills in transgender population located in the USA who faced serious discrimination. Two exploratory studies (Parker et al., 2008; Leitch, 2007) in their studies of people who experienced natural disasters (tsunami) found that 90% of the participants reported significant improvement in PTSD symptoms. However, both these studies were only explanatory in nature so results must be interpreted with caution.

After COVID-19 pandemic, there is increasing interest in delivering online mental health services and developing group-based programs to reach out to remote and larger populations in the community in a cost-effective manner. Studies have shown that SE in group programs is effective in decreasing PTSD (Briggs et al., 2017). In the current systematic review SE is provided as a web based synchronous session to two groups of breast cancer survivors for eight weeks (Vagnini et al.,

2023) and SE is provided via zoom to two groups of adults traumatized by the pandemic for eight weeks (Özel, 2023).

Dropouts

Both the RCTs report some dropouts during follow up. Brom et al. (2017) reports that there were no significant dropouts- 10 participants dropped out for personal reasons that had nothing to do with SE. Andersen et al. (2017) reports that there were random dropouts during the follow-up of 12 months. The model did correct for the dropouts in the results on SE effectiveness. All the remaining six studies did not report any dropouts.

Trauma severity

In each study, SE was administered to populations with complex PTSD or chronic PTSD. Refugees, homeless people, breast cancer survivors, people who experienced terrorism and assault, those who faced natural disasters., and those who experienced pandemic were the type of populations located in different countries were the target population.

Results for the effectiveness of SE in treating Comorbidities

The second hypothesis predicted that Somatic Experiencing® intervention for individuals with PTSD will be significantly more effective in decreasing the comorbidities associated with post-traumatic stress levels of experimental group than that of the control (placebo) group.

Of the eight studies, seven studies measure comorbidities associated with PTSD- three studies measure anxiety and depression (Brom et al., 2017; Changaris, 2010; Vagnini, 2023). Two studies report on subjective distress and psychological distress (Özel, 2023; Leitch et al., 2019) and one study on well being, defined as reduced depression symptoms using a self rating scale (Gomes,

2014). Özcan (2021) does not include comorbidities as a variable in their study. All studies find that following SE intervention, the experimental group reported reduction in depression, anxiety, psychological distress, and pain compared to their baseline metrics and compared to the control group. Leitch et al. (2009) in their study of SE as a short-term intervention for natural disaster (Social workers experiencing hurricanes) found it effective in decreasing subjective psychological distress between pre and post treatment measurements using a self developed scale but there was no change in the physical symptoms between experimental group and the control group.

Based on the results, we can say that SE has a moderate and positive effect on reducing comorbidities associated with PTSD among diverse populations.

Treatment of Comorbidities

One of the objectives in using SE to treat trauma is to address cognitive, affective, and somatic symptoms of trauma (Levine, 2015; Payne et al., 2015). Seven studies report moderate positive effects of SE on depression (Brom et al., 2017); pain intensity, disability from pain, pain-related catastrophizing (Andersen et al., 2017); psychological distress (Özel, 2023 & Leitch et al., 2009); well-being (Gomes, 2014); and anxiety and depression (Changaris, 2010 & Vagnini, 2023). The consensus finding was that SE was effective in reducing comorbidities be they affective or somatic. In two studies the effects though positive were not significant as both the experimental group with the intervention and the control group on TAU saw similar reductions in pain (Andersen et al., 2017) and anxiety (Changaris, 2010). In the study by Leitch et al. (2009), that studied the effectiveness of SE among 142 social workers who were survivors of hurricanes in New Orleans, two or three months after they experienced the disaster, they found the pre and post treatment measures of physical distress were the same for both experimental and control groups.

However, during the follow-up period of 16 weeks, the distress was lower among the experimental group compared to the control group.

These findings parallel the findings on SE reducing the anxiety and depressive symptoms in an uncontrolled study of transgender population in the USA (Briggs et al., 2018) and an increase in the quality of life of students in a three-year SE program (Winblad et al., 2018). These findings suggest that SE has a role beyond treatment of PTSD and could be effective in treating affective and somatic symptoms that accompany trauma.

Results for the effectiveness of SE in improving resilience

Individuals with PTSD who have successfully completed Somatic Experiencing® therapy would have improved resilience than those of the control (placebo) group who have not received Somatic Experiencing® therapy. Both quasi-experimental studies addressed the influence of SE on mindfulness and social support among refugee women living in a shelter in Turkey (Özcan, 2021), hope, insight among the experimental group facing covid-19 pandemic in Turkey. Tow case-control studies measured resilience and adaptive coping skills/ strategies following SE treatment among survivors of natural disaster (Leitch et al., 2009) and among survivors of breast cancer (Vagnini et al., 2023). All the studies found significant improvements in resilience and reduction in coping skills such as avoidance, reduction in helplessness among the experimental group following SE. Vagnini et al. (2023) included a body image scale (BIS) metric, a novel construct, in assessing the effectiveness of SE on breast cancer survivors. The study found a positive relationship between SE and improved body image. The results confirm the third hypothesis.

