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**TRAUMA RELEASING EXERCISES AS A TREATMENT  
TECHNIQUE: A SCOPING REVIEW**

by

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**A dissertation submitted in fulfilment of the requirements for the degree  
Master of Occupational Therapy**

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## DECLARATION

I, Linda Aletta Joan Roos, student number 20005769, hereby declare that this dissertation, "*Trauma Releasing Exercises as a treatment technique: a scoping review*," submitted in accordance with the requirements for the Master of Occupational Therapy (MOccTher) degree at University of Pretoria, is my own original work and has not previously been submitted to any other institution of higher learning. All sources cited or quoted in this research paper are indicated and acknowledged with a comprehensive list of references.

A handwritten signature in black ink, appearing to read 'L. Roos', is positioned above a horizontal line.

**Signature: Linda Roos**

## ETHICS STATEMENT

The author, Linda Aletta Joan Roos, whose name appears on the title page of this dissertation, has obtained the applicable research ethics approval (ethics number: 442/2020) for the research described in this work, as evident in Annexure A.

The author declares that she has observed the ethical standards required in terms of the University of Pretoria's Code of Ethics for Researchers and the Policy Guidelines for responsible research.

A handwritten signature in black ink, appearing to read 'L. Roos', is positioned above a horizontal line. The signature is written in a cursive style.

**Signature: Linda Roos**

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## ABSTRACT

**Introduction:** Trauma Releasing Exercises (TRE) is a novel mind-body technique, used by some healthcare practitioners to address stress, anxiety and other related problems in clients. Occupational therapists use mind-body techniques to improve occupational performance, but are required to use evidence-based techniques. There has not yet been a solid base of synthesised literature on this technique to support evidence-based practice.

**Aim:** The aim of the study was to describe and synthesise the characteristics of TRE intervention studies. Such an overview of research evidence is helpful to understand the breadth and content of studies, to identify gaps and further research needs, and to guide the potential use of the technique in evidence-based treatment.

**Methodology:** A scoping review was conducted according to the JBI (formerly Joanna Briggs Institute) scoping review framework. A comprehensive search for all TRE intervention studies, peer reviewed and non-peer reviewed, with exclusion of non-English studies, was performed and 18 studies were selected. Data were extracted and data analysis was done with descriptive statistics. Results were presented in summarised text, tables and graphs.

**Results:** In the identified studies, TRE was used predominantly with populations exposed to stress and trauma, with measurement tools assessing various body functions typically impacted by stress and potentially improved with treatment. Possible benefit for clients diagnosed with Parkinson's disease, multiple sclerosis and epilepsy was identified. Descriptive and inferential statistics from the studies indicated potential improvement in mood-related aspects, as well as improvement in anxiety-related sleep difficulties, pain and cognitive functions. The studies included a wide scope of study designs, including less rigorous methodologies, therefore the results should be considered as preliminary.

**Conclusion:** This technique could potentially be used with clients exposed to stress and trauma, diagnosed with neurological disorders and even other populations. The study results are, however, tentative. To use this technique within evidence-based practice, further and more rigorous research will be required.

**Significance:** A research synthesis will guide future research on this novel technique and enable healthcare practitioners to base treatment-related decisions on research evidence. With continuing research and a strengthened knowledge base, this technique could have a place in evidence-based occupational therapy practice.

**Key Terms:** Autonomic nervous system, mind-body technique, relaxation, scoping review, stress, Trauma Releasing Exercises

## LIST OF ABBREVIATIONS

Abbreviation	Meaning
ANS	Autonomic nervous system
AOTA	American Occupational Therapy Association
CAM	Complementary and alternative medicine
DALYs	Disability-adjusted life years
DB	Diaphragmatic breathing
EBHC	Evidence-based healthcare
EBP	Evidence-based practice
EUR	Euro
GI	Guided imagery
HPA	Hypothalamus-pituitary-adrenal
JBI	(Formerly known as) Joanna Biggs Institute
MBSR	Mindfulness-based stress reduction
MS	Multiple sclerosis
OM	Objective measure
OT	Occupational Therapy
OTPF-IV	Occupational Therapy Practice Framework, 4th edition
PMR	Progressive muscle relaxation
PNS	Parasympathetic nervous system
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
PTSD	Post-traumatic stress disorder
QoL	Quality of Life
R	Rand

RCT	Randomised controlled trial
RLS	Restless legs syndrome
SNS	Sympathetic nervous system
SR	Self-report
TRE	Trauma Releasing Exercises
USA	United States of America
US Army	United States Army



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# CHAPTER 1: INTRODUCTION

## 1.1. BACKGROUND

In 2010, David Bercei, a clinical social worker from the United States of America (USA), presented his newly developed mind-body technique, Trauma Releasing Exercises (TRE®), at a conference in Cape Town. During the following two years, he personally trained South African professionals in the use of this technique and, thereafter, qualified trainers continued to conduct training throughout South Africa.<sup>1</sup> Since the initial training, interest in this therapeutic technique has grown to such an extent that by 2014 South Africa had the highest concentration of trained practitioners.<sup>1</sup> At the time of this study, 68 South African healthcare practitioners, including clinical and counselling psychologists, social workers, medical doctors, occupational therapists, nurses, and biokineticists were registered as certified TRE providers on the TRE-for-Africa website.<sup>2</sup> It has been reported that this technique assists with reducing built-up tension in patients suffering from anxiety-related disorders,<sup>3-6</sup> autoimmune conditions<sup>7</sup> and, possibly, certain neurodegenerative disorders,<sup>8</sup> consequently leading to improvement in stress levels and anxiety,<sup>4,7-9</sup> quality of sleep,<sup>4-5,7</sup> fatigue,<sup>7</sup> attention<sup>5</sup> and memory.<sup>5</sup>

## 1.2. PROBLEM STATEMENT

TRE is a relatively new mind-body technique that can be taught in a few sessions without the need for complicated language and terminologies.<sup>1</sup> It can be used in group settings,<sup>3-4,10</sup> has been reported to obtain therapeutic results within a short period of time,<sup>4-6</sup> and could potentially be working on a deeper level than other mind-body and relaxation techniques.<sup>6</sup> All the mentioned characteristics of this technique could be highly beneficial in the South African context, where there are multiple stressors and challenges,<sup>11-12</sup> including a heterogeneous population with various cultures and different languages, high unemployment rates, and limited access to and ability to afford healthcare treatment.<sup>13</sup>

There is, however, not yet a solid base of synthesised literature on TRE intervention research,<sup>10,14</sup> with the available research being significantly diverse in nature and content.<sup>14</sup> Without a literature synthesis, it will be difficult to determine the knowledge gap with regards to this technique, and practitioners will be limited in their ability to evaluate the potential usefulness of this technique in their context. Additionally, practitioners will be limited in determining how to measure the outcomes of treatment.

### **1.3. RESEARCH QUESTION, AIM AND OBJECTIVES**

#### **1.3.1. Research question**

The research question is: What intervention research has been done on TRE as a treatment technique and what are the characteristics of these studies?

#### **1.3.2. Research aim**

The aim of this study is to describe the characteristics of TRE intervention studies. This aligns with the research question, title and problem statement.

#### **1.3.3. Research objectives**

The research objectives are to describe the following study characteristics:

- i. The characteristics of the populations treated with TRE.
- ii. The study designs and other methodological aspects utilised in the studies.
- iii. The structure of the TRE treatment programmes used in the studies.
- iv. The measurement tools used to measure the TRE treatment outcomes.
- v. The recorded outcomes of the TRE treatment.
- vi. To identify the gaps in the literature, determining areas in which further research is required.



## **1.4. DEFINITION OF KEY TERMS**

### **1.4.1. Trauma releasing exercises**

This technique consists of seven stretching exercises used to elicit a self-induced, non-pathological body tremor response.<sup>15</sup> As the tremor moves through the body, it releases deep chronic muscular tension.<sup>6</sup> It has been theorised that this technique assists the nervous system to return to a balanced state. By releasing the built-up charge of a fight-, flight- or freeze response,<sup>6</sup> it leads to improvement in anxiety-related symptoms.<sup>4-5,7,9,15</sup>

### **1.4.2. Mind-body practices**

Mind-body and mindfulness practices utilise a mental technique or combination of mental and physical techniques to improve mind-body functioning. Mind-body practices are classified as a nonconventional treatment category for techniques used to address mental health conditions.<sup>16</sup> Examples of these practices are mindfulness-based stress reduction, relaxation techniques, and yoga.<sup>16-17</sup> Occupational therapists use these techniques to improve participation and function in their clients.<sup>18-22</sup> TRE could also be considered a mind-body technique.<sup>15,23</sup>

### **1.4.3. Evidence-based practice**

The process of evidence-based practice (EBP) is when healthcare professionals base their decisions and actions on “best” research evidence, professional experience and expertise, as well as the client’s preferences and circumstances.<sup>24-</sup><sup>25</sup> It requires of healthcare professionals to continue learning throughout their career and to be willing to consider contradictory evidence, which could be different from present knowledge and practice.<sup>24</sup> A synthesis of the TRE research literature is an important step towards potentially including TRE as part of evidence-based practice with certain client groups.

#### **1.4.4. Intervention study**

An intervention study is where intervention or treatment is applied by a researcher, at some point during a study, to a group of participants or only to a selected few members of a group.<sup>26</sup> These studies are designed to determine the direct effect of a treatment on dysfunction.<sup>27</sup> The scoping review includes only studies that report on TRE intervention studies.

#### **1.4.5. Stress**

The definition and understanding of the term 'stress' depends on the research field,<sup>28</sup> as it is a widely used term. For the purpose of this study, the focus will be on stress as defined by the American Occupational Therapy Association (AOTA): "...a natural neurophysiological and psychological response to a stressor."<sup>29</sup> In this review, there is also a focus on the inappropriate chronic stress response, which leads to mental and physical health problems.<sup>30-31</sup>

### **1.5. CONTEXT**

The context of the studies included in the review were a therapeutic setting, where the purpose of TRE treatment was to improve participants' functioning on a physical, emotional, cognitive or social level. This aligned with the objective to describe diverse therapeutic outcomes of TRE treatment. It was not necessary during the review process to additionally formulate any setting-related exclusions. Studies from any country, and in rural and urban settings were included.

### **1.6. ASSUMPTIONS**

#### **1.6.1. Paradigm**

According to Bunnis and Kelly,<sup>32</sup> the quality of research does not necessarily depend on the type or superiority of the specific paradigm used, but rather on the transparency and integrity of the used philosophy and methods. The researcher

approached the scoping review study from a post-positivist paradigm.<sup>32-33</sup> Due to quantitative methods used to present and summarise the results from the quantitative and qualitative studies, as well as a strict protocol followed without much scope for subjectivity, assumptions were based on the post-positivist paradigm.

### **1.6.2. Ontological assumptions**

Ontological assumptions indicate how the researcher understands- or sees the nature of reality.<sup>32</sup> Within the post-positivist paradigm, it is assumed that reality is stable and based on an objective truth,<sup>32</sup> but that research evidence is, however, liable to error due to the complexity of investigation.<sup>33</sup> With a scoping review, the researcher assumed that by extracting data as objectively as possible from the included studies, with input from a second reviewer, a “probable” reality could be presented by the synthesised results.

### **1.6.3. Epistemological assumptions**

For a scoping review, Thomas et al.<sup>34</sup> suggested two possible epistemologies or theories of the nature of knowledge, namely subjectivism and objectivism. Due to the quantitative nature of the scoping review’s results, relative objectivism was considered a more suitable approach. Relative objectivism indicates that objective knowledge is the ideal, but not completely achievable.<sup>33</sup> The researcher assumed that knowledge related to TRE treatment could be obtained by extracting and synthesising data from the included studies, but that the nature of the knowledge obtained will most probably not be completely objective.

### **1.6.4. Methodological assumptions**

With a post-positivist paradigm, the aim is to get to the “probable” truth with well-defined concepts, controlled circumstances and precise testing.<sup>32</sup> Within this paradigm, the researcher assumed that by using a well-defined scoping review protocol, knowledge could be gained.

Not specifically related to the chosen paradigm, the researcher also made the following assumptions regarding the included, mainly quantitative, studies:

- The authors of the included studies were truthful in reporting their study results and other characteristics pertaining to their studies.
- That the authors and researchers attempted to avoid bias in their studies and acknowledged the biases that they became aware of.
- That participants in the studies were truthful in their answering during self-report measurement tools and/or interviews.
- That the recommended TRE exercise routine and protocol, as taught during the training process, had been followed in the studies, so that results between different studies are comparable.

### **1.7. DELINEATION**

The literature included in the review was limited to available intervention studies (peer reviewed and non-peer reviewed) where the outcomes of TRE treatment has been measured quantitatively or qualitatively. Intervention studies were defined as those studies reporting on primary data collected as part of a study where treatment was applied to a group of participants, or a selected few members of a group. The purpose of the intervention studies should have been to investigate the direct effect of treatment in a therapeutic setting.<sup>26-27</sup> Studies where TRE was used in combination with another treatment technique were excluded. Studies in rural- and urban settings, from any country, were allowed with no exclusions with regards to the study participants, populations or diagnostic groups. Any quantitative or qualitative research design that assessed the effect of TRE treatment on a person was considered, with literature reviews, theory papers, expert opinions and editorials excluded.

With regards to types of literature, publication types included academic journal articles, academic books or book chapters (including eBooks and eBook chapters), dissertations, medical reports, case reports and other informal reports with detailed treatment results, conference papers, as well as academic posters with detailed study results. Sources that were excluded were magazine articles, blogs, podcasts,

websites, wire feeds, advertisements and community briefs. Sources were limited to English studies, but foreign language articles could be included when a full English abstract with detailed study results was available. Literature published up to November 2022, the month in which the data search was completed, were included. More detail with regards to the eligibility criteria applied in the study is in Section 3.4.

## **1.8. SIGNIFICANCE**

This review provides a summary of the characteristics and outcomes of TRE intervention studies. At the time of the study, the researcher was not aware of any type of literature synthesis on this treatment technique. The scoping review provides a summarised knowledge base from where TRE, the outcomes of treatment, and even the measurement tools used to assess treatment outcomes, can be evaluated. This knowledge can be applied to treatment.

The knowledge gained from this review could specifically be useful for healthcare professionals, including occupational therapists, who use mind-body techniques to address stress and anxiety in their clients. In a preliminary review of the literature, it was noted that the implementation of TRE varied between studies. A research synthesis could indicate the more effective and successful implementations of TRE, guiding the technique's use in treatment.

A scoping review will, furthermore, assist in guiding future research. With an indication of insufficient evidence in certain areas of the research field, it will guide the continuation of research in these areas to strengthen the knowledge base for improved research support, so that professionals can use the technique as part of evidence-based practice.<sup>35</sup>

## **1.9. OVERVIEW OF THE CHAPTERS**

This dissertation is divided into six chapters. Chapter 1 provides an introduction and background information on the research topic. In Chapter 2 the literature is reviewed

and presented in four sections, which include a discussion on stress, anxiety and health-related consequences; occupational therapy and mind-body practices; trauma releasing exercises focussing on the development of TRE, the exercise routine, tremors, the theories supporting TRE and how it could be applicable in the South African context; and, lastly, the concept of evidence-based practice with a suitable model for guidance. Chapter 3 focusses on the research methodology, with a description and rationale for the use of the scoping review method, an explanation of the eligibility criteria for the included literature and, thereafter, the process of the scoping review, with, lastly, aspects pertaining to quality, rigour, and ethical considerations. In Chapter 4, the results of the review are presented and summarised according to the study's objectives and in Chapter 5 the findings are discussed in more detail, in relation to relevant literature. As a conclusion, Chapter 6 presents a summary of the main findings, the implications for practice, a critical evaluation of the study's strengths and limitations, and recommendations for future studies.

## **1.10. CONCLUSION**

Since it was first presented in South Africa, the interest in- and use of TRE has grown among healthcare practitioners. The technique is, however, being used with limited research support and there is no research synthesis that can be consulted. With a review of the research literature and a consequent description of study characteristics, including study populations, methodology used, TRE treatment structure, measurement tools used and study outcomes, as well as identification of gaps in the literature, the evidence base for this novel technique has been summarised. This may guide future research, improve healthcare professionals' ability to determine if- and how they could use this technique in their practice.

Prior to performing the study, the literature was consulted to clarify topics relevant to the study, namely how stress and anxiety affect health, occupational therapists' use of mind-body techniques, TRE and its history, as well as evidence-based practice. These will be discussed in Chapter 2.

## CHAPTER 2: LITERATURE REVIEW

### 2.1. INTRODUCTION

In the fast-paced modern age where people have to keep up with rapid advances in technology, constant access to information, financial insecurity and environmental changes with unpredictable consequences, stress is a common problem.<sup>36-37</sup> High- and chronic levels of stress can lead to the development of physical and mental health problems.<sup>29,31,36</sup>

Disability-adjusted life years (DALYs) are years of life lost due to premature mortality or due to time lived in a state of less than full health. By 2019, the global number of DALYs due to mental disorders were reported to be 125.3 million, with mental disorders being one of the top ten conditions contributing to burden of disease worldwide.<sup>38</sup> Statistics indicate that anxiety disorders are the most common of all mental health disorders in the United States and countries of the Organisation for Economic Cooperation and Development (OECD).<sup>39-40</sup>

Large-scale studies on the mental health burden in the South African population is limited, with the most comprehensive study to date published in 2009.<sup>41</sup> The South African Stress and Health (SASH) study reported that anxiety disorders were the most common class of lifetime disorders at 15.8%,<sup>41</sup> but with a possibility that the study could have underestimated the prevalence of common mental health disorders in South Africa.<sup>41</sup> More recent statistics presented by the South African Depression and Anxiety Group (SADAG) indicated that one in every six South Africans suffer from anxiety, depression or a substance-use disorder,<sup>11</sup> and up to six million South Africans are likely suffering from post-traumatic stress disorder (PTSD), when taking into account the rate of crime and motor vehicle accidents in the country.<sup>11-12</sup>

High levels of stress and anxiety affect the individual, but also have a debilitating effect on society and on a country's economy. Mental health-related costs for countries in the European Union (EU) were estimated in 2018 to be more than 4% of Gross Domestic Product (GDP), equivalent to over EUR 600 billion per year,<sup>40,42</sup> with similar figures reported in Canada, Australia and Japan.<sup>40</sup> These costs include

those related to health systems, social security programmes, as well as losses due to lower productivity and unemployment rates. A report from 2017 indicated that the total annual cost to the South African economy due to loss of earnings caused by major depression and anxiety disorders added to a total of more than R40 billion.<sup>43</sup>

Occupational therapists form part of the interdisciplinary healthcare team assisting clients in coping with stress and anxiety.<sup>19</sup> Debilitating levels of stress and anxiety interfere with productivity and lead to the loss- or disruption of occupation.<sup>19,42,44</sup> Such levels of stress affect participation across life roles.<sup>19</sup> The occupational therapist's role is to guide and assist clients towards participation and optimal performance in everyday occupations.<sup>45</sup> Literature supports the effectiveness of occupational therapy in managing mental health-related symptoms and highlights the positive effect thereof on functional performance.<sup>46</sup>

Treatment modalities used by occupational therapists that have been indicated as effective in reducing arousal states and stress levels are mind-body practices.<sup>19</sup> Mind-body practices include relaxation techniques and mindfulness.<sup>17,19,47</sup> Teaching a client relaxation practices and mindfulness assist in improving the client's participation in daily life activities and occupations<sup>19</sup> by reducing stress levels and anxiety. Even occupational therapy clients with physical limitations, neurological disorders and developmental delays experience increased anxiety, where mind-body practices could improve participation.<sup>20-22,48-49</sup>

Trauma Releasing Exercises (TRE), a new mind-body therapeutic method,<sup>7,17</sup> could be an option for healthcare practitioners to implement.<sup>2</sup> This technique has been reported to be beneficial in decreasing stress and anxiety,<sup>7,9,50</sup> as well as addressing other stress-related symptoms.<sup>5,7,50</sup> Evidence-based practice requires practitioners to consider the research evidence on the effectiveness of an intervention procedure when making decisions about the use of such a procedure. Consequently, the research evidence on TRE should be investigated in order for healthcare practitioners to make informed decisions about its application.

In this chapter, four topics that are relevant to this study will be investigated and discussed. Firstly, stress, the stress response, anxiety, and how these conditions affect health will be addressed, in order to understand how TRE and other mind-



body techniques may modulate the stress response. The role that occupational therapists play and the techniques they use in addressing stress and anxiety will then be discussed to clarify why TRE may be a technique that occupational therapists could consider. Thereafter, TRE as a mind-body technique will be discussed, addressing the development of the technique, the exercise routine, the nature of the tremors elicited, the theories behind TRE and consideration of the aspects that separate TRE from other mind-body practices. Lastly, the concept of evidence-based practice and research will be described to highlight the importance of summarising and synthesising research evidence on the effectiveness of TRE.

## **2.2. STRESS, ANXIETY AND HEALTH-RELATED CONSEQUENCES**

High levels of stress and anxiety can have a significant impact on people's mental and physical health,<sup>29,31</sup> as well as a country's economy.<sup>40,42-43</sup> However, stress and anxiety can be considered as the body's normal and adaptive response to an unpleasant situation or a perceived threat, with the purpose of preparing the body to deal with danger.<sup>19,51</sup> To have a better understanding of the function of normal stress and anxiety levels, and how dysfunctional high levels of stress and anxiety can affect a person's health, the following aspects should be clarified: what stress is, how the body reacts to stress, the difference between stress and anxiety, and how stress and anxiety affect a person's health.

### **2.2.1. Stress**

Stress is a widely used term, with no uniform definition amongst different disciplines or research areas.<sup>28</sup> In modern society, the term is used for many different unpleasant experiences such as health concerns, work pressure and even daily hassles.<sup>28</sup> Early research was only focused on physical stressors. Hans Selye (1907 – 1982),<sup>28</sup> a qualified doctor who was mostly interested in research, borrowed the word “stress” from the physics and engineering field. He coined the term “stress response”, referring to the physiological response of the body to physical stressors, for instance, severe physical strain, abnormal temperatures, and surgical procedures.<sup>28</sup> Later, during World War II, researchers started investigating

psychological stressors, trying to make sense of soldiers' "shell shock" symptoms when they returned home after enduring chronic combat threat. Post War, the focus of stress research widened to other types of more common psychological stressors, including, for instance, grief and the anticipation of an unpleasant event.<sup>28</sup> The definition and understanding of stress and stressors developed over time, with a focus on different aspects of stress, depending on the research field.

For the purpose of this study, the focus will be on the stress response as experienced on a physiological and psychological level. This has been defined by the American Occupational Therapy Association (AOTA) in their societal statement on stress, trauma, and PTSD as the following: "*Stress is a natural neurophysiological and psychological response to a stressor.*"<sup>29</sup>

Stress, or the stress response, can be elicited by a psychological, social, environmental or physiological demand, where the demand typically requires change in behaviour.<sup>52</sup> The stress response is also usually elicited when a situation involves novelty, lack of predictability, lack of control or a social-evaluative threat (being evaluated or judged).<sup>53-54</sup> Stress is not associated with one specific emotion, but there are certain negative emotional states that can be linked to the experience of stress, for instance, frustration, anger, fear and anxiety.<sup>54</sup> The physiological and psychological stress response typically leads to an adaptive behavioural response.<sup>54</sup>

Causes of stress can be divided into four main subtypes, namely life events, chronic strains, daily hassles, and network events.<sup>52</sup> Life events lead to stress due to the short period of time within which a person is forced to adjust to a change in status or role, for instance when marrying or when a spouse dies.<sup>52</sup> Chronic strains are repeated and continuing demands over a period of time,<sup>52</sup> for instance, the stress of coping with work and family responsibilities, the stress of continuing crime, or more severe war-related stress. Daily hassles are various minor stresses experienced throughout the day,<sup>52</sup> for instance, traffic when commuting to work or having to consider loadshedding (the scheduled limitation of electricity supply to reduce load on the system) within a daily schedule. Stress can also be experienced due to 'network events' (when a person in the social network suffered), for instance, a family member losing their job.<sup>52</sup>

### **2.2.2. The stress response**

When a person experiences one or more of the above-mentioned stressors, the body reacts automatically with a coordinated physiological, psychological and adaptive behavioural response, called the stress response.<sup>54</sup>

During the physiological part of the response, two primary physiological stress response systems, namely the sympathetic nervous system (SNS) and the hypothalamus-pituitary-adrenal (HPA) axis, are activated. These systems prepare the body for a fight or flight reaction.<sup>54</sup> The SNS has an almost immediate, but short-lasting effect, while the HPA axis has a delayed, but longer-lasting effect. The impact of the SNS could last for minutes, while the HPA axis could have an impact which lasts for hours to days.<sup>54</sup> An important aspect to note, for the purposes of this study, is that a person has no voluntary control over the initiation and termination of activity in the SNS and HPA axis, but can modulate the activity when using relaxation techniques.<sup>54</sup>

The SNS, together with the parasympathetic nervous system (PNS), form part of the autonomic nervous system (ANS).<sup>54-55</sup> The ANS innervates and controls the functioning of the body's internal organs, glands and blood vessels,<sup>54</sup> regulating cardiac and smooth muscle functioning, regulating the secretion of glands, and controlling body temperature, digestion, heart rate, respiration, metabolism and blood pressure.<sup>55</sup> The ANS is, therefore, responsible for survival,<sup>55</sup> with the SNS and PNS having opposite effects on target organs and systems. The SNS has an activating effect, with an increase in heart rate, respiration, blood pressure and blood sugar levels, and slowing of the digestive system.<sup>55</sup> The PNS has a calming function, leading to a decrease in heart rate, respiration, blood pressure, etc. It slows the body down and assists in maintaining homeostasis.<sup>55</sup> When a stressful situation is over, the PNS system is usually activated.

