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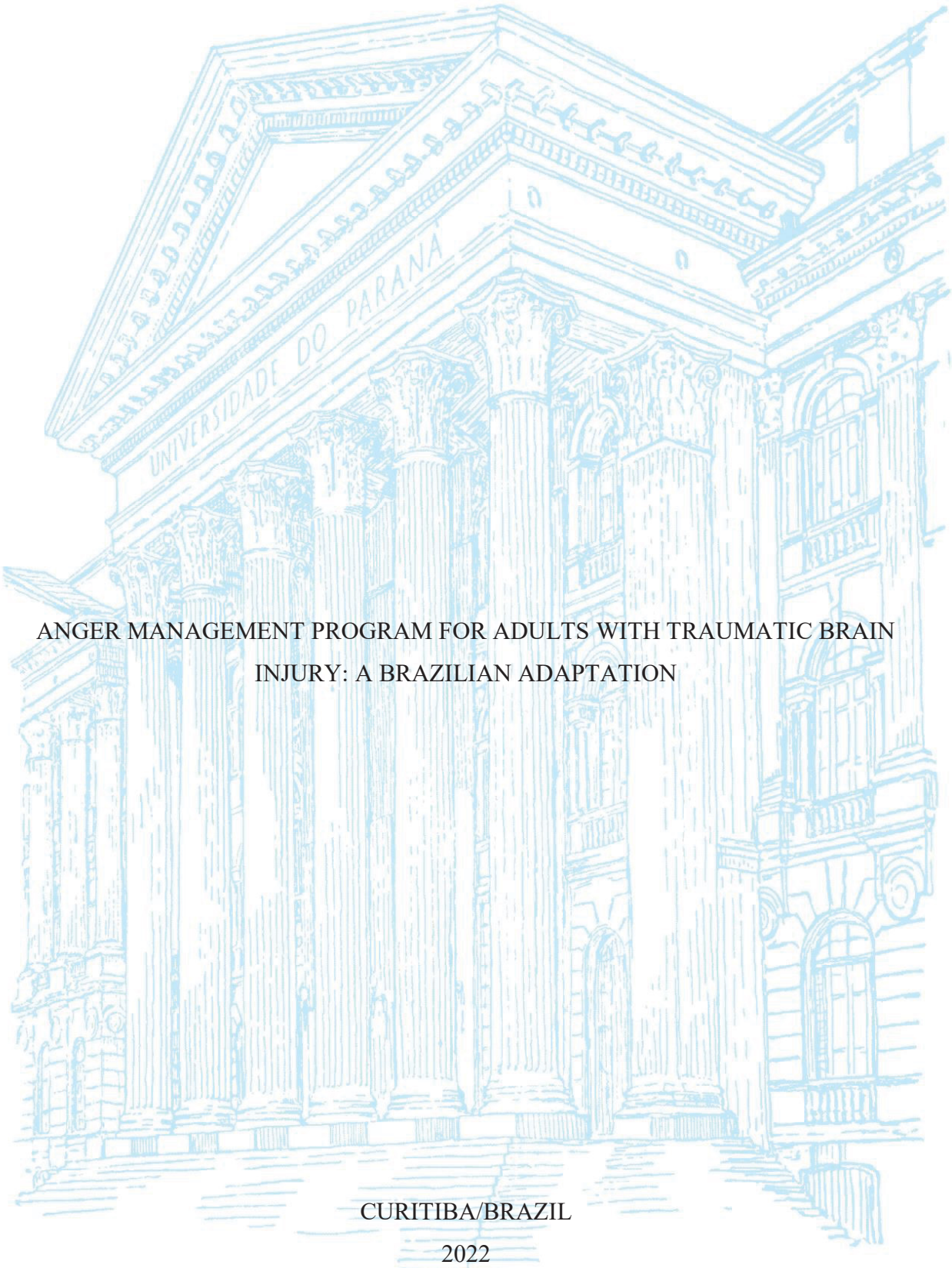

ANGER MANAGEMENT PROGRAM FOR ADULTS WITH TRAUMATIC BRAIN INJURY: A BRAZILIAN ADAPTATION

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2022

GABRIELA WEINERT MORAES

ANGER MANAGEMENT PROGRAM FOR ADULTS WITH TRAUMATIC BRAIN INJURY: A BRAZILIAN ADAPTATION

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For Mom, Dad, and Gustavo for being my support until here.

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“Life is the art of encounter though there are many discounters throughout life.”

Vinicius de Moraes

RESUMO

A Lesão Encefálica Adquirida (LEA), mais especificamente o Traumatismo Cranioencefálico (TCE), é uma questão de saúde pública, que afeta não só as pessoas diretamente, mas também o seu entorno familiar. Trata-se de uma questão social e econômica a nível mundial, que impacta a vida do sujeito a nível cognitivo, emocional e psicossocial. O comportamento agressivo e a desregulação da raiva são frequentes entre os sobreviventes do TCE, o que afeta diretamente suas relações socias. Portanto, programas de intervenção neuropsicológica que integrem tanto os aspectos cognitivos como os emocionais demonstram-se indispensáveis no acompanhamento de pessoas com TCE. Na literatura acadêmica, há poucos estudos sobre programas específicos de manejo da raiva para esta população. Considerando esse contexto, a presente dissertação foi desenvolvida, e composta por três estudos relacionados com o tema. O primeiro estudo consistiu numa revisão sistemática da literatura que visava examinar as atuais evidências sobre intervenções de manejo da raiva após LEA. As análises dos 10 artigos selecionados permitiram concluir que os programas de intervenção centrados em estratégias de gestão da raiva conduzem a resultados positivos para a vida cotidiana da pessoa. Contudo, entre os estudos encontrados, há grandes diferença metodológicas de pesquisa e das características dos participantes. O segundo estudo descreveu o processo de adaptação do Anger Self-Management Training (ASMT), um programa de intervenção americano para pessoas com TCE, à realidade brasileira e à metodologia online. O primeiro passo foi a tradução completa do material para o português do Brasil. Depois, uma avaliação da sensibilidade cultural do programa foi realizada em conjunto com uma profissional com experiência na área reabilitação neuropsicológica para adultos após o TCE no Brasil, que resultaram em modificações pontuais no que se refere a apresentação do conteúdo. A segunda parte consistiu na adaptação do programa para apresentação online. O Google Drive foi utilizado como ferramenta para o armazenamento e organização do material de apoio. O terceiro estudo refere a um estudo de caso múltiplo com dois participantes que visava testar a eficácia do programa ASMT com a população brasileira e na modalidade online, utilizando métodos mistos. Foram recolhidos dados quantitativos e qualitativos a partir de questionários e entrevistas com os participantes e familiares, e vídeos das sessões. Os resultados sugeriram que o programa ASMT era apropriado para a cultura brasileira e para a utilização da modalidade online. Os dados qualitativos mostraram um desenvolvimento favorável da gestão da raiva com adesão e generalização das técnicas propostas durante o programa. Os dados quantitativos mostraram uma melhoria significativa na pontuação de um participante em relação à experiência e expressão da raiva. O presente estudo contribuiu para o campo da reabilitação neuropsicológica no Brasil e para o desenvolvimento do campo da teleneuropsicologia.

Palavras-chave: Traumatismo Cranioencefálico. Manejo de raiva. Reabilitação Neuropsicológica. Telereabilitação.Video conferência.

ABSTRACT

Acquired Brain Injury (ABI), more specifically Traumatic Brain Injury (TBI), consists of a public health matter, which affects not only the direct persons but also their families. It is a social and economic issue worldwide. There are many cognitive, emotional, and psychosocial impacts throughout people following TBI. Aggressive behavior and anger misadjustment are a common reality among survivors of TBI and have a huge impact on their social relationships with others. Thus, intervention programs targeting both cognitive and emotional aspects aimed at this population are necessary. Also, it should be noted that there are few studies about anger management programs for TBI. Considering such a context, the present dissertation was developed, and composed of three studies related to the theme. The first study consisted of a systematic literature review that aimed to examine the current evidence on anger management interventions following ABI. The analyses of the 10 selected articles have allowed concluding that intervention programs focused on strategies for anger management lead to positive results for the person's daily life. However, the studies had important methodological differences among the studies and heterogeneous characteristics of ABI participants. The second study described the process of adapting the Anger Self-Management Training (ASMT), an American intervention program for TBI to the Brazilian reality and an online method. The first step was the full translation to Brazilian Portuguese. After an evaluation of the cultural sensibility of the program with semantic and conceptual modifications with a professional with experience in working with neuropsychological rehabilitation for adults following TBI in Brazil. The second part was the online version adaptation by the creation of a Google Folder, organization of support material, and adaptation of home independent practices to the online interface. The third study was a multiple case study with two participants that aimed to test the effectiveness of the ASMT program with the Brazilian population and in the online modality, using mixed methods. Quantitative and qualitative data were collected from questionnaires and interviews with participants and significant others and videos of the sessions. Results suggested that the ASMT program was appropriate for the Brazilian culture and the use of the online modality. The qualitative data showed favorable development of anger management with adherence to and generalization of the techniques proposed during the program. Quantitative data showed a significant improvement in one participant's scores regarding anger experience and expression. The present study contributed to neuropsychological rehabilitation and the development of the field of teleneuropsychology.

Key-words: Traumatic Brain Injury. Anger Management. Neuropsychological Rehabilitation. Telerehabilitation.Videoconferencing.

LIST OF FIGURES

Figure 1 - Search results and study inclusion…….....33
Figure 2 - Study selection process using PRISMA flow diagram …….…..35
Figure 3 - Number of articles per year ……36
Figure 4 - Steps of Assessment and Summary of Anger-Self-Management Program…….60
Figure 5 - Program Adaptation Steps ……..66

LIST OF TABLES

Table 1- Distribution of Journals.....36
Table 2 - Studies Characteristics and outcomes 37
Table 3 - Summary of quantitative studies …….41
Table 4 - Summary of qualitative studies ……...48
Table 5 - Treatment components of the ASMT treatment arms …….61
Table 6 - Scores on STAXI-2 subscales 70
Table 7 - Description of strategies taught during the ASMT program 79
Table 8 - Neuropsychological Assessment Instruments 82
Table 9 - Neuropsychological assessment conducted with IL 90
Table 10 - IL's anger scores at three testing points 92
Table 11 - Neuropsychological assessment conducted with RB 97
Table 12 - RB's anger scores at three testing points 98

LIST OF ABBREVIATIONS

ABI	- Acquired Brain Injury
ACC	- Anterior Cingulate Cortex
AHN	- Anterior Hypothalamic Nucleus
aI/IFG	- Insula/Inferior Frontal Gyrus
ASMT	- Anger Self-Management Training
BLS	- Bilateral Septum
BNST	- Bed Nucleus of The Stria Terminalis
CEREI	- Centro de Estudos em Reabilitação e Interdisciplinaridade
GAM	- General Aggression Model
GCS	- Glasgow Coma Scale
MA	- Medial Amygdala
NR	- Neuropsychological Rehabilitation
PAG	- Periaqueductal Gray
PFC	- Prefrontal Cortex
PTA	- Post-Traumatic Amnesia
SO	- Significant Other
TBI	- Traumatic Brain Injury
RCTs	- Randomized Controlled Trials
VC	- Videoconferencing
VMH	- Ventromedial Hypothalamus
WHO	- World Health Organization

TABLE OF CONTENTS

Chapter 1 - Introduction 15

Traumatic Brain Injury 16
Impact of Traumatic Brain Injury 17
Neuropsychological Rehabilitation following TBI 19
Theory of emotions 20
The aggressive brain 23
Anger and aggression following Traumatic Brain Injury 24
Objectives 27

Chapter 2 - Anger Management in Traumatic Brain Injury: A systematic review 29

Method 31
Classification and appraisal 34
Results 34
Characteristics of the included studies 34
Intervention's characteristics 40
Effectiveness of interventions 43
Quantitative research 43
Qualitative research 45
Discussion 49
Conclusion 55

Chapter 3 - Adaptation of an Anger Management Intervention in Brazil 56

Teleneuropsychology 57
Anger *Self*-Management Program (ASMT) 59
Cultural Adaptation 62
Information gathering 63
Preliminary adaptation design 65
Preliminary adaptation tests 68
Adaptation refinement 72
Discussion 73

Chapter 4 - Multiple Case Study 76

Method 78
Study Design 78
Setting 80
Participant recruitment 80

Significant others 81
Measures 82
Procedures 85
Data analysis 86
Results 87
Case one 87
Case two 94
Discussion 102
Clinical Variables 102
ASMT Program 111
Advantages and disadvantages of the online methodology 113
Conclusion 114
Chapter 5 – General Conclusions 116
References 119
Annexes 130
Annex 1: Anger Log Session 1 130
Annex 2: Anger Log Session 2 131
Annex 3: Anger Log Session 3 133
Annex 4: Feelings Checklist 135
Annex 5: Balance Sheet – Handouts Session 1 and 2 136
Annex 6: Calming Strategies – Handouts Session 1 and 2 137
Annex 7: Feeling List – Handouts Session 3 138
Appendices 139
Appendix A: Participant's Balance Sheet 139
Appendix B: Portuguese Version - Calming Strategies 141
Appendix C: Portugues version - Feelings Checklist 142
Appendix D: Anger Log Filled Out – Assignment session 1 143

Chapter 1: Introduction

Traumatic brain injury (TBI) is one of the main causes of acquired brain injuries (ABI), which lead to heterogeneous health conditions and disabilities worldwide, thus becoming a public health and economic issue (Dewan et al., 2018). The major goals of the neuropsychological rehabilitation of persons with acquired brain injury are to facilitate social participation and the productive life of individuals (Abrisqueta-Gomez, 2012). Although during the last 60 years research has advanced considerably, it still is a field that needs investment — especially in the area of the emotional reactions after TBI.