Resilience and Social support

For a complete lived experience sensation, images, behavior, affect, and meaning (SIBAM) flow and connect with one another (Levine, 2015). However, this is not so for a traumatized person whose world view is a fragmentation of the coherence of experience (van der Kolk, 2015). SE is directed at regulating the autonomic nervous system by prioritizing bottom-up processing of emotions of hyperarousal and mediating pure survival responses (Payne et al., 2015). This is done with SE providing a safe and supportive space for individuals to connect with the trauma stored in the body, discover, and increase resilience and improve/ develop adaptive coping skills to resolve their trauma (Levine, 1997). Resilience is measured by competencies such as higher forward focus, less preoccupation with disease, flexibility, hopefulness, and flexibility (Vagnini et al., 2023).

Four studies explicitly focused on SE method to improve mindfulness and social support among female refugees (Aricia Özcan, 2021); increase hope, insight, and developing new resilient behaviors in adults experiencing the pandemic (Özel, 2023); improve resilience and coping skills among social workers who experienced hurricanes (Leitch et al., 2009), and developing resilience, coping skills, and improved body image among breast cancer survivors. All the four studies reported that SE was effective in increasing resilience and developing coping skills. Vangaris et al. (2019) found that SE was very effective in improving the body image (and all the twenty-one participants who received SE therapy reported that they were satisfied with their body and felt safe within their bodies, despite the threat of cancer. Qualitative findings reiterated the empirical findings with majority of the participants “feeling a significant connection with the body and emotional experiences” (Vangaris et al., 2019). In contrast, controls on the wait list did poorly

becoming hopeless, helpless, anxious, and exhibiting avoidance behaviors, causing the researchers to become concerned (Vangaris et al., 2019).

Similarly, a six-week SE Stabilization Program offered to refugee women a shelter was effective in increasing mindfulness and social support levels. The program was culturally adapted for the refugees, but the protocol was like that of a SE program and was administered by an SE practitioner. at a shelter (Arici Özcan, 2021). Özel (2023) used semi-structured interviews to collect qualitative data on the intervention and outcomes, using the codes of hope, universality, insight, and interpersonal output (new behaviour). Coping skills were measured with the COPE-Revised scale. The study found that SE positively and significantly impact feelings of hope, insight, and interpersonal output among participants experiencing the pandemic. Participants stated that they began believing in the possibility of change for the better. Coping skills in the experimental group increased as well. All the three studies found that participants benefited from being a part of the group. SE applied to Groups was very helpful in sharing experiences, reflecting on the experiences, and feeling secure in sharing their trauma with the group. Participants felt less lonely and felt more confident about themselves. Participants reported that being part of a group contributed significantly to learning coping skills and increasing their window of tolerance to stressful situations (Özel, 2023). This finding was common to other studies that delivered SE in a group setting (Vagnini et al., 2023). Interestingly, though the female refugees received one on one treatment, they also reported that living in the same shelter helped them feel supported, secure, and improved their resilience and coping skills (Aricia Özcan, 2021). Leitch et al. (2019) reported a similar finding for social workers who had experienced hurricanes and were providing crisis management to survivors of the disaster. Following the same application in an uncontrolled field

study of 150 tsunami victims in India observed an improvement in well-being, reduced avoidance strategy, and improvement in coping skills (Parker et al., 2008).

Limitations and Future Directions

The systematic review conclusions about the effectiveness of SE in treatment of PTSD, comorbidities, and improving resilience must be interpreted with caution.

As with all research methods, systematic reviews suffer from inherent limitations, by their very nature and the flaws can become compounded if a systemic review does not follow the rigorous and transparent process (Opheim, 2019; Uttley et al., 2023). Uttley (2023) list four domains in a systematic review and the associated problems with each domain. These are comprehensive as in inclusive of all studies; rigorous in describing the intervention; transparent in enabling reproducibility of the systematic review; and objective in handling the review process.

While all attempts were made to ensure the transparency and objectivity by carrying out the systematic review process as laid out in literature (Siddaway & Hedges, 2019; Caldwell, 2020), there were some compromises made in the comprehensiveness and rigorous section. Due to the resource intensive nature of the search process for relevant publications, the author employed a tight search string, leading to loss of some studies, especially in grey literature. If an article was not identified by the title and abstract, it may not have been detected during the search process. The preliminary search results contained a majority of theoretical and qualitative studies reflecting the paucity of quantitative studies, especially with research designs on the top levels of evidence hierarchy.