The SNS, when activated as part of the stress response, is responsible for the release of epinephrine (adrenaline) and norepinephrine (noradrenaline).<sup>54</sup> Norepinephrine, released directly onto target organs via the axons of postganglionic neurons, is responsible for pupil dilation, increased respiration and heart rate, as well as directing blood flow to the skeletal muscles of the limbs and away from the organs, to prepare the body for fight or flight.<sup>54</sup> Systemic release of epinephrine from

the adrenal glands is responsible for increase in heart rate, cardiac output and blood glucose levels, while norepinephrine released systemically from the adrenal glands is responsible for an increase in blood pressure and energy mobilisation.<sup>54</sup> Psychological stressors lead to a more global activation of the SNS, including the systemic release of the hormones, instead of activation of specific SNS neuronal units for minor adjustments to maintain homeostasis.<sup>54</sup>

The HPA axis is a neuroendocrine system and responsible for the secretion of cortisol, a glucocorticoid hormone.<sup>54</sup> The adaptive function of cortisol is to increase blood glucose levels, increase cardiovascular tone, modulate immune system functioning and move stored fat tissue to other areas in the body.<sup>54</sup> Cortisol is fat-soluble and, therefore, can cross the blood-brain barrier (which is not possible for epinephrine and norepinephrine).<sup>54</sup> The effect of cortisol on brain functioning is regulating emotions, sleep, appetite, memory, learning and reward processes, which assist in adaptation during stressful times.<sup>54</sup>

Brain regions responsible for higher-level stressor processing and coordination of the stress response, via control over the SNS and HPA axis, are the hypothalamus, thalamus, brainstem and limbic system components.<sup>54</sup> Limbic system components include the medial prefrontal cortex, lateral septum, hippocampal formation and the amygdala.<sup>54</sup> These higher order brain regions are responsible for activation of the SNS and HPA axis, as well as for producing the psychological stress response.<sup>54</sup> With regards to limbic system function, the medial prefrontal cortex is responsible for decision-making that is situation-specific, recognising stressor manageability, and for controlling emotionally motivated behaviours.<sup>54</sup> The hippocampus manages the forming and retrieval of stress-related contextual memories, while the amygdala is responsible for learned associations between stressful experiences and environmental cues, coordination of stereotypic defensive behaviours (for instance, the freeze response), and for producing negative emotions.<sup>54</sup> The lateral septum modulates affective tone, mood and related behaviours. Affected attention and decision-making, which forms part of the psychological stress response, is dependent on medial prefrontal cortex functioning. Reduced function in the medial prefrontal cortex, due to the release of norepinephrine and dopamine in the brain during times of increased stress, leads to automatic reactive behaviours instead of reflective behaviour.<sup>54</sup> The higher order brain regions are responsible for the

psychological stress response in the form of emotional states developing, such as fear, irritation or anxiety.<sup>54</sup>

The psychological and physiological stress response then leads to adaptive behaviour, initially called the fight-or-flight response.<sup>44,54,56</sup> More recently, due to advances in the understanding of the human stress response, it has been advocated for to expand the term to freeze, flight, fight or fright response.<sup>56</sup> These adaptive responses are activated without much cognitive reflection.<sup>57</sup> A person presents with a “freeze” reaction when they are hypervigilant and watchful, with a “flight” response when trying to avoid or remove themselves from an unpleasant situation, and in “fight” mode when reacting aggressively towards the source of stress.<sup>56</sup> “Fright” is when a person experiences tonic immobility, being unable to move. Fright is an adaptive human response when there is no possibility of fleeing from the situation or winning the fight.<sup>56</sup>

### **2.2.3. Anxiety**

While stress is a physiological and behavioural response, anxiety is defined as an emotional state.<sup>58</sup> Anxiety is defined by excessive worry that does not disappear, even in the absence of the stressor.<sup>59</sup> Some level of anxiety is functional, as it could indicate a potentially unsafe situation, therefore assisting a person in avoiding danger. It could also motivate a person to complete difficult tasks.<sup>57</sup> Anxiety is considered a disorder when it interferes with a person’s productivity and when the level of fear experienced is inappropriate to the situation.<sup>19</sup> Anxiety typically presents in a combination of physiological, behavioural and psychological reactions, with an effect on cognitive function as well.<sup>44,60</sup>

The physiological symptoms of anxiety are mostly related to ANS function, including headaches, perspiration, heart palpitations, muscle tension, a dry mouth, tightness in the chest and mild stomach discomfort.<sup>44,60</sup> Motor symptoms could also be present, for instance, restlessness.<sup>44</sup> Behaviourally, anxiety could present in a limited ability to act, communicate thoughts and feelings, or handle usual situations.<sup>60</sup> On a psychological level, anxiety is experienced as a state of apprehension and unease.<sup>60</sup> With regards to cognitive function, thought processes,

focus and judgement could be affected. During acute anxiety, a person's thoughts will be focussed on- and potentially catastrophising a perceived threat. Chronic anxiety leads to negatively inclined thoughts.<sup>44</sup> Normal levels of anxiety can lead to improved attention, with increased alertness, while abnormal levels of anxiety negatively affect focus of attention and, subsequently, recall ability.<sup>44</sup> With regards to insight and judgement, an anxious person focuses selectively on details that justify their reactions.<sup>44</sup>

Bourne<sup>60</sup> describes three types of anxiety: free-floating anxiety, situational anxiety, and anticipatory anxiety. Free-floating anxiety is when anxiety is experienced suddenly and cannot be connected to a specific situation, while situational anxiety is in response to a specific situation. Anticipatory anxiety is when anxiety arises when thinking about a specific situation that might happen in the future.<sup>60</sup>

Acute and chronic exposure to stress and stressors could lead to an anxiety disorder.<sup>52,59-60</sup> In the academic literature, several anxiety disorders are classified as "stress-induced disorders", indicating that anxiety has been precipitated by stress.<sup>31</sup> It should, furthermore, be noted that when a person experiences normal anxiety, the body also reacts with the stress response, preparing for potential danger. However, when this response remains activated in times of safety, or is overactivated during times of minor stressors, it could lead to the symptoms experienced when suffering from an anxiety disorder.<sup>57</sup>

#### **2.2.4. Stress and health**

The body's stress response is functional, in that it prepares a person for action against a potential threat. However, in the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5), as well as other literature sources, it is indicated that an inappropriate chronic stress response can lead to mental- and physical health problems and conditions.<sup>29-31,54</sup> The harmful effects result from the cumulative consequence of a repeated stress response over time<sup>54</sup> and can affect illness progression, and even cause the development of mental and medical health problems.<sup>51,54</sup>

When considering the normal stress response, an increased heart rate improves blood flow and oxygen to the body's large muscle groups, preparing the body for action. When the nervous system is dysregulated and an increased heart rate is not appropriate to the situation, it leads to the anxiety symptom of heart palpitations.<sup>57</sup> A decrease in blood flow to the skin and extremities, which is functional in limiting wound-related blood loss during a threatening situation, could lead to the pale-coloured skin that a person presents with when anxious.<sup>57</sup> Hyperventilation is non-functional due to a dysregulated system, but in a stressful situation increased respiratory rate assists in increasing oxygen to the bodily tissues to ready the body for action.<sup>57</sup> Furthermore, a slowing down of the digestive system during a stressful situation saves needed energy for the muscles of extremities needed to help with fight-or-flight and prevents the need for waste excretion at an inappropriate time. With a chronically slowed-down digestive system, a person may suffer from stomach pain and constipation.<sup>57</sup>

On a physiological level, the SNS and HPA axis are responsible for the modulation of the body's physiological systems, via catecholamines (epinephrine and norepinephrine) and glucocorticoids (cortisol). When the basal and reactive function of the SNS and HPA axis is changed due to a chronic stress response, it affects the correct balance in the physiological systems, leading to pathology on a systemic level.<sup>54</sup> In addition to affecting these modulatory aspects, a change in the levels of glucocorticoids and catecholamines affect three processes that can have a negative impact on all physiological systems: increased inflammation, metabolic imbalance, and circadian dysregulation.<sup>54</sup> Increased inflammation can lead to worsening of inflammatory-related disorders, like rheumatoid arthritis, asthma and inflammatory bowel disease. Metabolic imbalances can lead to increased blood sugar levels, high blood pressure and an abnormal level of cholesterol, which increase the risk of stroke, cardiovascular disease and type 2 diabetes.<sup>54</sup> When the body's circadian rhythm is dysregulated, it could affect, amongst other things, the sleep/wake cycle and might even be partly responsible for migraines.<sup>61</sup>

Affected function of the SNS and HPA axis systems also play a role in mental health problems.<sup>54</sup> Chronically elevated glucocorticoid levels can lead to neuronal damage and brain volume reduction, which can be linked to cognitive and emotional disruptions observed in mental health difficulties.<sup>54,57</sup> A chronic increase in

glucocorticoid levels are responsible for dendritic atrophy in the hippocampus and prefrontal cortex, with increased dendritic branching in the basolateral amygdala.<sup>54</sup> These changes could increase amygdala-dependent emotional learning and behaviour, while limiting suitable contextualisation and situation-specific regulation of emotional learning.<sup>54</sup> Patients with an anxiety disorder present with a heightened arousal and startle response, which correlates with a chronically activated SNS and significantly increased levels of noradrenaline.<sup>51</sup> Anxiety and depression disorders are the most prevalent psychopathologies related to chronic stress.<sup>59</sup>

## **2.3. OCCUPATIONAL THERAPY AND MIND-BODY PRACTICES**

### **2.3.1. The role of occupational therapy**

An occupational therapist's role is to guide and assist clients towards participation and optimal performance in daily occupations.<sup>45</sup> Daily occupations consist of activities of daily living, instrumental activities of daily living, health management, rest and sleep, education, work, play, leisure, and social participation. These overarching occupation categories encapsulate various occupations, for instance, the occupation of grocery shopping that is an example of an instrumental activity of daily living.<sup>45</sup>

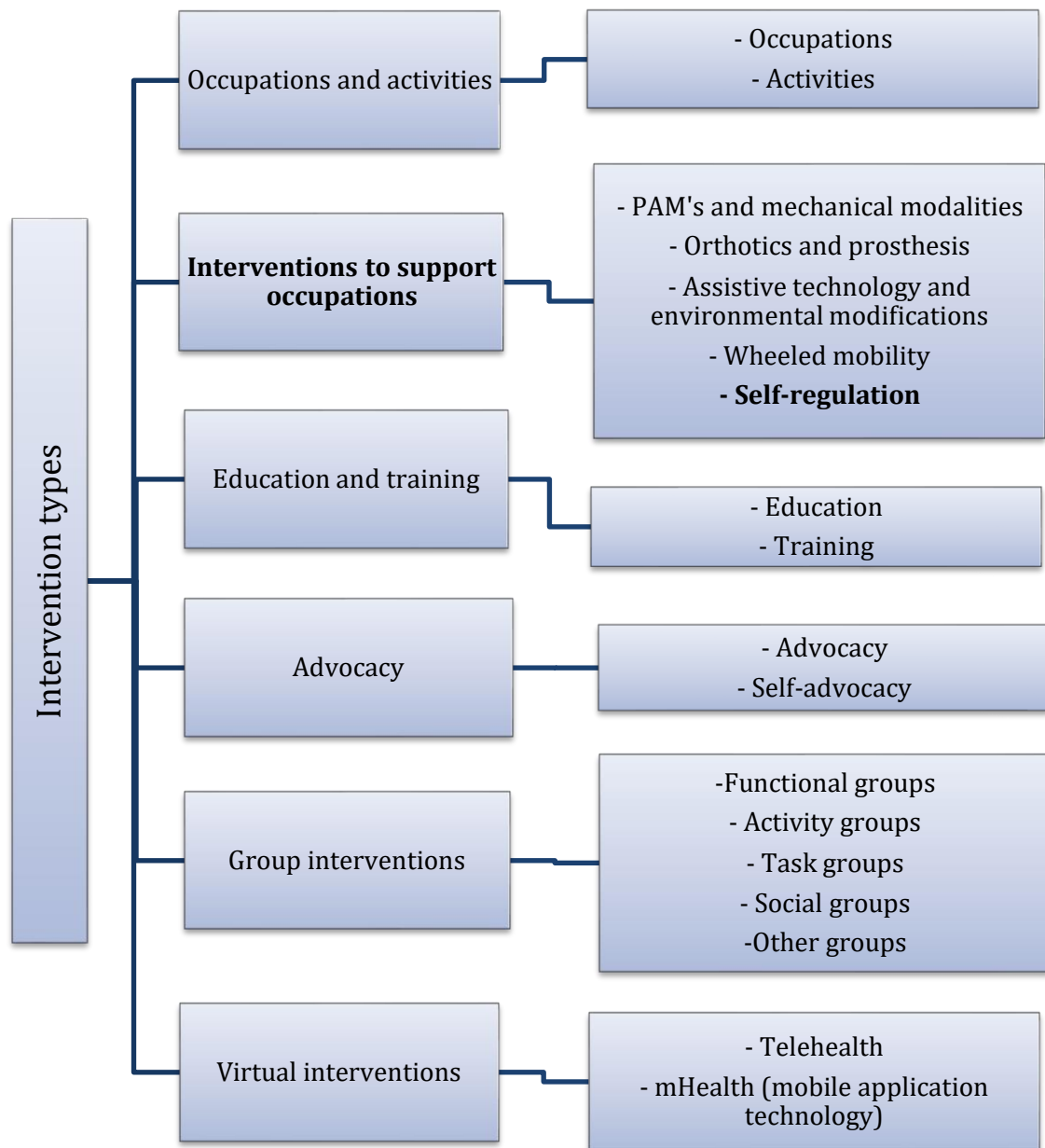
Clinically significant stress and anxiety can lead to affected participation and performance in occupational areas.<sup>62</sup> By leading to emotional dysregulation, stress and anxiety affect client factors, such as the specific mental function of emotion,<sup>45,62</sup> but also several other domains, namely a person's performance skills, performance patterns and daily occupations.<sup>19,45</sup> Client factors are a client's specific body functions, structures and beliefs, while performance skills consist of a person's process skills, motor skills and social interaction skills. Performance patterns encompasses a client's routine, rituals, roles and habits.<sup>45</sup>

Client factors typically affected by stress and anxiety include mental body functions (emotional regulation,<sup>19,62</sup> attention<sup>44,54</sup> and memory<sup>44,54</sup>), global mental functions (psychosocial aspects,<sup>19</sup> energy<sup>19,44</sup> and sleep<sup>19,44,54</sup>) and body system functions (immune,<sup>54</sup> cardiovascular, digestive and metabolic functions<sup>54</sup>). With regards to



performance skills, for example, an anxiety-related tremor could hamper motor skills, affected cognitive abilities could slow down process skills,<sup>19</sup> and social withdrawal could limit initiation of conversations in social skills.<sup>19</sup> Furthermore, stress and anxiety could lead to the dysfunctional performance patterns of e.g. substance abuse,<sup>19,63</sup> altered eating patterns,<sup>19,64</sup> and social withdrawal.<sup>19,65</sup> By affecting all these domains, stress and anxiety also hampers the occupations of work, instrumental activities of daily living, social participation, leisure,<sup>62</sup> as well as health management.<sup>19</sup>

Interventions used by occupational therapists to address these affected domains are organised within the following categories in the fourth edition of the Occupational Therapy Practice Framework (OTPF-IV),<sup>45</sup> indicated in Figure 2.1: occupations and activities; interventions to support occupations; education and training; advocacy; group interventions; and virtual interventions.<sup>45</sup>



**Figure 2.1.** *The OTPF-IV Categorisation of Occupational Therapy Intervention Types*<sup>45</sup>

These interventions can also be divided into two different approaches, namely a bottom-up or top-down approach. With a top-down approach, an affected occupational area is addressed directly with later consideration of the related foundational skills,<sup>66</sup> while with a bottom-up approach, deficits in client factors and other basis skills are addressed first, with the aim of improvement carrying over to occupational functioning.<sup>66-67</sup>

The focus of this literature review will be on mind-body practices, which can be considered a self-regulation technique, falling within the category of interventions to support occupations.<sup>45</sup> According to the OTPF-IV, self-regulation techniques address specific client factors, in this case emotional regulation, and, therefore, can be considered a bottom-up approach. Mind-body practices could also be classified within the group intervention category, as it could be used within a group setting as well.<sup>45</sup>

### **2.3.2. Mind-body practices to improve participation**

Mind-body practices are classified as a nonconventional or complementary and alternative medicine (CAM) treatment.<sup>16,68</sup> CAM is defined as healthcare practices that fall outside mainstream treatment and are not part of standard medical care.<sup>68</sup> Mind-body practices are acknowledged as treatment for mental health conditions by Lake<sup>16</sup> in Kaplan and Sadock's Comprehensive Textbook of Psychiatry. Relaxation techniques and mindfulness meditation are two modalities within the mind-body treatment category<sup>16-17</sup> that are used by occupational therapists to improve participation and functioning in their clients.<sup>18-22</sup> These techniques are classified as self-regulation techniques in the OTPF-IV, and are interventions that support occupations.<sup>45</sup>

Various authors<sup>19,63,69-73</sup> recommend the use of mind-body practices to improve participation and function. These techniques are used as part of occupational therapy intervention for clients with mental health diagnoses (e.g. anxiety-related disorders,<sup>19</sup> mood disorders,<sup>74</sup> personality disorders,<sup>70</sup> drug- and alcohol-related disorders<sup>63</sup>), for children with mental health difficulties,<sup>72</sup> as well as for mental health promotion in the community.<sup>75</sup> They could, however, also be used for clients diagnosed with physical injuries and chronic pain,<sup>20,49</sup> long-term neurological conditions,<sup>20,48</sup> and cognitive and developmental disorders,<sup>20</sup> as these conditions also lead to stress and anxiety due to participation- and occupational performance difficulties.

Mind-body practices recommended in the occupational therapy literature are mindfulness-based meditation (see Section 2.3.2.1)<sup>20,22,49,76</sup> and relaxation

techniques. Relaxation techniques, include deep breathing (Section 2.3.2.2),<sup>16,19,69</sup> progressive muscle relaxation (PMR) (Section 2.3.2.3),<sup>16,19,47,73</sup> and guided imagery (GI) (Section 2.3.2.4).<sup>16,69</sup> An additional relaxation technique, namely systematic desensitisation, is mentioned in Kaplan and Sadock's Comprehensive Textbook of Psychiatry and also listed in a review article on occupational therapy-led interventions for clients with anxiety and stress.<sup>16,18</sup> Relaxation and mindfulness training is used as a means to counteract the body's stress response by eliciting the relaxation response and reducing arousal levels.<sup>21</sup> See Annexure B for a research summary on mind-body practices compiled by the researcher from the results of an informal literature search on a single database platform, EBSCOhost.

#### *2.3.2.1. Mindfulness-based meditation*

Mindfulness-based meditation is a technique used to guide a client in becoming aware of- and attentive to the present moment, including bodily sensations and emotions, without judgement.<sup>77</sup> The focus is on lived experiences, taking thoughts away from future- and past-focused thoughts that lead to anxiety.<sup>20,77</sup> Mindfulness may, therefore, improve occupational engagement by helping a client to reach the state of "flow", experiencing timelessness when optimally engaged in an activity.<sup>20,76</sup> Supporting evidence for the use of this technique in healthcare to address anxiety, depression, chronic pain, stress, quality of life and even cognition is increasing.<sup>20,22,49</sup>

The effects of mindfulness intervention on healthy adults (without a diagnosed condition),<sup>78-81</sup> children,<sup>81</sup> and older adults with-<sup>22,82</sup> and without dementia<sup>83</sup> have been summarised in reviews, presented in Annexure B. Overall, there was an indication of improvement in anxiety, stress and depression in these population groups, with some indication of improved quality of life and maintained cognitive function in older adults with dementia. A review of mindfulness intervention on the physical rehabilitation population<sup>20</sup> indicated improved adaptation to illness, improved quality of life, and acceptance of pain symptoms. The reviews recommended increased quality and quantity of research studies, due to the heterogenous nature of the characteristics of the studies, different types of intervention programmes, and publication bias. A widely recognised mindfulness-based relaxation technique is Mindfulness-based stress reduction (MBSR).<sup>20</sup>

#### 2.3.2.2. *Deep breathing*

During deep breathing, a client is taught to take deep breaths, inhaling deep into the abdomen.<sup>60</sup> Deep abdominal breathing assists in increased oxygen supply to the brain and muscles, directing the client's focus to the body, as well as normalising autonomic arousal by activating the PNS.<sup>60</sup> When a person is anxious, breathing is often shallow, fast and higher up in the chest area. In a relaxed state a person tends to breathe more deeply and from the abdomen.<sup>60</sup> During deep abdominal breathing exercises, a person is often encouraged to inhale slowly for a few seconds, pause for a few seconds, and then to exhale for a few seconds, with another pause for a few seconds before inhaling again.

Evidence in the literature,<sup>84</sup> presented in Annexure B, indicated that deep breathing may lead to decreased symptoms experience when implemented with conditions like anxiety, chronic functional constipation, pre-hypertension, gastroesophageal reflux disease, migraines and cancer-related eating problems.<sup>84</sup> The effects include lowered blood pressure and heart rate, as well as improved respiratory function and quality of life.<sup>84</sup> Conclusiveness of a review on available studies on deep breathing was, however, limited due to poor quality of the included studies and considerable heterogeneity between the studies.<sup>84</sup> When used by healthy adults, research indicated that diaphragmatic breathing could assist in lowering physiological and psychological stress.<sup>85</sup>

#### 2.3.2.3. *Progressive muscle relaxation*

Another relaxation practice, PMR, is a technique during which sixteen different muscle groups, from the head and face to the feet, are tensed and released systematically in sequence to produce a deep relaxed state.<sup>60</sup> The client is also usually guided in maintaining focus on the muscles to limit distracting thoughts.<sup>60</sup> According to Bourne,<sup>60</sup> it is especially successful in people where anxiety is related to muscle tension, therefore helping to decrease anxiety and tension-related symptoms like headaches, backaches, jaw tightness, tension around the eyes, muscle spasms, high blood pressure and sleep difficulties.<sup>60</sup>

One systematic review indicated possible improvement in health-related outcomes for cancer patients, with effects on anxiety, depression, self-esteem, nausea and vomiting.<sup>86</sup> The majority of other reviews looked at studies on relaxation techniques in general, with PMR being one of the techniques reported on in the summaries. This hampered a clear picture of the benefits of PMR on other diagnostic groups and populations. In these studies, improved sleep in older adults were indicated when PMR was used as part of a multi-component approach,<sup>87</sup> and possible improvement in stress levels in people with addictive behaviours was indicated when applying PMR.<sup>88</sup> A randomised controlled trial (RCT) indicated improved quality of life in women postpartum after the use of PMR.<sup>89</sup> The studies are also listed in Annexure B.

#### 2.3.2.4. *Guided imagery*

Guided imagery is a relaxation technique that guides a person in focussing on positive, relaxing images, which then leads to relaxation.<sup>60</sup> A person usually lies down with the eyes closed and listens to a downloaded auditory guide, assisting the person in visualising peaceful settings.<sup>60</sup>

Evidence in the literature with regards to the effectiveness of guided imagery is very limited, compared to the other techniques. Limited evidence supporting guided imagery was confirmed by Meghani et al. in an integrative review.<sup>90</sup> The review indicated marginal positive effects in the usefulness of guided imagery in managing pain, insomnia and anxiety in critically ill patients. Two of the included studies, where guided imagery was used in combination with other complementary therapies, reported statistically significant, clinically improved outcomes. According to Lake,<sup>16</sup> in Kaplan and Sadock's *Comprehensive Textbook of Psychiatry*, guided imagery was indicated to be effective in improving sleep in patients where worrying thoughts hampered their ability to fall asleep, compared to PMR, which is effective for people where somatic complaints affect sleeping ability.

#### 2.3.2.5. *An alternative mind-body technique*

TRE could also be considered a mind-body technique. To determine into what mind-body category TRE falls as a treatment technique, a clear understanding of the similarities and differences between mindfulness approaches and relaxation practices is required. In an article by Luberto et al,<sup>17</sup> the authors give an evidence-informed perspective on these similarities and differences. One of the main differences between the techniques is that during mindfulness approaches, a client is taught to accept the present psychological and physical discomfort to limit struggling with thoughts and feelings, while during relaxation practices the aim is to teach a client to change physical and psychological discomfort by eliciting the relaxation response.<sup>17</sup>

Many mind-body practices, however, are multi-modal by incorporating aspects of mindfulness and relaxation practices. Relaxation practices often incorporate mindfulness, for instance, when during deep breathing the client's attention is focussed on the present moment and their physical sensations with openness and acceptance. During mindfulness practices, the relaxation response is also often elicited, leading to a sense of calmness.

TRE could potentially be classified as a mind-body relaxation practice, where the purpose is to elicit a relaxation response. Aspects of mindfulness are, however, also incorporated, where the client is encouraged to be aware of their physical sensations and to allow and experience their emotions in the present moment.<sup>23</sup>

## **2.4. TRAUMA RELEASING EXERCISES**

As mentioned above, TRE could be classified as a relaxation technique. It has a somatically-based approach,<sup>4,15</sup> while also incorporating aspects of mindfulness.<sup>23</sup> During this intervention, the body's natural tremor mechanism is used to relieve built-up tension by eliciting a relaxation response.

### **2.4.1. The development of TRE**

Berceli developed TRE after many years of working in countries affected by war and other disasters.<sup>6,23</sup> During traumatic conflict situations, he noticed that the majority of people assumed a protecting “foetal” position with contracted anterior flexor muscles.<sup>6,23</sup> He deduced that the repeated activation of these flexor muscles lead to built-up tension and theorised that if this tension could be released, it may diminish the body’s survival response and lead to stress relief.<sup>15</sup>

The psoas muscle group (consisting out of the psoas major and psoas minor muscles) was identified as specifically important in this process, due to being part of the primary flexor muscles that contract when a person is in danger.<sup>6</sup> The psoas major muscle originates on the transverse processes and vertebral bodies of the 12<sup>th</sup> thoracic vertebra and the first to fifth lumbar vertebrae, as well as their associated intervertebral discs. The muscle then inserts on the lesser femoral trochanter and connects the upper body with the lower body.<sup>91</sup> The psoas minor muscle stretches from the first lumbar vertebrae to the superior pubic ramus. The psoas major and iliacus muscles (which stretch from the anterior surface of the ilium to the lesser femur trochanter) form the iliopsoas muscle, which is responsible for hip flexion.<sup>91</sup>

Berceli additionally observed that after a traumatic event, children usually tremored, while adults did not.<sup>1,6</sup> Adults’ higher cortical control over the tremor response allows for increased attention to- and processing of relevant threat-related information in the moment, in order to plan for escape.<sup>92-93</sup> It was also discovered during interviews by Berceli that adults tried to suppress their body’s natural tremor mechanism in order to hold up appearances and not show weakness.<sup>23</sup> Higher cortical control is beneficial in the immediate situation, but it is theorised that over the long run, it hampers the body from release of stress-related tension. The TRE exercises were developed to elicit the suppressed, natural tremor mechanism and signal to the body that it is safe to return to a state of rest.<sup>6</sup>






### **2.4.2. The TRE exercise routine**

The TRE technique consists out of seven stretching exercises. The focus of the intervention is on fatiguing the major muscle groups of the legs and pelvis, especially the hip flexor muscles (which includes the psoas muscle group),<sup>6,23</sup> while also stretching and stressing specific myofascial patterns.<sup>50</sup> This is done to elicit spontaneous neuromuscular tremors in the body.<sup>6,23,50</sup>

The first six exercises are performed in standing, while during the last exercise the person is expected to lie down on the floor in a position that activates the tremors. Table 2.1. provides more detail on the exercises.

**Table 2.1. The TRE Exercise Routine**

Exercise 1	Photo demonstration	QR code for video demonstration
<p>Standing with legs apart just beyond shoulder-width and feet pointing forwards, the feet are tilted to one side so that weight is shifted onto the lateral aspect of one foot and the medial aspect of the other foot. This position is held for a few seconds after which the feet are tilted towards the other side and held for a few seconds. These movements are repeated five to eight times, stretching and stressing the muscles responsible for inversion and eversion of the feet. After the exercise, the legs are shaken to relieve any discomfort.<sup>94</sup></p>		
<p><b>Exercise 2</b></p> <p>With one foot placed in front of the other, all the body weight is transferred to the front leg (the back leg can be lifted, and one hand placed on the wall for balance). The heel of the front foot is then lifted as high as possible and lowered for five to eight repetitions or until fatigue is experienced. In a standing position, the one leg is then shaken to relieve pain or discomfort after which the exercise is repeated on the other leg. During this exercise the calf muscles are fatigued.</p>		

### Exercise 3

### Photo demonstration

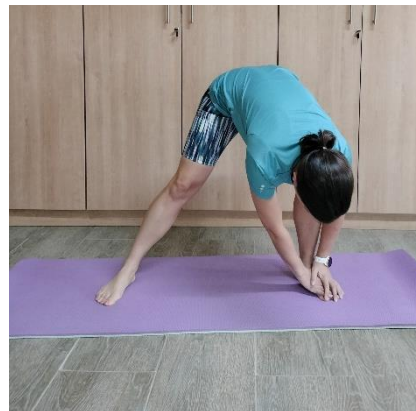
### QR code for video demonstration

During this exercise, both hands are placed on the floor close to the feet, bending forward with the upper body. The one leg is lifted off the floor with knee flexed, while all the body weight is placed on the other leg. The knee of the weightbearing leg is then flexed and straightened to place strain on the quadriceps muscle. This movement is repeated five to ten times, depending on the person's strength and ability. The exercise is repeated on the other leg. This exercise can be modified when a client suffers from knee or back pain.



### Exercise 4

The legs are spread apart, knees slightly flexed, so that the inner thigh adductor muscles are stretched. During trunk flexion, the client touches the floor, if possible, and takes three deep breaths. This position places strain on the hamstring muscles as well. The hands and upper body are then moved to the one foot, still in trunk flexion, where the position is held for three deep breaths. The exercise is repeated towards the other leg. Next, moving towards the middle in trunk flexion, the person stretches backwards to behind the legs, for three deep breaths. After slowly coming up in a standing position, the legs are shaken to relieve discomfort.



### Exercise 5

### Photo demonstration

### QR code for video demonstration

The legs are again spread open wide with hands placed partly on the lower back and buttocks for support of the lower back. The pelvis is then pushed forward to stretch the psoas muscle group, but with a natural arching of the back. The upper body and hips are then turned towards one side to look over the one shoulder, maintaining the arched back. In this position three deep breaths are taken. The exercise is then repeated towards the other side. The body is lastly turned to face forward with pelvis still pushed forward, taking three deep breaths again.



### Exercise 6

During this exercise, the client is directed to sit in a squat position against the wall, as if there is a chair underneath him or her. This position places strain on the quadriceps muscles. After a few minutes, pain or even slight shaking could be experienced. To relieve pain, the client can move their back slightly up the wall a few centimetres and continue. The client is directed to find a position where the legs are shaking, but there is no pain. This position is held for approximately three to five minutes, after which the person can stand up and bend forward to reach the floor, if possible, with the knees slightly bent. This “hanging” position is held for another minute.