This thesis focused on the rehabilitation of anger and aggressive behaviors following traumatic brain injury in adults in Brazil. Chapter 1 provides an overview of the epidemiology and the neuropsychological impact of TBI, the neuropsychological rehabilitation, the theory of emotions, and anger post-TBI. Chapter 2 presents a systematic review of rehabilitation programs for anger management in TBI. The purpose of this chapter is to provide an overview of the researches and approaches relevant to the intervention of anger and aggressive behaviors. It is not intended to provide an in-depth discussion of all intervention programs. Chapter 3 provides an overview of recent studies about telerehabilitation following ABI and a detailed description of the ASMT program's principles. The chapter also details the cultural adaptation process of the ASMT program for Brazil. Chapter 4 investigates perceived effectiveness of the Anger Self-Management Training (ASMT) by participants and their significant others in the Brazilian population and in the online modality, using mixed methods. Initially this study had been designed for a quasi-experimental study methodology and face-to-face group intervention. Because of the current pandemic, the methodology was adapted to a multiple case study with individual and online intervention. The final chapter of the thesis provides a summary of of the results found

in this research. Implications for clinical practice, limitations of the thesis and directions for future research are also presented.

Traumatic Brain Injury

Traumatic brain injury (TBI) is defined as an "alteration in brain function, or other evidence of brain pathology, caused by an external force" (Brain Injury Association of America, 2020). An external force may include a blow, bump or jolt to the head, the head suddenly and violently hitting an object, or when an object pierces the skull and enters brain tissue (American Association of Neurological Surgeons, 2020). According to the World Health Organization (2006), TBI is the major cause of death and disability in children and young adults around the world and is involved in nearly half of all trauma deaths. There are three peaks of incidence for TBI: children, young adults, and elderly people (World Health Organization, 2006).

The "silent pandemic" is a common term used to describe TBI, for it is still difficult to accurately identify the number of people affected by a trauma in the brain, especially mild TBI (Coburn, 1992; Rusnak, 2013). Despite this underreporting, TBI is considered one of the most alarming public health problems in the world (Rubiano et al., 2015), becoming an economic and social global issue.

A study estimated that 69 million individuals will have a TBI each year — the majority being in North America and Europe, of which 81% will be mild, 11% moderate, and 8% severe (Dewan et al., 2018). Approximately 5.3 million people in the USA and nearly 7.7 million people in Europe are living with a disability caused by TBI (Rubiano et al., 2015). Consequently, enormous challenges are seen in public health worldwide. Besides the fact that epidemiology studies are rare in Brazil, many TBI cases are not recognized as such and are, thus, excluded from official statistics. However, the last epidemiological study found (ruled by DATASUS from 2008 to 2019) showed that 131,014 hospital admissions per year were

associated with TBI, totaling an incidence of 65.54 hospital admissions per 100,000 inhabitants per year. Brazil spends an average of US$ 43,238,339 million on hospital expenses per year, corresponding to US$ 327.68 per admission. The most affected population is young adults (20 to 29 years and 30 to 39 years), with a higher male prevalence (Carteri & da Silva, 2021).

Impact of Traumatic Brain Injury

Cognitive deficits and behavior problems are common among survivors of acquired brain injury (ABI) and have a huge impact on their social relationships with others, their treatment, family, and caregivers. The most common cognitive changes found in clients at a rehabilitation center are related to memory and attention deficits, executive functioning problems, and a decrease in information processing speed, which include planning and organizational difficulties (Wilson, 2008).

Mood can be affected by ABI both directly, as a consequence of the injury to the brain segments involved in the regulation of affect, and indirectly, as a result of the impacts and sequelae of the injury itself. Different areas of the brain are involved in the process of experiencing basic emotions — such as fear, anger, sadness, surprise, disgust, and happiness. Consequently, survivors of brain injury have a range of emotional changes (Ford, 2017). Pereira (2011) describes four emotional reactions commonly found in people with TBI: self-awareness, anxiety, depression, and anger outbursts.

Impaired self-awareness is a common manifestation among people who suffer a brain injury. The limited understanding of the severity of their disabilities and the correlated inabilities may limit the engagement of patients in rehabilitation, and the adherence to the main objectives of this process (Prigatano and Schacter, 1991 in Pereira, 2011). According to the author, the literature agrees that self-awareness depends on the integration of various

cognitive and emotional aspects, and pre-frontal injuries are usually associated with the presence of changes in the individual's self-awareness.

Anxiety is reported as the main variant during rehabilitation (King, 1997; Prigatano, 2005). Following a brain injury, anxiety may manifest as nervousness, insecurity, or fear (Sohberg & Mateer, 2015). It may also appear as a result of the perception of a reduction in functional ability, increasing the experience of failure and concern about the future. Anxiety is a frequent emotional reaction because, regardless of the cognitive aspects being preserved, after TBI the person has to experience a new life reality (Pereira, 2011). For example, prolonged organic recovery or the re-establishment of a routine after the period of hospitalization can be agents that cause this anxiety (King, 1997).

According to May (1980), one of the factors that causes anxiety is the value of social acceptance and fear of being alone. In persons with TBI, social isolation is a common concern due to the long-term cognitive and behavioral impact on relationships, which can cause the loss of previous friendships and difficulties in creating new bonds (Salas et al., 2018). Thus, as a consequence of post-ABI cognitive and/or physical dysfunctions, many individuals may experience anxiety about acceptance and social framework, and depression is often reported as one of the barriers to the success of long-term rehabilitation (Dawson et al., 2007). The diagnosis of depression after ABI is complex as there is a strong association between symptoms of depression and psychosocial and cognitive sequelae of brain injury (Sohberg & Mateer, 2015).

According to Pereira (2011), after a variety of interventions in the cognitive and physical consequences, persons with ABI can still feel different about their abilities and limitations, considering their previous conditions. The traumatic event may be experienced as a break in the previous psychological balance. This disruption can generate a self-awareness crisis, which leads to a review of life goals.

Anger outbursts can frequently be observed following TBI due to the brain injury site. Pereira (2011) points out that anger can be considered part of the human existential condition and anger outbursts can be triggered by perceived impotence/disability in the face of physical and cognitive limitations.

Because of cognitive and emotional changes, behavior and behavioral control consequences are common after ABI. Disinhibition, impulsiveness, socially inappropriate behavior, and lack of initiative are reported as the most frequent reactions in individuals after injury, who can become aggressive when irritated or frustrated (Sohberg & Mateer, 2015).

Neuropsychological Rehabilitation following TBI

Neuropsychological Rehabilitation (NR) for a long time was criticized for not having a specification of performance effectiveness and professional guidance. Prigatano (1999) demonstrated the influences of researchers that collaborated for what is NR today. Goldstein, according to the author, was the pioneer of a humane approach in this field, bringing to light the interaction between the environment and the injury disabilities as an important influence for inappropriate behavior. In the 20th century, Goldstein's ideas shaped a new way of perceiving rehabilitation as a dynamic process and the person as a whole in this process (Prigatano, 1999). During the Second World War, Luria and Zangwill elucidated the importance of functional adaptation (Wilson, 2008), rebuilding new habits from intact skills to compensate and retrain dysfunctions (Prigatano, 1999; Wilson, 2008). Diller and Ben-Yishay were the precursors of neurorehabilitation after brain injury.

The holistic approach, unlike the traditional neurorehabilitation, understands brain injury as being part of the wider life context beyond its physical and cognitive elements (Abrisqueta-Gomez, 2012). Holistic neuropsychological rehabilitation is a field in progress whereby the focus is broader than cognitive rehabilitation, also including emotional,

psychosocial, and behavioral aspects, whose main goal is to establish an optimum level of well-being, and meaningful and satisfactory life (Cicerone et al., 2008; Wilson, 2017).

A study measured the efficacy of both approaches and the results showed that neuropsychological aspects improved in both interventions (Cicerone et al., 2008). However, patients who underwent the holistic model showed improvements in productive and social skills, expressed in daily life and formal measures. Considering that the main barrier to the success of the intervention with people with TBI is the psychosocial difficulties associated with brain injury (Wilson, 2008), this study reinforced the importance of including the emotional and psychosocial interventions for rehabilitation effectiveness, especially when considering long term outcomes.

Despite the growing demand for neuropsychological rehabilitation services, Brazil faces several difficulties in the development of this area, due to the lack of educational institutions offering training in this area, the difficulty in delimiting protocols with evidence, the need to adapt rehabilitation strategies used in other cultural contexts, and the difficulty in identifying indicators appropriate to the Brazilian reality to evaluate rehabilitation programs (Hamdan et al., 2011).

Theory of emotions

There are two routes in the brain to emotional experience. The first, also known as the "fast" route, is more primitive and instinctive as it goes straight from the sensory input to the amygdala in the limbic system. The result of this pathway is an immediate and strong emotional reaction. The "slow" route passes in the frontal and the hippocampus areas, which allow to assess the danger and consult the repertoire of past situations to decide on how to behave from several possible responses (Ford, 2017).

Several studies in the area of neuroscience, based on pharmacological and electrophysiological researches with animals and humans, provided a basis for models on the

functioning of emotions (Murphy et al., 2003). The models of emotion can be divided into three groups according to Murphy et al. (2003): (1) single-system models; (2) dual-system models; and (3) multisystem models. The single-system models are the begging of scientific studies on the functioning of emotions and consider a specific system as responsible for the emotional responses. Two examples of this model are the Limbic System Theory of Emotion and the Right-Hemisphere Theory. Although these areas are still considered important in the understanding of emotions, new researches show that these models may no longer be sufficient to explain the complexity of emotions.

The dual-system models range from the simplest to the most complex theories. However, each theory considers two main separable neural systems to explain the emotion. Some studies argue that there are separable neural systems for positive and negative emotions (Davidson, 1984; N. A. Fox & Davidson, 1986; Heller & Nitschke, 1997; Kalin, Larson, Shelton, & Davidson, 1998; Robinson & Manes, 2000 in Murphy et al., 2003). While some theories have focused on the differential functioning of the hemispheres in the codification of different emotional dimensions, other theories point out emotions as adaptive responses to the environment, with a tendency of approximation or withdrawal action according to the presentation of pleasurable or aversive stimuli. These theories are also explained by the different neural involvement of the hemispheres (Cloninger, 1987, behavioral activation and behavioral inhibition systems; Davidson, 1998, approach and withdrawal systems; J. Gray, 1982, behavioral approach and behavioral inhibition systems; Lang, Bradley, & Cuthbert, 1990, appetitive and aversive systems in Murphy et al., 2003). Although researches types of research in this field were dedicated to the study of emotional valence or tendency to action, there is a lack of understanding about emotional excitement.

Unlike dimensional models, the *affect programs* emerge as specific neuronal patterns of complex emotional responses. Ekman (1992) in his model includes the emotions of fear,

repugnance, anger, happiness, sadness, and surprise, and indicates that these do not change between cultures and are identified by distinct facial expressions. Although there is a greater understanding of emotions in isolation, it is not possible to fully characterize the neural basis of human emotion since the research is specific to a certain experimental paradigm, a specific emotional condition, or a particular subset of the population. Another limitation pointed out by Murphy et al. (2003) is the statistical power of studies that include neuroimaging.

The evidence for the neural models presented has come from behavioral methodologies based on brain injuries and electrophysiological examinations. With the advance of technology, new possibilities for the study of human emotions arise, increasing the number of studies on emotions (Murphy et al., 2003). However, as Boddice (2017) argued, emotions are an important diachronic component in the individual and relational sphere of human beings. When speaking of emotion, it is not possible to exclude the subjective experience of each person and their relational effects, although more global perspectives are important to understand the neuro functioning of emotions. For this study, we adopted Damasio's theory of emotions.

Damasio, in his book “The Feeling of What Happens” (1999), defined emotion as a complex chemical and neural response that forms different patterns. The author recognizes that culture and learning play a role in the expression and the meaning of emotions, but he states that “emotions are biologically determined processes, depending on innately set brain devices, laid down by a long evolutionary history”. That is to say that, despite the influences of culture, there is a biological function of emotions that are activated with conscious deliberation. The emotions are expressed by the body but also affect several brain circuits — these modifications shape neural patterns which can become feelings of emotion (Damasio, 1999). According to Damasio (1999), emotion can be defined by complex and automatic body reactions to specific stimuli, while feelings are the awareness of the physical

modifications on the body when emotion is experienced. Feelings would consist of subjective responses to certain stimuli.

According to this theory, there are two biological functions of emotion: a) to produce a specific reaction to the inducing situation; b) to regulate the internal state of the organism to be prepared for the specific reaction. That is, emotions are crucial for survival-oriented behaviors. Consciousness plays a key role in a better adaptation of emotional response as it allows a full perception of the organism and the understanding of the emotion and the other elements involved in the inducing context (Damasio, 1999).

Damasio (1999) has a multisystem vision of the mechanism of emotion. For him, "different emotions are produced by different brain systems". Three steps are involved in the emotional process. First, subcortical areas induce emotions. One example of a fundamental subcortical site is the amygdala. Second, the activity of these brain sites varies for each emotion, creating different patterns for different emotions. For example, sadness seems to activate the prefrontal cortex and the hypothalamus, while anger does not activate any of these cortical regions. Third, specific brain areas are involved in the recognition of each emotion. While the amygdala is responsible to recognize the fear in facial expressions, other sites are specialized in discerning emotions like happiness or anger.

Therefore, understanding emotions has evolved over time and in conjunction with advances in technology. Even today there is no consensus in the literature on the brain mechanism involved in emotion, but it has proved essential and still plays an indispensable role in our survival.

The aggressive brain

Aggressive behaviors have a complex source and can have different faces, shapes, and intensities. Studies with animals have focused on mapping the aggressive brain to better understand human neurofunctional systems (Bartholow, 2018). Some human studies already

demonstrate the brain areas involved in anger. The areas that seem to be involved in the control of aggression are part of a bigger system response to regulate the social behavior generally: anterior hypothalamic nucleus (AHN), ventromedial hypothalamus (VMH), medial amygdala (MA), bilateral septum (BLS), periaqueductal gray (PAG), and the bed nucleus of the stria terminalis (BNST) (Bartholow, 2018; Newman, 1999).