Kuhfuß et al. (2021) is the first literature scoping review on Somatic Experiencing® in treating trauma and the first systematic review on effectiveness of SE in treating PTSD and

practitioner and client's perspectives on the method- specific key factors. However, their conclusions on the effectiveness of SE suffer from drawbacks. Of the sixteen studies included in the systematic review of Kuhfuß et al. (2021), only 31% (5 studies) were RCTs, quasi-experimental studies, and case control studies - all on the top levels of evidence hierarchy.

In the current systematic review, only experimental and observational studies with controls were included. Though grey literature (unpublished studies) was included in the search, only dissertations were included assuming they passed through academic vetting. Qualitative studies on the effectiveness of SE were excluded as they required a thorough review of the paper to assess the bias and validity of the individual findings. Therefore, the intervention was not assessed with the rigor that would have come from including all types of research designs. Finally, it was not possible to synthesise the studies statistically and do a meta-analysis of the effect size of SE on outcomes due to varying research designs- RCTs, quasi-experimental studies, and case-control studies. Systematic reviews suffer from publication bias (Gopalakrishnan & Ganeshkumar, 2013), meaning that only studies that show positive effects of SE on PTSD are published. In my search, there were no studies that found SE ineffective either in peer reviewed or in grey literature.

At the study level included in the systematic review, all the studies had a small sample size. The entire sample size of all included studies is 440. None of the studies had a common population group. Each study had different inclusion criteria like refugees with PTSD, homeless population with PTSD, etc. None of the studies had overlapping population group. The disease severity, ie., PTSD diagnosis varied across population groups with refugees, survivors of natural disasters, war survivors, domestic violence survivors, homeless population all having complex PTSD and population facing the pandemic, breast cancer survivors, and individuals with low back pain

having chronic PTSD. An additional problem with the studies was the lack of heterogeneity within the study, reflected in the gender imbalance with some of the studies having only females, indicating a gender imbalance issue in extrapolating the studies to the general population.

There were only 2 RCTs that are typically considered the gold standard for evaluating interventions. Though the quasi-experimental design studies come close to the quality of RCTs, the two studies had a small sample size. All studies had a control group, however the randomization in selection and assignment of participants varied among case control methods. In the four case control studies, there was self selection of participants into the treatment and control groups. All case controls studies reported significant recall bias, i.e., participants unable to recall specifics and omitting details and reporting bias. This is common in case control studies.

The included studies had varying follow up intervals, different SE sessions, different ways of delivering SE all giving rise to confounding bias in the findings. While it is heartening to see that SE can be applied to diverse population in different settings, it also limits the generalizability of the studies to other populations. Given only eight studies were included in the systematic review, the evidence base is weak, so we can conclude that SE is a promising approach in treating PTSD.

Therefore, further research particularly RCTs and quasi- experimental studies with satisfactory sample sizes is necessary. Further, while RCTs can establish the effectiveness of treatment, it is only half the picture. For clinicians, patients, and policy-makers, it is also important to compare SE with other interventions and knowing how cost-effective they are. Finally, this systematic review only includes SE as a stand-alone treatment for PTSD. It is suggested that future research should focus on investigating SE in combination with other therapeutic approaches. Future research is

necessary to understand and isolate the key factors of SE that have the maximum effect on patient well being.

Some of the studies on somatic experiencing despite having a sample of all females do not evaluate the experience of the study group through a feminist perspective of PTSD. It would be educational and enlightening to approach PTSD through feminist, indigenous people's, and transgender person's perspectives.

Conclusion

The aim of this capstone was to evaluate the effectiveness of SE on treating PTSD symptoms, reducing comorbidities, and improving resilience, developing adaptive coping skills, and increasing social support among diverse populations. The application of SE involves a body-based approach that focuses on the innate regulatory capacity of the body to help individuals navigate and heal from traumatic experiences.

This is the first study that evaluates the effectiveness of SE by undertaking a systematic review of experimental and observational research design studies- gold standard for evidence-based decision making. This study included only RCTS, Quasi-experimental design studies, and case control studies that are rigorous in studying effectiveness of treatments/ interventions in health care.

As shown, SE has positive and significant effect in treating PTSD symptoms; SE has positive and moderate effect in treating comorbidities such as pain, anxiety, depression; and SE treatment develops resilience and social support among populations with complex and chronic trauma. The study also concludes that SE is effective and can be adapted in treating PTSD in a variety of heterogenous population groups such as refugees, people who experienced natural

disasters, people who experienced war and terrorism, people who experienced the pandemic, breast cancer survivors, and those suffering from severe low back pain. All these studies were also located in different settings across the world and could be modified to deliver in person, in groups, and online. This is reflected in the low dropouts from the treatment in the systematic review.