## Exercise 7

## Photo demonstration

## QR code for video demonstration

During this exercise, the client lies down on the floor in the “butterfly” position with soles of the feet together and knees relaxed and open in abduction. In this position, the pelvis is lifted off the floor for 30 seconds to a minute, again stretching the psoas muscle group as well as the inner thigh adductors. The pelvis is then lowered back to the floor with the knees relaxed and in abduction. The client is instructed to adduct the knees slightly, only centimetres at a time, to elicit a tremor response. The feet can then be placed flat on the floor with the knees still flexed and the body trembling. The tremor is allowed to move into the pelvis and lower back if possible. Initially a person should not tremor for longer than 15 minutes, due to body fatigue. At the end of the exercise, the legs are extended so that the client is lying flat on the floor. The client can rest in a supine, prone or side-lying position, depending on what is most comfortable.<sup>15</sup>



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During these exercises, a person is advised to breathe deeply and to focus on their breath and body sensations. Thoughts should be brought back to the breath and sensations. Self-regulation techniques are taught and monitored during TRE to enable the person to tolerate- and experience physical sensations, cognitions and emotions without becoming overwhelmed. When experiencing an intense emotion, it is advised to continue breathing deeply and to allow the emotion until it subsides. A person is, however, advised to stop anytime during the process should they feel overwhelmed.<sup>23,94</sup>

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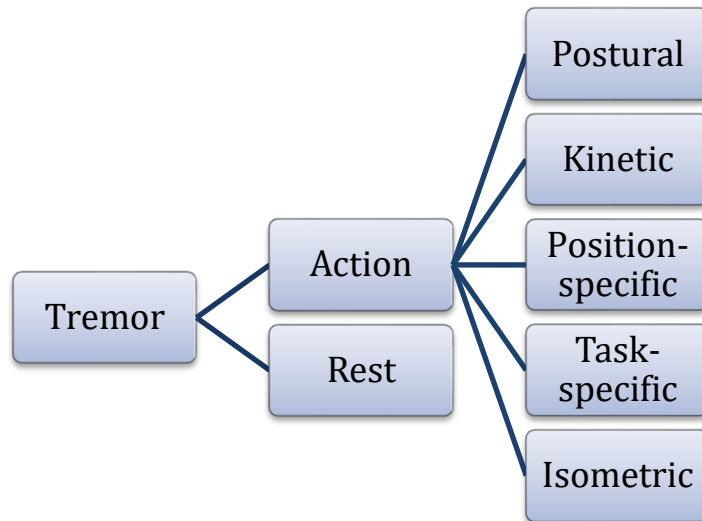
When a person is new to TRE, the tremor response is allowed for a limited duration of 15 minutes, but as the person's body gets used to the technique and its effect on the body, it can be performed for longer periods of time.<sup>6</sup> It is recommended to initially perform the exercises for three to four times a week during the first month of treatment, after which the frequency could be reduced to approximately twice a week.<sup>6,94</sup>

According to the training manual, the exercises can be modified for the elderly or people with disabilities if, for instance, they experience difficulty lowering down and getting up from the floor.<sup>1</sup>

### **2.4.3. Tremors**

In the medical- and health field a tremor is defined as: "...an involuntary, rhythmic, oscillatory movement of a body part."<sup>95(p.2)</sup> Physiological tremors are present in varying degrees in all healthy normal people.<sup>95-98</sup> Physiological tremors are usually not visible or symptomatic<sup>95</sup> and can be present during different conditions, for instance, task execution, maintenance of a posture, and during rest.<sup>96,98</sup> These tremors should be differentiated from pathological tremors, which are typically visible, continuous and debilitating.<sup>95</sup> Physiological tremors result mainly from homeostatic, peripheral movements of joints and muscles in order to maintain posture and move limbs.<sup>96</sup> These tremors can be intensified by drug intake, certain medical conditions, as well as by fatigue and stress. When intensified, the tremors are called enhanced physiological tremors due to increased amplitude oscillations.<sup>98</sup>

Tremors can also be categorised phenomenologically into two categories, namely resting tremors and action tremors.<sup>99</sup> Resting tremors are present when the body part is fully supported against gravity and the muscles are not actively contracting.<sup>99</sup> Action tremors are present during voluntary movement and muscle contraction, and can be divided into postural, kinetic, position-specific, task-specific and isometric tremors, as indicated in Figure 2.2.<sup>96,99</sup>



**Figure 2.2.** *Phenomenological Categorisation of Tremors*<sup>96,99</sup>

Postural tremors occur when maintaining a posture against gravity, while kinetic tremors are present during movement and include initial tremors, dynamic tremors, and intention- or terminal tremors.<sup>99</sup> Position-specific tremors occur when holding a certain posture, and task-specific tremors occur during a specific task or are exacerbated during the task. Isometric tremors occur during muscle contraction against resistance, but where there is no change in position of the affected body part.<sup>96,99</sup> Physiological tremors and enhanced physiological tremors can be categorised under postural tremors and kinetic tremors.<sup>96</sup>

In the TRE literature, it is theorised that not all types of tremors are pathological or have to be treated with medication.<sup>15</sup> The word ‘tremor’ is often associated with pathology and disease<sup>50,100</sup> and trembling or shaking are usually indicated as a symptom of certain mental health conditions<sup>100</sup> and certain neurodegenerative disorders.<sup>101</sup> Therefore, a tendency can be observed in the medical field of using medication to address this perceived pathological symptom. Tremors could, however, in certain circumstances, be the body’s innate mechanism of completing the stress response and relieving built-up tension.<sup>6,15,50</sup> There has, unfortunately, not been much focus in research on the therapeutic potential of tremors.<sup>15,50</sup>

It is theorised that the tremors elicited during TRE assist with the release of built-up tension and are, therefore, non-pathological and beneficial.<sup>6,15,50</sup> The tremors

experienced during TRE are mostly referred to as self-induced, unclassified therapeutic tremors<sup>3,10,50,102-103</sup> or neurogenic tremors.<sup>5,50,103-105</sup> The tremors are described as most similar to enhanced physiological tremors, but with unique activation conditions, frequency, amplitude and topography.<sup>4,10</sup> These tremors are basically action tremors, activated posturally and isometrically, widely distributed, and with variable amplitude and frequency.<sup>10</sup> Porges<sup>15</sup> theorised that isometric tremors, which are tremors that could also be occurring naturally, increase the amplitude of the physiological tremors, leading to the tremor experienced during TRE. These tremors could be the nervous system's innate way of down-regulating the ANS to a state of homeostasis, discharging excess energy from the body's readiness to react to a situation in fight, flight or freeze.<sup>6</sup> It is theorised that as these tremors move through the body, they assist with the release of deep chronic muscle tension and, when used on a regular basis, could help to prevent the small stressors of everyday life to develop into chronic tension.<sup>6</sup>

#### **2.4.4. Theories supporting TRE**

Berceli used several theories to make sense of- and explain his technique.<sup>15</sup> Amongst these theories were his own theory on the body's instinctual reaction to trauma, Scaer<sup>106</sup> and Levine's<sup>107-108</sup> theory on a tremor mechanism in animals and how it relates to human behaviour, and, lastly, Porge's Polyvagal theory.<sup>109</sup>

##### *2.4.4.1. The body's reaction to trauma*

As mentioned in Section 2.3.1., Berceli<sup>6,23,104</sup> theorised that the human body is hard-wired to assume a protecting "foetal" position during traumatic situations, which results in built-up tension in the anterior flexor muscles when these muscles are repeatedly activated. He linked this protecting reaction to the fight/flight response initiated by the ANS and, therefore, postulated that if the built-up muscle tension in the anterior flexor muscles could be released, it may diminish the body's survival response, returning the nervous system to a state of homeostasis.<sup>15,94</sup> Berceli<sup>6</sup> highlighted the role of the psoas muscle group in this process, as these deep-set muscles form part of the anterior flexor muscles that contract during the startle



reflex, usually triggered in defense.<sup>23,110</sup> One of the aims of the exercises done in TRE is to release tension in this specific muscle group.<sup>94</sup>

#### 2.4.4.2. *The animal model*

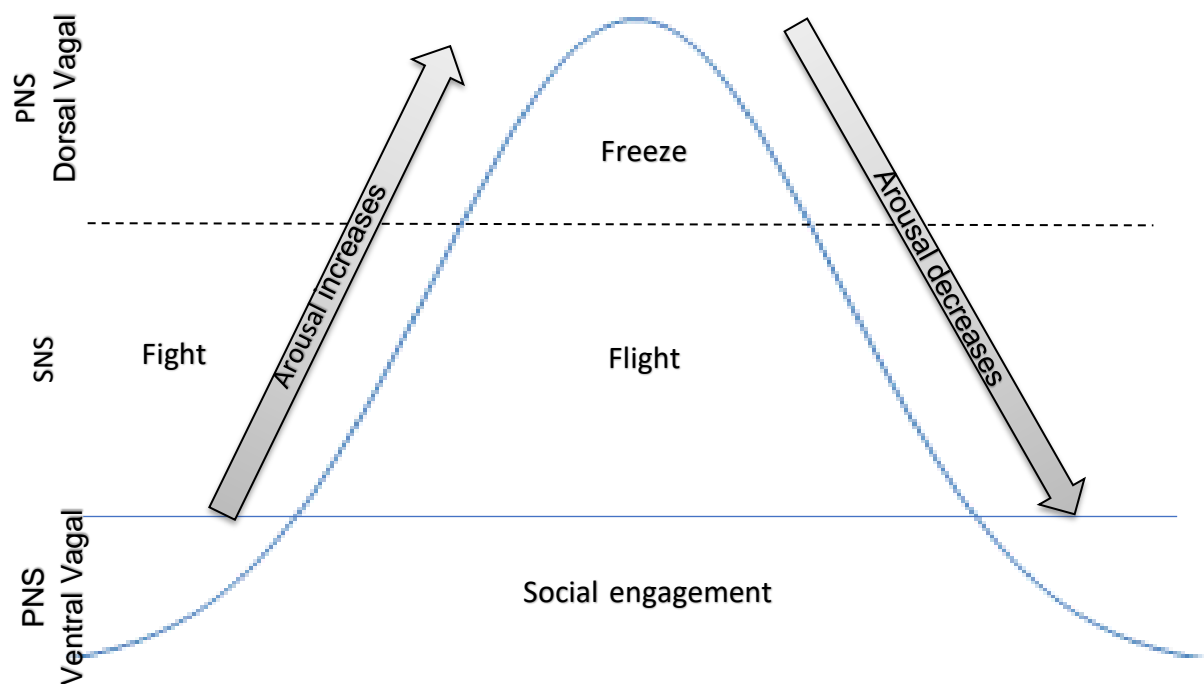
In addition to observing an instinctual defensive posture, Berceli<sup>23</sup> also noted that children tremored during traumatic experiences, while the adults in the same situation did not. He postulated that the children's response were similar to that of animals after encountering trauma.<sup>6</sup> He based his opinion on Levine's animal model of the fight, flight and freeze response.<sup>107-108</sup> Scaer<sup>106</sup> and Levine<sup>107-108</sup> wrote about an innate tremor mechanism that can be observed in wild animals in their natural setting, when trembling or shaking after a life-threatening experience. Should an animal manage to survive a threat by fleeing, fighting or remaining in an immobilised state for a period of time, its body usually tremors or shivers afterwards. After this response, the animal usually seems fully functional and mobile again.<sup>107</sup> The opposite was also observed. It has been noted that when captured animals were released back into the wild and they have not gone through the instinctive tremor response, they usually do not survive.<sup>108</sup> Scaer<sup>106</sup> and Levine<sup>107-108</sup> theorised that a decreased ability to adapt to the demands and threats in the wild were indicated when the animal did not go through the tremor response after captivity.

Berceli<sup>105</sup> agreed with Levine<sup>107-108</sup> and Scaer<sup>106</sup> that humans share this innate tremor mechanism with the animal species, but that the majority of humans were generally socialised out of the tremor response and, as a consequence, develop stress-related illnesses.<sup>6,106-108</sup> It is postulated that the inability to release the built up energy from the nervous system's fight, flight or freeze response leads to an imbalanced, hyper-aroused or even hypo-aroused ANS.

#### 2.4.4.3. *The Polyvagal theory*

Porge's Polyvagal theory provides a useful framework for explaining the TRE mechanism and its therapeutic effect over time.<sup>4,15</sup> Traditionally, the ANS is divided into two branches, namely the SNS responsible for fight and flight behaviours and the PNS responsible for either health, growth and restoration when safe, or for an

immobilised response when in danger. According to the Polyvagal theory, the ANS consists out of three parts:<sup>111</sup> the SNS and two branches of the vagus nerve. The vagus nerve, which is the tenth cranial nerve and forms a major part of the PNS, has a ventral vagal branch responsible for “rest, digest and calm”, and a dorsal vagal branch responsible for an immobilised state.<sup>111</sup> Figure 2.3.<sup>112</sup> indicates the three states or levels of nervous system responses, which, according to Polyvagal theory, are linked to the three ANS branches: social engagement linked to the PNS’s ventral vagal nerve; fight or flight linked to the SNS; and freeze, which is linked to the PNS’s dorsal vagal nerve.



**Figure 2.3.** *The Polyvagal Theory's Stress Response (based on Walker)<sup>112</sup>*

The Polyvagal theory indicates that a person’s nervous system unconsciously monitors the environment for signs of risk or safety, with responses ordered hierarchically, depending on the situation.<sup>111</sup> If a person feels safe, social engagement (parasympathetic ventral vagal state) is activated, a state during which connection with others, regulation and a feeling of safety are possible. If a person senses danger, the fight/flight system (SNS) is activated and the body is mobilised and ready for action. However, if the nervous system perceives the danger as

becoming life threatening, the body will move into an immobilised state (parasympathetic dorsal vagal state).<sup>111</sup> It is theorised that TRE assists a person in discharging built-up energy from the defensive responses of fight, flight and freeze. It, therefore, decreases arousal levels, activating the ventral vagal part of the PNS, so that the person can move back into the social engagement state.<sup>15</sup>

These explanations on the mechanism and effect of TRE are based on theories, and Berceli himself stated: “...I want to propose some theories about the tremor mechanism...These theories come directly from the feedback of people’s experiences. Because of this, they are always subject to change, scrutiny and revision.”<sup>15(p18)</sup> Therefore, uncertainty exists around how the tremor mechanism works and its effect on the body. Albeit the case, the purpose of this study is not on proving or disproving any theories, but rather to investigate the characteristics and effects of TRE treatment itself.

#### **2.4.5. TRE compared to other mind-body practices**

As indicated in the literature, occupational therapists already make use of mind-body techniques to address stress and anxiety and improve clients’ participation in their life roles. As with mindfulness, deep breathing, PMR and guided imagery, TRE is a cost-effective technique that can be administered in groups and used as a self-help tool when the client has been familiarised with the technique.<sup>3-4,9-10,50</sup> However, aspects that could separate TRE from the other mind-body techniques are that TRE is a simpler technique to teach, with potentially less cognitive load and less reliant on language comprehension.

When there is no common language between the provider and client and communication is limited, the TRE provider can focus on visual demonstration of the exercises and guide the client in eliciting the tremors. Language is required when teaching and explaining a mindfulness technique, how to perform PMR, and when guiding a client in using GI. Deep breathing could be demonstrated with limited language, but an aspect of this technique is incorporated into the TRE routine.<sup>23</sup>

Furthermore, when a client is hypervigilant and easily distracted, which is often the case with traumatised and anxious clients, it could be difficult for the client to focus on a single aspect or thought during a mindfulness technique, or to focus on specific visual imagery. TRE is less taxing cognitively, as the initial main focus is on performing the physical exercises and breathing deeply, which then elicits a tremor response.

In the South African context, TRE would be a suitable technique to address stress, anxiety and trauma.<sup>113</sup> Within this multilingual, multicultural context, with a high prevalence of poverty and trauma,<sup>11-12</sup> TRE is a simple technique that could be taught with limited costs incurred and limited use of language.<sup>4-6</sup>

## **2.5. EVIDENCE-BASED PRACTICE**

Even though TRE could potentially be an appropriate therapeutic technique when considering the South African context, occupational therapists need to be aware of the evidence base for it in order to judiciously incorporate TRE into practice.<sup>24,35</sup> Health care practitioners are advised to base their decisions and practices on the best available scientific evidence, integrated with their knowledge and expertise, the client's preferences and values, as well as knowledge on the context where care is provided, for effective, quality treatment.<sup>24,35,114</sup> This decision-making process is called evidence-based practice (EBP).

### **2.5.1. The JBI Model of Evidence-based Healthcare**

A suitable model to guide the understanding of the evidence-based process, and to guide the TRE research synthesis process, is the revised JBI (formerly known as Joanna Biggs Institute) Model of Evidence-based Healthcare (EBHC), shown in Figure 2.4.<sup>35</sup> The JBI Model of EBHC is a non-linear, flexible model that indicates five major components required for an evidence-based healthcare process: evidence generation, evidence synthesis, evidence transfer, evidence implementation, and global health.<sup>35</sup>



**Figure 2.4.** JBI Model of Evidence-Based Healthcare (used with permission from Wolters Kluwer Health, Inc – Annexure C)<sup>35</sup>

Evidence generation, the first step of the evidence-based process, consists of research, expertise (and experience), and discourse. The outcomes of well-designed research studies are considered more credible, but when research on a specific topic or treatment does not yet exist, clinicians have to base their decisions on other sources of knowledge, such as opinions and anecdotes.<sup>25,115</sup> Discourse is also considered a type of evidence generation that involves communication on a specific topic through writing or debate, based on personal experience or anecdotes.<sup>35</sup>

The second step indicated by the model, evidence synthesis, comprises systematic reviews, evidence summaries and guidelines. Systematic reviews form the core of

evidence synthesis and can be considered secondary research. Evidence summaries or rapid reviews are conducted in a shorter period of time and are, therefore, sometimes suggested to address the needs of decision makers, policy makers and other knowledge users.<sup>116</sup> Guidelines, usually developed with rigorous methodology and informed by systematic reviews, are statements with recommendations for optimised patient care.<sup>35</sup> This study will focus on the second step of the evidence-based process, providing a synthesis of the available TRE evidence. The method of a scoping review, and not a systematic review, has been chosen due to the predicted limited scope and heterogenous nature of the research. A scoping review is a type of knowledge synthesis<sup>117</sup> that is used to explore and map the available evidence on a research topic.<sup>117</sup> It shares characteristics with a systematic review, in that it aims to be transparent, systematic and reproducible,<sup>116</sup> but it does not have a specific focussed clinical question.<sup>115</sup>

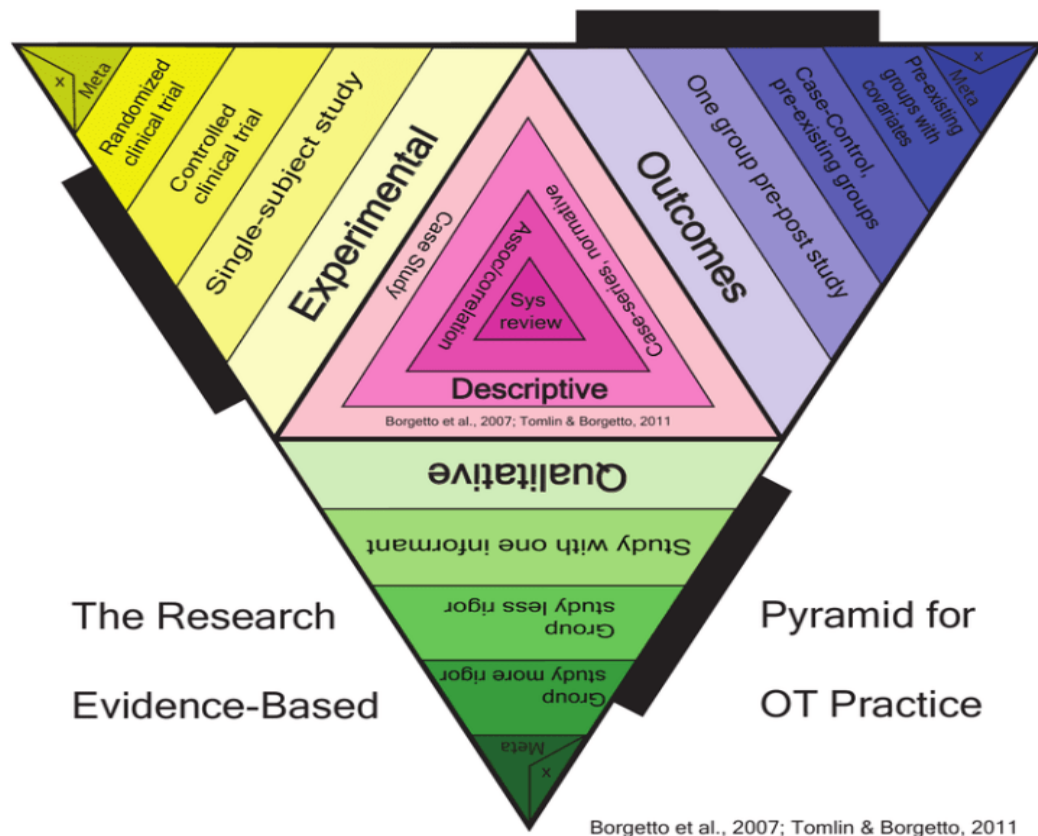
The last three steps of the JBI model of EBHC, following evidence synthesis, are evidence transfer, evidence implementation, and global health. During evidence transfer, methods of active dissemination are used, as well as systems integration and education.<sup>35</sup> Evidence implementation is achieved with context analysis, facilitation of change, and evaluation of the process and outcome.<sup>35</sup> Lastly, during the global health step, collaborative transnational research and work are encouraged, with priority on improving health and equity for people worldwide.<sup>35</sup>

This study aims to follow the EBHC research process in determining whether TRE could be used in modern evidence-based medicine. With no formal summary of the available evidence, this study will operationalise the second step of the JBI model, namely evidence synthesis.

### **2.5.2. The Research Pyramid**

Another model that should be considered during the scoping review study, is Tomlin and Borgetto's Research Pyramid for Evidence-based Occupational Therapy (OT) Practice,<sup>118</sup> as can be seen in Figure 2.5. In conventional research, certain research designs are considered superior to other designs, and are, therefore, typically arranged within a hierarchy with the most rigorous design at the top. In Tomlin and

Borgetto's more comprehensive model,<sup>118-119</sup> when folding the experimental, outcomes and qualitative triangles upwards, it forms a pyramid where the three sides are occupied by three different forms of research designs, and with descriptive research at the base.<sup>118</sup> These four categories of research are indicated as equal in the model, with the hierarchical aspect of increased rigour retained within each side to form a pyramid in a vertical dimension towards the point of highest rigour.<sup>118</sup>



**Figure 2.5.** *The Research Pyramid for Evidence-Based OT Practice (used with permission from Tomlin, Annexure D)*<sup>119</sup>

This model, which indicates that each category of evidence is equally valuable, has been developed for use within the occupational therapy evidence-based healthcare setting and aligns with the clinical reasoning requirements of occupational therapists.<sup>24</sup> This model will be useful, due to a variety of research designs typically included in a scoping review.

## **2.6. CONCLUSION**

As the literature indicates, TRE is a mind-body therapeutic technique that could be useful in the South African context. It could be used by occupational therapists to address stress and anxiety in their clients and improve participation. When applying the JBI model of EBHC for guidance in the research process and how to incorporate TRE as part of evidence-based practice, it was indicated that a summary of the research evidence is required. Furthermore, by considering the Research Pyramid's hierarchy of research designs, all types of studies were included in the review.

Guided by this study's aim and objectives, a summary of the TRE research literature will identify the possible populations and diagnostic groups that could benefit from this treatment; indicate what type of study methodologies have been used to study the effect of TRE; describe potential effective structuring of the TRE treatment programme; describe the cognitive, emotional, social and physical outcomes of treatment; indicate useful measurement tools to measure TRE treatment outcomes; as well as indicate limitations and gaps in the research literature. A summary and analysis of the research will, then, also guide the next step and direction of the continued evidence-based research process.



## **CHAPTER 3: METHODOLOGY**

### **3.1. INTRODUCTION**

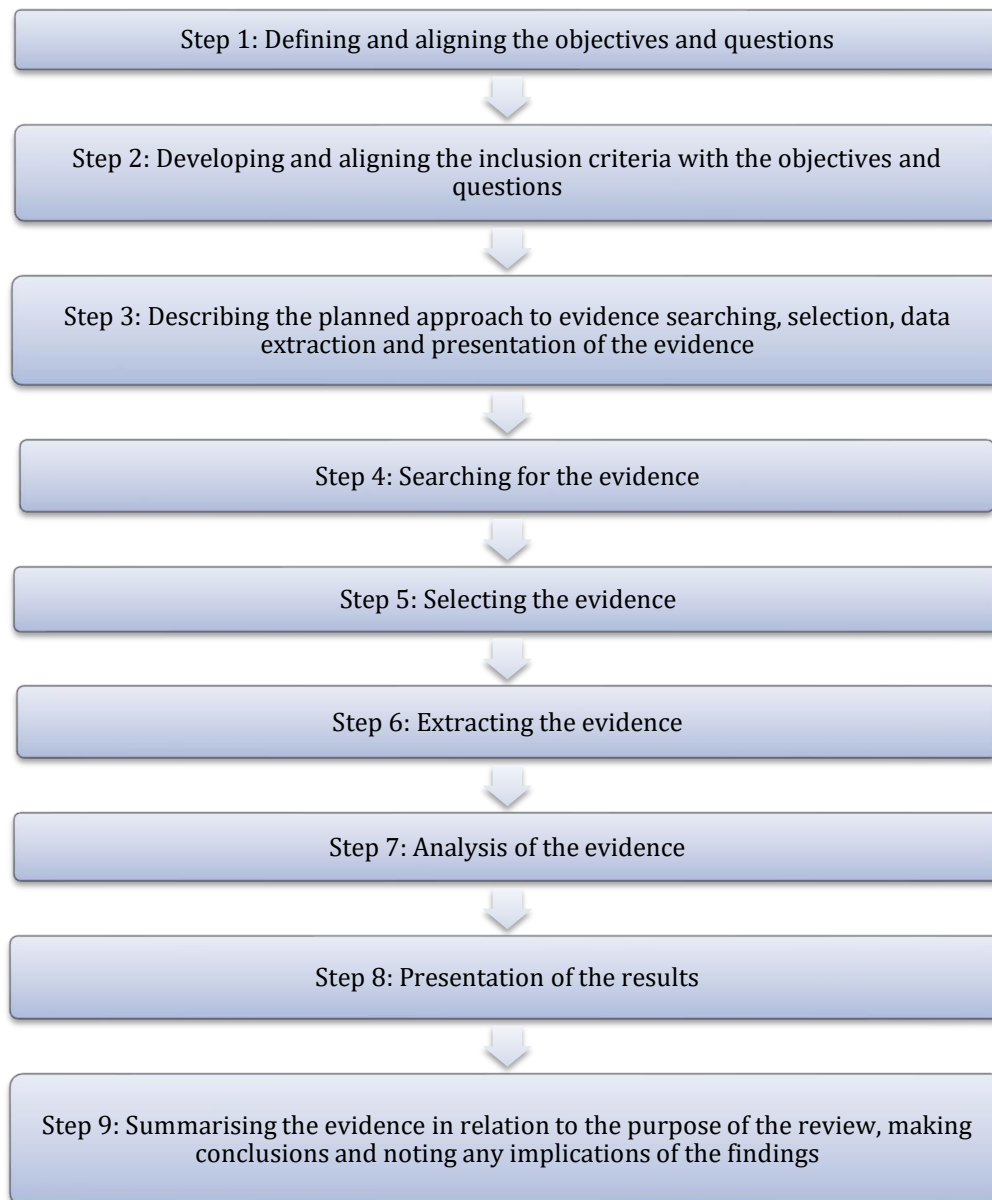
In this chapter, the study's methodology will be discussed, starting with a description of- and motivation for the use of the scoping review method. Thereafter, the eligibility criteria for the included literature will be addressed, before looking at the scoping review process. The description of the scoping review process will include the search strategy, selection of studies, extraction of the data, data analysis and, lastly, the presentation of the results. Aspects pertaining to quality, rigour, as well as ethical considerations will be discussed towards the end of the chapter, describing the steps taken and aspects considered during the research process to ensure good quality, ethical research.