A recent meta-analysis with healthy youth and adults correlated the motor response inhibition to determine a neural architecture of anger (Puiu et al., 2020). The result showed that bilateral frontoparietal network including the anterior insula/inferior frontal gyrus (aI/IFG), premotor and midcingulate cortices, as well as a strong right-lateralized temporoparietal convergent activity, are involved in the response inhibition. In the state of anger, the preponderant areas bilateral anterior cingulate cortex (ACC), and right aI/IFG underlie transient anger. The aI/IFG was the only activity consistent between response inhibition and anger. Therefore, this area seems to have a notorious involvement in unpredictable scenarios that require high maintenance and goal-directed behaviors (Puiu et al., 2020).

Anger and aggression following Traumatic Brain Injury

The study of aggression began with individuals who had neural lesions as a consequence of brain injuries. A classic case is Phineas Gage, who had a profound modification in his personality and behavior, besides cognitive sequels. After this case, the involvement of the prefrontal cortex (PFC) in the regulation of anger and aggressiveness started to be accepted (Bartholow, 2018). Nowadays, there is a greater understanding of the relationship between PFC and aggressive behavior. People with TBI are more likely to suffer a frontal lobe injury from the cerebral neuroanatomical position, which can explain the aggression in these individuals. Disinhibition, impulsiveness, socially inappropriate conduct

is reported as the most frequent reactions in persons following a brain injury (Sohberg & Mateer, 2015).

Giancola (2000) did an overview of the theoretical perspectives of aggression. The studies reviewed pointed out that low executive functioning or damage to the prefrontal cortex was related to increased aggression due to problems in planning and regulating goal-directed behavior and the inhibition of aggression (Giancola, 2000). The inhibition response is indicated as the strongest predictor of reactive aggression behavior when compared to other executive functions like working memory, flexibility, and divided attention (Tonnaer et al., 2016).

The General Aggression Model (GAM) proposed by Anderson & Bushman (2002) considers the presence of social, cognitive, developmental, and biological factors in the explanation of human aggression. This model sustains that social-cognitive phenomena are influenced by knowledge structures, such as perception, interpretation, decisions, or behavior. In other words, what the persons believe and how they understand the events and expect the other's reaction influences the aggression responses. The previous experiences build a pattern of perception in complex levels. Anger is usually linked with hostile attribution biases (Allen et al., 2018).

The model is divided into proximate and distal aspects. The proximate process happens in three stages. First, aspects from the person and the situation can increase or decrease the probabilities of aggression by the influence on moment internal state (cognition, affect, and arousal) in the next stage. Personal factors that grow the chances of aggressive responses can be related to unstable self-esteem, hostile attribution biases, aggressive behavioral scripts, high trait anger, low self-control, or conscientiousness; while situational factors can be associated, for example, with social stress, social rejection, frustration, pain, or noise. The factors that increase aggression are known as risk factors (Allen et al., 2018).

The second stage is about the routes that are involved in the process of appraisal and decision making, which pass through cognition, affection, and arousal. These three variables compound the person's internal state and are directly influenced by the first stage, besides influencing each other in interactive and reciprocal ways. Any changes in these variables alter the likelihood of aggression. The input variables can interfere with the mood and emotions, resulting in aggressive thoughts, and modifying the arousal state (Allen et al., 2018).

The third stage is responsible for the appraisal and decision of response on aggressive or nonaggressive. This stage is the end and beginning of a new cycle because the result will influence the person and the situation factors, generating new actions and reactions. The appraisal depends on the interpretation of the circumstances, which is influenced by the person’s present internal state, the available resources, and the event itself. This appraisal is immediate, but if the persons have mental resources and time, they can engage in a deliberative reappraisal of the circumstances, or change the first immediate response, showing a new behavior. Then they will be starting a new cycle (Allen et al., 2018).

The distal aspects englobe biological and persistent environmental factors influencing the personality, which shapes person and situation factors. Executive functioning is one of the biological modifiers that can increase the probability of aggression. Environmental modifiers can be, for example, related to cultural norms, maladaptive families, or parenting (Allen et al., 2018).

Therefore, as noted, aggression is associated with various factors and brain injury can impact many of these elements beyond cognitive factors. Aggressive behavior, both verbal and physical, can result from a combination of neuropsychological and emotional deficits, including decreased inhibition and increased frustration (Alderman, 2003). The self-esteem of the person with ABI is often affected (Sohberg and Mateer, 2015), as it is related to self-

awareness and self-perception — which impact the understanding of their abilities and limitations that can lead to insecurities and catastrophic thoughts around themselves.

Frustration presents itself in the discrepancy between the desire to solve a problem and their ability to do so. The source of frustration can be perceived by the individual as internal or external and can manifest itself in various ways (McNeil, 1959). The frustration in TBI can appear when the person tries to perform a cognitive skill that was lost after injury.

A longitudinal study examined the prevalence and predictors of aggressive behavior among TBI survivors at 6, 24, and 60 months after discharge in 228 patients with moderate to severe brain injury. This study found that 25% of the participants were classified as aggressive and prevalence did not change over time. Depression post-TBI and younger age at the time of injury were the most significant predictors of aggression following TBI at 6, 24, and 60 months (Baguley et al., 2006). This result is not surprising, but it is alarming since depression is one of the most frequent emotional reactions following TBI.

Therefore, aggression following TBI may be manifested by disinhibition, impulsiveness, and/or poor social judgment, and may be related to damage to the frontal lobe of patients, or also as a result of mood disorders or untreated psychotics (Lauterbach et al., 2015). However, there are patients with a history of TBI who may manifest depressive symptoms through irritability, anger, hostility, and aggression (Seel et al., 2010). Or, as pointed out, depression can be a predictor of more severe forms of aggressive behavior (Baguley et al., 2006).

Objectives

- To translate and adapt an intervention program for the Brazilian population to deal with affective reactions of anger in people with Traumatic Brain Injury;
- To adapt the intervention program for an online modality;

- To investigate the availability of rehabilitation programs focusing on anger management in TBI;
- To explore the effectiveness of the intervention program from clients' and their families' perspectives.

Chapter 2: Anger Management in Traumatic Brain Injury: A systematic review

ABSTRACT

Aggressive behavior and anger misadjustment are major problems following acquired brain injury that can cause numerous negative consequences in one's life, such as social isolation and legal problems. The objective of this systematic review was to identify the impact of the neuropsychological intervention on anger and aggressive behaviors following ABI. A systematic search of PubMed, PsycINFO, Lilacs, Scopus, and Scielo was conducted up to August 2021 to identify empirical studies reporting pre-and post-intervention changes on validated measures of anger management in adults with ABI. A total of 10 studies (3 RCTs, 7 pre-post trials) was identified, which examined the impact of anger management intervention. The findings on the efficacy of these interventions were inconclusive, but all showed some positive effects on anger management after the intervention. Such findings highlighted the methodological differences between the studies and the heterogeneous characteristics of ABI participants. The impacts of problematic anger are well known in the literature and clinical practice, future studies are needed to clarify the effectiveness of the interventions and identify the essential elements for rehabilitation of aggressive behavior and anger dysregulation after ABI.

Keywords: Anger management, Acquired Brain Injury, Traumatic Brain Injury, Rehabilitation, Aggression.

Cognitive deficits, behavior misadjustment, and emotional problems are common among survivors of Acquired Brain Injury (ABI). The evolution and recovery of functions depend on several factors, such as etiology and characteristics of the lesion, the premorbid situation of the person, educational level, demographic variables, among others. The main goal of neuropsychological rehabilitation is to help people with disabilities to reduce the impact of their cognitive impairments in daily life, promoting optimum levels of well-being, independence, and quality of life (Wilson, 2008, 2017).

The aggressive behavior and anger misadjustment is a common reality among survivors of TBI and has a huge impact on their social relationships with others, on their treatment, and its effects on family and caregivers (Baguley et al., 2006; Winegardner et al., 2016). Twenty-five to thirty-three percent of people with severe TBI showed clinically significant aggression, which remained stable for 5 years post-discharge and fluctuated across time (Baguley et al., 2006). Although the origins of the anger post-TBI are complex and can manifest differently for each individual, aggressive behavior was frequently associated with a higher level of depression and lower levels of satisfaction. Besides that, direct injury to frontal/executive systems, cognitive deficits in communication, and pre-injury personality characteristics may all play a role (Baguley et al., 2006; Hart et al., 2017).

Aggressiveness can be directly attributed to frustration and presents itself in the discrepancy between the desire to solve a problem and the ability to do it (McNeil, 1959). The manifested aggression in TBI could appear as disinhibition, impulsiveness, and/or poor social judgment (Lauterbach et al., 2015). Also, some people with a history of TBI may manifest depressive symptoms through irritability, anger, hostility, and aggression (Seel et al., 2010).

Anger dysregulation can result in some severe consequences for the individual's life, if not treated with the cooperation of the family of the individual with TBI. A study

conducted by Slaughter et al. (2003), for example, pointed out that 58% of the incarcerated people reported having had a mild TBI at least once in their life, and 29% reported having had a mild TBI in the previous year of the prison. Posttraumatic anger is related to higher levels of family and career stress and burden. Anger misadjustment after TBI affects the individual and the family directly. Despite being a social problem, TBI is also an economic issue worldwide due to the direct and indirect costs of a person with brain function disorder for the government.

The current systematic review aimed to provide an examination of the impact of the neuropsychological intervention on anger and aggressive behaviors following ABI.

Method

This systematic review was designed based on PRISMA guidelines (*Preferred Reporting Items for Systematic Reviews and Meta-analyses*), which consisted of a 27-item checklist and a four-step flow chart.

The first step was to set four research questions to guide this systematic review:

- What is the impact of interventions on anger management in people with TBI?
- Which instrument is most used for the anger assessment?
- What types of interventions have been researched with patients following TBI?
- Is there a difference in effectiveness between the group and individual interventions?

The following literature databases were searched systematically: Pubmed, PsycINFO, Lilacs, Scopus, and Scielo. MESH and DECs headings were used for the searches. Four combinations of key terms were used in each database to ensure no articles were missed:

1. Brain injury AND anger management
2. Brain injury AND anger AND therapy
3. Brain injury AND anger AND intervention

4. Brain injury AND anger AND rehabilitation

The review examined qualitative, quantitative, and mixed methodology studies that evaluated interventions for participants post-ABI. Studies were included when: (1) the study population included adults with ABI; (2) a neuropsychological intervention was examined for effectiveness with quantitative and/or qualitative outcomes; (3) anger or aggression was specifically addressed by the intervention. Exclusion criteria were studies including (1) participants <18 or > 65 years of age; (2) participants with a diagnosis of psychiatric disorder or drug dependency; (3) participants were veterans; (4) systematic review studies and metanalyses. The reason for excluding the above-mentioned studies we were specifically interested in anger management intervention with adults post-ABI. The studies including elders were excluded because usually high rates of post-traumatic stress disorder and psychologically traumatic events are reported among them as additional consequences.

The language was limited to “English” and there were no publication date limits. The last search was conducted in August 2021. Duplicates were removed. All potentially relevant studies were collected and managed with Mendeley. The first step of selection was by title/abstract, assessed by one reviewer (Figure 1). Interventions were considered effective in the case of a statistically significant difference between pre and post-intervention, or clinically relevant to at least one outcome variable.

The studies selected were read in their entirety to do the final selection. The following data were extracted by the articles selected: author(s), year, country of origin, journal, study design, sample size, mean participant age, mean time since injury, injury severity as measured by Glasglow Coma Scale (GCS) scores or post-traumatic amnesia (PTA) days, intervention protocol, outcome measure(s) and study results.

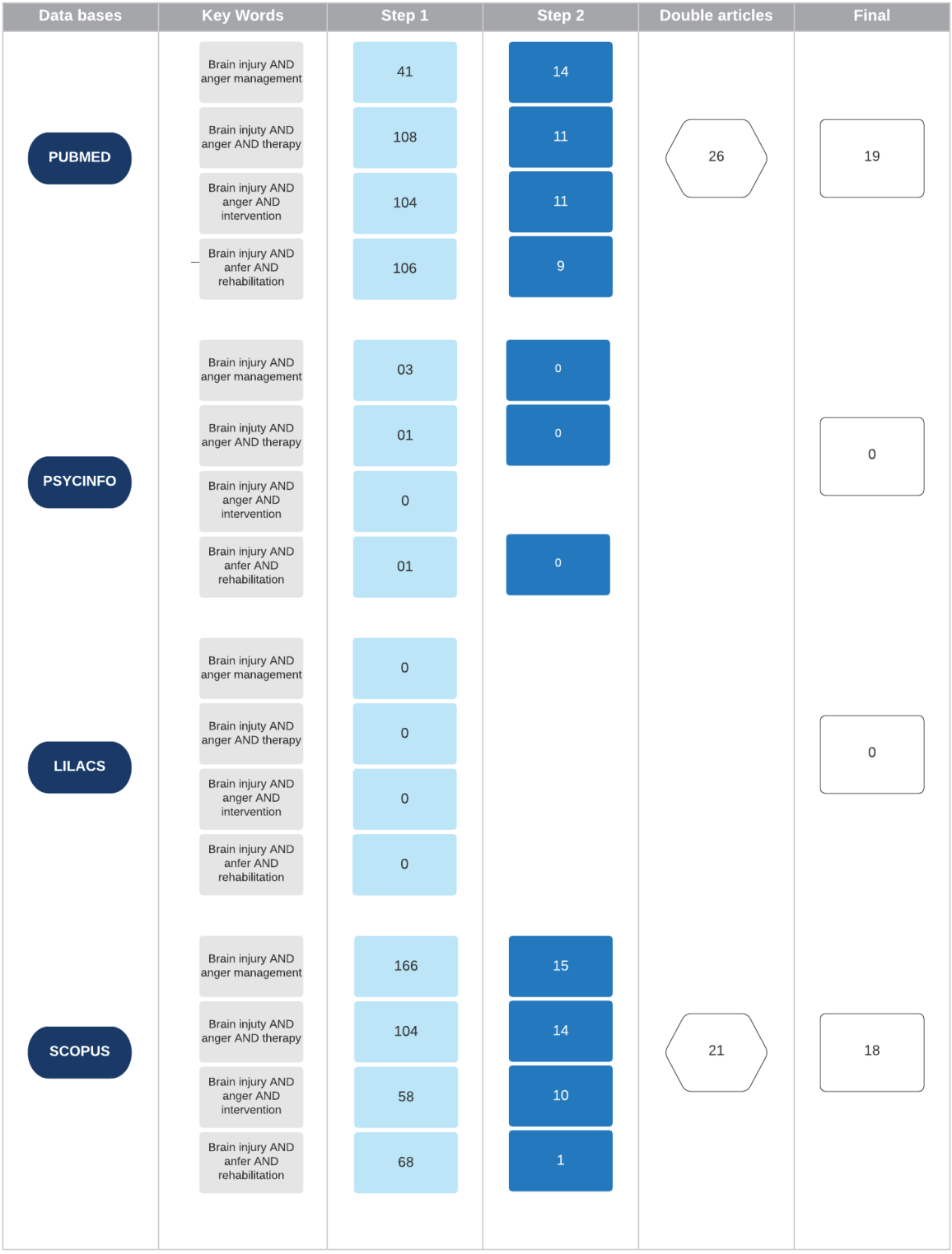

Figure 1 Search results and study inclusion

Classification and appraisal

Twenty-five studies were fully reviewed, ten articles were included in the study. The level of evidence was determined based on the criteria used by Cicerone et al. (2011). The first level was Class I evidence, which consisted of well-designed, prospective, randomized controlled trials (RCTs). Articles categorized as Class II evidence included prospective, nonrandomized cohort studies; retrospective, nonrandomized case-control studies; or multiple-baseline studies that permitted a direct comparison of treatment conditions. Class III evidence was applied for studies with clinical series without concurrent controls or single-subject designs with adequate quantification and analysis, and studies that were designed as comparative effectiveness studies but did not include a direct statistical comparison of treatment conditions. We also included qualitative studies at this level.