Further, the strength of this systematic review was including only those studies that were at the top levels of evidence hierarchy, meaning that the findings of the systematic review have low risk of bias with high validity. The current systematic review is a synthesis of current best evidence about the effectiveness of the treatment, its relevance to the population being treated, and the extrapolative power of the findings to larger populations. To conclude, it is encouraging to find SE as a treatment is effective and requires further research especially RCTs to corroborate further the efficacy of this treatment for PTSD.

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Appendix A: Somatic Therapy- Types and Techniques

Somatic experiencing therapy: Aimed at helping people heal from trauma, somatic experiencing therapy focuses on releasing trauma that remains trapped in the body.

EMDR: Eye movement desensitization and reprocessing (EMDR) therapy uses bilateral stimulation to help people suffering from the effects of trauma in reprocessing distressing memories.

Sensorimotor: Sensorimotor therapy focuses on healing trauma and unhealthy early childhood attachment relationships, exploring painful memories through words, somatic sensations, and movements.

Hakomi method: The Hakomi method combines experiential techniques with somatic awareness to promote psychological growth, integrating principles of Eastern philosophy including Buddhism and Taoism.

Bioenergetic analysis: This approach, based on the mind-body connection, involves a trained therapist helping a client through physical exercises to release patterns of tension stored in the body because of emotional patterns.

Biodynamic psychotherapy: Developed by Gerda Boyesen, biodynamic psychotherapy focuses on the mind-body-spirit connection, integrating a range of interventions to holistically heal the mind and body as one.

Brainspotting: Brainspotting therapy is based on the idea that the effects of trauma can get "stuck" in the body, causing physical and mental distress. Certain eye positions, or "brainspots," can help the relevant areas of the brain process challenges from the inside out.

Breathwork: Breathwork involves a variety of breathing techniques that aim to improve wellbeing. By altering a person's breathing pattern, encouraging slow, deep breaths, or breathing in a conscious manner, the client can achieve reduced stress and healing.

Appendix B: Somatic Therapy- Terms and Definitions

- **Grounding:** A body-focused approach that refers to a person's ability to experience themselves through their physical presence. The purpose of grounding is to express the emotional experience through physical action.
- **Boundary Development:** Boundary development involves fostering client awareness of the current surroundings and encouraging them re-establish boundaries as the environmental and social circumstances change so that they can respond in a way that is resilient and that feels safe.
- **Self-Regulation:** Encouraging the client to increase mindfulness during periods of emotional intensity while developing the ability to respond adaptively.
- **Movement and Process:** Body-focused therapies incorporate the whole body as an agent for recognizing and changing emotional states. Body movement including postures, gestures, and use of space are utilized to understanding the individual experience and ability to heal.
- **Sequencing:** Analyzing sensorimotor tension throughout the body as emotional release. Tension moves throughout the body as a means of processing and helps emotional healing.
- **Touch/Massage:** The intentional and attentional use of touch/massage directly stimulates the autonomic nervous system and can accelerate healing the parts of the self that have been holding onto stress due to adverse experiences.
- **Titration:** The process of experiencing minor exposure to stressors with the goal of increasing resilience and decreasing pain. The therapist will analyze muscle tension, breathing changes and other physical responses to gauge both progress and effectiveness.

Source: Chamberlain, Julia & Troy, Benjamin. (2023). *Somatic Therapy: How It Works and What to Expect.* https://www.choosingtherapy.com/somatic-therapy/