### **3.2. RESEARCH DESIGN**

A scoping review is a review of the existing research on a topic, with the aim of knowledge synthesis, to guide further research and practice.<sup>120-121</sup> It is an ideal approach when the researched field is relatively new;<sup>122-123</sup> when there is a need to assess the extent, range and nature of research in a specific field; for summarising research evidence when the nature thereof is heterogenous;<sup>122-123</sup> and to determine the gaps in the literature.<sup>121-124</sup> The scoping review approach was considered suitable for this study, as Trauma Releasing Exercises (TRE) is a novel treatment technique with limited research support.<sup>125</sup>

### **3.3. RESEARCH METHOD**

The scoping review was conducted according to the JBI (formerly known as Joanna Biggs Institute) scoping review framework.<sup>122,125</sup> The JBI's methodology is based on Arksey and O'Malley's framework, published in 2005,<sup>125-126</sup> and incorporates Levac and colleagues' 2010 refinement of the steps.<sup>127</sup> The JBI scoping review framework consists of nine steps, indicated in Figure 3.1.<sup>125</sup>



**Figure 3.1.** *JBI Scoping Review Framework*<sup>125</sup>

To ensure a rigorous and transparent review, and accurate reporting of the results, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist was also used as a guideline.<sup>121</sup>

### 3.4. ELIGIBILITY CRITERIA

The process of determining eligibility for included records was guided by the aspects indicated in Table 3.1. The inclusion and exclusion criteria were developed keeping in mind the study's research question, aim and objectives. The overarching aim of this study is to describe the characteristics of TRE intervention studies. The study objectives are to describe the following study characteristics:

- i. The characteristics of the populations treated with TRE (including diagnostic groups).
- ii. The study designs and other methodological aspects utilised in the studies.
- iii. The structure of TRE treatment programmes used in the studies.
- iv. The measurement tools used to measure the TRE treatment outcomes.
- v. The recorded outcomes of the TRE treatment.
- vi. To identify the gaps in the literature, determining areas in which further research is required.

**Table 3.1.** *Criteria for Inclusion and Exclusion of Studies*

Eligibility aspect	Inclusion	Exclusion
Participants	Any population, from any context, including any country, in rural- and urban settings.  Any diagnostic groups, including healthy individuals, participants with mental health disorders, neurological disorders, physical disorders, or any other diagnostic category.	No exclusion with regards to participants, diagnostic groups or populations.
Concept	TRE as a treatment technique, with sufficient information provided to determine how TRE was applied.  Variations in TRE treatment structures, i.e. amount and frequency of sessions, duration of treatment, and group or individual sessions, as long as the full treatment protocol was followed.	Other somatically-based, mind-body approaches.  Studies where TRE was used in combination with another treatment technique, which affected the ability to measure the effect of TRE treatment alone.  Studies where it was clear that the full TRE treatment protocol was not followed.
Context	A therapeutic setting, where the purpose of TRE treatment was to improve participants' functioning on a physical, emotional, cognitive or social level.	A non-therapeutic setting.

Eligibility aspect	Inclusion	Exclusion
	Studies from any country, in rural- and urban settings.	
Types of sources	<p>All available intervention studies (peer reviewed and non-peer reviewed) where the outcomes of TRE treatment has been measured quantitatively or qualitatively.</p> <p>Academic journal articles, academic books or book chapters (including eBooks and eBook chapters), dissertations, medical reports, case reports and other informal reports with detailed treatment results, conference papers, as well as academic posters with detailed study results.</p> <p>English studies, as well as foreign language articles when a full English abstract with detailed study results was available.</p> <p>Literature published up to November 2022, the month in which the data search was completed.</p>	Magazine articles, blogs, podcasts, websites, wire feeds, advertisements and community briefs.
Study designs	Empirical studies.	Literature reviews, theory papers, expert opinions and editorials.

### 3.5. PROTOCOL

The JBI scoping review framework recommends a planned approach to evidence searching, literature selection, data extraction and presentation of the evidence before starting with the actual process. Planning of the research process was done according to the guidelines of the JBI scoping review framework during the development of the research proposal for the research ethics committee.<sup>125</sup> This planned approach was followed, refined and adjusted as necessary throughout the review process. The review protocol was not registered, as registration of a scoping review protocol was not yet required at the time of this study.<sup>125</sup>

### 3.6. SEARCH STRATEGY

Following the formulation of a detailed review plan, the next step in the JBI scoping review process is to search for the evidence. A three-step search strategy, as

recommended by the JBI, was followed to identify all relevant literature. These steps included an initial pilot search during which the search terms were refined, a final search of all the relevant databases, and, lastly, a hand search of relevant reference lists. Assistance from an information specialist was obtained throughout the search process and reporting of the process was guided by the PRISMA-ScR checklist.<sup>121</sup>

### **3.6.1. Pilot search and refining of search terms**

Preliminary search terms were chosen, with the assistance of an information specialist, by considering terms that were most frequently used in the TRE literature. A Boolean search string was developed from these terms and used during an initial search of a database, Scopus. Three additional terms, identified during an informal search of available TRE-related articles, were added to the list and tested during the final pilot search. Two research platforms, Web of Science and EBSCOhost, were searched with the assistance of the information specialist. The final search terms and Boolean search string can be seen in Table 3.2. (see next pages). Details on the search terms and refinement process are indicated in Annexure E.

### **3.6.2. Final search**

A final, detailed search was performed across all suitable electronic databases, using the search terms identified during the pilot search. The information specialist provided guidance regarding suitable online databases and platforms, as well as the appropriate search strategies used on each database and platform. The intention was to cover as many different databases as possible, to ensure that all TRE-related literature, including grey literature, would be identified. Individual databases used were Web of Science, Scopus, PubMed, UPSpace Health Sciences and NIH library. Database platforms used were EBSCOhost and ProQuest Central. The search was finalised on 22 November 2022. A final consultation with two information specialists at the end of November confirmed that all possible appropriate databases were covered during the search. See Table 3.2. for details regarding the final search strategy and results.

**Table 3.2. Final Search: Search Strategy and Results Generated per Database or Research Platform**

Database/Platform	Search strategy	Initial yield	Total (without duplicates)
<b>Web of Science</b>	("Trauma Releas* Exercise*") OR ("Tension Releas* Exercise*") OR ("Trauma Releas* Process") OR ("Neurogenic Tremor*") OR ("self-induced unclassified therapeutic tremor*") OR ("trauma release technique") OR ("Tension and Trauma Releas* Exercise*") OR ("tension/trauma releas* exercise*")  Filters: English, no patents	16	16
<b>Scopus</b>	("Trauma Releas* Exercise*") OR ("Tension Releas* Exercise*") OR ("Trauma Releas* Process") OR ("Neurogenic Tremor*") OR ("self-induced unclassified therapeutic tremor*") OR ("trauma release technique") OR ("Tension and Trauma Releas* Exercise*") OR ("tension/trauma releas* exercise*")  Filters: English	13	13
<b>EBSCOhost (all databases included)</b>	("Trauma Releas* Exercise*") OR ("Tension Releas* Exercise*") OR ("Trauma Releas* Process") OR ("Neurogenic Tremor*") OR ("self-induced unclassified therapeutic tremor*") OR ("trauma release technique") OR ("Tension and Trauma Releas* Exercise*") OR ("tension/trauma releas* exercise*")  Filters: English and limited to academic journals, eBooks, books and dissertations	18	17
<b>ProQuest Central (all databases included)</b>	("Trauma Releas* Exercise*") OR ("Tension Releas* Exercise*") OR ("Trauma Releas* Process") OR ("Neurogenic Tremor*") OR ("self-induced unclassified therapeutic tremor*") OR ("trauma release technique") OR ("Tension and Trauma Releas* Exercise*") OR ("tension/trauma releas* exercise*")  Filters: English with no wirefeeds, newspaper articles, magazines, blogs, podcasts or websites	64	64
PubMed	"Trauma Releas* Exercise*" [tw] OR "Tension Releas* Exercise*" [tw] OR "Trauma Releas* Process" [tw] OR "Neurogenic Tremor*" [tw] OR "self-induced unclassified therapeutic tremor*" [tw] OR "trauma release technique" [tw] OR "Tension and Trauma Releas* Exercise*" [tw] OR "tension/trauma releas* exercise*" [tw]	44	44

Database/Platform	Search strategy	Initial yield	Total (without duplicates)
	Filters: Free full text, Full text, English		
<b>UPSpace Health</b>	Trauma Releasing Exercises OR Tension Release Exercises OR Trauma Release Process OR Neurogenic Tremor OR self-induced unclassified therapeutic tremor OR trauma release technique OR Tension and Trauma Releasing Exercises OR tension/trauma releasing exercises  Filters: English	No relevant articles	0
<b>NIH library</b>	"Trauma Releasing Exercises" OR "Tension Release Exercises" OR "Tension Releasing Exercises" OR "Trauma Release Process" OR "Neurogenic Tremor" OR "self-induced unclassified therapeutic tremors" OR "trauma release technique" OR "Tension and Trauma Releasing Exercises" OR "tension/trauma releasing exercises"  More relevant articles were found in this database when excluding * and ) from the search terms  Filters: English, no patents	28	27
<b>Total (database search)</b>		183	181
<b>Hand search</b>	Searched all relevant articles' reference lists	14	14
	Added additional document that was published within the date range	1	1
<b>Total</b>		198	196

### 3.6.3. Hand search

The final step of the search process was for the primary researcher to hand search the reference lists of all identified relevant literature, as well as publication lists of authors who published relevant studies on TRE. Additional literature was identified. One author had to be contacted via email to determine whether more formal documentation was available on her research studies, as the study information in her non-peer reviewed published slideshow and posters was limited. There was, however, no additional documentation available. The hand search process was finalised on 25 November 2022, but an additional dissertation that was published within the date range specified was found at a later stage and added to the full text screening list in January 2023.

### 3.7. SELECTION OF STUDIES

The database search yielded 183 results and the hand search added 14 results. The study selection process commenced with the uploading of the citations of these identified studies into Rayyan, a web-based software tool that assists reviewers with systematic review methodology.<sup>128</sup> A total number of 36 duplicate articles were removed by the researcher and 161 records remained for the screening process. A title and abstract screening tool was developed (see Annexure F) to assist and guide the researcher and her supervisors during the screening process. The screening tool was developed to specify the inclusion and exclusion criteria for the literature in detail and was piloted by the researcher and supervisors during an initial screening of three articles. After refinement of the tool, the titles and abstracts of all the articles were independently screened by the researcher and one of her supervisors against the pre-specified inclusion criteria.<sup>125</sup> Percentage agreement between the researcher and her supervisor was calculated by using the percentage agreement equation:<sup>129</sup>

$$\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100$$



An acceptable agreement percentage is above 80 percent.<sup>130</sup> Percentage agreement during the title and abstract screening was 94.4% and disagreements were resolved through discussion during an online meeting. Consensus was reached on the inclusion of 33 of the records for the full text screening process.

The final 33 records (which included the records from the databases and from the hand search) were retrieved in full and uploaded onto Rayyan for easy reference. Each record was assessed on the full text against the inclusion criteria. The researcher assessed all the records, while the supervisor assessed 17 records and the co-supervisor assessed 16 records independently. The percentage agreement was once again calculated using the same formula as mentioned above, with 85% agreement as result. After a discussion amongst the researcher and her supervisors, the disagreement was resolved with a final result of 20 records being included for the data extraction process. These 20 records were based on 18 studies, because in some cases, two records reported on the same study.<sup>7,131-133</sup> Comprehensive details will be provided in Section 4.1.

The results of the search and study inclusion process is reported in full in a flow diagram, as recommended in the PRISMA-ScR checklist.<sup>121</sup> The flow diagram was adapted from the PRISMA 2020 Statement by Page and Colleagues,<sup>121,134</sup> as seen in Figure 3.2.

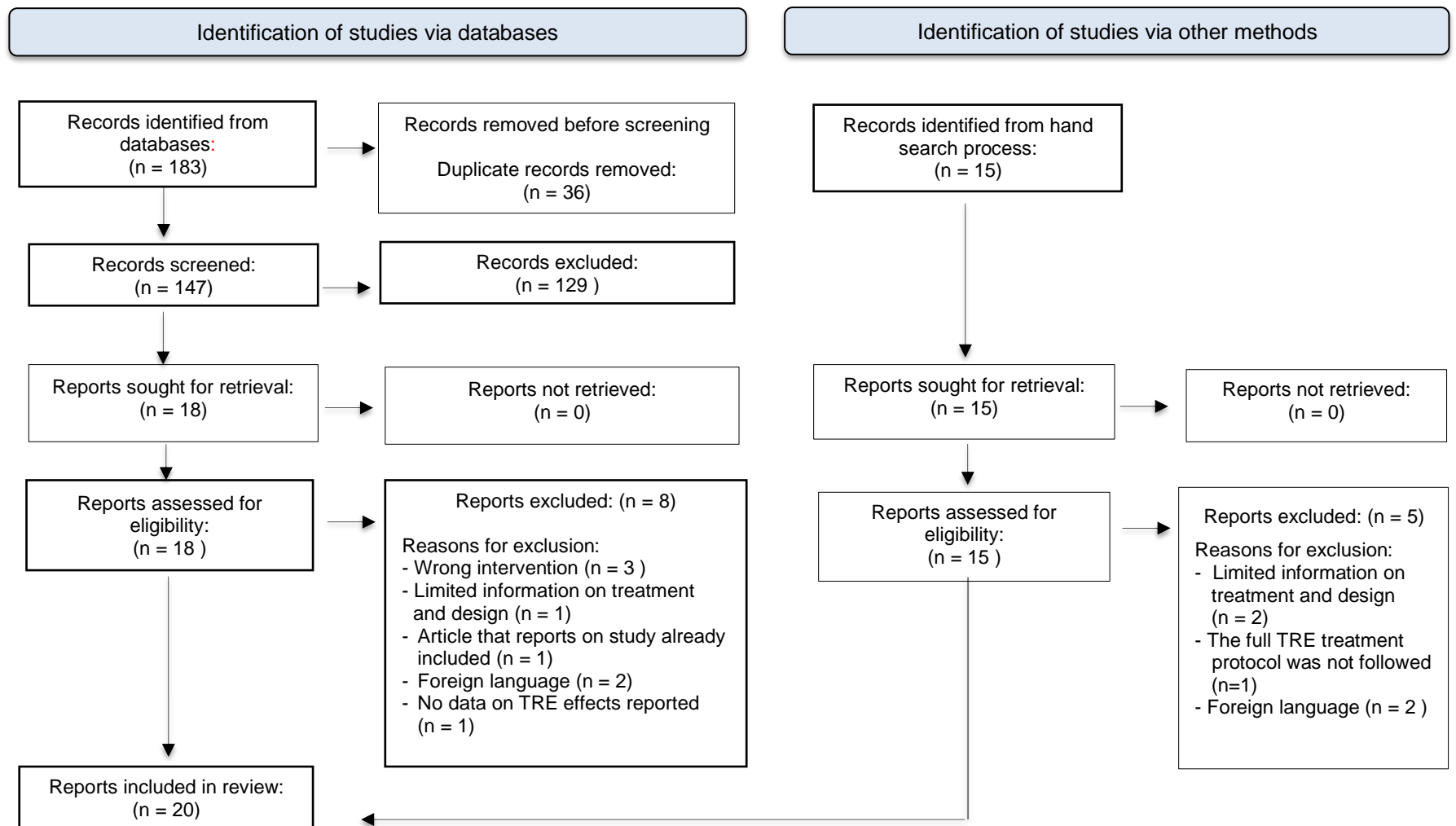


Figure 3.2. Flow Diagram for the Scoping Review Process adapted from the PRISMA 2020 Statement by Page and Colleagues<sup>134</sup>

### 3.8. DATA EXTRACTION

The next step in the process was to extract the required data from the identified records to provide an overview of the characteristics of the TRE studies. A data extraction tool was first developed by the researcher, guided by the objectives of the study. Table 3.3. indicates how the extraction categories link to the study's objectives. After development of the tool, it was pilot tested on three records to ensure that the relevant data is extracted. The results of the pilot extraction were checked independently by the researcher's study supervisors for appropriateness of the categories included, as well as accuracy and consistency of the data extracted. Adjustments were made to the tool after a consultation between the researcher and her supervisors. Thereafter the full extraction process, often referred to as data charting in a scoping review,<sup>125</sup> was completed. With the help from a research assistant, the extraction results were independently checked for accuracy.

**Table 3.3.** *Data Extraction Categories and Subcategories Linked with the Study's Objectives*

<b>Study objectives</b>	<b>Categories in data extraction tool</b>
<b>General information</b>	General: Author, date, study title, publication type
<b>To describe the characteristics of the populations in the TRE studies</b>	Participants: Diagnostic group, co-morbidities, in- and exclusion criteria, number of participants, age, gender, other treatment, other relevant details
<b>To describe the methodology used in the TRE studies</b>	Methodology: Study aim, design, sampling method, screening for eligibility, control group, setting
<b>To describe the structure of the TRE treatment programmes used</b>	Intervention: Structure of TRE session (with educational, practical, home exercise and support component), provider, location, frequency and duration of tremor and treatment session, duration of treatment, location, evidence of treatment integrity/procedural reliability, alternative treatment
<b>To identify and describe the measurement tools used to measure the TRE treatment outcomes</b>	Measurement: Measurement tools and what it measures, time points measured, person measuring/reporting, attempt to test validity/reliability of tool
<b>To describe the various outcomes of treatment</b>	Outcomes

Study objectives	Categories in data extraction tool
<b>To identify gaps in the literature, determining areas in which further research is required</b>	Constraints reported by authors and indications for future research. A summary of all the above categories will also assist in addressing this objective.

### 3.9. DATA ANALYSIS

The extracted and categorised data, as captured in the data extraction form, formed the basis from which the study results were obtained. Descriptive statistics were used to analyse and summarise the data according to the different study objectives. The population characteristics, methodological aspects, different treatment structures, outcome measurement tools, therapeutic outcomes and recommendations for future research by the authors were presented in tabular format, with accompanying descriptive summaries and graphs where necessary, to address the study aim and objectives.<sup>122,125</sup> Simple frequency counts and percentages were used. No inferential statistics were used and no formal quality assessment of the included studies was done. The main objective of a scoping review and of this study was to provide an overview of the existing evidence and not to critically appraise it.

### 3.10. QUALITY AND RIGOUR

To ensure good quality and rigour during the study, the researcher followed the following criteria, recommended in the literature:

- Performing the correct type of review: The researcher carefully considered the appropriate type of review that would address the research question and objectives of the study. A scoping review was chosen due to a broader research question and aim to determine the extent and breadth of research done on TRE, while a systematic review would have been appropriate for a more specific research question aiming to explain a phenomenon and address quality of research.<sup>135</sup>

- Following a detailed protocol: A protocol, in the form of a research proposal, was developed before conducting the review and it was followed closely during the research process. The development of the protocol was guided by the strict guidelines for a scoping review protocol by the JBI.<sup>135</sup> Following a protocol ensures rigorous implementation of the review process.<sup>135</sup> It can also help to avoid or minimise bias, which improves the quality of the study.<sup>135-136</sup> Source selection bias was avoided by planning to include all possible relevant databases<sup>136</sup> and to consult with an information specialist regarding suitable databases for the search. Publication bias was avoided by a detailed plan on which sources will be included in the study, indicating that grey literature will also be searched for. To avoid scope bias, it was planned and indicated in the protocol that there will be no geographical constraints or time constraints on the records searched for and included.
- Consistent reporting: The PRISMA-ScR checklist was used as a guideline to further ensure a rigorous and transparent review with accurate reporting of the results.<sup>121</sup>
- Principles regarding reliable selection of studies and data extraction and neutrality of the evidence, recommended in the literature,<sup>125,136</sup> were followed to ensure reliable results. Objectivity was increased and bias limited by two reviewers working independently during the data selection and extraction process. Percentage agreement between the reviewers was calculated at 85% during the records selection process and the disagreements were resolved by discussion. Disagreements with regards to the extracted data were also resolved through discussion.

### **3.11. ETHICAL CONSIDERATIONS**

Ethical clearance (442/2020) was obtained from the Faculty of Health Sciences' research ethics committee prior to the data collection process. The research project did not involve human participants and, therefore, the risk-benefit ratio, fair selection of participants, informed consent as well as privacy and confidentiality principles

were not applicable. There were, however, other ethical aspects and principles that had to be considered and that were adhered to during the study:

- The researcher followed the exact protocol for a scoping review as outlined by the JBI, to ensure research integrity and reliable data and study outcomes.<sup>125</sup>
- Objectivity was incorporated and researcher bias was limited by having at least two independent reviewers during the data search, data selection and data extracting process. Transparency of the process and accuracy of method reporting were ensured by using the PRISMA-ScR checklist throughout the research process.<sup>121</sup> Irrespective of the nature of the research results (i.e. favourable to the use of TRE or not), the researcher will disseminate the research findings.
- The researcher ensured responsible publication by avoiding duplication. No literature synthesis on TRE could be found during a preliminary search. Furthermore, the relevance and value of the study were considered. The study investigated a technique used globally and it was, therefore, relevant and important to summarise the current literature that reports on applying this technique in intervention. Although such a review falls short of evaluating the evidence for the effectiveness of the technique, it was a first step in describing the literature and identifying gaps in the research.
- The researcher avoided committing plagiarism. She did not repeat others' work and ideas verbatim and referenced all citations, diagrams, pictures and other work used, as well as asked permission where required.
- Competence and expertise of the researcher is important. The researcher completed the compulsory Applied Research Methodology course and read extensively on research methods and the specific research topic. The researcher, furthermore, consulted twice monthly with two research supervisors, who themselves have already shown their research competence in several publications. An information specialist was also consulted during the data search process.

Please refer to Annexures G, H and I for the signed declarations of plagiarism, storage and Helsinki Declaration.

### **3.12. CONCLUSION**

In this chapter, details regarding the methodology of the scoping review study were presented. This included the study design and study method used, after which the eligibility criteria for the studies were reported. The search strategy for eligible studies was discussed and the study selection process was addressed. The last steps of the review process, namely data extraction and data analysis, were then explained. Finally, the steps that were followed to ensure quality and rigour of the research process, as well as ethical considerations were presented. The results of this research study will be discussed in the following chapter.

## CHAPTER 4: RESULTS

### 4.1. INTRODUCTION

In this chapter, the results of the review will be presented and summarised according to the study's objectives. The data extraction process was guided by the research question and objectives. The question of the study was: What intervention research has been done on Trauma Releasing Exercises (TRE) as a treatment technique and what are the characteristics of these studies? The study objectives, which guided the formulation of the different data extraction categories, were to describe the following study characteristics:

- i. The characteristics of the populations treated with TRE.
- ii. The study designs and other methodological aspects utilised in the studies.
- iii. The structure of TRE treatment programmes used in the studies.
- iv. The measurement tools used to measure the TRE treatment outcomes.
- v. The recorded outcomes of the TRE treatment.
- vi. To identify the gaps in the literature, determining areas in which further research is required.

Data related to the studies' population characteristics, namely diagnoses, sample size, age, gender, socio-economic circumstances and countries will be presented first. Thereafter, information regarding the different study designs used, sampling methods and time point measurements will be presented. The applied TRE treatment structures will then be explored, after which the various measurement tools used will be presented according to the Occupational Therapy Practice Framework's (OTPF-IV) domain categorisation, in combination with the outcome results. Lastly, the authors' recommendations for future research will be presented. Gaps in the literature will be addressed in the Discussion and Conclusion chapters.

It should be noted that, in some cases, two records reported on the same study. In the case of Johnson and Naidoo's study,<sup>131</sup> the published article reported on quantitative results of the study, while Johnsons' dissertation<sup>132</sup> included additional qualitative results collected during the same study. With regards to the study from Lynning et. al.,<sup>7</sup> the published article reported on quantitative results, while a



conference abstract reported on qualitative information collected from the same participants.<sup>133</sup> In both cases, both records were included in the review. The review therefore included 20 records, but was based on 18 studies. In the remainder of the dissertation, the 18 studies are referred to, but information from 20 records are considered. Table 4.1. provides an overview of the included review studies, with details on author and year of study, the study aim and publication type.

**Table 4.1. Overview of the Included Studies**

<b>Authors (year)</b>	<b>Study aim</b>	<b>Publication type</b>
<b>Atterbury (2019)</b>	Investigating the effects of TRE on selective motor and non-motor symptoms of clients with Parkinson's disease	Dissertation
<b>Beattie &amp; Berceli (2021)</b>	To assess TRE training's effect on chronic pain self-efficacy, perceived stress, and thriving	Report Part of quality assurance for Standard TRE Protocol
<b>Berceli (2007)</b>	Test the effects of TRE on stress and resulting feelings of anxiety, with stress being the physiological response and anxiety the emotional response	Dissertation
<b>Berceli et al. (2014)</b>	Investigate the feasibility of a 10-week TRE training and intervention programme and to determine the association between the TRE use and self-reported health-related quality of life changes	Journal article Global Advanced Health Medicine Journal
<b>Botha (2022)</b>	To investigate the acute effects of a single TRE session on a participant's cardiac autonomic response and also the interictal state anxiety of a person with epilepsy	Dissertation
<b>Harrison et al. (2018)</b>	To determine the effect of TRE on the severity of restless legs syndrome (RLS) compared to a control discussion group	Journal article Journal of the American Board of Family Medicine
<b>Heath &amp; Beattie (2019)</b>	To describe the effects of TRE on post-traumatic stress disorder (PTSD)	Journal article Journal of Military and Veteran's Health
<b>Heath (2013)</b>	Assess response to a TRE one-day workshop, for bushfire affected communities	Informal non-peer reviewed report on survey results
<b>Herold &amp; Nibel (2016)</b>	<ol style="list-style-type: none"> <li>1. To show that psychological stress can decrease physical well-being</li> <li>2. To show that health problems are a concern among high prestigious academics</li> <li>3. To investigate the effect of TRE on the well-being of psychotherapists</li> </ol>	Journal article Psychological Counselling and Psychotherapy
<b>Hruby &amp; Beattie (2021)</b>	Determine whether TRE is a suitable and feasible technique for firefighters to decrease stress, as well as to measure the effect of TRE on stress, anxiety and depression	Non-peer reviewed case-study report
<b>Johnson &amp; Naidoo (2017)</b> with additional information on the qualitative part of the study from <b>Johnson (2013)</b>	To compare the effects of treatment techniques based on three different evolutionary brain developmental stages –TRE based on brainstem and diencephalon evolution, Transpersonal Psychology based on limbic brain development, and Transactional Analysis working on a cortical level (considering the quantitative results)	Journal article South African Journal of Psychology

<b>Authors (year)</b>	<b>Study aim</b>	<b>Publication type</b>
	To explore the impact of the burnout and stress interventions on the participants, using qualitative information	Dissertation
<b>Kent (2018)</b>	To assess the effectiveness of TRE in reducing symptoms of PTSD, as adjunctive treatment	Report: prepared for US Army Medical Research and Materiel command
<b>Lynning et al. (2021)</b> With additional information on the qualitative part of the study from an abstract by <b>Lynning et al. (2019)</b>	To assess a TRE treatment programme with participants with multiple sclerosis and explore outcome measures that can be used in future randomised controlled studies. To explore the participants' experiences on the effect of TRE on their mental and physical health and functioning	Journal article Journal of Traditional and Complementary Medicine Abstract Annual Rehabilitation in Multiple Sclerosis (RIMS) Conference 2019
<b>McCann (2011)</b>	To explore self-reported experience of TRE in terms of reducing physical, mental and emotional stress, specifically referencing perception of anxiety levels, and improving quality of life	Dissertation
<b>Salmon (2016)</b>	To explore the effect of TRE on a participant diagnosed with bipolar disorder, presenting with physical symptoms	Non-peer reviewed report
<b>Salmon (2013)</b>	To determine the effect of TRE on the physical, emotional and psychological aspects of well-being of at-risk youth, with a focus on anxiety and quality of life	Non-peer reviewed report
<b>Swann (2019)</b>	To investigate whether a period of 4 weeks with three times a week TRE practice would decrease symptoms of co-occurring PTSD and non-specific chronic lower back pain in adults	Dissertation
<b>Thommessen &amp; Fougner (2020)</b>	To explore the TRE experiences of drama students and the technique's use to improve professional performance and personal welfare	Journal article Theatre, Dance and Performance Training Journal

## **4.2. CHARACTERISTICS OF THE POPULATIONS TREATED WITH TRE**

During data extraction, the following population characteristics were considered: diagnoses, sample size, gender of the participants, their age, socio-economic circumstances, as well as the country in which the participants lived or received treatment. Table 4.2 provides an overview of these population characteristics, after which the characteristics will be described separately.