Results

Characteristics of the included studies

Figure 2 depicts a flowchart that shows the results of the selection process with the number of studies according to each step. The search strategy identified 10 studies that met the review criteria. Table 1 shows the distribution of the journals and Figure 3 presents the number of articles per year of publication. Of these, two studies were randomized controlled trials (Hart et al., 2017; Medd & Tate, 2000), another RCT crossover (Aboulafia-Brakha & Ptak, 2016), and the remaining seven studies were pre-post trials.

Studies were published between 1992 and 2017. Study sample sizes ranged from 1 to 90 participants. Meantime since ABI was less than 6 months (acute) in one study (O'Leary, 2000), and over 6 months (chronic) in seven studies (Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; Hart et al., 2012, 2017; Medd & Tate, 2000; Walker et al., 2010; Winegardner et al., 2016), and not reported in two studies (Rochat et al., 2016; Uomoto & Brockway, 1992). Mean brain injury severity was severe in five studies (T. Aboulafia-

Brakha et al., 2013; Hart et al., 2012, 2017; Medd & Tate, 2000; Walker et al., 2010), moderate in one study (Aboulafia-Brakha & Ptak, 2016), and not reported in four studies (O'Leary, 2000; Rochat et al., 2016; Uomoto & Brockway, 1992; Winegardner et al., 2016). Table 2 provides the studies' characteristics and main outcomes.

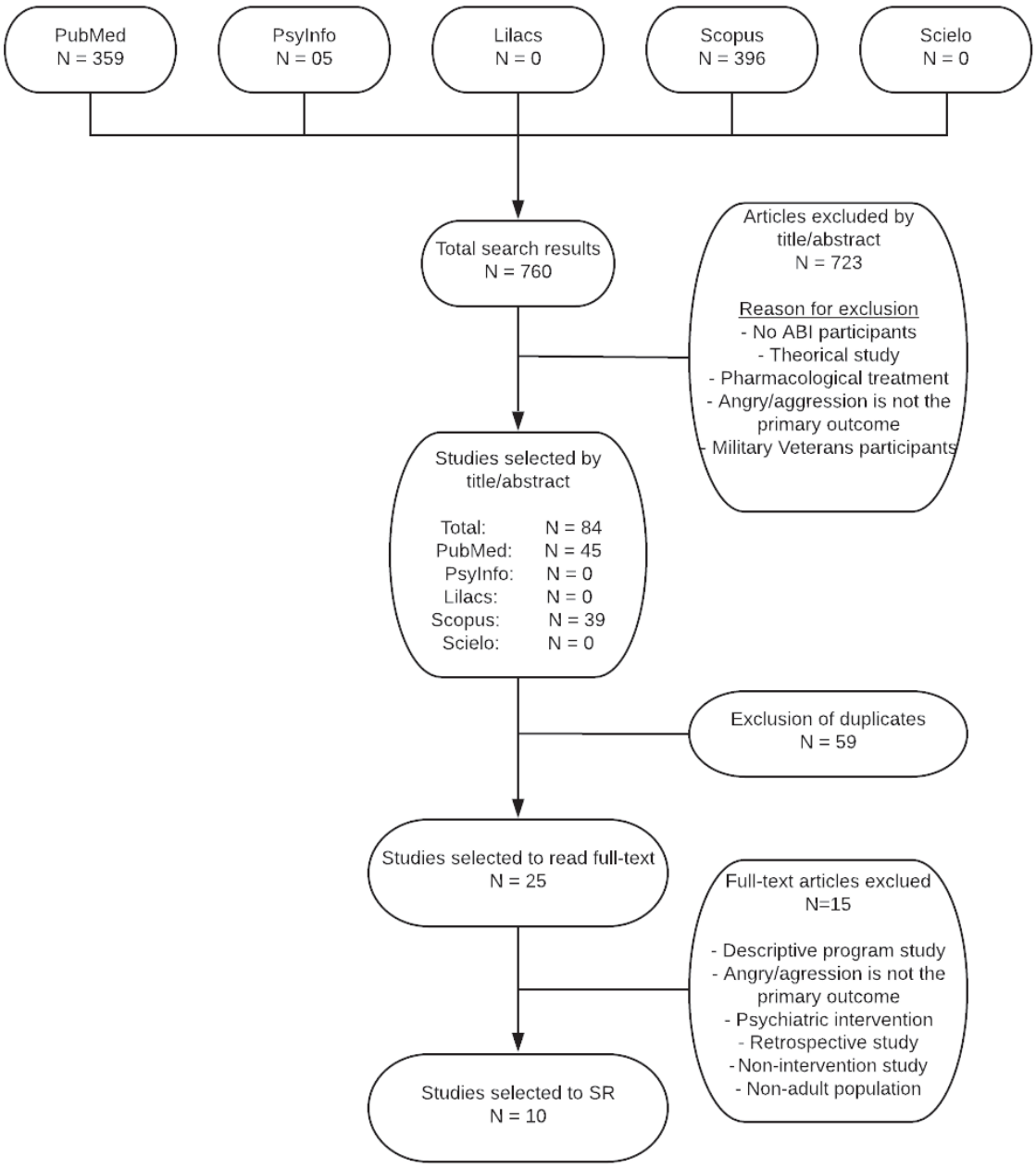

Figure 2. Study selection process using PRISMA flow diagram.

Table 1. Distribution of Journals

Journal	Quantity	Impact Factor
Archives of Physical Medicine and Rehabilitation	1	3.098
Brain Injury	3	1.609
Behavioral Interventions	1	0.731
Journal Head Trauma Rehabilitation	2	2.814
Neuropsychological Rehabilitation	2	2.556
Neuro Rehabilitation	1	1.654
TOTAL:	**10**	

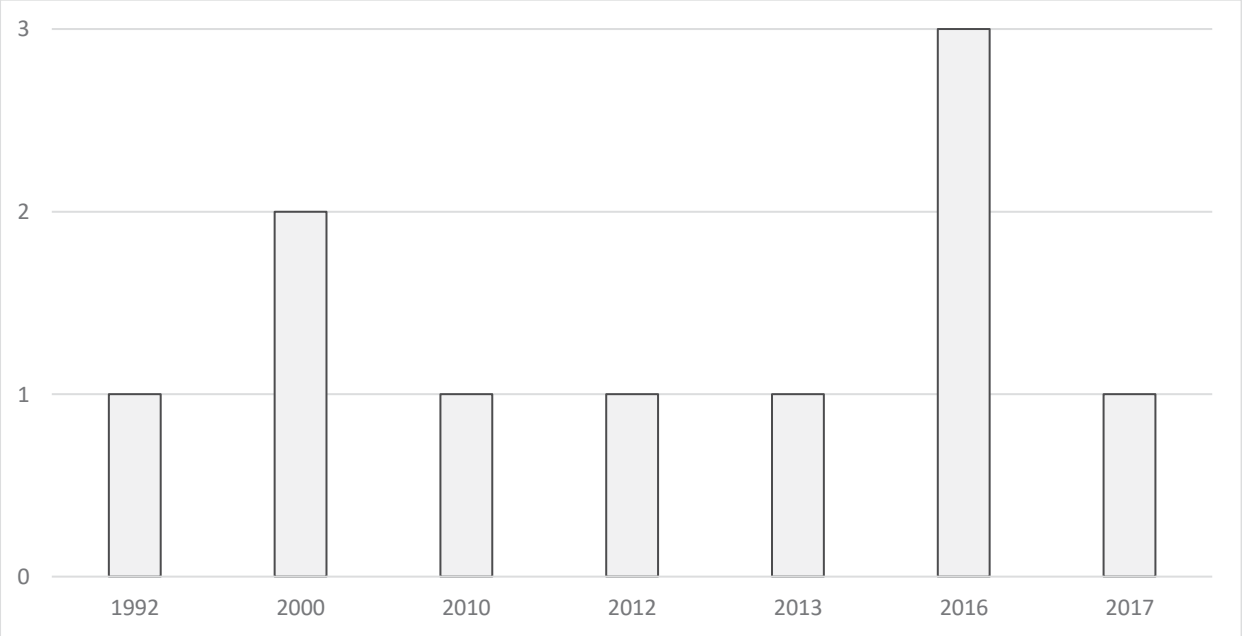

Figure 3. Number of articles per year

Table 2. Studies Characteristics and Outcomes

Study	Design	Quality	Participants	Intervention	Measures [a]	Outcome	Effective intervention (+/-)
Aboulafia-Brakha et al. 2016	Paired-randomized trial	Class I	N = 19; Gender: males = 16, females = 3. *AB group* (N = 8): Mean age = 46.1 ± 10.3 yr; Mean time since brain injury = 12.7 ± 9.7 mo. *BA group* (N = 11): Mean age = 39.3 ± 14.0 yr; Mean time since brain injury = 19.45 ± 11.25 mo. Mean GCS for all participants = 7.8 ± 4.3	Participants were randomized to one of two groups (AB or BA). The AB group received an 8-wk anger management program (60 min, 1x/wk), followed by a 4wk psycho-educational program. For group BA, the order was reversed. Outcomes were assessed at baseline: 6–12 wk prior intervention (T0), second baseline: first session (T1), 4 wk after beginning the intervention (T2), 8 wk after beginning the intervention (T3), 12 wk after the intervention, the final assessment (T4).	AQ-12, STAXI-2: TA; AX-I; AX-O; AC, MARS	• AQ-12 scores significantly improved from TI to T4. • All STAXI-2 subscales showed significant improvement from T1 to T4. • MARS subscales of rumination and venting showed significant improvement from T1 to T4. Other subscales were non-significant. • Anger levels did not significantly change between T0 and T1, but decreased significantly at T4. • Adaptive anger coping strategies also increased following intervention. • Expressed anger decreased following the anger management program compared to the psychosocial adjustment program.	+
Aboulafia-Brakha et al. 2013	Pre–post intervention	Class II	N = 10; Gender: males = 8, females = 2; Mean age = 47.0 yr; Mean time since brain injury = 27.5 mo; Median GCS = 5.0 (range: 3–9)	Cognitive-behavioral program for treating anger and aggressiveness. Intensity: 8wk, 60-min sessions, 1x/wk. Participants were assessed 1–4 wk prior to the intervention (T1: pre), 1 wk after the intervention (T2: post), and 4–5 mo after the intervention (T3: follow-up).	AQ-12	• No significant difference in AQ-12 scores from T1-2 (p = 0.84). But there were significantly lower AQ-12 scores at T3 compared to T1 (p = 0.02).	-
Hart et al, 2017	Multicenter randomized controlled trial	Class I	N=90; Gender: males= 73, females=17. *ASMT group* (N=60) Mean Age: 30,4 ± 10,2 yr. Mean time since brain injury: 69 mo.	Anger self-management training (ASMT) focused on self-monitoring, self-awareness of anger and problem-solving. There were a total of 8, 60–90 min sessions (1x/wk). Outcomes were assessed at baseline (T1),	STAXI-2: TA, AX-O; BAAQ	• After treatment, ASMT response rate (68%) exceed that of PRE (47%) on TA.but not in AX-O or BAAQ, this find persist at T4.	-