Appendix C: Search Results

No	Article	Study Type	Publication type
1.	Almeida, A. K., Macêdo, S. C. G. D. M., & Sousa, M. B. C. D. (2019). A systematic review of somatic intervention treatments in PTSD: Does Somatic Experiencing®(SE®) have the potential to be a suitable choice?. Estudos de Psicologia (Natal), 24(3), 237-246.	Theoretical/ Qualitative	Journal
2.	Andersen, T. E., Lahav, Y., Ellegaard, H., & Manniche, C. (2017). A randomized controlled trial of brief somatic experiencing for chronic low back pain and comorbid post-traumatic stress disorder symptoms. *European Journal of Psychotraumatology*, *8*(1), 1-9.	Quantitative	Journal
3.	Arici Özcan, N. (2021). The Effectiveness of Somatic Experience Based Stabilization Program for Refugee Women's Post-Traumatic Stress, Mindfulness and Social Support Level. *Psycho-Educational Research Reviews*, 10(1), 46–60. Retrieved from https://perrjournal.com/index.php/perrjournal/article/view/91	Quantitative	Journal
4.	Briggs, P. C., Hayes, S., & Changaris, M. (2018). Somatic experiencing® informed therapeutic group for the care and treatment of biopsychosocial effects upon a gender diverse identity. *Frontiers in Psychiatry*, *9*, 1-18.	Quantitative	Journal
5.	Brom, D., Stokar, Y., Lawi, C., Nuriel-Porat, V., Ziv, Y., Lerner, K., & Ross, G. (2017). Somatic experiencing for posttraumatic stress disorder: a randomized controlled outcome study. *Journal of Traumatic Stress*, *30*(3), 304-312.	Quantitative	Journal
6.	Changaris, M. C. (2010). Assessing the efficacy of somatic experiencing for reducing symptoms of anxiety and depression. Unpublished doctoral dissertation, John F. Kennedy University.	Quantitative	Grey literature
7.	Ellegaard, H., & Pedersen, B. D. (2012). A qualitative study of psychotherapeutic interventions for patients with non-specific low back pain of 3–12 months' duration. *BMC Musculoskeletal Disorders*, *13*(1), 166.	Quantitative	Journal
8.	Gamboa, J. (2020). Resource for a Brief Early Somatic Intervention to Reduce Symptoms of Post-traumatic stress disorder for Victims of Violent Crime in Acute Hospital Settings in Southeast Los Angeles. Unpublished Doctoral dissertation, Pepperdine University.	Theoretical	Grey literature
9.	Gomes Silva, S. (2014). Engaging touch and movement in somatic experiencing trauma resolution approach. Unpublished doctoral dissertation, International University for Graduate Studies.	Quantitative	Grey literature
10.	Hays, J. T. (2014). Healing trauma in the psyche-soma: Somatic experiencing® in psychodynamic psychotherapy. Unpublished doctoral dissertation, Pacifica Graduate Institute.	Qualitative	Grey literature
11.	Heller, D. P., & Heller, L. (2004). Somatic experiencing in the treatment of automobile accident trauma. *US Association for Body Psycho-Therapy Journal*, *3(2)*, 42-52.	Qualitative	Journal
12.	Hughes, V.T. and P.A. Levine. 2016. Treating military sexual trauma with somatic experiencing, in Treating Military Sexual Trauma, L.S. Katz, Editor. Springer Publishing Company: New York. p. 195–216.	Theoretical with case studies	Book chapter
13.	Kaplan, A. H. (2006). Listening to the body: Pragmatic case studies of body-centered psychotherapy. Unpublished doctoral dissertation, Rutgers. The State University of New Jersey	Theoretical with case studies	Grey literature

No	Article	Study Type	Publication type
14.	Kuhfuß, M., Maldei, T., Hetmanek, A., & Baumann, N. (2021). Somatic experiencing - effectiveness and key factors of a body-oriented trauma therapy: a scoping literature review. *European journal of psychotraumatology*, *12*(1), 1929023. https://doi.org/10.1080/20008198.2021.1929023	Scoping literature review & Quantitative	Journal
15.	Langford, Paula. (2021). Somatic experiencing, EMDR, and Brainspotting. 10.4324/9780429276613-6.	Theoretical	Journal
16.	Laval, C. (2008). *Comparing trauma treatments: Similarities and differences between somatic experiencing and eye movement and desensitization and reprocessing*. Doctoral dissertation, City University of Seattle.	Theoretical	Grey literature
17.	Leitch, M. L. (2007). Somatic experiencing treatment with tsunami survivors in Thailand: Broadening the scope of early intervention. *Traumatology*, *13*(3), 11-20.	Quantitative	Journal
18.	Leitch, L., & Miller-Karas, E. (2009). A case for using biologically based mental health intervention in post-earthquake China: evaluation of training in the trauma resiliency model. *Emergency Mental Health*, *11*(4), 221-233.	Quantitative	Journal
19.	Leitch, M. L., Vanslyke, J., & Allen, M. (2009). Somatic experiencing treatment with social service workers following Hurricanes Katrina and Rita. *Social Work*, *54*(1), 9-18.	Quantitative	Journal
20.	Levine, P., & Kline, M. F. T. (2011). Use of somatic experiencing principles as a PTSD prevention tool for children and teens during the acute stress phase following an overwhelming event. In V. Ardino (Ed.), *Post-Traumatic Syndromes in Childhood and Adolescence: A handbook of research and practice* (pp. 279-295). Chichester, UK: Wiley.	Theoretical with case studies	Book
21.	Olssen, M. C. (2013). *Mental health practitioners' views on why Somatic Experiencing works for treating trauma.* Unpublished clinical research paper, St. Catherine University.	Qualitative	Grey literature
22.	Özel, D. (2023). 'We are all in this together': Coping with stress during uncertain times through somatic experiencing. Group Analysis, 0(0). https://doi.org/10.1177/05333164231189471	Quantitative	Journal
23.	Parker, C., Doctor, R. M., & Selvam, R. (2008). Somatic therapy treatment effects tsunami survivors. *Traumatology*, *14*(3), 103-109.	Quantitative	Journal
24.	Patrick, Daniel J., "Somatic Experiencing and Expressive Arts Therapy to Support Autonomic Regulation in Trauma Treatment with Adults: A Literature Review" (2021). Expressive Therapies Capstone Theses. 418. https://digitalcommons.lesley.edu/expressive_theses/418	Literature review	Grey literature
25.	Payne, P., Levine, P. A., & Crane-Godreau, M. A. (2015). Somatic experiencing: using interoception and proprioception as core elements of trauma therapy. Frontiers in Psychology, 6(93), doi: 10.3389/fpsyg.2015.00093	Theoretical	Journal
26.	Ranson, N. M. (2015). Somatic Experiencing and the freeze response in social work practice. *Somatic Psychotherapy Today*, *5*(4), 94-96.	Theoretical & qualitative	Journal
27.	Samuel, R. D., & Brom, D. (2022). Potential applications of somatic experiencing® in applied sport psychology. Journal of Sport Psychology in Action, 14(2), 97–109. https://doi.org/10.1080/21520704.2022.2119318	Theoretical	Journal
28.	Taylor, P. J., & Saint-Laurent, R. (2017). Group psychotherapy informed by the principles of somatic experiencing: Moving beyond trauma to embodied relationship. *International Journal of Group Psychotherapy*, *67*(sup1), 171-181.	Theoretical & qualitative	Journal