**Table 4.2.** *Overview of the Population Characteristics in the TRE Studies*

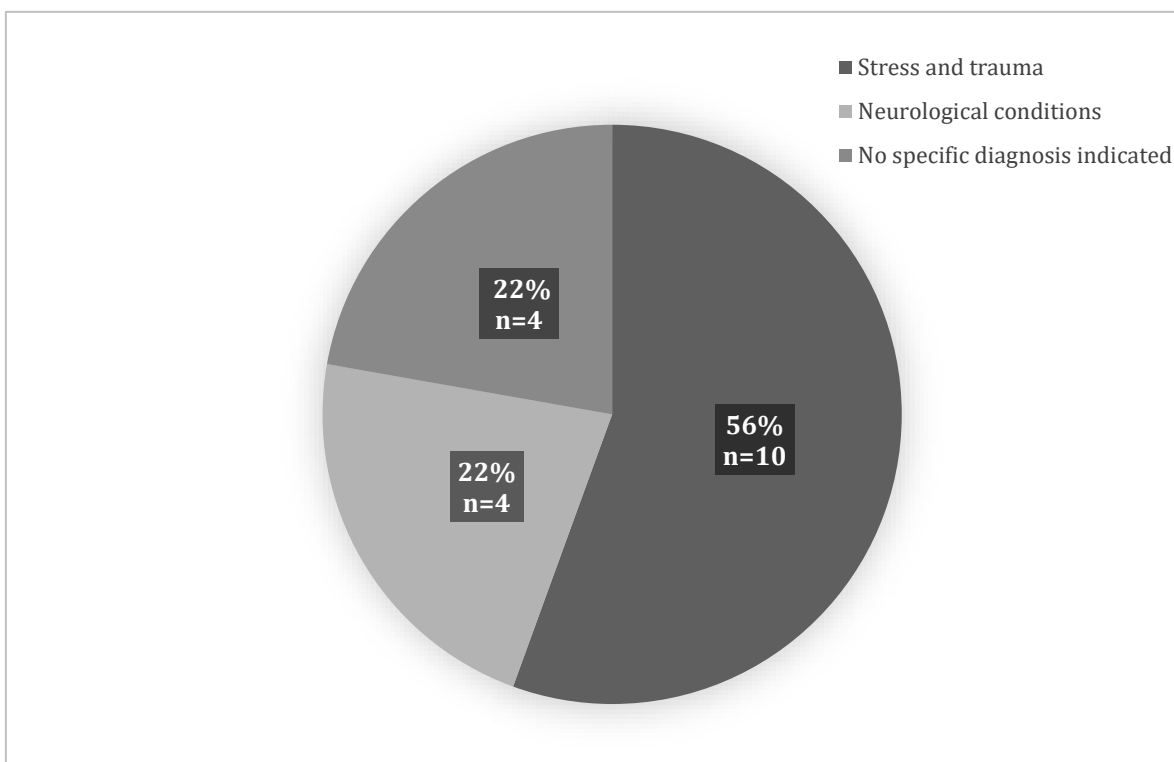
Author (year)	Diagnostic group or reason for treatment	Sample size	Age of participants	Gender	Areas/Countries	Other relevant population details
<b>Atterbury (2019)</b>	Idiopathic Parkinson's disease	36	55 to 84 years	31% female 69% male	Southern and northern suburbs of Cape Town, and Cape Winelands South Africa	Participants from an urban setting
<b>Beattie &amp; Berceli (2021)</b>	Not limited, included anxiety, depression, PTSD, asthma, autoimmune disease, musculoskeletal-, cardiac- and gastrointestinal conditions and chronic pain	14	21 to 70 years, majority within the 41 to 60 years group	79% females 14% males 7% nonbinary	Australia, Canada, Czech Republic, Germany, Peru, Poland, Russian Federation, Serbia, Slovenia, South Africa, United Kingdom, USA	No additional detail provided
<b>Berceli (2007)</b>	Able bodied kinesiology students who experienced day to day study-related stress	61	22 to 35 years	59% females 41% males	USA	College students from Arizona State University, within an urban setting
<b>Berceli et al. (2014)</b>	Assumed chronic stress due to occupational demands	21	25 to 62 years	90% female 10% male	Cape Town, South Africa	i) Lower socio-economic area ii) Low literacy: only 3 participants above poverty line and educational level past basic literacy (Grade 10) iii) 6 different ethnic groups iv) 17 participants non-professional.
<b>Botha (2022)</b>	Epilepsy	11	20 to 27 years	64% female 36% male	Helderberg, Cape Winelands and northern and southern suburbs of Cape Town, South Africa	No additional information.
<b>Harrison et al. (2018)</b>	RLS	18	Intervention group: mean 56.2 years Control group: mean 60.4 years	61% female 39% male	Monash University Peninsula Campus, Victoria Australia	No additional information

Author (year)	Diagnostic group or reason for treatment	Sample size	Age of participants	Gender	Areas/Countries	Other relevant population details
<b>Heath &amp; Beattie (2019)</b>	PTSD, following acquired brain injury	1	48 years	100% male (1 male)	Australia	Former Private, serving in the army as tradesman with no active deployment
<b>Heath (2013)</b>	Stress and trauma due to direct and indirect exposure to bushfires	30	Not indicated	Not indicated	Yarra Glen, Victoria, Australia	i) Rural setting ii) Members of bushfire-affected communities, but others who wanted to attend were also allowed
<b>Herold &amp; Nibel (2016)</b>	Psychotherapists, with a master's qualification in medicine or psychology, suffering secondary traumatisation, which can decrease physical well-being	71	Mean age is 37.3 to 48.6 years in different training groups. Different participants could have attended multiple trainings.	Not indicated	Kiev, Kharkov and Khmelnytskyi in Ukraine	i) Rural and urban areas ii) Psychotherapists who participated in TRE group trainings
<b>Hruby &amp; Beattie (2021)</b>	Firefighters (first responders) due to high level of stress and trauma	2	Not indicated for the final two participants	Not indicated	Iowa, USA	Firefighters, including the manager of the Firefighter training
<b>Johnson &amp; Naidoo (2017), Johnson (2013)</b>	Teachers working in violence-prone districts with high stress levels and high levels of burnout	63	40 to 50 years (majority)	49% female 51% male, with women majority in TRE group.	Cape Flats, Western Cape in South Africa	i) Urban setting ii) Low socio-economic circumstances
<b>Kent (2018)</b>	PTSD	92	Average age of 49.8 years (SD 13.4)	25% female 75% male	Virginia, USA	Veterans
<b>Lynning et al. (2021), Lynning et al. (2019)</b>	Multiple sclerosis (MS) with six relapsing remitting MS, one secondary progressive MS, two primary progressive MS, one participant requiring cane for walking	9	43 to 66 years	56% females 44% males	In and around Copenhagen, Denmark	No additional detail provided

Author (year)	Diagnostic group or reason for treatment	Sample size	Age of participants	Gender	Areas/Countries	Other relevant population details
<b>McCann (2011)</b>	No diagnosis indicated. Introductory Level 1 TRE Training Course participants	50	21 to 70 years	84% females 16% males	Cape Town, South Africa Urban	TRE course participants
<b>Salmon (2016)</b>	Bi-polar disorder, with symptoms including intermittent severe anxiety, depression and generalised pain syndrome	1	23 years	100% female (1 female)	Umhlanga, Kwazulu Natal in South Africa (urban setting)	i) Urban setting ii) Higher income (based on living conditions and travel)
<b>Salmon (2013)</b>	At-risk children, due to increased stress and trauma levels	152	17 to 25 years	100% female (152 females)	Western Cape, South Africa	i) Rural and township areas ii) Poverty exposed. iii) More than 50% of participants reported sexual abuse and/or rape. iv) Residing at the Chrysalis Academy for 3 months
<b>Swann (2019)</b>	Co-occurring PTSD and non-specific chronic lower back pain (nsCLBP)	9	32 to 73 years	67% females 33% male	California, USA	i) Urban setting ii) Wide range of income levels and educational levels
<b>Thommessen &amp; Fougner (2020)</b>	Drama students due to TRE's ability to possibly improve body awareness and release stress	12	College age, no further details indicated	50% female 50% male	Norwegian NSKI University College, Norway	Bachelor in Acting students at college

#### 4.2.1. Diagnostic groups treated with TRE

As seen in Table 4.2., various diagnostic groups were included in the studies. Figure 4.1. indicates the different categories of diagnostic groups identified. Data from the 18 studies indicated that the majority of TRE research has been performed on participants who experienced high levels of stress and trauma ( $n = 10$ ). In many of these studies ( $n = 7$ ) high levels of stress, emotional strain, trauma or burnout were indicated, while a few studies ( $n = 3$ ) indicated a specific diagnosis of PTSD.



**Figure 4.1.** *Diagnostic Groups across the TRE Studies (n = number of studies)*

Persons with neurological conditions were also included ( $n = 4$ ). The effect of TRE was researched on participants diagnosed with idiopathic Parkinson's disease ( $n = 1$ ),<sup>8</sup> restless legs syndrome ( $n = 1$ ),<sup>137</sup> epilepsy ( $n = 1$ )<sup>138</sup> and multiple sclerosis ( $n = 1$ ).<sup>7</sup>



The remaining studies ( $n = 4$ ) did not indicate a specific diagnosis for participants. One of these studies was focussed specifically on drama students and aimed to improve body awareness and professional performance.<sup>139</sup>

The total number of participants across all the included studies according to available information was 660. Of these participants, 68% ( $n = 449$ ) were within the stress and trauma diagnostic group, 11% in the neurological conditions group ( $n = 75$ ) and 21% in the group with no specific diagnosis indicated ( $n = 137$ ). The participant percentages are relatively similar to the study percentages, with stress and trauma also in the majority.

#### **4.2.2. Gender**

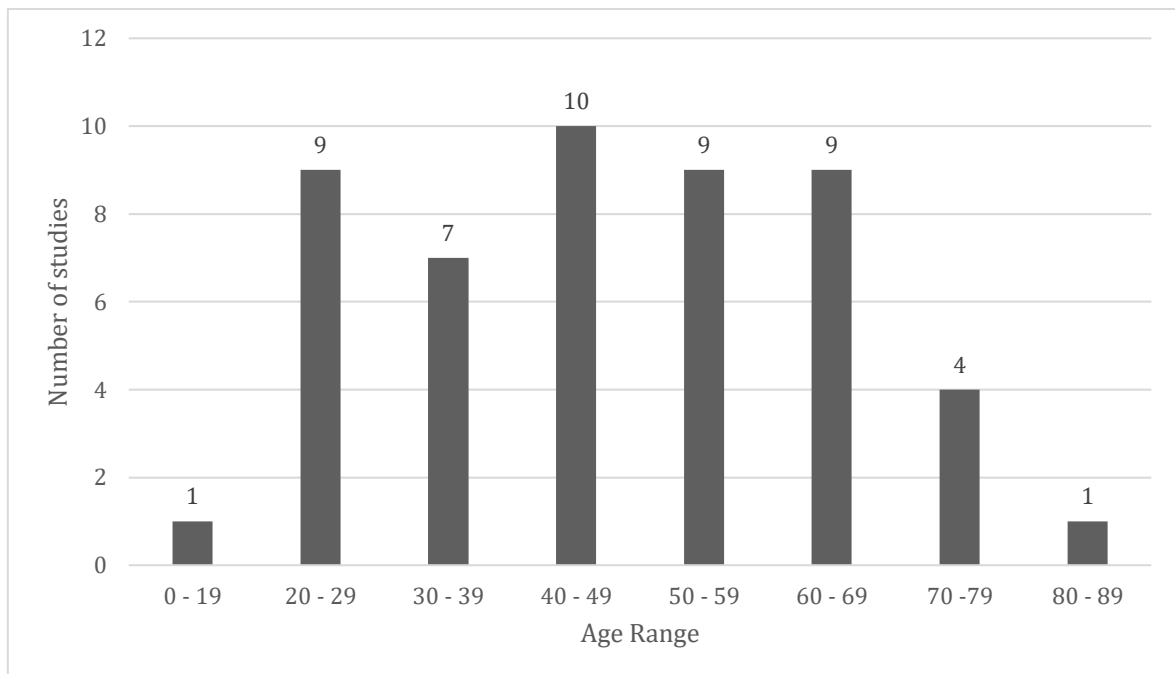
Female participants were in the majority overall, with 361 female participants (66%) and 188 male participants (34%), recorded from 15 studies. Three studies' participants could not be included in these calculations due to limited details provided regarding the gender of the participants. In 11 studies, the majority of participants were female, with two of the studies having only female participants and three studies above 80% female participants.

A few studies ( $n = 3$ ) indicated majority male participants. Two of these studies investigated the use of TRE with military veterans, where males are typically in the majority and the other study investigated TRE with participants diagnosed with Parkinson's disease, a disease that is twice as prevalent in men as in women.<sup>140</sup>

#### **4.2.3. Age**

Figure 4.2. indicates the age groups and the number of studies each age group had been represented in. For purposes of the extraction process, age categories were divided into ten-year intervals, with the highest represented age category 40 to 49 years. Most age groups were represented in the review, but there were no participants below the age of 17 years. No studies included in the review reported on TRE treatment for children. The youngest participant was 17 years old,

participating in a study within a highly traumatised community,<sup>141</sup> and the eldest participant in the review was 84 years old, participating in a Parkinson's disease study.<sup>8</sup> The inclusion criteria of several of the studies specified that the participants had to be 18 years or older ( $n = 6$ ).



**Figure 4.2.** *Age Ranges Represented in the Studies*

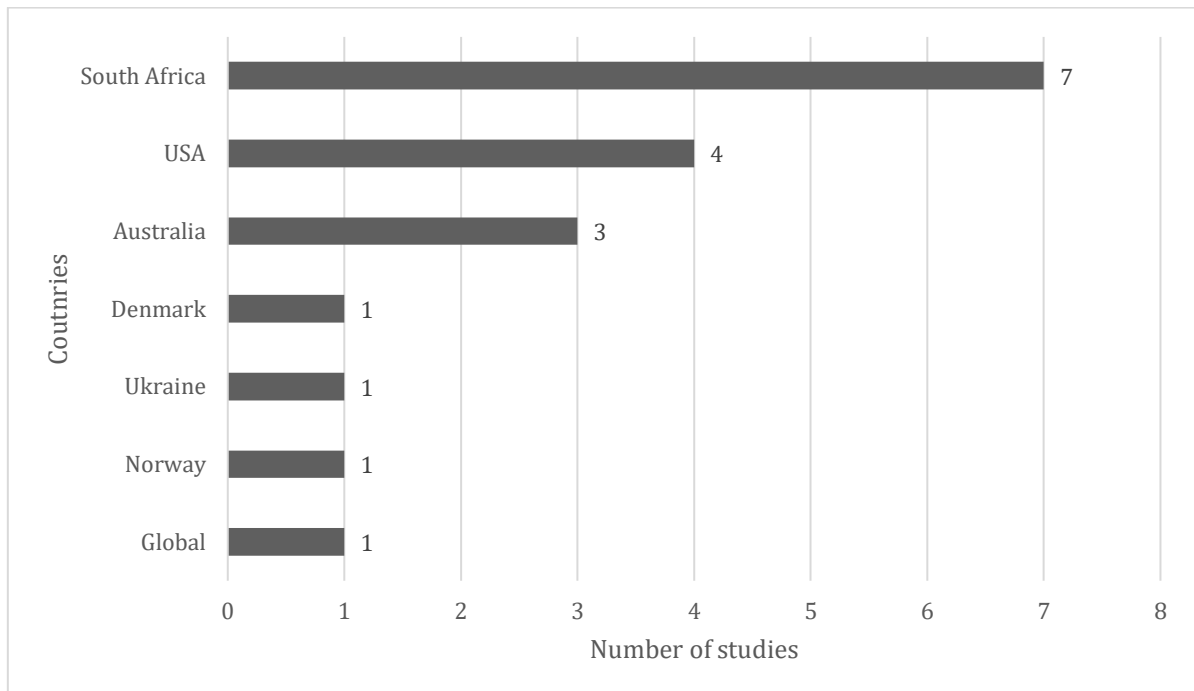
#### **4.2.4. Socio-economic circumstances**

Data with regards to participants' socio-economic circumstances were extracted from the reports, but limited information regarding this aspect was available. Not many studies stated the participants' personal circumstances. A few studies ( $n = 3$ ) specifically focussed on participants in high-risk, traumatised communities, indicating low socio-economic circumstances. All three studies were done within communities with limited resources in the Western Cape, South Africa.

#### **4.2.5. Countries where the studies were conducted**

The various countries represented in the studies are indicated in Figure 4.3. Additional studies from other countries were included in earlier stages of the review,

but they were not included in the final selection due to the review's inclusion criteria of English studies only.



**Figure 4.3.** *Number of Studies from Different Countries*

It should be noted that two of the studies with a South African population were published in peer-reviewed journals and three were dissertations. The studies based on populations in the United States of America (USA) included two dissertations and a research report for the US Army, with no peer-reviewed articles. The studies with an Australian population included two peer-reviewed articles and an informal survey report. The studies from Norway and Denmark were published in peer-reviewed journals and the Ukrainian study was a journal article as well. It is interesting that more studies have been done and published on populations from South Africa than on populations from the USA, where TRE originated.

#### **4.3. STUDY DESIGNS AND OTHER METHODOLOGICAL ASPECTS**

Table 4.3. provides an overview of the methodological aspects of the studies, including the study designs, sampling methods used and time point measurement

details. Even though 18 studies were included in this review, 20 records will be reported on in this section, due to quantitative and qualitative subsections of two of the 18 studies.<sup>7,131-133</sup> The table is followed by a descriptive summary on each of the mentioned aspects.

**Table 4.3.** Overview of the Methodological Aspects of the Records

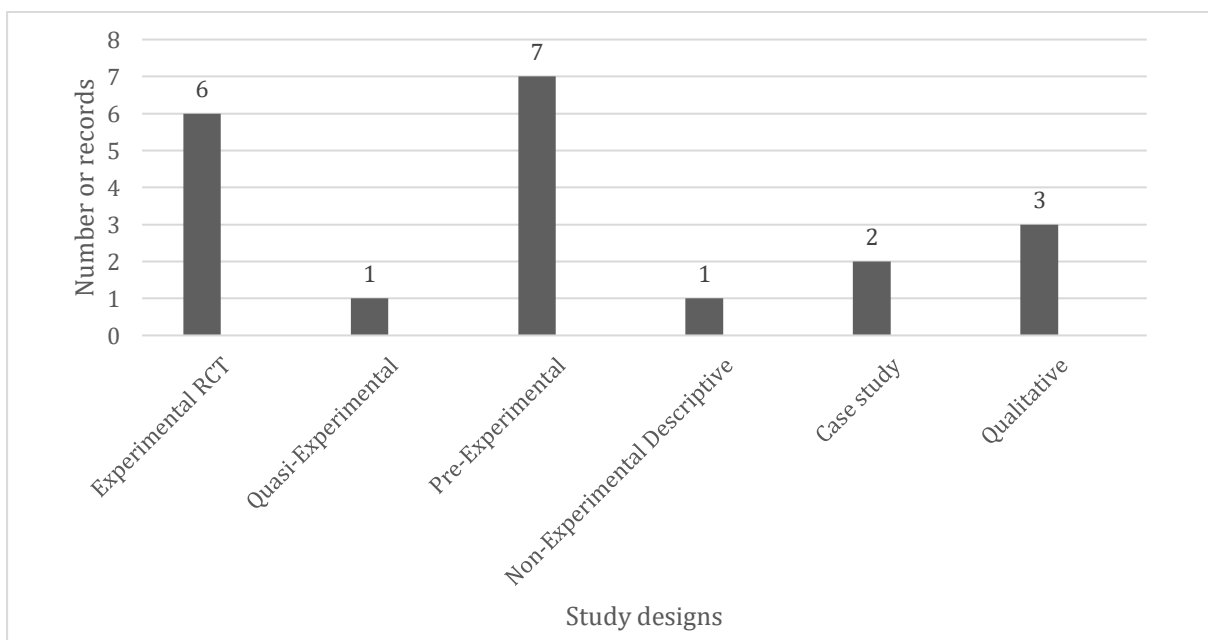
Author (year)	Design						Sampling method		Time points measured		
	Experimental Randomised Controlled Trial	Quasi -experimental	Pre-experimental	Non-experimental Descriptive	Single Case-study	Qualitative	Convenience	Purposive	Post-intervention only	Pre- and post-intervention only	Three or more time points <sup>a</sup>
Atterbury (2019)	X						X				X (5)
Beattie & Berceli (2021)			X				X				X (3)
Berceli (2007)	X						X			X	
Berceli et al. (2014)			X				X			X	
Botha (2022)	X						X			X	
Harrison et al. (2018)	X						X				X (6)
Heath & Beattie (2019)					X			X			X (4)
Heath (2013)				X			X		X		
Herold & Nibel (2016)			X				X			X	
Hruby & Beattie (2021)			X				X			X	
Johnson & Naidoo (2017)		X					X			X	
Johnson (2013)						X	X			X	
Kent (2018)	X						X				X (4)
Lynning et al. (2021)			X				X				X
Lynning et al. (2019)						X	X		X		
McCann (2011)			X				X			X	

Author (year)	Design						Sampling method		Time points measured		
	Experimental Randomised Controlled Trial	Quasi -experimental	Pre-experimental	Non-experimental Descriptive	Single Case-study	Qualitative	Convenience	Purposive	Post-intervention only	Pre- and post-intervention only	Three or more time points <sup>a</sup>
Salmon (2016)					X			X	X		
Salmon (2013)			X				X			X	
Swann (2019)	X						X				X (4)
Thommessen & Fougner (2020)						X	X		X		

<sup>a</sup> The number of actual measurement points is provided in brackets

### 4.3.1. Study designs

Figure 4.4 shows the different designs and number of these designs used across the 20 records. The most used designs were the pre-experimental design and the experimental randomised control trial (RCT) design.<sup>142</sup> In the quasi-experimental design study,<sup>142</sup> the participants were self-assigned to the treatment and control groups, taking into consideration their time schedules and logistics.<sup>131</sup> The pre-experimental design studies were single-group pretest-posttest studies without a control group to which treatment results could be compared, therefore not falling within the randomised experimental studies category.<sup>142</sup> The majority of the RCT studies were dissertation studies ( $n = 4$ ), with one RCT study published in a peer-reviewed journal<sup>137</sup> and the other study forming part of a research project for the US Army.<sup>5</sup> The quasi-experimental study was published in a peer-reviewed journal.



**Figure 4.4.** *Different Designs Used in the Records ( $n = 20$ )*

The non-experimental, descriptive study included summarised results from a survey completed by participants after a TRE workshop to assist in improving future TRE workshops.<sup>143</sup> With regards to the qualitative studies ( $n = 3$ ), two studies were part of larger quantitative studies. The qualitative studies used semi-structured

interviews ( $n = 2$ )<sup>133,139</sup> and focus groups ( $n = 1$ ).<sup>132</sup> The qualitative study that did not form part of a larger study was published in a peer-reviewed journal.<sup>139</sup>

#### **4.3.2. Sampling methods**

Only non-probability sampling methods were used in the studies. Convenience sampling<sup>144</sup> ( $n = 16$ ) included recruiting student participants at a college or academy ( $n = 2$ ),<sup>105,141</sup> or TRE trainees and treatment participants ( $n = 5$ ).<sup>50,139,143,145-146</sup> In other studies, participants were recruited from certain groups ( $n = 3$ ), for instance teachers at high-risk schools in the Cape Flats,<sup>131</sup> caregivers at a specific centre<sup>10</sup> and firefighters from one fire station.<sup>147</sup> The case studies used purposive sampling.<sup>148-149</sup>

#### **4.3.3. Time point measurements**

With regards to time point measurements, presented in Table 4.3., it was noted that there were studies that used a single assessment post-intervention ( $n = 4$ ), studies with one assessment prior- and post-intervention ( $n = 9$ ), and studies where assessment was performed three or more times ( $n = 7$ ). Two of the studies where assessment was performed only post-intervention were qualitative studies, where semi-structured interviews were conducted after treatment.<sup>133,139</sup> The other two studies included a post-workshop survey<sup>143</sup> and a case study.<sup>148</sup>

With regards to the studies where measurements were performed at three or more time points, measurements were typically performed at baseline and equal intervals during treatment<sup>8,137</sup> or regular intervals post-treatment,<sup>5,50,150</sup> with one study assessing outcomes as far as six months post-intervention.<sup>5</sup> In two studies the researchers executed different measures at different times. In Heath and Beattie's study,<sup>149</sup> a stress scale was administered at baseline and twice post-intervention, with additional open-ended questions after the final assessment. Additionally, a journal was kept by the participants during the first month post-training. In Lynning et al.'s study,<sup>7</sup> with participants diagnosed with MS, spasticity and fatigue was measured at baseline and post-intervention, but also included a daily symptom self-



report scale that was used from a week prior to intervention up to just post-intervention.

#### **4.4. APPLIED STRUCTURE OF THE TRE TREATMENT PROGRAMMES**

Table 4.4. contains detail regarding how the structure of TRE treatment varied between the studies. Data are provided regarding the treatment provider; the TRE treatment components, which included a psychoeducational component, practical component and self-practice component; information with regards to the duration and frequency of sessions and treatment; as well as the total number of guided sessions. (See next page.)

**Table 4.4. Applied TRE Treatment Structure per Study (n = 18)**

Author (year)	Provider	TRE treatment structure			Duration/frequency					
	Certified TRE provider	Psychoeducation	Practical component, group (G) and/or individual (I)	Self-practice	Guided session frequency (weekly)	Recommended self-practice frequency (weekly)	Tremor duration (minutes)	Session duration (minutes)	Treatment duration (weeks) (* days)	Total guided sessions
Atterbury (2019)	yes	yes	yes, G	yes	3–1 <sup>a</sup>	0–2 <sup>a</sup>	max 10	50–60	9	17
Beattie & Berceli (2021)	yes	N/R <sup>b</sup>	yes, I/G	yes	N/R	2–3	10–15	N/R	12	N/R
Berceli (2007)	N/R	N/R	yes, I/G	N/R	3	N/R	N/R	60	2	6
Berceli et al. (2014)	N/R	yes	yes, G	yes	1	2–3	N/R	N/R <sup>c</sup>	10	10
Botha (2022)	yes	N/R	yes, I	N/R	1	N/R	5	30–35	1	2
Harrison et al. (2018)	yes	N/R	yes, G	yes	1	3	15	60	6	6
Heath & Beattie (2019)	N/R	yes	yes, G	yes	2	N/R <sup>d</sup>	N/R	30	4	4
Heath (2013)	yes	yes	yes, G	N/R	N/R	N/R	N/R	N/R	1 day	N/R
Herold & Nibel (2016)	yes	yes	yes, G	N/R	N/R	N/R	N/R	N/R	2–3 days* (n=71) +/-16 (n=12)	N/R
Hruby & Beattie (2021)	yes	yes	yes, G	yes	1	1–3	15	N/R	4	1
Johnson & Naidoo (2017)	yes	yes	yes, G	N/R	1	N/R	N/R	90	10	10
Kent (2018)	N/R	N/R	yes, G	yes	2	2	15–30	60	4 24 (self)	8
Lynning et al. (2021)	yes	N/R	yes, I	yes	1	daily	max 15	30–45	9	9
McCann (2011)	N/R	yes	yes, G	N/R	2/day	3	N/R	N/R	5	7

Author (year)	Provider	TRE treatment structure			Duration/frequency					
	Certified TRE provider	Psychoeducation	Practical component, group (G) and/or individual (I)	Self-practice	Guided session frequency (weekly)	Recommended self-practice frequency (weekly)	Tremor duration (minutes)	Session duration (minutes)	Treatment duration (weeks) (*days)	Total guided sessions
Salmon (2016)	yes	N/R	yes, I/G	yes	4 (2/day)	3–4	45	60	16	9
Salmon (2013)	yes	N/R	yes, G	yes	1	N/R	N/R	120	12	12
Swann (2019)	yes	N/R	yes, G	N/R	2/day	2–3	15	S1: 120 S2: 90	5	2
Thommessen & Fougner (2020)	N/R	yes	yes, G	N/R	1	N/R	N/R	N/R	2–3 years	N/R

<sup>a</sup> TRE sessions were tapered from provider to home: 2 weeks only provider sessions, 4 weeks two provider sessions and one self-practice, 3 weeks one provider session and two self-practice

<sup>b</sup> N/R = not reported

<sup>c</sup> TRE session duration not indicated, but weekly provider sessions, which included guided TRE and psychoeducation, were altered weekly between 3-hour and 7-hour sessions

<sup>d</sup> The number of recommended sessions were not indicated, but the participant reported five full TRE self-practice sessions and 13 “quick start” sessions during the first month following training

The majority of the studies ( $n = 13$ ) indicated that treatment was provided by a certified TRE provider, with four of the remaining studies having the founder of TRE, Berceli, as part of the research or treatment team, overseeing the treatment aspect.<sup>5,10,105,145</sup> It was unclear in the remaining study whether the provider was fully TRE certified.<sup>139</sup>

As seen in Table 4.4., three components are typically part of TRE training and treatment, namely psychoeducation, supervised practice of the technique, and self-practice. Psychoeducation as part of the treatment was mentioned in half of the studies ( $n = 9$ ). However, in several of the studies ( $n = 14$ ) the authors did not include detail on whether all three components were included. This does not necessarily mean that one of the components were excluded.