			PRE group: N=30; Gender: male = 24, females=6. Mean Age: 36,2 ± 13,3 yr. Mean time since brain injury: 72 mo.	after the fourth treatment session (T2),1 wk after the last treatment session (T3) and 8wks after the T3 (T4).		• In both conditions, over half of those who responded at T3 also showed at T2, but the between-group difference did not reach statical significance.	
Hart et al, 2012	Pre-post treatment pilot study	Class II	N = 10, Gender: males= 8, females= 2; Mean age= 43.3 ± 13.52 yr; Mean time since brain injury=62.0 ± 70.87 mo; Mean PTA duration=114.4 ± 218.25 days.	Anger self-management training (ASMT) focused on self-monitoring, self-awareness and problem-solving. There were a total of 8, 60–90 min sessions (1x/wk). Outcomes were assessed at baseline and postintervention.	STAXI-2: TA, AX-O; BAAQ	• Self-reported anger scores significantly declined from pre to posttreatment on the STAXI-2 and BAAQ.	+
Leary, 2000	Pre–post intervention	Class III	N = 5, Gender: males = 5; Age range = 21– 42 yr; Time post-injury range = 4 mo to 5 yr	Participants completed an anger management training program; sessions were 60 min long, 2x/wk for a total of 10 wk. Outcomes were then collected for 10 wk after the intervention.	Instances of physical and verbal aggression.	• Instances of physical and verbal aggression decreased for all five participants following the treatments.	+
Medd and Tate, 2000	Paired-randomized trial	Class I	N = 16, Gender: males = 14, females = 2. *Treatment*: Mean age = 35.88 ± 12.40 yr; Mean time post-injury = 37.25 ± 40.77 mo *Control*: Mean age = 34.0 ± 9.44 yr; Mean time post-injury = 74.25 ± 117.0 mo; Mean PTA duration for both groups = 14 days.	Intervention: Participants were randomized to the anger management treatment program or to a control wait list group that received the intervention after the study was finished. The anger management program included psychoeducation, increasing participants' awareness of their anger, and strategies to cope with an anger response. Treatment sessions were 1x/wk for 5–8 wk. Outcomes were assessed at baseline, immediately after completion of intervention and a 2 mo f/u.	STAXI-2: TA; AX-I; AX-O; AC.	• The treatment group showed a significantly greater decrease in AX-O than the control group from pre-post. • There was a trend towards improving T-ang and AC scores for the treatment group. • No significant between or within group differences for AX-I scores in either group from pre-post. • T-ang and AC scores significantly improved from pre-intervention versus combined post-intervention and f/u.	+
Rochat et al, 2016	Single-case study	Class II	N=1; Gender male, age 47 yr	Two successive psychological intervention. The first focused on improving the recognition and expression of basic emotions, the second consisted of a self-regulation program. 3 mo interval between interventions.	Home-made diary; Likert scale; NPI; UPPS-P;	• Both interventions resulted in a reduced frequency and intensity of anger outbursts. • Both interventions on the outcomes indicated a medium effect size.	+

				Both included 60 to 90-minute sessions, for 8wk, 1x/wk.			
Uomoto & Brockway, 1992	Two case studies	Class III	N=2; Gender: males= 2, Age rage 22-43yr	Anger management training to patients and behavioral management training to family members. The intervention lasted 8-12 weeks, 60-90 min sessions, 1x/wk. Outcome behavioral assessment was made at baseline, one month and three-month follow-up sessions occurred.	Family Observing Qualitative	• Decreased anger outbursts in both cases.	+
Walker et al, 2010	Repeat-measures design with convenience sampling	Class II	N = 52, Gender: males= 40, females = 12; Mean age = 32.3 ± 11.3 yr; Mean time post injury = 49.2 ± 50.4 mo; Mean PTA duration = 51.3 ± 53.7 days.	Psycho-educational anger management group, 2 hour/session, 1x/wk for 12 wk. Outcome were assessed baseline, 12 wk and follow-up (3-16 mo post-treatment)	STAXI: state anger, TA, AX-I, AX-O, AC.	• Significant reduction from pre-post on T-ang and AX-O, and significant increase in AC. • No significant differences from post-intervention to follow-up.	+
Winegardner et al, 2016	Two case studies	Class II	N=2; Gender: males=2, Age Rage: 37-46 yr. Time post-injury rage: 11 to 24yr.	Perspective taking training for treating anger. Intensity: 6-wk, 60min, 1x/wk. AQ-12 outcome were assessed at baseline, pre and post-intervention. IRI were assessed pre and post-intervention.	AQ-12; IRI; Semi-structured interview with participants and spouse.	• Both patients showed post-treatment declines in aggression. • No significantly statistical in perspective-taking measure. • Spouses described important behavioral changes in their partners, including better perspective taking.	+

Note: AQ-12= Aggression Questionnaire-short Form; AC = Anger Control subscale of the STAXI/2; AX-I = Anger Expression-In subscale of the STAXI/2; AX-O= Anger Expression-Out of the STAXI-2; BBAQ= Brief Anger-Aggression Questionnaire; IRI= Interpersonal Reactivity Index; MARS= Multidimensional Anger Reaction Scale; MBI= Maslach Burnout Inventory; NFRI-R= Neurobehavioral Functioning Inventory-Revised; NPI= Neuropsychiatric Inventory; PTA= Post-trauma amnesia; QRS= Questionnaire on Resources and Stress for Families with Chronically Ill or Handicapped Members; STAXI-2 = State Trait Anger Expression Inventory version 2; TA= Trait Anger subscale of the STAXI-2; T-ang = Trait Anger subscale; UPPS-P= Impulsive Behavior Scale; Wk = week; Yr = year.

[a]Outcome measure used for anger or aggressive behaviour

Intervention's characteristics

In terms of participant characteristics, of the ten studies included in the review, five (50%) had participants with TBI only and five were 'mixed' (i.e., participants were a combination of patients with TBI and other ABI, such as stroke). Most commonly, the interventions were delivered weekly (n=9, 90%), and ranged from 5 to 12 weeks in duration, the minimum duration of 8 weeks being the most common time (n=7; 70%). Half of the interventions were individual (n=5, 50%) and the other half were group interventions. Family members or significant others were reported to be involved in some aspect of the study in 7 (70%) of all included studies. Of these, family members or significant others were only involved in the assessment processes (i.e., not involved in the group/intervention per se) in 3 (30%) studies, and they were involved at the intervention at least one time in 5 studies (50%).

The focus of intervention differed across studies, however, a major *self-awareness* about the emotions and anger was the most common focus. One study focused specifically on perspective-taking skills. All studies somehow worked coping skills, problem-solving, self-awareness, developing strategies to deal with an angry response. Many different strategies were used, nevertheless, role-playing, videotapes, completion of anger logs were often across the studies.

Table 3 Summary of quantitative studies

Study	Intervention Focus	Comparison	Intervention type	Participants	SO	Primary outcome measure(s)	Results
Aboulafia-Brakha et al. 2016	(1) Self-awareness; (2) managing emotion in emergencies; (3) cognitive restructuring; (4) prevention strategies	Compared intervention across different time points. One group (AB) started with an 8wk anger management program (A) followed by 4wk psychosocial and cognitive impact of BI (B). This order was reversed in the BA group.	Cognitive-Behavioral Group; 8 wk; 60 min 1x/wk	N = 19 with mixed TBI/ABI. Average Glasgow Coma Scale score indicated moderate TBI. Interventions were held in groups of 3 participants	No	AQ-12, STAXI-2: TA; AX-I; AX-O; AC, MARS	No significant difference between intervention group outcomes across time points. Anger only improved after the anger management program. All STAXI-2 subscales showed significant improvement from T1 to T4
Aboulafia-Brakha et al. 2013	(1) Self-awareness; (2) managing emotion in emergencies; (3) cognitive restructuring; (4) prevention strategies	Compared anger and aggressiveness pre-post intervention	Cognitive-Behavioral Group; 8wk; 60 min; 1x/wk	N= 10 with moderate to severe TBI. Interventions were held in groups of 4, 3 and 2 participants.	No	AQ-12	Significant lower levels of perceived aggressiveness were observed only at four months after the end of the program, but not at the one week after its completion.
Hart et al, 2017	(1) Self-awareness; (2) Problem solving	Compared Anger self-management training (ASMT) to Personal Readjustment and education (PRE) intervention. And test the efficacy of ASMT.	Individual; 8wk; 90 min; 1x/wk	N = 90 with severe TBI.	Yes 3 sessions	STAXI-2: TA and AX-O; BAAQ	There was a significantly greater post-treatment response rate to ASMT compared with PRE. There were more treatment responders at 8 weeks compared with shortly after treatment.
Hart et al, 2012	(1) Self-awareness; (2) Problem solving	Anger self-management training (ASMT) pre-post intervention on anger.	Individual; 8wk; 90 min; 1x/wk	N = 10 severe TBI.	Yes 3 sessions	STAXI-2: TA and AX-O; BAAQ; semi-	Effect sizes were large on the measures of propensity for anger (TA), outward expression (AX-O), and volatile acting out (BAAQ).

						structure interview	
Medd and Tate, 2000	(1) Self-awareness; (2) Strategies to deal with an angry response	Efficacy of the Treatment Group (TREAT) to Waiting-list Group (WAIT).	Individual; 5-8 wk;1x/wk. No information regarding the time of session.	N=16 with mixed TBI/ABI. Average Post-traumatic amnesia indicated severe TBI.	Yes. 1 session	STAXI-2: TA; AX-I; AX-O; AC. Qualitative feedback	There was only significant difference in the AX-O between TREAT and WAIT. Improvements in the management of anger were maintained at 2 months of follow-up. Also, the findings indicated poor generalization effects to levels of self-esteem, depression and self-awareness.
Walker et al, 2010	(1) Self-awareness; (2) Strategies to help reduce the feeling of anger; (3) problem-solving	Group anger management program for severe TBI: pre-post intervention on anger.	Group; 12 wk; 120 min 1x/week.	N = 52 severe TBI. A range of four to eight participants per group	Yes 1 session	STAXI: state anger, TA, AX-I, AX-O, AC.	Significant decreases in the frequency of experiencing angry feelings (TA), and the frequency of outward expression of anger (AX-O). Significant increases in the frequency of controlling feelings of anger (AC). These gains were maintained over the follow-up period. Current feelings of anger and frequency of repressing anger (AX-I) did not change over time.
Winegardner et al, 2016	(1) Perspective taking skills	Changes in anger and perspective training pre-post intervention.	Group: 6-wk, 60min, 1x/wk.	N=2 with mixed severe TBI/ABI. Interventions were held in groups of 2 participants.	No. SO was only involved in the assessment	AQ-12 and semi-structure interview	Both participants showed post-treatment declines in aggression. Minimal changes occurred on the perspective-taking measure.

Note: AQ-12= Aggression Questionnaire-short Form; AC = Anger Control subscale of the STAXI/2; AX-I = Anger Expression-In subscale of the STAXI/2; AX-O= Anger Expression-Out of the STAXI-2; BBAQ= Brief Anger-Aggression Questionnaire; IRI= Interpersonal Reactivity Index; STAXI-2 = State Trait Anger Expression Inventory version 2; SO = significant Other; TA= Trait Anger subscale of the STAXI-2; T-ang = Trait Anger subscale; Wk = week; Yr = year.

Effectiveness of interventions

Two RCTs identified by the review showed significant improvements as a result of group intervention. The RCT that compared a group intervention with therapy with adequate information, emotional support, and opportunities to ventilate feelings did not show statistical significance between groups.

All the studies analyzed seemed to present some positive results in anger control. One specific study effect was found immediately, after only four weeks of the beginning of the intervention.

Quantitative research

Table 3 provides a summary of the 7 quantitative studies including intervention focus and type, comparison, participants, anger management measure, and results. Regarding these studies, participants were exclusive TBI in 4 (57.1%) and involved both ABI and TBI in 3 (42.9%). Participant numbers ranged from 2 to 90. The severity of the injury was specified in all of the studies, and this varied from moderate to severe. It appears that anger intervention has a greater impact on the expression of anger directed at other people or at the ambient (AX-O) than on the tendency to repress these feelings (AX-I) (Medd & Tate, 2000; Walker et al., 2010).

Significant improvements as a result of group intervention were identified on at least one of the outcome measures used in all of the studies. However, in two studies, significantly lower levels of perceived aggressiveness were observed only after the follow-up period program, but not at the week after its completion (Aboulafia-Brakha et al., 2013; Hart et al., 2017).

There were four pre-post studies that report on outcomes of the interventions (Aboulafia-Brakha et al., 2013; Hart et al., 2012; Walker et al., 2010; Winegardner et al., 2016). Only two studies compared an anger intervention with principles of psychoeducation

on ABI and measured the effectiveness of interventions between groups (Aboulafia-Brakha & Ptak, 2016; Hart et al., 2017). One study compared the effectiveness of the intervention with a Waiting List (Medd & Tate, 2000). These studies concluded that anger improvement was significantly associated with the intervention focused on anger management. Three studies that evaluated the effectiveness of the intervention after a follow-up period concluded that the gains on anger management were maintained (Aboulafia-Brakha et al., 2013; Medd & Tate, 2000; Walker et al., 2010).

Three of the interventions were individual (N=3, 42.9%) and four were group interventions (N = 4, 57.1). The group or individual modality does not appear to interfere with the effectiveness of the intervention; however, no study has been done to specifically investigate this issue. According to Aboulafia-Brakha & Ptak (2016), one advantage of the group intervention is the possibility to learn about alternative ways of viewing situations by adopting the other's point of view and strategies to deal with them – an opportunity to share similar experiences, difficulties, and adjustments post-TBI. In contrast, in a study that assessed the preference between the group and individual intervention, the participants tended to prefer the individual approach over the group approach, as they considered it important to tailor information to suit each person (Medd & Tate, 2000).

Of these articles, four were based on cognitive-behavioral theory (Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; Medd & Tate, 2000; Walker et al., 2010), two studies focused their theory on the idea of a "final common path way" of the anger expression associated with impaired self-awareness and problem-solving (Hart et al., 2012, 2017). One study, based on the theory of mind (ToM), focused the intervention on the perspective-taking, that is, on interpreting the intentions and mental states of the people who live with and/or relate to the participants. (Winegardner et al., 2016).

The instrument most used to measure anger and the efficacy of the intervention was the State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1988; N=5, 71.4%), followed by Aggression Questionnaire-short Form (AQ-12; Bryant & Smith, 2001; N=3, 42.8%). Two other instruments were also used to assess anger: Brief Anger-Aggression Questionnaire (BAAQ) and Multidimensional Anger Reaction Scale (MARS).

Qualitative research

Three qualitative research studies were identified. The studies are summarized in Table 4. Participants were exclusive severe TBI in 1 (33.3%) and the other two involved both ABI and TBI in 2 (66.3%) and did not inform the severity of the injury. Participant numbers ranged from 1 to 5.

Of the three studies, two studies proposed two complementary interventions for anger management. The first research, proposed an intervention focused on coping skills and managing stress, and the other focused exclusively on anger management (O'Leary, 2000). These interventions occurred during the same period but were held on different days of the week. This study only used the analysis of the hassle logs, no interviews were conducted with the participants. This reduces the possibility of analyzing the effectiveness of the intervention. Since the interventions were applied simultaneously, it was not possible to attribute which program influenced the results of improved anger expression more. In addition, the author indicates that the sample of participants differed in important ways concerning time post-injury and pre-intervention levels of aggression. A more homogeneous sample could bring new results (O'Leary, 2000).