No	Article	Study Type	Publication type
29.	Vagnini, D., Grassi, M. M., & Saita, E. (2023). Evaluating Somatic Experiencing® to Heal Cancer Trauma: First Evidence with Breast Cancer Survivors. *International journal of environmental research and public health*, *20*(14), 6412. https://doi.org/10.3390/ijerph20146412	Quantitative	Journal
30.	Winblad, N. E., Changaris, M., & Stein, P. K. (2018). Effect of somatic experiencing resiliency-based trauma treatment training on quality of life and psychological health as potential markers of resilience in treating professionals. *Frontiers in Neuroscience*, *12*, 70.	Quantitative	Journal

Appendix D: Included Studies

No	Article	Study Type	Publication type	Study Design	Included/ Excluded
1	Andersen, T. E., Lahav, Y., Ellegaard, H., & Manniche, C. (2017). A randomized controlled trial of brief somatic experiencing for chronic low back pain and comorbid post-traumatic stress disorder symptoms. *European Journal of Psychotraumatology*, *8*(1), 1-9.	Quantitative	Journal	RCT	Included
2	Arici Özcan, N. (2021). The Effectiveness of Somatic Experience Based Stabilization Program for Refugee Women's Post-Traumatic Stress, Mindfulness and Social Support Level. *Psycho-Educational Research Reviews*, 10(1), 46–60. Retrieved from https://perrjournal.com/index.php/perrjournal/article/view/91	Quantitative	Journal	Quasi-experimental	Included
3	Briggs, P. C., Hayes, S., & Changaris, M. (2018). Somatic experiencing® informed therapeutic group for the care and treatment of biopsychosocial effects upon a gender diverse identity. *Frontiers in Psychiatry*, *9*, 1-18.	Quantitative	Journal	Uncontrolled	Excluded
4	Brom, D., Stokar, Y., Lawi, C., Nuriel-Porat, V., Ziv, Y., Lerner, K., & Ross, G. (2017). Somatic experiencing for posttraumatic stress disorder: a randomized controlled outcome study. *Journal of Traumatic Stress*, *30*(3), 304-312.	Quantitative	Journal	RCT	Included
5	Changaris, M. C. (2010). Assessing the efficacy of somatic experiencing for reducing symptoms of anxiety and depression. Unpublished doctoral dissertation, John F. Kennedy University.	Quantitative	Grey literature	Case- control	Included
6	Ellegaard, H., & Pedersen, B. D. (2012). A qualitative study of psychotherapeutic interventions for patients with non-specific low back pain of 3–12 months' duration. *BMC Musculoskeletal Disorders*, *13*(1), 166.	Quantitative	Journal	Uncontrolled	Excluded
7	Gomes Silva, S. (2014). *Engaging touch and movement in somatic experiencing trauma resolution approach*. Unpublished doctoral dissertation, International University for Graduate Studies.	Quantitative	Grey literature	Case-control	Included
8	Kuhfuß, M., Maldei, T., Hetmanek, A., & Baumann, N. (2021). Somatic experiencing - effectiveness and key factors of a body-oriented trauma therapy: a scoping literature review. *European journal of psychotraumatology*, *12*(1), 1929023. https://doi.org/10.1080/20008198.2021.1929023	Scoping literature review & Quantitative	Journal	Scoping review	Excluded
9	Leitch, M. L. (2007). Somatic experiencing treatment with tsunami survivors in Thailand: Broadening the scope of early intervention. *Traumatology*, *13*(3), 11-20.	Quantitative	Journal	Uncontrolled	Excluded
10	Leitch, L., & Miller-Karas, E. (2009). A case for using biologically based mental health intervention in post-earthquake China: evaluation of training in the trauma resiliency model. *Emergency Mental Health*, *11*(4), 221-233.	Quantitative	Journal	Uncontrolled	Excluded
11	Leitch, M. L., Vanslyke, J., & Allen, M. (2009). Somatic experiencing treatment with social service workers following Hurricanes Katrina and Rita. *Social Work*, *54*(1), 9-18.	Quantitative	Journal	Case-control	Included