With regards to frequency and duration of treatment provided in the studies, supervised provider sessions varied from once a week to three times a week and, sometimes, twice a day when treatment formed part of a training process. Provider sessions were mostly conducted in a group setting ( $n = 13$ ). Self-practice, when recommended ( $n = 10$ ), was typically recommended two to three times a week, with one study recommending daily self-practice.<sup>7</sup> Studies often did not provide detail regarding self-practice compliance,<sup>7,10,50,147</sup> except for one study reporting poor adherence to the self-practice recommendation<sup>141</sup> and another study reporting sufficient adherence to the self-practice component due to high accountability ensured in the study.<sup>150</sup> Due to overall limited information regarding self-practice adherence, the total number of sessions per study in Table 4.4. included only the provider sessions.

A typical TRE practical session included a check-in period prior to the physical exercises,<sup>8,131,139,141,147</sup> which was used to guide the participants in focussing on their present emotional and mental state, performing a body scan and practicing deep breathing. After the tremoring part of the session, a relaxation period was indicated, sometimes called “integration”<sup>148</sup> followed by a check-out period during which the participants were encouraged to notice any changes in their body, emotional state or mental state and share their TRE-related experiences with other participants.<sup>8,131,138-139,141,147</sup> A session ranged from 30 to 90 minutes, with the tremoring part of the exercise taking 10 to 15 minutes. In a study where the tremor

period was longer than indicated in the other studies, namely 45 minutes, the participant was individually monitored by the provider for any adverse reactions.<sup>148</sup>

Treatment duration and the total of guided sessions varied widely between studies, with treatment ranging from a single session to 16 weeks, and drama students performing TRE for 2 to 3 years.<sup>139</sup> Another study reported 4 weeks of treatment with continuing self-practice for 6 months before the final outcome measurement.<sup>5</sup> Total guided sessions ranged from a single guided session to 17 sessions.

When participants presented with physical limitations, for instance, participants with Parkinson's disease<sup>8</sup> and multiple sclerosis,<sup>138</sup> the TRE protocol allowed for modifications to the exercises.

#### **4.5. MEASUREMENT TOOLS USED AND THE OUTCOME RESULTS**

Various measurement tools were used to measure the outcomes of TRE treatment. Table 4.5 lists the quantitative measurement tools used in the majority of the quantitative studies ( $n = 16$ ), with an indication of the types of outcomes it measured, according to the OTPF-IV's outcomes and domain categories.<sup>45</sup> The measurement tools used in the studies assessed health, quality of life (QoL), performance patterns and condition-specific outcomes, with the measurement of health outcomes subdivided into the OTPF-IV's body function categories. The treatment outcome results are also listed in the table, together with the measurement tools with which they were assessed. Below the table, the qualitative and social validity measures used in four of the records (one quantitative study) are also indicated.

**Table 4.5.** Quantitative Measurement Tools and Reported Outcome Results (According to OTPF-IV Categorisation) from Quantitative Studies (n = 16)

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors	
	Health (body functions)								QoL				
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)	Performance patterns		Condition specific
<b>Atterbury (2019)</b>													
Instrumented 2-minute walk (2MW) with APDM Mobility Lab system, OM						√							i) Improvements in gait performance and quality were indicated in the TRE group, when compared to exercise control group. ii) Significant practical improvements for motor experiences of daily living, specifically related to gait disturbances and postural instability. iii) TRE treatment led to a statistically significant decrease in gastrointestinal complaints (also in exercise control group) as well as improved scores for nocturia. iv) Improved scores for concentration and forgetfulness was indicated in the TRE group, with practical significance. v) TRE group presented with greater improvement than control group in depressed mood, anxiety and somatic symptoms. TRE treatment also presented to be more
Mini Balance Evaluation Systems Test (BESTest), OM						√							
Activity-specific Balance Confidence scale (ABC scale), SR						√							
Non-Motor Symptoms Questionnaire (NMSQ), SR												√	
Non-Motor Symptoms Scale (NMSS), SR												√	
Movement Disorder Society's Unified Parkinson's Disease Rating Scale (MDS-UPDRS), SR												√	
Parkinson's Disease Questionnaire (PDQ-8), SR												√	

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
Patient Health Questionnaire for somatic, anxiety and depressive symptoms (PHQ-SADS), SR	√		√	√	√		√	√					effective in improving frequency and severity of mood, relating to perceived stress, with moderate practical significance.	
<b>Beattie &amp; Berceli (2021)</b>														
Perceived Stress Scale (PSS-10), SR	√									√			i) No statistically significant changes in perceived stress, when comparing pre-treatment, 4-weeks post- and 12-weeks post-treatment. ii) Statistically significant improvement in flourishing when comparing all three time-points. iii) Improvement in pain self-efficacy, but not statistically significant, when comparing all three time points.	
Flourishing Scale (FS), SR										√				
Pain Self-efficacy Scale (PSEQ) <sup>b</sup> , SR					√					√				
<b>Berceli (2007)</b>														
Polar Precision S810i heart rate monitor, OM							√						i) Reduction in heart stress response indicated, slightly more in the exercise control group than TRE group. Uncertainty in TRE group due to unfamiliar tremors could have affected the heart stress response.	
Activation-Deactivation Adjective Check List (AD-ACL), assessing momentary arousal states, SR			√											

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
Spielberger State-Trait Anxiety inventory (STAI X-1), state anxiety section, SR	√												<p>ii) No statistically significant changes indicated in AD-ACL scores. Accuracy of test was questioned.</p> <p>iii) Reduction in anxiety-present and statistically significant increase in anxiety-absent scores on STAI X-1 subscale and total scores, for TRE group.</p> <p>iv) The study concluded that the STAI X-1 might be a more accurate measure to indicate stress reduction than AD-ACL for this type of study.</p>	
<b>Berceli et al. (2014)</b>														
Health, Wellness and Quality of Life Questionnaire (HWQoL), SR	√								√				<p>i) Statistically significant improvement in life enjoyment, as well as participants' overall impressions of their physical, mental and emotional health, stress and overall quality of life.</p> <p>ii) Due to insufficient participant literacy, data from diaries could not be analysed.</p>	
Diary documenting TRE-related experiences and adherence to self-practice, SR											√			
<b>Botha (2022)</b>														
H10 Polar Electro Oy heart rate variability app and validated heart rate variability analysis software, OM								√					<p>i) A single TRE session had no effect on cardiac autonomic response, measured in heart rate, blood pressure and heart rate variability, when compared to control group.</p> <p>ii) No negative effect on cardiac autonomic response,</p>	
Sphygmomanometer, OM								√						



Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
Perceived Stress Scale (PSS-10), SR	√									√			therefore an acute 30-minute TRE session will not be harmful to clients with epilepsy (3-months seizure-free) iii) Decrease in participants' interictal state anxiety symptoms with large practical significance. iv) Improvement in reported comfort levels pre- to post intervention, with large practical significance.	
Spielberger State-Trait Anxiety inventory (STAI-S), state anxiety, SR	√													
Subjective Visual Analogue scale with comfort rating (rating 1 to 10), with descriptive pictures, SR	√													
<b>Harrison et al. (2018)</b>														
International Restless Legs Syndrome Rating Scale (IRLS), SR												√	i) TRE and discussion control groups indicated similar improvements over time on study outcomes. ii) Clinically meaningful reduction in RLS symptom severity for both discussion and TRE groups. iii) Reduction in reported depression and improvement in sleep quality indicated in both groups. iv) An average of 65% of TRE participants complied to the recommended home self-practice programme.	
Global RLS severity ratings (visual analogue scale 0 to 10), SR												√		
Global stress ratings scale (visual analogue rating 0 to 10), SR	√													
Major Depression Inventory (MDI), SR	√													
Pittsburgh Insomnia Rating Scale (PIRS-20), SR				√										
Journal documenting self-practice, SR												√		

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
<b>Heath &amp; Beattie (2019)</b>														
Perceived Stress Scale (PSS-10), SR	√									√			i) Marked, descriptive decrease in perceived stress, from pre-intervention to one- and four months post intervention. ii) Clinically significant improvement in physical and emotional well-being directly after treatment. These included all comfort/discomfort aspects. iii) Participants indicated TRE to be a suitable complementary technique to other treatments due to longer periods not dependent on a therapist; cost-effectiveness; improved sleeping; increased lower back, hips and pelvis flexibility; feeling more comfortable in own body, feeling more self-reliant and motivated.	
TRE comfort/discomfort questionnaire (with regards to relaxation, pain, energy, thoughts, ability to cope, connection to body), SR	√		√		√					√				
Journal documenting self-practice, SR											√			
Open-ended questionnaire: addressing participant's benefits and ongoing use of TRE, SR									√		√			
<b>Herold &amp; Nibel (2016)</b>														
Questionnaire (not indicated whether validated tool) assessing self-reported job satisfaction, job strain, health complaints, pain and health status, SR	√			√	√		√	√	√				Outcomes on two participant groups were reported ( $n = 71$ and $n = 12$ ): i) Health complaints descriptively lower post TRE training when considering the table provided in the article ( $n = 71$ ). There were no specific statistical summary.	

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors	
	Health (body functions)								QoL				Performance patterns
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)			
													ii) Overall descriptive decrease in health complaints, with a mean of 3 less health complaints/symptoms ( <i>n</i> = 12) iii) Approximately 50% decrease in health-related claims ( <i>n</i> = 12) iv) Participants reported improvement with regards to knee pain, dizziness, feeling energised and relief of general physical tension ( <i>n</i> = 12).
<b>Hruby &amp; Beattie (2021)</b>													
The Depression, Anxiety and Stress Scale (DASS21), SR	√												Descriptive improvement indicated: mild to moderate depression and mild anxiety symptoms decreased to within normal limits ( <i>n</i> = 2).
<b>Johnson &amp; Naidoo (2017)</b>													
Copenhagen Burnout Inventory (CBI), SR	√		√										i) Significant reduction in teacher stress (personal burnout) and learner burnout (due to teacher's work with learners) was indicated with TRE treatment, when compared to waitlist control group. ii) No significant change in work burnout with TRE. iii) Significant within-group reduction of perceived stress for TRE group.
Perceived Stress Scale (PSS), SR	√								√				

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
<b>Kent (2018)</b>														
Delis-Kaplan Executive Function System (D-KEFS), subtests Verbal fluency and Colour-word Interference, OM		√											i) TRE was indicated as a potentially useful approach to address trauma-related cortical functions: -Attention and working memory improved more in the TRE group when compared to the waitlist control group and alternative treatment group. - The whole sample improved on executive function's list fluency ability, the alternative treatment group improved relative to TRE group on category inhibition. ii) The whole sample indicated improvement in affective aspect of pain, as well as in insomnia from pre- to post-intervention, with no between group difference. iii) The whole sample indicated decreased depression and PTSD symptoms, sustained over 6 months, with no between group differences. iv) No improvement in well-being over time in the whole sample, from pre- to 6-months post intervention.	
Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), OM		√												
Neuropsychological Assessment Battery (NAB)'s Word generation test, OM		√												
McGill Pain Questionnaire (MPQ), including an affective component, SR	√				√									
Insomnia Severity Index (ISI), SR				√										
PTSD Symptom Scale (PSS, Foa), SR	√											√		
Patient Health Questionnaire-9-Depression Scale(PHQ-9), SR	√													
RAND 36-Items Short Form Health Survey (SF-36), SR	√		√		√	√				√				

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
Ryff Scales of Psychological Well-being (3 subscales), SR									√	√				
<b>Lynning et al. (2021)</b>														
Modified Ashworth Scale (MAS) for baseline spasticity of ankle plantar flexors, OM						√							i) No statistically significant changes in spasticity indicated by PSAD. ii) Significant change in reported day-to-day symptoms. In eight of the nine day-to-day symptoms statistical significant change was indicated (fatigue, pain, spasticity, muscle weakness, walking difficulty, sensory disturbances, dizziness, and bladder dysfunction), with borderline significant change in bowel dysfunction. Significant increase was also indicated in sleep quality iii) Approximately 50% decrease in reported fatigue.	
Portable Spasticity Assessment Device (PSAD), OM						√								
Newly developed patient reported day-to-day outcome tool (PRO), administered via smartphone, SR												√		
Modified Fatigue Impact Scale (MFIS), SR			√											
<b>McCann (2011)</b>														
Spielberger State-Trait Anxiety inventory (STAI-S), state anxiety section, SR	√												i) No significant differences after TRE training in state anxiety (STAI-S) or in emotional well-being (SF-36). ii) Significant differences indicated in self-reported anxiety, after TRE (PGWBI).	
RAND 36-Items Short Form Health Survey (SF-36), SR	√		√		√	√				√				

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors	
	Health (body functions)								QoL		Performance patterns		Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)			
Psychological General Well-Being Index (PGWBI), one-week version, SR	√								√	√			
<b>Salmon (2013)</b>													
Health, Wellness and Quality of Life Questionnaire (HWQoL), SR	√								√			Results of the questionnaire indicated the percentage of participants that reported improvement in the following areas: i) Mental/emotional state: 68.42% ii) Handling of stress: 73.03% iii) Well-being: 76.97% iv) Enjoyment in life: 59.87% v) Quality of life: 59.21%	
<b>Salmon (2016)</b>													
Informal interview to explore participant's improvement, SR	√				√				√	√		Participant reported: i) Improved control over her life with a more positive outlook on life and feeling "lighter". ii) Pain was still present, but feeling healthier and able to be weaned off her psychiatric medication. The provider noted that the upper limb tremor stopped during TRE sessions and that the participant presented with control over the condition-related tremor.	

Measurement tool, objective measure (OM) or self-report (SR)	Outcomes measured: Health, QoL <sup>a</sup> (OTPF) and condition-specific											Primary outcomes reported by authors		
	Health (body functions)								QoL				Performance patterns	Condition specific
	Specific mental function (emotion)	Specific mental function (higher cognitive, attention, memory)	Global mental function (energy)	Global mental function (sleep process and quality)	Sensory functions (pain)	Neuromusculoskeletal system	Cardiovascular system	Digestive, metabolic, genitourinary system	Life satisfaction	Self-concept (belief/feelings)				
<b>Swann (2019)</b>														
Oswestry Low Back Pain Disability Questionnaire, SR					√								i) The use of TRE as treatment for PTSD or non-specific chronic lower back pain was not conclusively supported by the study results. Data was insufficient to indicate whether TRE was at least just as effective as PMR. ii) Clinically significant decrease in PTSD symptoms post 4-week TRE self-practice. iii) Descriptive change in emotional distress with TRE treatment, compared to statistically significant change in PMR control group after training. iv) No improvement in quality of sleep indicated for both treatment groups. v) Better response rate in TRE group than PMR group during and after self-practice. The study indicated that a high degree of accountability is required for self-help techniques.	
Defense and Veterans Pain Rating Scale (DVPRS), SR					√									
PTSD Checklist for DSM-5 (PCL-5), SR	√											√		
Subjective Units of Disturbance (SUDS), SR	√													
Insomnia Severity Index (ISI), SR				√										
TRE self-practice assessment on Survey Monkey, SR											√			
<sup>a</sup> QoL – Quality of life <sup>b</sup> Pain self-efficacy – a person’s belief or expectation in being able to cope with performing and participating in various behaviours and activities while experiencing pain. <sup>151</sup>														

Qualitative and social validity measures were also used in some of the studies ( $n = 4$ ). Four records used qualitative ( $n = 3$ )<sup>132-133,139</sup> and social validity ( $n = 1$ )<sup>143</sup> measures:

- i. Heath<sup>143</sup> used a 6-question questionnaire with a 9-point rating scale to assess workshop participants' experience of a TRE workshop. The participants indicated that the presented information on the body's stress response and neurogenic tremors were useful, an improved state of calmness was reported, and a likeliness of the participants continuing with TRE exercises after the workshop.
- ii. In the qualitative part of Johnson's study,<sup>132</sup> participants indicated during focus group interviews an awareness of feeling grounded and in touch with their bodies, a physical release of stress and burnout, a feeling of being calm and in control, as well as a changed perception of thinking processes and self-concept.
- iii. Lynning<sup>133</sup> used semi-structured interviews to explore themes related to the TRE-experiences. Lynning's participants ( $n = 9$ ) indicated a variety of mental and physical benefits from TRE: improved sleep ( $n = 5$ ), a sense of "loosening up" in the whole or parts of the body ( $n = 5$ ), improved mood or resilience ( $n = 5$ ), improved levels of energy ( $n = 3$ ), better bladder functioning ( $n = 4$ ), decreased spasticity ( $n = 3$ ), and gait improvement ( $n = 3$ ).<sup>133</sup>
- iv. Three central themes were indicated during Thommessen and Fougner's semi-structured interviews:<sup>139</sup> improved self-awareness of mind and body, improved skilled performance under pressure, and improved skill in creating a character. Additionally, challenges in sharing of emotions in a group context were also reported by some participants.

#### **4.5.1. Measurement tools**

As can be seen in Table 4.5 and the additional information with regards to social validity and qualitative measures, a variety of measurement tools were used, including physiological measurement tools, condition-specific measurements and questionnaires, mood-related questionnaires, cognitive tests, and questionnaires addressing quality of life aspects. Measurement tools also included interviews and



focus groups exploring TRE-related experiences and journals in which participants had to document self-practice adherence.

There was very little overlap of these measurement tools across studies, with only eight measurement tools (which included journaling and interviewing) being used more than once. In total, 51 different measurement tools were used across the 18 studies. The majority of the measurement tools were self-report measures. Physiological responses and cognitive abilities were assessed with objective measurement tools.

Interestingly, a wide variety of health-related body functions were assessed across the studies to determine the effect of TRE. These functions included the obvious specific mental function of emotion, but also higher cognitive skills mental functions, sensory functions and even body system functions. Emotion was assessed in the majority of the studies ( $n = 17$ ), with quality of life also measured frequently ( $n = 11$ ). Most studies ( $n = 15$ ) included at least one test that measured symptoms of anxiety, stress or quality of life. Sensory function of pain ( $n = 8$ ) was also regularly measured. Interestingly, global mental function of sleep and system functions, which included cardiovascular, genitourinary and digestive system functions, were also measured in some of the studies.

#### **4.5.2. Reported study outcomes**

Before addressing the study outcomes, it should be noted that the quality of the included studies varied widely. The scoping review included peer-reviewed and non-peer reviewed studies, with several of the studies reporting an exploratory nature,<sup>7,8,137-138,145</sup> pilot testing,<sup>7,10,105,131,141,145</sup> or preliminary results<sup>8,137-138,146</sup> ( $n = 10$ ). Many of the studies aimed to assist in building research evidence for TRE. Some of the results are, therefore, descriptive, with others including inferential statistics.

Improvement in anxiety symptoms were reported most frequently ( $n = 7$ ), which included improvement in PTSD symptoms. Other improvements reported were a decrease in a depressed mood ( $n = 5$ ) and improvement in quality of life aspects ( $n = 4$ ). An improvement in sleep quality and ability was reported in some of the studies

( $n = 4$ ) and improvement in pain, somatic symptoms or coping with pain ( $n = 4$ ) was also indicated. Two studies specifically reported cognitive improvements, which included decreased forgetfulness, improved concentration, increased working memory and improved executive functioning. Improved energy levels or reduced fatigue ( $n = 2$ ) was furthermore described.

Heart stress response was assessed in two studies to indicate the effect of TRE on the stress response on a physiological level. There were no indications of improvement at this level ( $n = 2$ ). In the one study, it was hypothesised that heart rate variability responsiveness could have been affected by the anti-epileptic drug treatment of the participants, epileptic low vagal tone, or due to the treatment consisting out of only one single TRE treatment session.<sup>138</sup> The other study reported a possibility that the unfamiliar tremor response in the participants of the TRE group could have led to increased stress, limiting a decreased heart stress response.<sup>105</sup>

Interestingly, it was indicated that TRE could possibly have a beneficial effect on neurological conditions ( $n = 3$ ). Increased anxiety, sleep difficulties and cognitive limitations often form part of these conditions and improved, as presented above. In Harrison et al.'s study,<sup>137</sup> improvement was the same for participants from the TRE treatment group and the discussion control group. The study investigated the effect of TRE on participants diagnosed with RLS. The authors hypothesised that repeated assessment, symptom regression toward the mean, or the group environment could have played a role in both groups.<sup>137</sup>

#### **4.6. STUDY RECOMMENDATIONS FOR FUTURE RESEARCH**

Authors of the included studies made recommendations regarding future research on TRE treatment. In Table 4.6. the various recommendations are provided, with a descriptive summary of the data following the table.

**Table 4.6. Recommendations by Authors for Future Research**

<b>Author (year)</b>	<b>Authors' recommendations for future research</b>
<b>Atterbury (2019)</b>	<ul style="list-style-type: none"> <li>i) An alternative comparison treatment.</li> <li>ii) The motor and non-motor gains from relaxation-based exercise intervention seemed to be promising. Greater focus on relaxation or stress management for persons with Parkinson's disease is recommended for future rehabilitation programmes.</li> <li>iii) Further research to determine benefits of TRE for persons with Parkinson's disease and in other stressed populations.</li> <li>iv) Objective stress measures should be used.</li> <li>v) Increased sensitivity of questionnaires, addressing specific symptoms.</li> <li>vi) A benchmark controlled trial. Self-determined motivation could have an effect on outcomes.</li> <li>vii) Evaluating the effect of supervised treatment, therefore use different TRE treatment groups with different supervision levels.</li> <li>viii) A mixed-method design for more insight into the participants' subjective experiences and benefits.</li> </ul>
<b>Beattie &amp; Berceli (2021)</b>	<ul style="list-style-type: none"> <li>i) Objective measurement tools, to assess the affected heart rate variability.</li> <li>ii) An active control group.</li> <li>iii) A longitudinal study.</li> <li>iv) Evaluation required from researchers outside of the TRE community.</li> </ul>
<b>Berceli (2007)</b>	<ul style="list-style-type: none"> <li>i) A more controlled treatment routine with a single researcher.</li> <li>ii) Use of more conclusive physiological measures, for instance blood analysis.</li> <li>iii) Using participants with increased stress levels, for the possibility for more noticeable results following treatment.</li> <li>iv) The treatment group should receive some education on tremors to limit fear and uncertainty affecting results.</li> <li>v) Explore the participants' awareness and ability to identify their psycho-emotional state, which has been reported to improve after TRE.</li> </ul>
<b>Berceli et al. (2014)</b>	<ul style="list-style-type: none"> <li>i) Use of a controlled trial with a larger sample size.</li> <li>ii) Increased number of outcome measures.</li> </ul>
<b>Botha (2022)</b>	<ul style="list-style-type: none"> <li>i) A longitudinal study, because treatment could affect vagal tone and possible cardiac autonomic responses.</li> <li>ii) Ensuring that control is applied for all medications.</li> <li>iii) Subjective changes in mood over time should be assessed with questionnaires.</li> </ul>
<b>Harrison et al. (2018)</b>	<ul style="list-style-type: none"> <li>i) Baseline data should be collected over a longer time period before treatment, to allow for scores to stabilise, and to counter for repeated assessment to have an effect on improvement.</li> <li>ii) The effect of group interaction on outcomes to be investigated.</li> <li>iii) A larger sample size to allow for small between group differences to indicate a significant difference.</li> </ul>
<b>Heath &amp; Beattie (2019)</b>	Continued investigation into TRE for recovery from trauma.

<b>Author (year)</b>	<b>Authors' recommendations for future research</b>
<b>Heath (2013)</b>	A different format: a half-day workshop with two shorter 2-hour follow-up sessions, which have been found to be beneficial in similar workshops.
<b>Herold &amp; Nibel (2016)</b>	<ul style="list-style-type: none"> <li>i) TRE treatment should be studied in alternative populations.</li> <li>ii) The treatment should be compared to alternative medical treatments.</li> </ul>
<b>Hruby &amp; Beattie (2021)</b>	<ul style="list-style-type: none"> <li>i) A larger sample size</li> <li>ii) Funding is needed for a randomised controlled trial.</li> <li>iii) An active control group with a longitudinal study.</li> <li>iv) Research should be performed by researchers from outside of the TRE community.</li> </ul>
<b>Johnson &amp; Naidoo (2017)</b>	<ul style="list-style-type: none"> <li>i) Participants should be randomly selected with blind assignment to treatment and control groups.</li> <li>ii) A larger sample size.</li> <li>iii) The tremors should specifically receive more attention in future research.</li> </ul>
<b>Kent (2018)</b>	<p>During a secondary analysis of results, the following aspects should be addressed due to the complexities and differences in participants:</p> <ul style="list-style-type: none"> <li>i) Comorbid psychiatric diagnoses and duration</li> <li>i) Mental health treatments and duration</li> <li>ii) Medications used</li> <li>iii) Chronic pain diagnoses and duration</li> </ul>
<b>Lynning et al. (2021)</b>	<ul style="list-style-type: none"> <li>i) Randomised research studies to investigate the effect of TRE.</li> <li>ii) Increased number of outcome measuring tools should be used, as well as tools that can assess over time, for instance a day-to-day measurement tool.</li> <li>iii) Measures to assess fatigue and sleep quality should be included.</li> <li>iv) Assessment of improvement could have been affected by initial low base-line scores for certain symptoms. Stricter inclusion criteria is required.</li> </ul>
<b>McCann (2011)</b>	<ul style="list-style-type: none"> <li>i) Limit the effect of uncertainty and fear by educating the participants on tremors.</li> <li>ii) Explore the potential gender preference differences, as TRE could possibly be used alternatively to “talk therapy”.</li> <li>iii) Research on relevant traumatised populations, for instance, the police force, paramedics and torture victims.</li> <li>iv) Include more objective measures, for instance, physiological measures or observer reports. Salivary cortisol testing was suggested.</li> <li>v) Varying the TRE session frequency.</li> <li>vi) A longitudinal study.</li> <li>vii) Use the Psychological General Well-being Index (PGWBI) test to allow for cross-study comparisons.</li> <li>viii) An interdisciplinary research approach due to the diverse nature of the theory behind TRE.</li> </ul>
<b>Salmon (2016)</b>	Use of TRE with psychiatric conditions may be explored under careful monitoring.
<b>Salmon (2013)</b>	No recommendations reported.

Author (year)	Authors' recommendations for future research
<b>Swann (2019)</b>	<ul style="list-style-type: none"> <li>i) To ensure a larger sample size, inclusion criteria with regards to lower back pain diagnosis should be adjusted and a video or podcast should be used to communicate information regarding training sessions for potential participants.</li> <li>ii) More information should be collected on the participants' medication use, because it can have an effect on results.</li> <li>iii) More information on participants' alternative medical conditions should be collected, as it can affect treatment results.</li> <li>iv) More time should be allowed for the participant recruitment process.</li> <li>v) The initial level of symptoms should be screened for, to ensure sufficient room for improvement with regards to symptoms – the study's participants had low levels of pain and PTSD symptoms, therefore with little room for improvement.</li> <li>vi) The use of a waitlist control group or alternative treatment to PMR for a control, to increase participant retention and participation.</li> <li>vii) The optimal frequency and duration of TRE self-practice should be investigated, as well as whether self-practice or guided practice is more beneficial</li> <li>viii) Investigate effective ways to motivate clients to continue with self-practice.</li> </ul>
<b>Thommessen, Fougner (2020)</b>	No recommendations indicated.

Several authors recommended changes to the study designs used ( $n = 11$ ). These included recommendations for controlled trials ( $n = 10$ ), randomised selection and blind assignment of participants ( $n = 1$ ), a benchmark controlled trial ( $n = 1$ ), a longitudinal study design ( $n = 4$ ), using alternative treatment or control groups ( $n = 1$ ), using a single researcher to facilitate the treatment groups ( $n = 1$ ), as well as a prolonged period of base-line data collection to allow scores to stabilise ( $n = 1$ ).

Recommendations were made with regards to the measurement tools used in the studies ( $n = 7$ ). Five studies recommended a more objective physiological measurement of stress, with suggested use of blood analysis, salivary cortisol and more objective observer reports.

Six studies made recommendations related to sample size. Several studies were conducted with relatively small sample sizes and recommended larger samples for future studies ( $n = 5$ ). One study indicated that by adjusting the recruitment procedure and inclusion criteria, a larger sample size could be possible in future.