The second research started the intervention with a focus on emotion recognition and expression training, followed by a self-regulation program with an 8-week interval between interventions (Rochat et al., 2016). This study assessed the frequency and intensity of anger expression in a single case study. The results point out that the frequency of aggressive

episodes tends to decrease during both interventions, but returns to increase after one month. However, the intensity of anger expressions continues to decrease, even eight months after the end of the intervention. The participant reported greater satisfaction with the second intervention, saying he implemented and used the "stop and breath" strategy in different situations, which helped him stop before overreacting, even after a long period since the end of the intervention program (Rochat et al., 2016).

The other study actively worked together with the family, intending to assist family members in the management of aggressive behavior in the home environment post-TBI (Uomoto & Brockway, 1992). The initial proposal of the study was that the meetings with the participants took place together with the family members, but one of the participants had difficulty understanding and following the discussion during the joint sessions. The participant and family sessions were separated to accommodate this difficulty. The participant had sessions with a psychologist while the family members followed up with another professional. This is an indication that for some people with major difficulties in language comprehension, individual sessions can be more fruitful and effective. The author claims that working with family members helps the individual with ABI to transfer the abilities learned to the home environment and maintain the gains over time. Besides that, according to the author, the intervention tends to be more effective if the person with ABI and their family members agree on and understand the anger management plan and techniques (Uomoto & Brockway, 1992).

In all studies, the effectiveness of the intervention was assessed by the number of aggressive episodes the person with TBI had during the week. In one study the records were made exclusively by the participant (O'Leary, 2000), in another study the records of the participant and the SO were considered (Rochat et al., 2016), and in another study, only the records of family members were considered (Uomoto & Brockway, 1992). Regarding the

methods of qualitative data analysis, two studies did not inform the model of analysis used (O'Leary, 2000; Uomoto & Brockway, 1992). One study used a quasi-statistical technique for data analysis (Rochat et al., 2016). All studies reported an improvement in anger management after the proposed interventions.

Table 4 Summary of qualitative studies

Study	Intervention Focus	Methodology	Intervention type	Participant/s	SO	Primary outcome measure(s)	Results
O'Leary, 2000	(1) Coping skills, (2) relaxation techniques, (3) anger-reducing techniques	Participants attended two one-hour session weekly. One hour focused on coping skills and managing stress. Second hour focused on anger management.	Group; 10wk; 60 min; 1x/wk for each intervention	N= 5 with mixed TBI/ABI. No information regarding severity.	No	Instances of aggressive events based on hassle logs. No explicit approach identified for data analysis.	The results suggest the curriculum training reduced levels of verbal and physical aggression for all 5 participants.
Rochat et al, 2016	(1) Emotion recognition, (2) Self-regulation	Two successive psychological intervention. The first focused on improving the recognition and expression of basic emotions, the second consisted of a self-regulation program. There were 8 wk-interval between interventions.	Individual; 8wk; 60 – 90 min; 1x/wk for each intervention	N=1 with severe TBI	No. SO was only involved in the assessment	Instances of aggressive events based on a home-made diary filled in by his spouse. A quasi-statistical procedure was used to data analysis.	Both interventions resulted in a reduced frequency and intensity of anger outbursts.
Uomoto & Brockway, 1992	(1) Coping skills, (2) Problem Solving,	Training family members in behavioral management techniques to increase or reduce the rate of a particular behavior. The behaviors were defined in the first session.	Participants were seen together with family members; 8-12 wks, 60-90 min sessions, 1x/wk	N= 2 with mixed TBI/ABI. No information regarding severity.	Yes. In every session.	Instances of aggressive events based on family Observing Qualitative. No explicit approach identified for data analysis.	The combination of patient training in self-management skills with family skill training resulted in decreased anger outbursts in both cases.

Note: SO = significant Other; Wk = week; Yr = year.

Discussion

This systematic review aimed to examine the current evidence on anger management interventions following ABI. The authors of all studies describe the need for researches like this because of the frequency of anger dyscontrol and aggressive behaviors, as well as the social negative consequences for the community. Anger problems can persist for a long period (Medd & Tate, 2000) and have an impact on family relationships, increasing the risk of illness in the primary caregivers (Uomoto & Brockway, 1992).

All of the studies' interventions share the primary goal of decreasing angry outbursts and aggressive behavior. Winegardner et al. (2016) emphasized that aggressive reactions can be associated with hostile intent on the interpretation of social situations. This study, therefore, focuses on training the perspective-taking and the changes in anger expression. Whereas Uomoto and Brockway (1992) focused on training and assisting family members to understand and deal with aggressive behaviors. The other studies differed in some details in the focus of the intervention, however, they followed the strand of self-awareness and problem-solving.

The first question was “What is the impact of interventions on anger management in people with TBI?”. The present study provided evidence that anger management programs may be effective in reducing aggression among individuals with moderate to severe ABI. However, the outcomes found in this systematic review present important methodological differences. Among the quantitative studies, four studies had a control group. Of these, only one study had an intervention in the control group that provided emotional support as empathic attention, effects information about TBI and its recovery course, with encouragement to focus on intact skills and opportunity to ventilate feelings (Hart et al., 2015, 2017). Thus, it did not focus on developing anger management strategies, but on nonspecific variables that could influence emotion and behavior. Still, the study showed a significantly greater post-treatment response rate to ASMT compared with the control group

as assessed by one measure, the Trait Anger scale from the STAXI-2 (Hart et al., 2017). The authors argued that the psychoeducational emphasis on the patterns of situations that made them feel angry could improve awareness of anger, and thus the understanding of anger triggers (Hart et al., 2017). Therefore, it is still necessary to differentiate more deeply the characteristics of an exclusive anger intervention from interventions that do not have specific elements for anger management but include listening elements, such as a safe space to talk about emotions and situations.

The quantitative studies that also analyzed qualitative data demonstrated that the participants adhered in their routine to the strategies taught in the programs (Hart et al., 2012; Medd & Tate, 2000), especially positive self-talk and time-out procedures (Medd & Tate, 2000). According to participant reports, one of the most valuable points of program participation was the increase of self-awareness and the improvement in efficiency in controlling their anger (Medd & Tate, 2000).

Two studies only showed efficacy in the expression of anger after the follow-up period (Aboulafia-Brakha et al., 2013; Hart et al., 2017). In parallel, one of the studies demonstrated a significantly greater post-treatment Trait Anger scale from STAXI-2 (Hart et al., 2017). One hypothesis raised by the authors is that Trait Anger assesses the negative perception of situations and the tendency to react with aggressive behavior. This scale can be influenced by developing a better awareness of situations that generate anger, enabling the development of new perspectives and coping strategies, while the outward anger expression scale assesses specific reactions of verbal or physical aggressive responses, such as yelling or hitting. The authors ponder the possibility that these reactions resemble habits and therefore take more time and practice to consolidate the change (Hart et al., 2017).

Despite the positive indication of the effect of specific interventions on anger management, it is important to point that there is a paucity of studies in this area, and just

three studies were classified as Class I. This finding suggests that there is still much to be studied and verified about anger intervention following ABI.

With regards to the second research question, “Which instrument is most used for the anger assessment?”, the majority of studies used the STAXI-2 as a measure of anger, which is a self-reported scale that assesses objectively the experience, expression, and control of anger. The test is composed of 57 items, which are grouped in scales and sub-scales (Spielberg, 2010). The choice of this instrument is justified in the literature by the accessibility of the wording, age- and gender-specific psychometric characteristics, and widespread use in anger intervention trials (Hart et al., 2015).

Regarding qualitative measures, the analysis of the studies points to a diversity of ways to assess the frequency and intensity of anger episodes. The most common way of assessing anger in qualitative studies is by filling out logs describing the stressful situation, the people involved, and the reaction at that moment. This was one way to access frequency and coping strategies. In all quantitative research, logs were also used, but not as an analysis of intervention effectiveness, but as a technique for developing self-awareness about anger. Some studies used semi-structured interviews to supplement the results (Hart et al., 2012; Medd & Tate, 2000; Winegardner et al., 2016). A standardized questionnaire would be interesting to guide the qualitative bias of anger management research post-ABI.

The third question guiding this review was “What types of interventions have been researched with patients following TBI?”. This review found that the majority of included studies were quantitative studies with at least one participant with TBI. All programs feature a semi-structured intervention with clear objectives in each session. In general, all interventions addressed self-awareness about anger episodes and learning techniques. Among the articles, only one study reported that one participant was unsatisfied with the repetitive, guided structure of the sessions (Hart et al., 2012). Another study pointed out that the

participants who dropped out of the program were the ones who had lower levels of anger than the group who finished the intervention. The authors reinforce the importance of establishing inclusion criteria that are sensitive to select people who would benefit from this type of intervention (Aboulafia-Brakha & Ptak, 2016), considering post-injury time, cognitive deficits, and self-awareness about their anger problems. However, in general, the interventions showed good adherence, with low dropout rates.

The most common intervention time was 8 weeks, with a one-week frequency (Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; Hart et al., 2012, 2017; Rochat et al., 2016). This frequency has proven effective and sufficient to address this specific topic (Aboulafia-Brakha et al., 2013), and, on the other hand, long interventions may run the risk of the client not terminating the program, even by bureaucratic issues, such as insurance (O'Leary, 2000). Some programs showed flexibility for the intervention time, Uomoto and Brockway (1992) set a duration of 8 to 12 weeks and Medd and Tate (2000) from 5 to 8 weeks. Greater flexibility of intervention time can be interesting for persons with severe cognitive deficits that demand more time and repetition of information for better understanding. Having made these considerations, it is important to stress that the average of 8 sessions per week is sufficient for the effectiveness of anger intervention with people with ABI.

A meta-analysis on anger management pointed out difficulties similar to those found in this current study, as heterogeneous measures for aggression with different focuses on the aspects of anger and aggression (Iruthayarajah et al., 2018). As pointed out previously, four interventions were based on the cognitive-behavioral theory (Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; Medd & Tate, 2000; Walker et al., 2010), two studies focused their theory on the idea of a "final common pathway" of the anger expression associated with impaired self-awareness and problem-solving (Hart et al., 2012, 2017). One

study, based on the theory of mind (ToM), focused the intervention in the perspective-taking, that is, in interpreting the intentions and mental states of the people who live with and/or relate to the participants. (Winegardner et al., 2016). Therefore, besides finding few studies that address this very important topic, there is still a distinct approach among many programs.

Although it is well established in the literature that anger dysregulation and aggression behavior after ABI is a significant problem because of its consequences on the quality of their relationships and social reintegration (Baguley et al., 2006; Roy et al., 2017; Vaishnavi et al., 2009; Wilson, 2008), studies in this field are scarce. It's been a few years now since TBI was recognized as a “silent pandemic” (Coburn, 1992). The consequences of untreated anger in these individuals are numerous and can have various impacts on small and large scales. The financial cost can be calculated by direct expenditure, such as inpatient and rehabilitation; however, many persons with TBI do not return to work (Coburn, 1992; Dawson et al., 2007), and several changes in the family dynamics take place. In addition, aggressive behavior can lead to serious consequences for the individual's life and society. A study that investigated the prevalence of TBI among 69 inmates in a county jail population indicated that sixty (87.0%) reported TBI over their lifetime; 25 (36.2%) reported TBI in the prior year (Slaughter et al., 2003). Therefore, several studies have been demonstrating the urgency of interventions focused on anger management for years; yet few studies are found in the literature to inform clinical practice with this population.

Finally, the last question was ‘Is there a difference in effectiveness between the group and individual interventions?’. According to this review, no differences in the success of the intervention can be perceived concerning the individual or group intervention. However, different benefits are observed in each modality. Persons with acquired brain injury (ABI) with cognitive deficits might benefit from a group treatment as it might offer psychotherapeutic advantages, such as a sense of belonging, and the opportunity for clients

to give feedback to another person regarding socially inappropriate behavior, successful use of coping compensatory strategies, and practice of their new skills (Bertisch et al., 2011; Demark & Gemeinhardt, 2002), in addition to being cost-effective (Walker et al., 2010). Because social isolation is frequent among persons with ABI, due to the decrease in activities and relationships, a high dependency on family members is common (Wilson, 2008). Small groups were observed in the interventions found in this review. According to Aboulafia-Brakha et al. (2013), for persons with cognitive impairment, the ideal number of participants per group should be four.

Another important feature of the study analysis is that a significant number of interventions do not include a family member or significant others (Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; O'Leary, 2000; Rochat et al., 2016; Winegardner et al., 2016). The involvement of a SO is pointed out as important support for the rehabilitation process (Wilson, 2008). One of the studies that did only one session with the family member pointed out that this was not enough, and that for future research it would be important to review the number of sessions in which the SO participates (Medd & Tate, 2000). The intervention program developed by Hart et al. (2012, 2017) invites the SO in three important moments: the beginning, the middle, and the end. This way, the family member can follow the rehabilitation process and provide support to the participant. Uomoto & Brockway (1992), who proposed an intervention entirely in conjunction with a family member, emphasize the relevance of a key SO during anger rehabilitation, especially when the participant has severe cognitive impairment. According to this study, the family would play an important role in helping the individual to maintain and generalize the gains of the intervention.

Finally, a final important point to note is that there is a large time gap between the published research. The first study found in this systematic review was from 1992, followed

by two studies published in 2000 and one in 2010. As of 2012, publications have become more frequent; however, the most recent study found was from 2017. Therefore, we have not had updates on anger management programs after ABI for four years, except for one publication on the follow-up of a survey conducted in 2017 (Hart et al., 2017, 2020).

Conclusion

This systematic review highlighted the paucity of studies evaluating the effectiveness of anger interventions for people with ABI. Other points found were the methodological differences among the studies; the heterogeneous characteristics of ABI participants, and unreported information about the severity and the time post-injury. Most studies had small sample sizes. The study's outcomes suggested a decrease in the frequency and intensity of aggressive episodes. The impacts of problematic anger are well known in literature and clinical practice, but additional research is needed to enable professionals and families to deal with this common reality.