No	Article	Study Type	Publication type	Study Design	Included/ Excluded
12	Özel, D. (2023). 'We are all in this together': Coping with stress during uncertain times through somatic experiencing. *Group Analysis*, 0(0). https://doi.org/10.1177/05333164231189471	Quantitative	Journal	Quasi-experimental	Included
13	Parker, C., Doctor, R. M., & Selvam, R. (2008). Somatic therapy treatment effects tsunami survivors. *Traumatology*, *14*(3), 103-109.	Quantitative	Journal	Ucontrolled field study	Excluded
14	Vagnini, D., Grassi, M. M., & Saita, E. (2023). Evaluating Somatic Experiencing® to Heal Cancer Trauma: First Evidence with Breast Cancer Survivors. *International journal of environmental research and public health*, *20*(14), 6412. https://doi.org/10.3390/ijerph20146412	Quantitative	Journal	RCT	Included
15	Winblad, N. E., Changaris, M., & Stein, P. K. (2018). Effect of somatic experiencing resiliency-based trauma treatment training on quality of life and psychological health as potential markers of resilience in treating professionals. *Frontiers in Neuroscience*, *12*, 70.	Quantitative	Journal	Uncontrolled	Excluded

Appendix E: Quality Assessment of Included Studies

	Study	Level of evidence	Control Group	Sample size >=10	Drop-outs/ Missing	Test Instruments	Effect sizes for PTSD	Therapy administered by SE practitioner	Patient education provided
1	Brom et al., 2017	***	*	*	*	***	**	**	**
2	Andersen et al., 2017	***	*	*	*	***	**	**	**
3	Aricia Ozcan, 2021	**	*	*	***	**	**	**	**
4	Ozel, 2023	**	*	*	***	**	**	**	**
5	Changaris, 2010	*	*	*	***	**		*	**
6	Leitch et al., 2009	*	*	*	***	**	**	**	**
7	Gomes, 2014	*	*	*	***	*		*	**
8	Vagnini, 2023	*	*	*	***	**	**	**	**
Note: Higher the number of stars, the better is the quality of the study									