Furthermore, recommendations were made with regards to populations for TRE-related research ( $n = 4$ ), including relevant trauma-affected populations and psychiatric conditions. Three studies suggested investigation into the optimum TRE treatment structure, considering supervision levels, frequency of self-practice and the most beneficial ratio between self-practice and facilitated treatment.

#### **4.7. CONCLUSION**

In this chapter, the data extraction results were presented. The characteristics of the study populations were discussed, which included the diagnostic groups, gender and age of the participants, socio-economic circumstances of the populations, as well as the countries where the studies originated from. Thereafter, data related to the study designs, sampling methods and time point measurements were presented. The methodological results were followed by data relating to the TRE treatment structures used in the studies. Measurement tools used, the results of the measurements, and the recommendations for future studies were presented. In the

following chapter these results will be discussed in more detail, again arranged according to the study objectives.

## **CHAPTER 5: DISCUSSION**

### **5.1. INTRODUCTION**

In this chapter the data that was presented will be discussed in more detail and in relation to the literature. The characteristics of the populations will be explored, including interesting aspects regarding the diagnostic groups, gender and age of the participants, and the countries where the studies originated. Thereafter, the methodological aspects, specifically research designs and sampling methods, will be discussed, after which the Trauma Releasing Exercises (TRE) treatment structures that were applied in the studies will be addressed. Lastly, the measurement tools used will be explored, as well as the outcome results. Recommendations made by the authors for future research will be discussed and incorporated into the above-mentioned sections.

### **5.2. CHARACTERISTICS OF POPULATIONS TREATED WITH TRE**

#### **5.2.1. Diagnostic groups**

TRE was developed to reduce built-up stress.<sup>15</sup> It is, therefore, no surprise that most of the included studies focussed on populations exposed to- and suffering from high levels of stress and trauma. The following populations were considered to benefit from this relaxation technique: clients suffering from post-traumatic stress disorder (PTSD) (including veterans);<sup>5,149-150</sup> non-professional care workers at a children's home for abused and orphaned children;<sup>10</sup> communities affected by bushfires;<sup>143</sup> mental health professionals with health problems, possibly related to work stress;<sup>146</sup> first responders who typically work in unpredictable and dangerous situations;<sup>147</sup> secondary school teachers working in violence-prone communities;<sup>131</sup> clients with a history of multiple diagnoses and treatments without significant improvement and with symptoms that could be trauma-related;<sup>148</sup> as well as youth from highly traumatised and poor communities.<sup>141</sup>



There are a variety of existing proven therapies available to address disabling levels of stress and anxiety, with the most common treatments being pharmacological treatment and psychosocial therapies.<sup>44</sup> These treatments are, however, often expensive, and long-term pharmacological treatments could lead to unwanted side-effects.<sup>16</sup> Due to the fact that TRE is a simple technique that can be easily taught in groups with the potential for being used as a self-help tool, it could be more affordable for clients,<sup>10,147</sup> therefore considered worthwhile to study on populations exposed to stress and trauma.

Another diagnostic group included in the research was chronic neurological conditions. These included Parkinson's disease,<sup>8</sup> multiple sclerosis (MS),<sup>7</sup> restless legs syndrome (RLS)<sup>137</sup> and epilepsy.<sup>138</sup> TRE's ability to assist in symptom reduction was explored. With Parkinson's disease and epilepsy, the aim was to address co-morbid stress and anxiety, thereby improving the participants' quality of life. In individuals with Parkinson's disease, increased stress levels due to condition-related struggles exacerbates the Parkinson's disease' symptoms<sup>8</sup> and, therefore, it has been hypothesised that the participants' symptoms and quality of life would improve when using TRE as a stress management technique.<sup>8</sup> Individuals with epilepsy often suffer from co-morbid anxiety<sup>138</sup> and, thus, TRE was used to address the anxiety.

With MS and RLS, it was hypothesised that TRE could have a direct effect on the disease-related symptoms due to the technique's reported ability to relieve deep muscle tension.<sup>7,137</sup> Many MS-related symptoms are claimed to be related to spasticity, and, therefore, should TRE reduce spasticity, it could have an effect on some of the other symptoms.<sup>7</sup> The study that focussed on a RLS population hypothesised that TRE treatment could improve symptoms in participants by releasing deep tension, based on a potential role that chronic physiological stress could be playing in this condition.<sup>137</sup> Medical treatments for MS and RLS are often accompanied by unwanted side-effects,<sup>7,137</sup> therefore, the exploration of an alternative or supplemental treatment option is indicated.

Apart from medical diagnostic groups, TRE was also used with a very different group of participants – drama students.<sup>139</sup> The study explored the effect of TRE on the students' personal wellness and professional performance. A drama curriculum

often includes techniques for improved psychosocial awareness, which could increase an actor's ability to create a character on stage.<sup>139</sup> With improved self-awareness and an ability to handle stress more easily, TRE could potentially improve an actor's ability to portray a character and to perform under stress.<sup>139</sup>

### **5.2.2. Gender**

A majority of female participants was noted across the studies. This could be due to the higher tendency of women, compared to men, in seeking treatment for health problems, specifically mental-health related.<sup>152-153</sup> Another explanation for the majority female participants could be sampling-related. Women have a tendency to be more compliant than men,<sup>154</sup> sympathising with a researcher's task,<sup>138</sup> potentially agreeing more easily to participate in a study. An unequal gender representation in the studies could affect external validity of the results due to possible gender differences in treatment. Bercei suggested that there could be differences between men and women in their ability to notice subtle bodily changes during treatment, and with regards to their sensitivity and acceptance of the effect of the tremors.<sup>105</sup>

### **5.2.3. Age**

Even though TRE is used in practice with children to address stress and trauma,<sup>15</sup> no studies focussed on the treatment of children. No specific reason or explanation for this gap in the literature could be found. One explanation could be difficulties to access child participants and ethical challenges when including children as participants in a research study.<sup>155</sup> As no studies have been conducted with children as participants, caution should be taken when utilising this technique with this group.

TRE is a simple technique with limited reliance on language, potentially making it ideal to use with children. The effect of TRE on children should be an avenue for further investigation, due to children also being exposed to trauma and significant levels of stress, with debilitating emotional and health sequelae.<sup>62,156</sup>

#### **5.2.4. Represented countries and population circumstances**

Interestingly, most of the English studies were performed and published on South African populations ( $n = 7$ ), even though TRE originated in the United State of America (USA). Berceli, who developed the technique, travelled to many different countries to teach his technique and train TRE providers. TRE is practiced in many countries, with a total of 69 countries indicated on TRE's official website.<sup>157</sup> Berceli first taught TRE in 2010 in South African and, by 2014, South Africa had the highest concentration of trained practitioners.<sup>1</sup> The higher concentration of trained practitioners could explain the number of studies performed in South Africa. Three of the included South African studies were dissertations,<sup>8,138,145</sup> with one of the published articles also originating from a dissertation.<sup>131</sup> Available studies on high-risk communities ( $n = 3$ ) were done only in South Africa. Berceli et al.<sup>10</sup> and Johnson<sup>132</sup> anticipated that TRE would be useful within high-risk, traumatised communities due to community members' limited access to healthcare and the ease with which TRE could be presented in groups, with minimal language requirements, and at limited costs.

Countries with diverse income levels were represented in the studies. The World Bank classifies countries as low income, lower-middle income, upper-middle income and high income.<sup>158</sup> The USA, Australia, Denmark and Norway are high income countries, with South Africa classified as a upper-middle income country and the Ukraine as a lower-middle income country.<sup>158</sup> There were, however, no studies reporting data from countries with a low income level. Evidence supporting the use of TRE in low-income countries is yet to be collected.

### **5.3. STUDY DESIGNS AND OTHER METHODOLOGICAL ASPECTS**

#### **5.3.1. Research designs**

The identified studies spanned the whole hierarchy of designs, including experimental randomised control trials (RCTs) and quasi-experimental designs, pre-experimental designs, non-experimental descriptive designs, as well as single case-

studies and qualitative studies. This diversity of designs could be expected with a scoping review, where peer-reviewed and non-peer reviewed records are included.

In the traditional single-hierarchy evidence-based practice (EBP) model of levels of evidence, the six identified RCTs in this review are promising, however, only one of these studies was peer-reviewed. RCTs are considered ideal, due to being more rigorous with controlled conditions to safeguard against bias.<sup>159</sup> RCTs, however, require more funding and time resources than other designs, which could be beyond the researcher's or research team's abilities, especially in a novel research field.

More than a third of the included studies used a control group or alternative treatment group with which treatment results could be compared. These included RCT studies and a quasi-experimental study. When using a control group or alternative treatment group, it assists in controlling for maturation, history and even a placebo effect of treatment.<sup>159</sup>

Despite the focus on experimental designs, in light of Tomlin and Borgetto's Research Pyramid for Evidence-based Occupational Therapy (OT) Practice, as described in Section 2.5.2,<sup>118-119,160</sup> research designs other than experimental designs are also considered valuable. Qualitative, outcome and descriptive research categories occupy a place on the pyramid model, at an equal level to the experimental designs, with increased levels of rigour within each category.<sup>118</sup> While RCT experimental designs are valuable for high internal validity due to tightly controlled conditions, the results are not always easily transferable to real-world settings.<sup>24</sup> Qualitative research can address a client's lived experiences, which should be considered essential in the healthcare field. Also, descriptive and outcome research (which include single-group, pretest-posttest studies in the pyramid model) can investigate real-world professional practice questions, not possible with RCTs.<sup>118</sup>

Two case studies<sup>149</sup> and the qualitative study<sup>139</sup> included in the review demonstrated the value of qualitative designs. In the studies, participants shared their experiences related to the treatment, which could not be obtained with rigorous experimental research. This form of information is important, and, in combination with quantitative data, could give a more comprehensive picture of the effectiveness of a treatment.

All levels of evidence have value in a novel research field to provide preliminary results, guide the formulation of hypotheses for future studies, and to motivate for funding of more rigorous studies.<sup>161</sup>

### **5.3.2. Sampling**

All included quantitative studies used non-probability convenience sampling. Convenience sampling is the sampling method most commonly used in clinical health studies. This sampling method is less expensive than random sampling methods and easier to apply.<sup>159</sup> Several studies were informal or part of a dissertation, where the researchers had limited time and funds available. Most studies were also dependent on volunteers. Due to the possibility of volunteers differing consistently from those who did not volunteer, due to certain personality traits or beliefs regarding the treatment, volunteer effects should also be considered when interpreting the results. Generalisability of the results is limited. The small sample sizes reported by the authors also limit generalisability.<sup>159</sup>

With regards to the designs and sampling methods, authors of the studies recommended more rigorous research designs, including an alternative treatment group and larger sample sizes. Some of the studies that already included alternative treatment groups recommended using a different alternative treatment group due to certain limitations with the alternative treatments used. Improving on study design aspects will have cost- and time implications, and could depend on the availability of funding.

## **5.4. STRUCTURE OF THE TRE TREATMENT PROGRAMMES**

With regards to the structure of the TRE treatment programmes in the studies, it was, firstly, noted that psychoeducation was often included, and, typically, comprised of informing the trainee or client on the basic neurophysiology and neuropsychology of the stress response, the theories behind the tremor mechanism, as well as the Polyvagal theory.<sup>8,147,149</sup> Psychoeducation is considered part of intervention, where participants are educated on aspects related to their diagnosis

and or treatment.<sup>162</sup> A narrative review on psychoeducation indicated that by improving a client's knowledge and understanding of their condition, the mechanisms behind treatment and what to expect of the treatment process, psychoeducation supports active treatment adherence and treatment persistence.<sup>163</sup> Therefore, by including this aspect in TRE treatment, it could promote adherence to treatment and possibly support consequent improvement in symptoms.

Participants were typically encouraged during a check-in period to practice deep breathing and perform a body scan for improved body- and mental state awareness. The TRE trainers' manual recommends teaching deep breathing and encouraging it throughout the session.<sup>1</sup> Guiding clients in mindfulness, which could include doing a body scan and focussing on sensations in the body, is also recommended. There is already research support on mindfulness and breathing techniques,<sup>20,79-80,84-85</sup> and, therefore, it could potentially add to the claimed benefits of TRE. However, when specifically studying the effect of the tremors induced by TRE, it may be considered to exclude mindfulness and deep breathing aspects to determine the effect of the tremors alone.

Self-practice was typically recommended two to three times a week. However, self-practice was not always adhered to by participants or reported on in the studies. One of the studies specifically stressed the importance of high accountability for self-practice to ensure adherence.<sup>150</sup> Adherence to self-practice and improvement of accountability could be investigated further due to TRE being promoted as a self-help tool. Adhering to self-practice could increase the effect of TRE on a client's health. A recent study on the optimal frequency of yoga (another mind-body exercise) indicated that the frequency of self-practice is important, with the most benefits observed when yoga was practised at least five times a week.<sup>164-165</sup> Study authors recommended determining the optimal frequency of TRE self-practice, as this could then guide the recommended structuring of TRE sessions.

Lastly, a tendency to provide guided sessions in a group format was noted. Therefore, occupational therapists could include this technique in a mental health group session, with a group format typically limiting costs to the client. Additionally,

group sessions could hold benefit to research studies, as larger sample sizes could be included simultaneously.

## **5.5. MEASUREMENT TOOLS USED**

A wide variety of measurement tools were used across the studies. With different study aims, measurements tools were used to assess emotion; higher cognitive abilities; sensory functions; body systems including the cardiovascular-, neuromusculoskeletal-, digestive- and the genitourinary systems; quality of life aspects; performance patterns; and also condition-specific aspects.

However, when carefully considering the various study aims, a common theme of stress was noted. The studies either investigated the effect of TRE on populations exposed to stress and trauma,<sup>5,10,131,141,143,146-148,150</sup> the effect of TRE on populations with a medical condition and co-morbid stress,<sup>7-8,138</sup> or even drama students' ability to perform better when stress has been reduced with the use of TRE.<sup>139</sup>

Stress can affect a person on many levels due to wide-spread consequences of chronic activation of the sympathetic nervous system (SNS) and the hypothalamus-pituitary-adrenal (HPA) axis.<sup>54</sup> As discussed in Section 2.2.2 and Section 2.2.4, activation of the SNS and HPA axis, which assist a person in functioning during stressful times, could lead to an imbalance in various body systems when activated chronically.<sup>54</sup> It is theorised that TRE could assist the body in returning to homeostasis<sup>15</sup> by releasing tension in the body and activating the PNS. Should this be possible, it could lead to improvement on many levels. With a variety of measurement tools, the studies investigated these different areas and the effect of TRE.

The majority of measurement tools were self-report measures, with only a few objective measurement tools to assess physiological responses and cognitive abilities. Psychological and emotional functions are not easily measured objectively and, therefore, the use of self-report measures is indicated. It is, however, important for these tests to produce reliable and accurate data to answer the study questions, to be easily accessible, easy to use, and it should be possible to reproduce the

results.<sup>159</sup> Most of the self-report measures used are easily obtainable and user-friendly.

A few studies did, however, use objective measurement tools. Cognitive abilities were assessed with standardised tests,<sup>5</sup> while heart rate variability measurements were used as an indication of stress levels.<sup>105,138</sup> Blood analysis and measurement of salivary cortisol levels were recommended as an alternative to heart rate variability measurement by Berceli, due to unreliable and inconclusive results in his study with the heart rate variability measurement.<sup>105,145</sup> Salivary cortisol measurement has been used in stress research for approximately three decades, with research indicating that studies have used this measurement longitudinally with success during participants' everyday life.<sup>166</sup> Changes in cortisol reactivity could be used to assess the effect of behavioural therapies on stress. A tutorial on the practical and statistical considerations when using salivary cortisol measurements<sup>166</sup> reported this technique as a resource-efficient way of measuring stress in everyday life. By following certain stipulated guidelines, reliable, comparable and valid results could be obtained with this type of measurement.<sup>166</sup>

Another recommendation regarding measurement tools was to use daily measurement tools. In one of the studies, a daily symptoms scale in the form of a smartphone application was used.<sup>7</sup> Technology in the form of applications could make daily assessments more user-friendly for participants with an increased chance of adherence over a short period.<sup>167</sup>

## **5.6. REPORTED OUTCOMES**

Various outcomes were reported, with the most frequently reported descriptive and/or statistical positive outcomes being decreased anxiety symptoms, improved sleep ability, decreased experience of pain or improved ability to cope with pain, and improved cognitive abilities. These results could support the use of TRE in relieving built-up stress, as chronic stress has been linked in the literature with anxiety,<sup>54</sup> sleep difficulties,<sup>54,61</sup> limited ability to cope with pain,<sup>168-169</sup> and affected cognitive abilities.<sup>19,54</sup>



### **5.6.1. Mood-related outcomes**

Decreased anxiety and PTSD symptoms were reported most frequently in the studies, but also a decrease in a depressed mood as a result of TRE treatment. Being chronically exposed to stress could lead to an anxiety disorder or depressive symptoms.<sup>52,59-60</sup> Cortisol levels being chronically elevated due to activation of the SNS can cause damage to neurons and reduction in brain volume, which has been linked to emotional difficulties.<sup>54,57</sup> A stress-related, chronically activated SNS also correlates with the heightened arousal and startle response that can be observed in people with an anxiety disorder.<sup>51</sup> Should TRE reduce tension and return the body to homeostasis with a decrease in cortisol release and deactivation of the SNS, it could possibly improve anxiety and depressive symptoms.

### **5.6.2. Sleep**

Sleep is typically considered an occupation when addressed by occupational therapists, but the physiological process and quality of sleep, which were assessed in the studies, is classified as a specific mental function in the Occupational Therapy Practice Framework, 4<sup>th</sup> edition (OTPF-IV).<sup>45</sup> Improvement in this specific mental function was reported after TRE treatment. Affected physiological processes of sleep and sleep quality could be related to abnormal stress levels. When the HPA axis' function is affected by a chronic stress response, resulting change in cortisol levels affect brain functioning, leading to circadian dysregulation.<sup>54</sup> A dysregulated circadian rhythm affects the sleep/wake cycle.<sup>61</sup> By assisting in returning the autonomic nervous system (ANS) to homeostasis as theorised<sup>15</sup> and by normalising cortisol levels, TRE could potentially improve sleep ability.

### **5.6.3. Pain**

Some of the studies indicated improvement in pain, somatic symptoms or in the ability to cope with pain. Chronic stress could play a role in the experience of pain and ability to cope with pain. Changes in the HPA axis due to chronic response to

stressors could lead to changes and sensitisation in the central nervous system and peripheral pain receptors, affecting experience of pain.<sup>169</sup> Therefore, nonpharmacological interventions for chronic pain often include stress reduction techniques. Insight is, however, limited into the specific stress-related biological mechanisms that affect pain outcomes and how these treatments could be affecting these underlying mechanisms for pain management.<sup>168</sup> Should TRE be successful in releasing stress and normalising the functioning of the HPA axis,<sup>15</sup> it could potentially explain the decreased levels of pain. Decreased stress levels could also improve participants' ability to cope with residual pain due to improved emotional functioning.

#### **5.6.4. Cognitive functions**

The literature indicates the possibility of cognitive abilities improving with decreased stress. Chronic stress-related elevation of cortisol could lead to cellular and molecular changes in the brain, which are linked to cognitive disruptions.<sup>54</sup> According to Duncan,<sup>19</sup> it could lead to forgetfulness, poor concentration, insufficient problem-solving ability and indecisiveness. The included TRE studies reported a decrease in forgetfulness, increased concentration, improved working memory and improved executive functioning. If TRE played a role in decreasing stress levels, it could explain the improved cognition.

#### **5.6.5. Additional outcomes and implications**

Quality of life was also indicated to improve with TRE treatment. Quality of life can be defined as a person's perspective on their satisfaction with life, their hope, self-concept, health, as well as perception of socio-economic aspects.<sup>45</sup> When there is improvement in anxiety, sleep, pain and cognitive abilities, quality of life should be affected positively.

It was furthermore indicated that TRE could have a positive impact on Parkinson's disease, multiple sclerosis and epilepsy, by improving anxiety, sleep difficulties, as

well as certain cognitive functions. This result indicated the potential of TRE to benefit people suffering from conditions other than mental health disorders.

All the improved areas of function fall within the treatment scope of occupational therapists, as indicated in the OTPF-IV.<sup>45</sup> TRE could potentially be a useful mind-body technique in the mental health field with clients suffering from dysfunctional levels of stress or diagnosed with anxiety, PTSD and depression. It could, additionally, be used in the rehabilitation and neurocognitive fields with clients suffering from Parkinson's disease, multiple sclerosis, epilepsy or other physical limitations due to co-morbid stress and anxiety. It would be interesting to investigate the use of TRE with children as well, who could also suffer from debilitating stress, sleep difficulties and stress-related cognitive limitations. Another aspect for investigation should be the effect of TRE on adults and children with sensory processing difficulties, due to the high prevalence of anxiety in this diagnostic group.<sup>170</sup>

## **5.7. SUMMARY**

In this chapter, the extracted data were discussed in relation to the literature. The characteristics of the populations were explored, which included the diagnostic groups, gender and age of the participants, as well as the represented countries and population circumstances of the participants. The discussion addressed that TRE was mainly used with participants exposed to stress and trauma, but that it was also used with participants with neurological conditions and even drama students. The unequally higher representation of female participants was addressed and the gap noted in research on children. Other population characteristics were addressed as well.

With regards to methodological aspects, the promising number of RCT studies were discussed, but the value of a variety of designs included were also argued. The use of only non-probability sampling was then discussed. Interesting aspects regarding the applied TRE treatment structures were addressed, with discussion on the value of psychoeducation, the use of deep breathing and mindfulness during treatment,

as well as aspects related to self-practice adherence. The preferred group format of the guided sessions was addressed as well.

Lastly, the measurement tools used and outcome results were explored and discussed, with specific focus on the variety of measurement tools, promising alternative measurements, and the positive outcomes of treatment. Improvements with treatment were linked in the discussion to the function of the SNS and HPA axis, and improved areas of function were linked to the scope of occupational therapy. Recommendations made by authors for future research were discussed in the appropriate sections.

## **CHAPTER 6: CONCLUSION**

### **6.1. INTRODUCTION**

In the previous chapter, the review results were discussed within the context of existing literature. In this chapter, the main findings of the study will be summarised, after which the implications of these findings for practice will be discussed. A critical evaluation of the study's strengths and limitations will follow, after which recommendations will be made for future research.

### **6.2. SUMMARY OF MAIN FINDINGS**

The research studies on Trauma Release Exercises (TRE) intervention that was available and included in the review varied widely in research designs and measurement tools used, diagnoses of participants, and even in some aspects of the TRE treatment structure. This heterogeneity could be expected in a scoping review on a novel treatment technique.

A broad range of research designs were reviewed, including experimental, pre-experimental, descriptive and qualitative designs. The variety of designs can be considered valuable for healthcare research purposes, in that it could provide a comprehensive picture of treatment effectiveness, as well as client experiences.<sup>24,118</sup> However, some of these studies and results appeared informal and several were indicated as preliminary, with less rigorous designs. These studies could still assist in guiding and informing the formulation of hypotheses for future studies and to motivate for funding of more rigorous designs.

Many different measurement tools were used in the studies, with very little overlap. However, most measurement tools assessed participant functions that could be affected by stress: mental functions (emotion, higher cognitive skills, attention, memory, energy, and sleep process and quality), sensory functions (pain), body system functions (neuromusculoskeletal, cardiovascular, digestive, metabolic and genitourinary systems) and quality of life. With measured improvement in these functions, it could support that TRE reduces stress and subsequently assists in

improving functions affected by stress. Most measurement tools were self-report measures, typically used in the assessment of psychological and emotional aspects. The only objective measures were standardised tests to assess cognitive skills and measures of heart rate variability postulated to indicate a change in stress levels. The heart rate variability measurement did not seem to be reliable in indicating expected changes in stress levels, but an alternative objective measurement was suggested, namely salivary cortisol level measurement.<sup>105,145</sup> This physiological measurement was indicated in the literature to be a promising alternative option.<sup>166</sup>

Positive treatment outcomes indicated with descriptive and/or inferential statistics were improvement in mood-related aspects (anxiety, post-traumatic stress disorder and depression); sleep quality and ability; pain, coping with pain or somatic symptoms; as well as in cognitive functions, which included concentration, memory and executive functioning. All these improvements could be linked to the sympathetic nervous system (SNS) and hypothalamus-pituitary-adrenal (HPA) axis functioning, which is typically affected by a chronic stress response.<sup>54</sup> An improvement in quality of life was also indicated, which should be expected with the above-mentioned improvements. The potential of TRE being useful with neurological conditions was further highlighted due to improvement in sleep, cognitive abilities and anxiety symptoms in this population.

With regards to diagnostic groups, as indicated above, it was noted that TRE is not only potentially useful with populations exposed to stress and trauma, but could additionally be used with people diagnosed with neurological conditions, specifically Parkinson's disease,<sup>8</sup> multiple sclerosis<sup>7</sup> and epilepsy.<sup>138</sup> Another interesting use for TRE was with drama students, where improvement in body awareness, self-concept and reduced tension could lead to improved portrayal of a character and better performance under stress.<sup>139</sup>

The treatment of children with TRE was not addressed in the studies, which indicated that caution should be taken when using TRE on this population. It additionally indicated a gap in the research, as it could be beneficial to investigate the effect of TRE on children who are also exposed to stress and trauma.

With regards to the treatment structure of TRE, the use of psychoeducation as a treatment component was noted. The use of psychoeducation as part of treatment is valuable, due to promoting treatment adherence by increasing clients' knowledge and understanding of treatment.<sup>163</sup> The preferred method for the guided practical component of treatment was a group format. Self-practice was highlighted as a component of treatment that required further attention. Participants did not always adhere to self-practice, but, when accountability was included, adherence improved.<sup>150</sup> One of the reported benefits of TRE is that it could be used as a self-help tool and, therefore, this aspect requires further attention.

### **6.3. IMPLICATIONS FOR PRACTICE**

Implications based on this review should be considered as tentative, due to the limited research base and preliminary nature of several of the included studies. It should, however, be considered that it is a novel research field and the information obtained is a promising start in establishing a research base for this intervention.

TRE could potentially be used by occupational therapists in the mental health field, physical rehabilitation setting and with clients diagnosed with neurological conditions. With these clients, TRE could potentially help to limit condition-related or co-morbid anxiety symptoms, and improve stress- and anxiety-related sleep difficulties, pain management, and cognitive limitations.

The research indicated that the preferred method for guided sessions was a group format, which would suit incorporating this technique in occupational group therapy sessions well. Treatment in a group format could also imply cost-effective treatment, with the possibility of treating clients from lower socio-economic areas as well. Incorporating a psychoeducation component when applying TRE is important, as well as including some form of accountability for self-practice to improve adherence to treatment.

There were no available intervention studies on TRE with children and, therefore, this technique should be used with caution on this population. However, children with sensory processing difficulties, who often receive intervention from

occupational therapists specialised in this area, typically present with high levels of anxiety.<sup>170</sup> Due to TRE's potential to improve these symptoms, occupational therapists working in this field could consider including this simple self-help technique in their treatment.

## **6.4. CRITICAL EVALUATION OF THE STUDY**

### **6.4.1. Strengths**

Due to the heterogenous nature of the TRE research literature, a scoping review was used for a synthesis of the available intervention research. The choice of this methodology was based on what was recommended in the research literature. The wide scope of the included studies, as well as numerous study objectives and data extraction categories, are considered a strength, as it allowed for a comprehensive picture of the TRE intervention research up to date. This enabled determining gaps in the literature and informed detailed recommendations for further research.

The methodological process followed added to the strength of the study. The JBI (formerly known as Joanna Biggs Institute) scoping review framework was followed meticulously to ensure methodological rigour and research integrity, ensuring reliable data and study outcomes. During the planning process and initial phase of the data search, an information specialist was consulted to ensure that all possible eligible studies were identified. The use of two independent reviewers throughout the data selection process aimed at limiting the effect of researcher bias and ensured objectivity in the study. Furthermore, the use of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist throughout the research process guided transparency of the process and accuracy of method reporting. To optimise quality and objectivity during the data extraction process, the extracted data was checked independently by a research assistant for accuracy.



#### **6.4.2. Limitations**

This review was comprehensive with regards to types of studies and populations included, but was still limited to an extent due to the exclusion of non-English records. Some of the records were excluded during a later stage of the study selection process due to only the abstract being in English. With available information from these records, it was clear that the exclusion of these non-English records and studies could have limited information on aspects such as the nationality of studied participants, additional diagnostic groups treated, and even potential additional outcomes of treatment.