Chapter 3: Adaptation of an Anger Management Intervention in Brazil

Cognitive deficits and behavior misadjustment are commonly observed among survivors of Acquired Brain Injury (ABI). The main goal of neuropsychological rehabilitation is to help the individual have the most functional life possible, and this can be achieved through a therapeutic plan that encompasses the person with a disability as a whole — from the cognitive to the emotional and psychosocial aspects (Wilson, 2008). As mentioned before, emotional aspects can be a direct consequence of the brain injury or a consequence of the abrupt change of life. However, it is important to highlight that emotional factors also play a role in cognitive functioning (Bertisch et al., 2011). Therefore, when thinking about the success of rehabilitation, it is essential to conduct the cognitive program along with the emotional processes for the patient to develop a sense of identity.

Anger is a common emotion in all human beings and has positive aspects when there is management and direction of action according to a goal, which is often related to protection and self-preservation. However, when the aggressive reaction is unbalanced and disproportionate, it can generate several serious consequences for the individual, the people around them, and even for society. As we have seen, aggressive behavior and angry outbursts are common in people who have had a TBI and these episodes do not tend to disappear spontaneously.

Brazil, like the rest of the world, is affected by thousands of cases of TBI every year. However, the research found on this theme was developed in North America, Europe, and Australia. Therefore, there seemed to be a cultural predominance over these studies, making it necessary to translate and adapt them to the Brazilian context.

Moreover, the present study was marked by the COVID-19 pandemic, which demanded online adaptations of neuropsychological interventions. Moreover, as Brazil is a

continental country with few rehabilitation centers specialized in traumatic brain injury, teleneuropsychology might be a viable alternative to reach a larger number of clients.

The present study design was initially planned before the pandemic outbreak, so it was necessary to adapt the proposed methodology to the new conditions of social distancing and sanitary security. This study aimed to adapt the program *Anger Self-Management Training* (ASMT) (Hart et al., 2012, 2015, 2017, 2020) to the Brazilian cultural context and to develop its online intervention modality.

This chapter provides an overview of recent studies about telerehabilitation following ABI and a detailed description of the ASMT program's principles. The pilot study specialized in traumatic brain injury is presented at the end of the chapter.

Teleneuropsychology

During the COVID-19 pandemic, telemedicine became an essential key to the care and the follow-up of individuals with any health issue, which represented an abrupt increase of 683% in attendance of telehealth in the first months (Mann et al., 2020). A recent study evaluated clinician feasibility, and the direct-to-home-teleneuropsychology service had high acceptance and satisfaction among patients (Parsons et al., 2021).

Therefore, telerehabilitation is a promising field of neuropsychology that might facilitate the inclusion of neurologically disabled groups (Ownsworth et al., 2018). There are different mechanisms utilized by telehealthcare programs that can include two-way videoconferencing (VC), chat rooms, e-mails, wireless phones, telephones, and virtual reality (Grosch et al., 2011; Ownsworth et al., 2018). There are many advantages of an online intervention as it can improve access to services for persons who live far from rehabilitation centers and it can also enable flexible scheduling and extended follow-up (Ownsworth et al., 2018, 2020).

However, some barriers could be identified as obstacles for the rehabilitation via the internet, especially for people with TBI, who might have sensory, motor, and cognitive impairments, lack of comfort with technology, and security concerns (Ricker et al., 2002). Cognitive difficulties reported were related to memorizing the steps to access the computer program and understanding how to use the internet properly (Ricker et al., 2002).

Despite these potential challenges, various studies have pointed out the beneficial results of telerehabilitation for people with ABI. A recent memory intervention study after stroke with two-hour weekly individual sessions conducted via Zoom demonstrated that the telehealth delivery seemed to be effective and did not reveal an outcome difference if compared to face-to-face intervention. The problems with the technology were minimum and did not interfere in the intervention (Lawson et al., 2020). Tsaousides et al. (2014) implemented the first study using VC for the delivery of an emotional regulation group treatment to individuals with TBI. The results showed high attendance at the intervention for seven participants, who obtained great satisfaction from the treatment. There were no significant problems with the technology and with the platform used (GoToMeeting). However, no changes in self-reported emotional regulation were observed after the 16 sessions. The authors pointed out that the reasons considering the satisfaction of the participants were unclear. They suggested that this treatment delivery option was viable and needed to be further studied.

A recent systematic review indicated that the telephone is the most utilized technology over telerehabilitation for adults with TBI (Ownsworth et al., 2018). Ownsworth et al. (2020) analyzed the perspectives of rehabilitation coordinators, individuals with ABI, and family caregivers on the usability and acceptability of VC rehabilitation. The results of the study indicated that there are a variety of positive perceptions about the use of VC in rehabilitation. Perceived benefits of VC were related to time and cost efficiencies, accessibility and

convenience, flexibility in the allocation of time to clients' needs, and the potential to be more independent by using electronic tools. Potential problems and parameters were observed especially in technical and internet connectivity that varied according to the location and weather conditions. Despite the good response to online treatment, several clients said they preferred the presential intervention due to the physical presence and contact. The coordinators indicated that the face-to-face modality was better for developing rapport and having a meaningful idea of the clients' situation (Ownsworth et al., 2020).

Although studies are still needed in this area, telerehabilitation is proving to be a viable and effective intervention delivery alternative for individuals after ABI. Ownsworth et al. (2020) recommended some precautions for better intervention experience and effectiveness: first, to structure guidelines and a video tutorial about the platform and to provide continuous assistance and technical support; second, to provide an orientation session about how to communicate via VC and the best conditions for online sessions. The use of headphones and access to a private environment were pointed as important points to ensure the confidentiality of treatment. The third precaution was to encourage clients, especially the ones with memory problems, to have additional VC with other people to practice.

The Anger Self-Management Program (ASMT)

The ASMT is an anger intervention program for people with TBI developed by an American research group of neuropsychologists and psychologists. A pilot study supplied the first pieces of evidence of its feasibility (Hart et al., 2012), followed by a 3-center randomized controlled trial that verified the efficacy of the program (Hart et al., 2017).

The program consists of an eight-session intervention, 60-90 minutes individual session per week, based on self-monitoring and problem-solving skills. The main goal of the ASMT is to improve emotional self-awareness and to develop a constructive repertoire to deal with frustration and conflict situations, through psychoeducation, self-awareness,

and anger management techniques (Hart et al., 2012, 2015). The program is suitable for people with mild to severe injuries, aged 18 to 65, with the injury starting at the age of 16 and at least 6 months prior to enrolment (Hart et al., 2015).

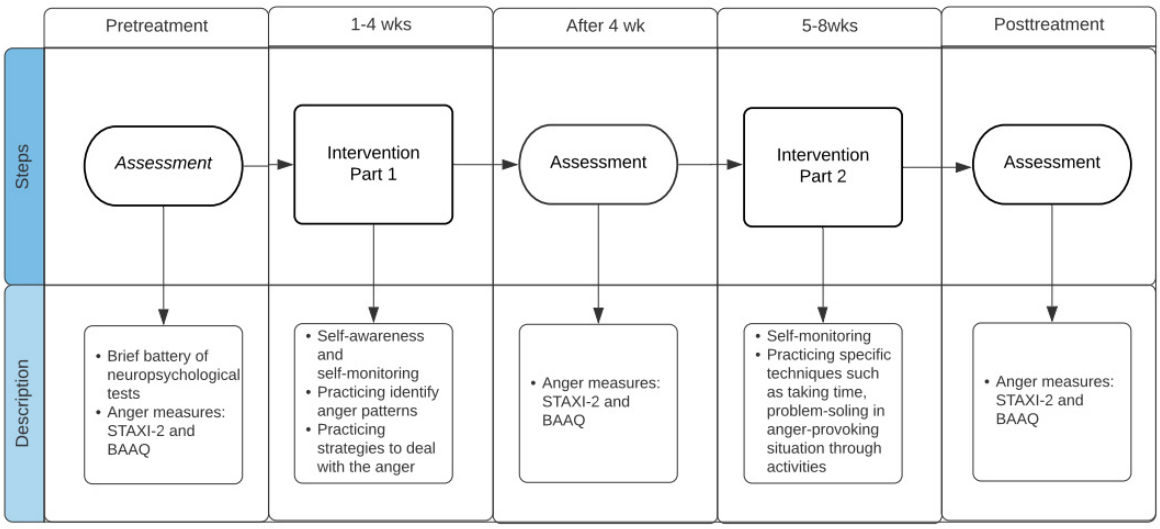

Figure 4 Steps of Assessment and Summary of Anger-Self-Management Program

Part 1 of the program emphasizes self-awareness and self-monitoring. The clinician utilizes supportive materials that allow the participant to identify what makes anger better and worse (e.g. Balance Sheet), anger patterns (e.g. Anger Logs), anger signs in their body, behavior, and thought, the other feelings related to anger episodes (e.g. Feeling Checklist) and strategies to deal with the anger (e.g. STOP-Return Technique, which consists of a 5-step method: read anger signals; decide to take time out; tell others involved that you are taking a time out; use the Time Out to calm down so you can think better and plan on how best to deal with the situation.; return to the person and the situation to deal with it). Part 2 is focused on practicing techniques such as taking time and problem-solving in an anger-provoking situation through activities. One activity example is Active Listening that allows the participant to understand what the other person is trying to say, encouraging positive communication. This technique is summarized in three main steps: (a) Listen attentively

without interrupting; (b) Restate as accurately as possible what the other person said; (c) Check to make sure you understood. Weekly assignments are scheduled for practice and incorporation of learned concepts (Hart et al., 2015).

All clients are encouraged to call a significant other (SO) to participate in the first, fourth, and eighth sessions and the assessment process. In addition, there is a brief assessment by telephone between sessions 6 and 7 about the SO's perspective on the person's participation in the program. (Hart et al., 2012, 2015).

The intervention is not based on “cognitive restructuring” techniques, but on “learning greater awareness and more precise discrimination of feelings as they occur, and on specific ways to increase the behavioral repertoire of constructive problem-solving approaches to anger provocation” (Hart et al., 2015, pp 187).

The instruments used to assess anger are the subscale Trait Anger and Anger Expression-out of STAXI-2 and BAAQ raw score. All participants are assessed in four different moments: Baseline (T1), after session 4 (T2), after session 8 (T3), and two months after T3 (T4). Both instruments are described in the next chapter.

Table 5 Treatment components of the ASMT treatment arms

Treatment component	ASMT
Core philosophy	Anger is a normal, adaptive emotion that becomes harder to manage after TBI. Self-management may be strengthened by learning strategies to bolster key executive functions: self-awareness and problem-solving. These skills help to recognize when anger is triggered, and to choose a reasoned response from an enhanced behavioral repertoire.
Session 1	Introduction to program content; education about anger (normalization); discussion of specifics of P’s anger responses; introduction of balance sheet, listing and existing calming strategies/supports in “reasons” for P’s anger in the (−) column throughout program, they are successively the (+) column (as techniques are learned added to the (+) column).
Session 2	Education about self-monitoring; reformulation of anger as a cue, not a solution; discussion of P’s characteristic anger cues in body/behavior; introduction of other feelings that accompany threats leading to anger, eg, shame, fear, and confusion.

Session 3	Practice in identifying other feelings as signals of anger and using them to communicate more effectively (vs communicating with anger).
Session 4	Training and practice in how to read anger signals as a cue to initiate the time out technique, a key problem-solving algorithm allowing P to "slow down the action" and formulate a reasoned response.
Session 5	Training and practice in using the mirror technique, a method of replacing negative with positive communication to defuse anger situations.
Session 6	Training and practice in active listening, a technique to enhance understanding of the viewpoints of others and to avoid nonconstructive argument.
Session 7	Self-assessment and consolidation of skills: P completes self-assessment of progress, evaluates own strengths and weaknesses related to program content, and reviews/practices techniques felt to be most in need of shoring up.
Session 8	Review and relapse prevention: final review of skills and concepts covered in program; discussion of likely future pitfalls and how they could be handled or circumvented; planning to use learned skills in various situations.
Weekly assignments	Completion of anger logs (introduced in session 1) to record key triggers, bodily/behavioral responses, other key data on incidents occurring between sessions; reviewed at start of sessions 2–7.
Involvement of SO, if any	SO participates in portions of sessions 1, 4, and 8, and provides brief telephone feedback privately to the T between sessions 6 and 7, to complete a brief progress assessment parallel to the P's self-assessment.
Proscribed elements	Topics or concerns not covered in treatment manual; T reminds P that program is focused on anger-related issues and encourages P to seek other help for different issues.

Abbreviations: ASMT, anger self-management training; P, participant; PRE, personal readjustment and education; SO, significant other; T, therapist; TBI, traumatic brain injury.
*Partially reprinted from Hart et al (2015).

Cultural Adaptation

Culture is the complex knowledge of a group that is passed down between generations (Barrera et al., 2013). Adaptations of cultural interventions in health care have been extensively studied and present a challenge to researchers and clinicians. Bernal et al. (2009) defined cultural adaptation as "the systematic modification of an evidence-based treatment (EBT) or intervention protocol to consider language, culture, and context in such a way that it is compatible with the client's cultural patterns, meanings, and values" (Bernal, Jimenez-Chafey, & Domenech Rodríguez, 2009, p. 362).

Although adaptations are effective clinical tools established for specific treatments and specific diseases (Bernal et al., 2009), precautions are essential in this process to maintain the benefits and efficiency of the treatment, such as regarding cognitive and linguistic peculiarities of that cultural subgroup in the intervention (Barrera et al., 2013). Therefore, when performing an intervention adaptation, it is important to understand the homogeneous and heterogeneous aspects between the original intervention group and the new group. Furthermore, the intervention construct must also be understood in its cultural expression (Barrera et al., 2013).

Barrera & Castro (2006) proposed four adaptation stages consisting of (a) information gathering, (b) preliminary adaptation design, (c) preliminary adaptation tests, and (d) adaptation refinement. The first step was focused on identifying which intervention elements need to be modified, regarding the similarities and differences of groups. The second step was based on developing a draft treatment adaptation. The third step, a pilot study was recommended to assess the initial cultural adaptation version. And finally, the necessary modifications identified were carried out. Based on these proposed adaptation stages, the present research describes each step in the cultural adaptation of the ASMT program.