Appendix F: Characteristics of Included Studies

								Intervention	
Authors	**Study Design**	**Research Question**	**Sample Size**	**Study Population**	**Location of Study Population**	**Experimental Group**	**Control Group**	**Experimental/ Treatment Group**	**Control Group**
Brom et al., 2017	RCT	IS SE effective in treating PTSD symptoms?	N=63	Adults- males and females with mean age of 40.5 years, diagnosed with PTSD.	Israel	N=30	N=33	15 weekly individual sessions with each session= 1 hour	Wait list
Andersen et al., 2017	RCT	IS SE effective in treating PTSD symptoms for patients with chronic low back pain?	N=91	Adults with chronic low back pain males and females with mean age of 50.6 years, diagnosed with PTSD	Denmark	N=45	N=46	6-12 individual SE sessions. Each session= 1hour plus supervised exercises by physiotherapists for low back pain	4-12 sessions of supervised exercises by physiotherapists for low back pain
Arici Ozcan, 2021	Quasi-experimental study	Is SE Stabilization Program effective in treating PTSD and improving mindfulness and social support among refugee women?	N=22	Female adult refugees who lived in a shelter.Age 22-52 years.	Turkey	N=11	N=11	6 SE sessions consisting of 18 activities, each lasting 20 minutes	Waitlist
Ozel, 2023	Quasi-experimental	Is SE effective in treating trauma and improving coping mechanisms and resilience during the Covid-19 pandemic?	N=41	Graduate working males and females with very high stress levels aged 22-26 years.	Turkey	N=18	N=23	Group SE therapy provided online to groups of nine indfividuals. SE session=1.5 hours	Waitlist
Changaris, 2010	Case control study	IS SE effective as a short-term intervention in treating PTSD and comorbid symptoms (anxiety and depression) in homeless population?	N=36	Adults homeless and living in a shelter, includes both males and females	USA	N=18	N=18	Individual SE sessions plus 4 weekly affect regulation skills training plus therapeutic activities of the shelter	Therapeutic activities of the shelter
Leitch et al., 2009	Case control study	Is SE with TRM effective as a short-term intervention for the treatment of social workers with PTSD?	N=142	Social workers- male and female between 22-55 years who worked in crisis management during hurricanes Katrina and Rita in New Orleans.	USA	N=91	N=51	Group psycheducation plus Individual SE/TRM sessions with each session= 40 minutes plus therapeutic activities in the facility	Group psychoeducation
Gomes, 2014	Case-control study	Does inclusion of touch and movement protocol in SE therapy increase its effectiveness?	N=10	Females only. Women traumatized by domestic violence.	USA	N=5	N=5	One 90-minute SE session+ touch and movement protocol session	One 90-minute SE session
Vagnini et al., 2023	Case control study	Is SE effective in treating trauma or improving psychological wellbeing in traumatized breast cancer survivors?	N=35	Females only. Breast cancer survivors with PTSD aged 33-62 years	Italy	N=21	N=14	Each group of seven participants received 8 weeks of web based synchronous group session of SE. Each session was once a week= 1 hour.	Waitlist

Appendix G: Measurement Instruments

	Study	Research Design	Measurement Scales for PTSD	Measurement Scales for Comorbidities	Comorbidities Measured	Other Measurement Scales	Measures of other effects
1	Brom et al., 2017	RCT	CAPS, PDS, HTQ-IV	CES-D	Depression		
2	Andersen et al., 2017	RCT	HTQ-IV	TSK, RMDQ, NRS, PCS	Pain & disability		
3	Aricia Özcan, 2021	Quasi-experimental	IES-R-A			MAAS, MSPSS	Mindfulness & Social support
4	Özel, 2023	Quasi-experimental	COPE-R	K10	Psychological Distress	Interviews	Hope, insight, new behaviour
5	Changaris, 2010	Case control	STAI	BDI-II	Anxiety & depression		
6	Leitch et al., 2009	Case control	IES-R-A	s.d. symptom score	Subjective distress-psychological and physical	Skala, s.d. coping scale	Resilience & coping skills
7	Gomes, 2014	Case control	External and self-ratings	Self-ratings	Well-being		
8	Vagnini, 2023	Case control	PACT (1-7)	HADS	Anxiety & depression	Mini-MAC, BIS	Coping strategies & body image

Appendix H: Measurement Intervals for Effectiveness of the Intervention

	Study	**Research Design**	**Measurement Intervals**		
			Pre-intervention	**Post-Intervention**	**Follow up**
1	Brom et al., 2017	RCT	Yes	Yes	15 weeks
2	Andersen et al., 2017	RCT	Yes	Yes	12 months
3	Aricia Özcan, 2021	Quasi-experimental	Yes	Yes	8 weeks
4	Özel, 2023	Quasi-experimental	Yes	Yes	12 weeks
5	Changaris, 2010	Case control	Yes	No	5 weeks
6	Leitch et al., 2009	Case control	Yes	No	16 weeks
7	Gomes, 2014	Case control	Yes	Yes	No
8	Vagnini, 2023	Case control	Yes	Yes	12 weeks

Appendix I: Hypotheses Testing

			H1	H2	H3
	Study	Research Design	Effectiveness of SE on PTSD Symptoms	Effectiveness of SE on Comorbidities	Effectiveness of SE on Resilience & Coping
1	Brom et al., 2017	RCT	+*	+*	
2	Andersen et al., 2017	RCT	+*	+	
3	Aricia Ozcan, 2021	Quasi-experimental	+*		+*
4	Ozel, 2023	Quasi-experimental	+*	+*	+*
5	Changaris, 2010	Case control	+*	+	
6	Leitch et al., 2009	Case control	+	+	X
7	Gomes, 2014	Case control	+	+	
8	Vagnini, 2023	Case control	+*	+*	+*

Note: +*= positively and highly significant. '+= positively and moderately significant. X= No effect.