The wide scope of the review and many study objectives, even though listed as a strength, also led to certain challenges. The large amount of data extracted made summarising the data difficult. This and many objectives limited the depth with which some objectives could be addressed. One valuable aspect that could have been explored in more detail would be the measurement tools used to assess mood-related aspects and quality of life, with special consideration of the validity of these tools and potential recommendations for measures used in future studies.

Lastly, a quality appraisal is not typically included in a scoping review,<sup>125</sup> but could have been beneficial for more definite conclusions with regards to treatment outcomes reported. For healthcare professionals using this technique as part of evidence-based practice, information on the rigour of studies reporting certain outcomes are important.

#### **6.5. RECOMMENDATIONS FOR FUTURE STUDIES**

This study was a scoping review providing an overview on TRE intervention research. Due to the limited studies found on this topic, with several informal and preliminary studies, it is recommended that further intervention research be done to strengthen the research base before a systematic review is performed.<sup>35</sup> A systematic review in which the quality of the intervention research is appraised will then be highly valuable.

A focus on increased rigour is recommended for future studies, to accumulate a strong base of TRE research. As indicated earlier, a variety of designs including experimental, descriptive and qualitative studies will be beneficial,<sup>118</sup> but with consideration of the rigour of the studies. An aspect that should be considered is using validated reliable measurement tools.

The use of TRE with children should be investigated, as well as the effect of TRE on children and adults diagnosed with sensory processing difficulties due to the accompanying high levels of anxiety in this group.<sup>163</sup>

For a more comprehensive assessment of affected stress levels and symptoms, objective measures should be included in the studies. It was concluded in the discussion of the measurement tools used that measurement of salivary cortisol levels could potentially be successful in determining treatment effect on stress levels.<sup>166</sup>

An interesting avenue of investigation could be the optimal frequency of self-practice sessions, as well as the ideal ratio between self-practice and guided sessions. Furthermore, as recommended in other studies, the effect of accountability on self-practice adherence could be explored, as well as the ideal method for ensuring accountability.

Lastly, daily outcome measurement tools could be investigated. Technological applications seemed a promising way of collecting data daily, with the possibility of an increased response rate due to being user-friendly.<sup>167</sup>

## **6.6. FINAL CONCLUSION**

This scoping review provides the first comprehensive overview of intervention studies done on TRE, a novel mind-body technique. The findings indicate that the research is still heterogeneous, with many preliminary studies and results. The results of the review, however, seem promising with the potential of TRE to improve mood-related aspects in clients, anxiety-related sleep difficulties, pain and cognitive limitations, as well as quality of life and improvements in persons diagnosed with neurological conditions. The potential for using this technique in occupational

therapy within the mental health field, physical rehabilitation, as well as with clients diagnosed with neurological conditions and sensory processing difficulties have been presented. With continuous research in the areas identified, this technique has the potential of being included in evidence-based occupational therapy practice.

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## **ANNEXURES**

### **LIST OF ANNEXURES**

- ANNEXURE A: Ethical clearance
- ANNEXURE B: A summary of research on mind-body practices
- ANNEXURE C: Permission to use the JBI Model of EBHC
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- ANNEXURE E: Pilot searches in Web of Science and EBSCOhost: a comparison between searches
- ANNEXURE F: Title and abstract screening tool
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**Annexure A**

**Ethical clearance**



UNIVERSITEIT VAN PRETORIA  
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Faculty of Health Sciences

**Institution:** The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0278 Approved for use through August 31, 2023.

Faculty of Health Sciences **Research Ethics Committee**

10 August 2022

**Approval Certificate  
New Application**

Dear Mrs LAJ Roos

**Ethics Reference No.: 442/2022**

**Title: Trauma Releasing Exercises as a treatment technique: a scoping review**

The **New Application** as supported by documents received between 2022-07-20 and 2022-08-10 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-08-10 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2023-08-10.
- Please remember to use your protocol number (442/2022) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

**Ethics approval is subject to the following:**

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

**On behalf of the FHS REC, Dr R Sommers**

MBChB, MMed (Int), MPharmMed, PhD

**Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria**

*The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)*

Research Ethics Committee  
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Fakulteit Gesondheidswetenskappe  
Lefapha la Disaense tsa Maphelo





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Faculty of Health Sciences

**Institution:** The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0278 Approved for use through August 31, 2023.

Faculty of Health Sciences **Research Ethics Committee**

13 July 2023

**Approval Certificate  
Annual Renewal**

Dear Mrs LAJ Roos,

**Ethics Reference No.: 442/2022 – Line 1**

**Title: Trauma Releasing Exercises as a treatment technique: a scoping review**

The **Annual Renewal** as supported by documents received between 2023-06-22 and 2023-07-12 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2023-07-12 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Renewal of ethics approval is valid for 1 year, subsequent annual renewal will become due on 2024-07-13.
- Please remember to use your protocol number (442/2022) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

**Ethics approval is subject to the following:**

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

**On behalf of the FHS REC, Professor C Kotzé**  
MBChB, DMH, MMed(Psych), FCPsych, PhD  
**Acting Chairperson: Faculty of Health Sciences Research Ethics Committee**

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Fakulteit Gesondheidswetenskappe  
Lefapha la Disaense Sa Maphele

**Annexure B**

**A summary of research on mind-body  
practices**

## A Summary of Research on Mind-body Practices

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
Mindfulness meditation				
Schumer SC, et al., <sup>79</sup> 2018	Systematic review and meta-analysis, including 65 randomised controlled trials	Adults (mostly non-clinical)	Small, but immediate and significant decrease in negative affectivity	Not indicated in article
Slemp GR, et al., <sup>78</sup> 2019	Systematic review and meta-analysis, including 119 studies of which 54 RCTs.	Working adults	Lowered employee distress (anxiety, stress, burnout and depression), with smaller effects for burnout than the other distress-related aspects.	Not indicated in article
Dunning DL, et al., <sup>81</sup> 2019	Systematic review and meta-analysis of RCTs, including 33 RCTs	Children and adolescents (mostly non-clinical)	Significant improvement in mindfulness, lowered depression, anxiety and stress (with active control groups).  Improvement in executive functioning, attention and negative behaviours (compared with control groups).	Not indicated in article
Han A, <sup>82</sup> 2022	Systematic review and meta-analysis, including 10 RCTs	Older adults with dementia or mild cognitive impairment	No significant difference in effect of mindfulness-based intervention on anxiety, depressive symptoms, quality of life, memory and overall cognitive functioning, when compared to control groups.	Cognitive function: Mini-Mental State Examination (MMSE), Mental State Examination (MSE), Cambridge Cognitive Examination (CAMCOG), Clinical Dementia Rating (CDR), Alzheimer's Disease Assessment Scale – Cognitive Subscale (ADAS-Cog)  Depressive symptoms: Centre for Epidemiologic Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS),

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
				<p>Cornell Scale for Depression in Dementia (CSDD)</p> <p>Anxiety: Geriatric Anxiety Inventory (GAI), Beck Anxiety Inventory (BAI), Rating Anxiety in Dementia (RAID)</p> <p>Stress: Perceived Stress Scale (PSS)</p> <p>QOL: Quality of Life in Alzheimer Disease (QoL-AD), World Health Organisation Quality of Life, abbreviated version (WHOQOL-BREF)</p> <p>Memory: Rey Auditory Verbal Learning Test (RAVLT), Productive Vocabulary Levels Test (PVL), Hopkins Verbal Learning Test (HVL)</p> <p>Executive functioning: Trail making test (TMT), Part B, Stroop test</p>
Li SYH, et al., <sup>83</sup> 2019	Review and meta-analysis of MBSR, including 6 RCTs	Older adults	Decreased depression immediately after intervention.	<p>Depression: Patient-Reported Outcomes Measurement Information System (PROMIS), Hospital Anxiety and Depression Scale (HADS), GDS, Brief Symptom Inventory 18 (BSI-18), Centre for Epidemiological Studies Depression Scale Revised (CESD-R), Hamilton Depression Rating Scale (HAM-D)</p> <p>Anxiety: PROMIS, HADS, BSI-18, Zung Self-Rating Anxiety Scale (SAS)</p> <p>Perceived stress: Trier Inventory for Chronic Stress (TICS), PSS</p>

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
Martin K, et al., <sup>80</sup> 2018	Review and meta-analysis, including 10 studies	Healthy adults and adults diagnosed with a psychological disorder	Preliminary support for decreased psychological distress and improved mindfulness performance.	<p>Depression: Beck's Depression Inventory (BDI-II), Patient Health Questionnaire-4 (PHQ-4), CES-D, Depression, Anxiety and Stress Scale – 21 items (DASS-21), Depression, Anxiety Stress Scale-10 (DASS-10)</p> <p>Anxiety: BAI, PHQ-4, DASS-21, DASS-10</p> <p>Stress: PSS, Perceived Stress Questionnaire (PSQ), DASS-21, DASS-10</p> <p>Mindfulness: Five Facet Mindfulness Questionnaire (FFMQ), Freiburg Mindfulness Inventory (FMI), Mindful Attention Awareness scale (MAAS)</p>
Hoffman L, et al., <sup>22</sup> 2020	Scoping review, including 19 articles (with one RCT)	Adults with dementia	Strongest support indicated for maintaining cognitive function. Also some support for improved quality of life, mental health and functional abilities (most support for quality of sleep improvement)	<p>Cognitive – Cambridge Mental Disorders of the Elderly Examination (CAMDEX-R), Trail Making Test, single-photon emission computerised tomography (SPECT), Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), MMSE, Cognitive and Affective Mindfulness Scale-revised (CAMS-R)</p> <p>QOL – QoL-AD, Warwick-Edinburg Mental Well-Being Scale (WEMWBS)</p> <p>Mental health: formal measures</p>
Hardison, ME, et al., <sup>20</sup> 2016	Scoping review, including 16 articles with only 3 Level I or II studies (including 2 RCT)	<p>Physical rehabilitation clients:</p> <p>musculoskeletal and chronic pain, neurocognitive and</p>	Preliminary support indicated for improvement in urinary incontinence, chronic pain, vestibular function, as well as promising with regards to	Not indicated in article

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
		neuromotor disorders as well as other affected body systems.	improved cognitive and behavioural aspects.  Strongest findings for improvement in adaptation to illness, increased quality of life, acceptance of pain symptoms	
Deep breathing: diaphragmatic breathing (DB)				
Hamasaki H, et al., <sup>84</sup> 2020	Narrative review: including 10 systematic reviews and 15 RCTs	Chronic obstructive pulmonary disease	Improved exercise capacity and respiratory function.  (intervention included DB, pursed-lip breathing and upper limb exercise)	Six-minute walk distance, respiratory rate and time, George's Respiratory questionnaire
		Chronic functional constipation (paediatric patients)	Improvement of disease-related symptoms, including quality of life	Defecation frequency
		Pre-hypertension	Lowered blood pressure, increased heart rate variability  (DB with biofeedback training more effective than just DB)	Blood pressure and heart rate variability
		Migraine	Decreased resurgence of migraines after one-year (with biofeedback assisted DB), decreased fatigue and nausea when compared to control group  (DB used with biofeedback training as intervention)	Report of nature of vomiting episodes, duration and frequency of migraine episodes, report of adverse effects such as fatigue

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
		Anxiety	Favourable changes in physiological indicators of anxiety – decreased breathing rate, heart rate, increased peripheral temperature. Also decrease in anxiety scores on the self-report inventory.  (DB used as intervention)	BAI, peripheral temperature, heart rate, respiratory rate
		Gastroesophageal reflux disease	Improved quality of life, reduced proton pump inhibitor usage  (DB used as intervention)	Time with a pH <4.0, Gastroesophageal reflux disease Health-Related Quality of Life Scale (GERD-HRQL)
		Cancer (and related eating problems)	Improved quality of life and increased weight  (two studies – one in which a relaxation technique that includes DB was used and the other with muscle relaxation, guided imagery and DB)	Karnofsky Performance Status Scale (KPS). Functional Quality of Life score
		Heart failure	Improved cardiorespiratory fitness, beneficial effects on cardiovascular health  (DB used as intervention)	Triaxial accelerometer, ActiGraph
Hopper SI, et al., <sup>85</sup> 2019	Quantitative systematic review: including one RCT, two quasi-experimental studies	Healthy working adults	Lowered physiological and psychological stress	Blood pressure (sphygmomanometer), DASS-21, respiratory rate (breathing recorded), salivary cortisol levels (Salivette cortisol)

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
Progressive muscle relaxation (PMR)				
Tan L, et al., <sup>86</sup> 2022	Systematic review and meta-analysis, including 12 RCTs	Cancer	Improved quality of life and self-esteem, with decreased anxiety, pain, depression, nausea and vomiting  (only PMR used as technique)	Nausea/vomiting: Index of Nausea and Vomiting Form 2 (INV-2), MASCC Antiemesis tool (MAT), Morrow Assessment of Nausea and Emesis (MANE)  Anxiety: State-Trait Anxiety Inventory (STAI), SAS  Quality of life: Quality of Life-Colostomy, European Organisation for Research and Treatment of Cancer Quality of Life questionnaire (EORTC QLQ-C30), Functional Assessment of Cancer Therapy – Breast (FACT-B), Functional Living Index-Cancer (FLIC), Quality of Life Instruments for Cancer Patients: Stomach Cancer (QLICP-ST)  Depression: Zung Self-rated Depression Scale (SDS)  Pain: MD Anderson Inventory (MDASI)
Smallfield S, et al., <sup>87</sup> 2018	Systematic review, including 13 RCT studies (with two RCT studies on PMR as part of a multi-component approach)	Older adults with sleeping difficulties	Reduced self-reported insomnia  (Two included studies used PMR, as part of a multi-component intervention. The other studies used other treatment techniques available to occupational therapists)	Variety of measurement tools, including Pittsburg Sleep Quality Index (PSQI) and a sleep diary



Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
Louvardi M, et al., <sup>88</sup> 2021	Systematic review, 4 RCTs.	Night eating syndrome (3 RCTs)	Reduced stress levels.  Statistically significant effect on salivary cortisol.  (PMR was applied in one of the studies)	Salivary cortisol, PSS
		Gambling (one RCT)	Reduced stress levels (PMR was used in the one study)	DASS-21 stress subscale
Zhang M, et al., <sup>171</sup> 2021	Systematic review and network meta-analysis, including 15 RCTs (studies on the effect of massage therapy, PMR and yoga)	Healthcare workers	Overall, physical relaxation methods (which included yoga, massage therapy, PMR and stretches) improved occupational stress measures significantly, when compared to non-intervention.  (PMR was applied in one of the studies)	PSS, Maslach burnout inventory for emotional exhaustion (MBI-EE), Health Status Survey Short Form (SF-36)
Gökşin I, et al., <sup>89</sup> 2018	An RCT	Woman in postpartum period	Improvement in quality of life	Maternal Postpartum Quality of Life questionnaire (MAPP-QoL)
Guided imagery				
Meghani N, et al., <sup>90</sup> 2017	Integrative review, including 9 studies with RCT designs in 6 studies	Critically ill adult patients	Marginal effects on insomnia, pain and anxiety	Sleep: Wrist actigraphy – measuring sleep routine, perceived sleep quality on 10-point scale, visual analogue sleep scale, sleep efficiency index, polysomnography

Author and Year	Study design	Diagnostic group or function	Study results	Measurement tool
				<p>Anxiety: HADS, numeric rating scale</p> <p>Pain: analgesic consumption, pain scores, numeric rating scale</p> <p>Pain and anxiety: Pain and anxiety/tension numeric scores on 10-point scale, linear analogue 0–100 scale</p>

## **Annexure C**

# **Permission to use the JBI Model of EBHC**

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Jun 01, 2023

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Licensed Content Title	The updated Joanna Briggs Institute Model of Evidence-Based Healthcare
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Licensed Content Date	Mar 1, 2019
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Number of figures/tables/illustrations	1
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Title	Trauma releasing exercises as a treatment technique: a scoping review
Institution name	University of Pretoria
Expected presentation date	Dec 2023
Order reference number	JBI permission for model use
Portions	the Joanna Briggs Institute Model of Evidence-based Healthcare, Figure 2 on page 60 of International Journal of Evidence-Based Healthcare 2018
Requestor Location	University of Pretoria 21 Mopane Street Florapark Polokwane, Limpopo 0699 South Africa Attn: Linda Aletta Joan Roos
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**Annexure D**

**Permission to use Borgetto and Tomlin's  
Research Pyramid for Evidence-based  
Occupational Therapy Practice**

---

## George S Tomlin sent you a message on ResearchGate

2 messages

---

**George S Tomlin via ResearchGate** <no-reply@researchgatemail.net>  
To: Linda Roos <u20005769@tuks.co.za>

19 September 2023 at 00:38

ResearchGate

---

## George sent you a message with an attachment



**George S Tomlin**  
University of Puget Sound

Dear Linda,

Thank you for your message and your plan to use the Research Pyramid as a rationale for considering all types of studies in the creation of professional knowledge.

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Best of success with your work.

George Tomlin

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**Annexure E**

**Pilot searches in Web of Science and  
EBSCOhost: a comparison between  
searches**

Search	Search terms	Change in terms	Database	Yields	Possible hits
<b>Search 1</b>	“Trauma Releasing Exercise*” OR	N/A	<b>Web of Science</b>	<b>47</b>	<b>8</b>
	“Trauma Release Process” OR				
	“Tension Release Exercise*” OR		<b>EBSCOhost</b>	<b>21</b>	<b>6</b>
	“Neurogenic tremor” OR				
	“Tension and Trauma Releasing Exercise*”				
OR “trauma releas*” OR “trauma-releas*”					
<b>Search 2</b>	“Trauma Releasing Exercise*” OR	<u>Removed:</u>	<b>Web of Science</b>	<b>20</b>	<b>9</b>
	“Trauma Release Process” OR	“trauma-releas*” and			
	“Tension Release Exercise*” OR	“trauma release*”			
	“Neurogenic tremor” OR	<u>Added:</u>			
	“Tension and Trauma Releasing Exercise*”	“self-induced unclassified therapeutic tremor*” OR	<b>EBSCOhost</b>	<b>30</b>	<b>16</b>
	“self-induced unclassified therapeutic tremor*”	“trauma release technique” OR			
	OR “trauma release technique” OR	“tension/trauma releas*”			
“tension/trauma releas*” exercise*”	exercise*”				

**Annexure F**

**Title and abstract screening tool**

### Title and Abstract Screening tool

Title of article	
Publication type	
Authors	
Year	

1. Is TRE\* the intervention applied in the study?
  - Yes
  - No
  - Unclear
2. Has the effect of TRE treatment (as a treatment on its own) been measured quantitatively or qualitatively\*\* and reported on?
  - Yes
  - No
  - Unclear
3. Is the article/document in English (or does it include a full abstract in English with detailed study results)?
  - Yes
  - No
  - Unclear
4. Is the study published as an academic journal article, academic book/book chapter (including eBooks/eBook chapters), dissertation, medical report, case report or other informal report with detailed treatment results, conference paper, or academic poster?\*\*\*
  - Yes
  - No
  - Unclear

#### Screening decision:

- If the reviewer answered NO to any of the questions, the citation will be **excluded**.
- If the reviewer answered YES to all of the questions, the citation will be **included** for the full-text screening.
- If the reviewer answered UNCLEAR to any of the questions, and YES to the remaining questions, the citation will be **included** for the full-text screening.

\*Alternative terms used in the literature for TRE treatment include Trauma Releasing Exercises, Trauma Release Process, Tension Release Exercises, Tension and Trauma Releasing exercises, and Tension/trauma Releasing Exercises. The terms 'self-induced unclassified therapeutic tremor' or 'therapeutic neurogenic tremors' could also indicate that TRE treatment has been applied, as these are the terms used for the tremor that is elicited.

\*\*TRE intervention had to be applied to a group of participants, a selected few members of a group, or a single person, with the purpose to study the direct effect of treatment on disfunction. The effect of treatment should also have been measured quantitatively or qualitatively and could, therefore, include the following research designs: This could include randomised controlled trials, non-randomised controlled trials, pre-post study designs, single-case designs, quasi-experimental designs, pre-experimental designs, as well as case reports. Literature reviews, theory papers, expert opinions and editorials were excluded.

\*\*\*Sources excluded are magazine articles, blogs, podcasts, websites, wire feeds, advertisements and community briefs.

**Annexure G**

**Declaration of plagiarism**



## DECLARATION REGARDING PLAGIARISM

I, Linda Roos (student number: 2000 5769) hereby declare that:

1. This dissertation titled, Trauma Releasing Exercises as a treatment technique: a scoping review, is submitted in accordance with the requirements for the degree: MOccTher at University of Pretoria.
2. I understand what plagiarism is and am aware of the University's policy in this regard.
3. I declare that this dissertation is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.
4. I have not used work previously produced by another student or any other person to hand in as my own.
5. I have not allowed and will not allow anyone to copy my work with the intention of passing it off as his or her own work.

### Student name

Linda Roos


### Student signature

  
\_\_\_\_\_

### Witness Name

Wouter Roos

### Witness Signature

  
\_\_\_\_\_

### Date

20 September 2023

## Annexure H

# Declaration of storage



**Declaration for the storage of research data and/or documents**

I, the principal researcher and supervisors of the following study, titled	Linda Roos Karin van Niekerk and Kerstin Tönsing Trauma Releasing Exercises as a treatment technique: a scoping review
will be storing all the research data and/or documents referring to the above-mentioned study in the following department:	Department of Occupational Therapy

**We understand that the storage of the mentioned data and/or documents must be maintained for a minimum of 15 years from the commencement of this study.**

Start date of study:	August 2022
Anticipated end date of study:	May 2023
Year until which data will be stored:	2037
Address where data will be stored:	University of Pretoria, Department of Occupational Therapy, 31 Bophelo Road, HW Snyman Building South, Level 5, Room 5-26, 0186, South Africa

Name of Principal Researcher	Signature	Date
Linda Roos		20 September 2023

Name of Supervisors	Signature	Date
Karin van Niekerk		27 September 2023
Kerstin Tönsing		29.09.2023

Name of Head of Department	Signature	Date
Kitty Uys		29 September 2023

**Annexure I**

**Declaration of Helsinki**

# Declaration of Helsinki

*Please note that all researchers must, from today, sign the attached declaration when handing in a protocol at the Faculty of Health Sciences Research Ethics Committee, University of Pretoria.*

<p><b>WORLD ASSOCIATION DECLARATION OF HELSINKI</b> <b>Ethical Principles For</b> <b>Medical Research Involving Human Subjects</b></p>
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Adopted by the 18<sup>th</sup> WMA General Assembly Helsinki, Finland, June 1964  
And amended by the  
29<sup>th</sup> WMA General Assembly, Tokyo, Japan, October 1975 35<sup>th</sup> WMA General Assembly,  
Venice, Italy, October 1983 41<sup>st</sup> WMA General Assembly, Hong Kong, September 1989  
48<sup>th</sup> WMA General Assembly, Somerset West, Republic of South Africa, October 1996  
and the  
52<sup>nd</sup> WMA General Assembly, Edinburgh, Scotland, October 2000

## A. INTRODUCTION

1. The World Medical Association has developed the Declaration of Helsinki as a statement of ethical principle to provide guidance to physicians and other participants in medical research involving human subjects. Medical research involving human subjects includes research on identifiable human material or identifiable data.
2. It is the duty of the physician to promote and safeguard the health of the people. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.
3. The Declaration of the Geneva of the World Medical Association binds the physician with the words, "The health of my patient will be my first consideration", and the International Code of Medical Ethics declares that, "A physician shall act only in the patient's interest when providing medical care that might have the effect of weakening the physical and mental condition of the patient."
4. Medical progress is based on research which ultimately must rest, in part, on experimentation involving human subjects.
5. In medical research on human subjects, considerations related to the wellbeing of the human subject should take precedence over the interests of science and society.
6. The primary purpose of the medical research involving human subjects is to improve prophylactic, diagnostic and therapeutic procedures and the understanding of the aetiology and pathogenesis of disease. Even the best proven prophylactic, diagnostic and therapeutic methods must continuously be challenged through research for their effectiveness, efficiency, accessibility and quality.
7. In the current medical practice and in medical research, most prophylactic, diagnostic and therapeutic procedures involve risks and burdens.



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8. Medical research is subject to ethical standards that promote respect for all human beings and protect their health and rights. Some research populations are vulnerable and need special protection. The particular needs of the economically and medically advantaged must be recognised. Special attention is also required for those who cannot give us or refuse consent for themselves, for those who may be subject to giving consent under duress, for those who will not benefit personally from the research, and for those for whom the research is combined with care.

9. Research investigators should be aware of the ethical, legal and regulatory requirements for research on human subjects in their own countries, as well as applicable international requirements. No national ethical, legal and regulatory requirements should be allowed to reduce or eliminate any of the protections for human subjects set forth in this Declaration.

## **B. BASIC PRINCIPLES FOR ALL MEDICAL RESEARCH**

10. It is the duty of the physician in medical research to protect the life, health, privacy and dignity of the human subject.

11. Medical research involving human subjects must conform to the general accepted scientific principles, be based on the thorough knowledge of the scientific literature, other relevant sources of information, and on adequate laboratory- and, where appropriate, animal experimentation.

12. Appropriate caution must be exercised in the conduct of research which may affect the environment, and the welfare of animals used for research must be respected.


13. The design and performance of each experimental procedure involving human subjects should be clearly formulated in an experimental protocol. This protocol should be submitted for consideration, comment, guidance and, where appropriate, approval to a specially appointed ethical review committee, which must be independent of the investigator, the sponsor or any other kind of undue influence. This independent committee should be in conformity with the laws and regulations of the country in which the research experiment is performed. The committee has the right to monitor ongoing trials. The researcher has the obligation to provide monitoring information to the committee, especially any serious adverse events. The researcher should also submit to the committee, for review, information regarding funding, sponsors, institutional affiliations, other potential conflicts of interest and incentives for subjects.

14. The research protocol should always contain a statement of the ethical considerations involved and should indicate that there is compliance with the principles enunciated in this Declaration.

15. Medical human research involving subjects should be conducted only by scientifically qualified persons and under the supervision of a clinically competent medical person. The responsibility for the human subject must always rest with a medically qualified person and never rest on the subject of the research, even though the subject has given consent.

16. Every medical research project involving human subject should be preceded by careful assessment of predictable risk and burdens in comparison with foreseeable benefits of the subject or to others. This does not preclude the participation of healthy volunteers in medical research. The design of all studies should be publicly available.

17. Physicians should abstain from engaging in research project involving human subjects unless they are confident that the risk involved have been adequately assessed and can be satisfactorily managed. Physicians should cease any investigations if the risks are found to outweigh the potential benefits or if there is conclusive proof of positive and beneficial results.

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18. Medical research involving human subjects should only be conducted if the importance of the objective outweighs the inherent risks and burdens of the subject. This is especially important when the human subjects are healthy volunteers.

### **C. ICH\* GUIDELINE FOR GOOD CLINICAL PRACTICE**

1. Clinical trials should be conducted in accordance with the ethical principles that have their origin in Declaration of Helsinki, and that are consistent with good clinical practice (GCP) and the applicable regulatory requirement(s).

2. Before a trial is initiated, foreseeable risk and inconvenience should be outweighed against the anticipated benefit for the individual trial subject and society. A trial should be initiated and continued if the anticipated benefits justify the risk.

3. The rights, safety and well-being of the trial subjects are the most important considerations and should prevail over interest of science and society.

4. The available non-clinical and clinical information on an investigational product should be adequate to support the proposed clinical trials.

5. Clinical trials should be scientifically sound, and described in a clear, detailed protocol.

6. A trial should be conducted in compliance with the protocol that has received prior institutional review board (IRB)/independent ethics committee (IEC) approval/favourable opinion.

7. The medical care given to, and medical decisions made on behalf of, subjects should always be the responsibility of the qualified physician or, when appropriate, of a qualified dentist.

8. Each individual involved in conducting a trial should be qualified by education, training, and experience to perform his or her respective task(s).

9. Freely given informed consent should be obtained from every subject prior to clinical trial participant.

10. All clinical trial information should be recorded, handled and stored in a way that allows its accurate reporting, interpretation and verification.

11. The confidentiality of records that could identify subjects should be protected, respecting the privacy and confidentiality rules in accordance with the applicable regulatory requirement(s).

12. Investigational product should be manufactured, handled, and stored in accordance with applicable good manufacturing practice (GMP). They should be used in accordance with the approved protocol.

13. Systems with procedures that assure the quality of every aspect of the trial should be implemented.

*\*International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH)*



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