Information gathering

In this first step, in addition to identifying homogeneous and heterogeneous aspects among the cultural groups, the search focused on identifying differences related to risk factors and outcomes. This allowed to understand if there were any differences between the groups regarding theoretical mechanisms that might interfere with the effectiveness of the intervention (Barrera et al., 2013).

A qualitative study by Simpson and coworkers (2000) with people with Italian, Lebanese, and Vietnamese cultural roots suggested that there was a universal experience of

physical, cognitive, and personality impairments about TBI independently of cultural particularities. However, a study by Prigatano and Leathem (1993) indicated that the way a person perceived their capabilities and limitations post-injury was influenced by culture. Therefore, in addition to the injury's direct impact on self-awareness, culture played a role in the interpretation of these post-injury changes, leading to an over or under-estimation of competencies. The cultural social stigma and shame also appeared to be linked to how patients and family members related with each other and with the community (Simpson et al., 2000), which could influence the rehabilitation process.

Culturally, family involvement in the care of a person post brain injury is higher in Latin American countries partially due to the lack of specialized services and support from the local health care system. However, despite this cultural difference, studies pointed out that the most important demand from family members was for professional information and support during the intervention (Kreutzer et al., 1994; Norup et al., 2015).

Thus, it is unquestionable that culture directly influences the disability adaptation process and treatment adherence after an acquired brain injury. However, Simpson et al. (2000) argued that there was a common ground of TBI sequelae that enabled a similar intervention approach with people of different cultural backgrounds. For example, deficits in problem-solving are common post-TBI and there are standardized steps that can be taught to help individuals overcome this difficulty in their daily lives. The culture could influence the nature of that person's problems and solutions as well as the personal and contextual aspects (Barrera et al., 2013); however, anyone, regardless of culture, could benefit from these techniques. The outcome of the problem-solution might differ, but the technique could be used by professionals in different countries and cultural contexts. The same seemed to be true for self-awareness. Standardized tools that enabled the further development of self-perception could be used regardless of culture — what changed would

be the individual's response to the technique. In order to do so, Simpson et al. (2000) pointed out that the most important point was to assess each person and family individually, without generalizing any assumptions. Thinking about Brazil, a continental-sized country, cultural differences exist within the national territory itself. Therefore, the professional should have the sensibility to individualize the approach according to the particularities and dynamics of that specific client and family. Techniques can help as a guide, but it is up to the specialized professional to adapt the approach and the language according to the characteristics of those individuals. When it comes to the persons with TBI, this is even more important because, besides cultural influences, pre-morbid characteristics, cognitive sequelae, and emotional aspects play an important role in the rehabilitation process.

Regarding the emotion of anger, some experiences are common across cultures, but the social validation of elements that cause anger may differ depending on the country's culture. Anger responses are highly culturally adapted despite having some commonalities, such as altered tone of voice, facial expressions, and verbal arguments (Alia-Klein et al., 2020).

Thus, according to the information gathered and despite the cultural differences between the United States and Brazil, the ASMT program focusing on anger management appeared to fit the needs and demands of Brazilians with TBI without major modifications to the core of the intervention. The steps for preliminary adaptation are described in the next topic.

Preliminary adaptation in the program design

First, we contacted the authors and owners of the original program to request authorization to adapt it to Brazilian reality. After authorization was granted and materials related to the intervention program were sent, the process of translation and cross-cultural

adaptation of the program began. Figure 5 contains a summary of the steps of the ASMT adaptation.

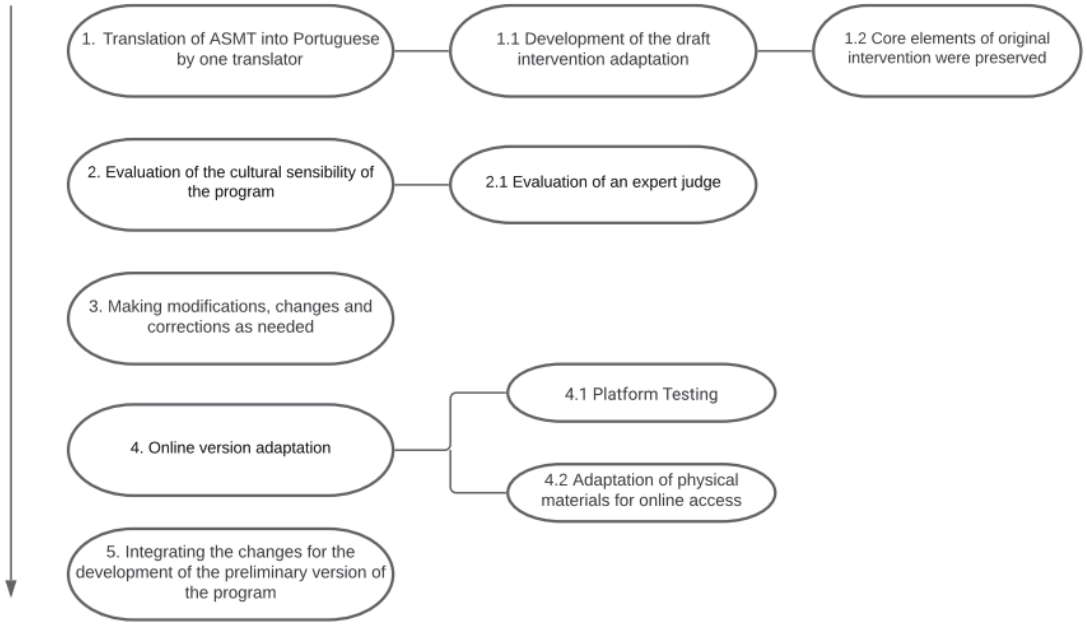

Figure 5 Program Adaptation Steps

According to the initial research on homogeneous and heterogeneous aspects between the cultural groups, the intervention materials were read and analyzed to identify the main points of adaptation. The core elements of the original intervention were preserved; major adaptations were in instructions that contained linguistic expressions that are not common in Brazil. The translation of the ASMT to the Portuguese language was performed by the leading researcher and resulted in a preliminary version of the program. One example of language expression that needed to be adapted was “knee-jerk reaction”, which has no translation in Portuguese, but can be easily understood if presented through a concrete description of the medical situation. Another example is the expression “tunnel vision”, which has been replaced by an expression with a similar meaning in Portuguese.

After the first translation, a researcher with expertise in neuropsychological rehabilitation of people with TBI was consulted to validate the cultural sensibility. After the professional's opinion, the main modifications included words that better expressed the

original content, especially in “The Feelings Checklist”, which contained a list of 62 feelings. The suggested changes have been integrated into the final version of the translated program.

Because of the COVID-19 pandemic, the ASMT program that was initially developed as a face-to-face intervention needed to be adapted for the online modality. The adaptation of the ASMT program was not planned before the pandemic, requiring a rapid development process. The adaptation followed the guidelines published by The Inter-Organizational Practice Committee (https://iopc.online/teleneuropsychology-guidelines).

The first step was to adapt the physical material of the ASMT program to an online version. In the original intervention, each participant had a folder to store the anger logs and extra documents. The solution found was to develop an online folder where the documents could be downloaded and accessed by both the participant and the researcher. The online tool used for this was Google Folder, because of its simple and easy design. In addition, this tool is widely used by students in Brazil, and as the target clinical group of the present research would be young people, it was assumed that the participants had already had previous contact with this tool. A Google Drive folder was created with the name of the potential participant and shared with him. In the first moment, there was a document with some recommendations for the intervention and the timetable of the program, and a Google Forms questionnaire. A video chat was scheduled to explain how the participant could interact with the materials. Some tests were carried out with the participant by filling out the form and writing in the documents. After this first test, the Google Folder tool was deemed suitable for the study.

All materials used in the intervention were transformed to have online access (see Annexes and Appendixes). The Home Independent Practices, such as an Anger Log that the participant should fill in having anger episodes, was adapted for a Google Form. The “Feelings Checklist” was also adapted to a Google Form. At times, when it was necessary to

show any material during the session, the researcher shared the computer screen. All materials used by the researcher were also added to the participant's folder.

At first, the platform chosen for the online meetings was Google Meet because it was widely used in Brazil, easily accessible, and has no session time limit. Ten minutes before the beginning of each session, the participant received the link to access the meeting. The participant was instructed by the researcher to be in a private environment, using headphones to maintain confidentiality. The participant was also asked to keep the camera on during the sessions for better contact between the parties.

The support materials were divided into different folders for each session. The folder was uploaded 5 minutes before the beginning of the session. Therefore, the participant had access to all of them at the end of the session. The sessions were recorded with the participant's consent by the *OBS Studio* program.

In this stage, usability tests were conducted in two sessions with a potential participant to determine how well participants can navigate equipment and procedures and identify training needs.

Preliminary adaptation study

A pilot study to investigate the preliminary version of the Brazilian and online adaptation of ASMT was executed using a single case design. Partial data from this study will be further presented in chapter 4. An important limitation of this pilot study was that the intervention had to be stopped after three sessions due to a cranial cap relocation surgery. This surgery was initially scheduled for after the end of the intervention, but was brought forward by the medical team. The services were only resumed at the beginning of the year 2021 due to a doctor's recommendation.

History

The participant (NS) was a 20-year-old single male who sustained a mild traumatic brain injury (GCS 13) at age 19 due to urban violence. He lived with his parents and his younger brother. He had finished secondary school and used to work as a telemarket consultant. Medical information indicated that he sustained a compound depressed fracture of the left occipitotemporal bone. He was in a coma for 15 days and, subsequently, exhibited poor memory and was aggressive and disruptive at home. From the time of his brain injury, he had a good physical recovery. He related no history of mental health or neurological difficulties before the TBI.

NS spontaneously described frequent irritability and difficulty in managing anger since his brain injury. He pointed out that he had frequent anger outbursts when he was upset. He expressed his anger by yelling loudly, especially at home during interactions with his family, when they did not let him do what he wanted or did not do what was planned. After the episodes, he tended to feel guilt and usually apologized to them. He reported symptoms of difficulty in solving mathematical problems, slow thinking, difficulty in remembering events, and being too dependent on others to remember commitments. He also reported feeling sad, anxious (e.g., he had difficulty sleeping because of worrying about the future), impulsive, and frustrated. He did not receive any neuropsychological or psychotherapy intervention until the date of the study and did not have a cognitive assessment at the time of the intervention.

The participant was referred by a psychologist who knew about the research. The first contact with the participant was made via WhatsApp to schedule a video call. Then a meeting was held with NS to explain the CEREI project and the ongoing study. NS showed interest in participating in the research. Thus, the other day we had a meeting with his mother to explain the research and the intervention program. Later, an online meeting was scheduled to present the sessions' calendar and the Google Drive folder to the participant.

Assessment

During the first appointment, a detailed interview was made with the participant, and in the following session, the STAXI-2 and BAAQ were administered. Both sessions were conducted via Google Meet. In the case of the instruments, the computer screen was shared with the image of the tests. The instructions and each item were read together with the participant. NS answered and the evaluator recorded the responses.

Table 6 Scores on STAXI-2 subscales

STAXI-2 Subscales	Percentile	Score T
Trait Anger (T-ang)	85	60
Anger Expression-Out (AX-O)	95	79
Anger Expression-In (AX-I)	90	61
Anger Control-Out (AC-O)	30	45
Anger Control-In (AC-I)	60	54

NS had high scores in the T-ang, AX-O and AX-I subscales. These results suggested that NS felt easily frustrated and treated unfairly by others. He expressed anger with aggressive behavior directed at other people or objects in the environment. In an interview with the participant and the SO, both reported that NS is verbally aggressive when he felt frustrated or threatened and had difficulty controlling or interrupting insults. The results of the STAXI-2 analysis also suggested that NS also repressed many of the feelings and had difficulty expressing them.

The BAAQ is more sensitive to extreme behavior responses of anger (Hart et al., 2015). The mean raw score in a normal population is about 4 (SD ±3) (Maiuro et al., 1987). The participant's BAAQ score was 6. This result indicated that NS did not show a tendency to extreme anger reactions.

Intervention

NS participated in the first three sessions of the ASMT. The first session aimed to introduce program content, to inform that anger is a normal emotion, and to talk about the perceptions of how NS experienced the anger (Hart et al., 2015). His mother also participated as the appointed significant other. The first part of the interview focused on a brief introduction about the impacts of brain injury on the control of moods, emotions, and impulses. After, we filled up the Balance Sheet about negative and positive things that make anger worse or better (Appendix A). The participant indicated that the autonomy, the changes in his relationship, and the financial situation collaborated to increase the feeling of anger. On the other hand, listening to music, eating, writing about how he felt, watching TV, going to church, and talking to his mother and friends reduced his anger and make him feel calmer. At the end of the session, a list of some other "Calming Strategies" (Annex 5) was discussed.

The second session focused on self-monitoring and reformulating the anger as a cue of how he is feeling. NS indicated the cues in his body, behavior, and thought when he was angry. After that, an introduction to "Other Feelings" (Annexes 4 and 6) that accompany threats leading to anger was presented to NS and discussed using situations that happened to the participant as examples (Hart et al., 2015). By analyzing the "Anger Logs" (Annex 1, 2, and 3; Appendix D), it was possible to notice along with NS a pattern in the two situations that left him irritated during the week. When things didn't happen as planned or as he expected, he got frustrated and irritated and started arguing with the people around him. Considering these situations the next step was to identify anger's clues on his body, behavior, and thought. To conclude the session, there was a "Feelings Checklist" to identify the different feelings he had in connection with the anger episode — before, during, or after. NS related that he felt insecure, vulnerable, confused, upset, frustrated, anxious, offended, among other feelings. It was introduced the concepts of "Small a" (lower levels of anger) and "Large A" (high levels of anger or rage).

In the third session, a practice in identifying “Other Feelings” as signals of anger and using them to communicate more effectively (Hart et al., 2015) was implemented. For this, a video clip was used as an example of communication with anger. NS was stimulated to identify other feelings in the movie character besides anger and how he could have communicated/behaved more effectively by giving voice to other feelings, such as sadness and fear. After that, a role-play with a situation of the “Anger Log” was performed and the researcher motivated the participant to talk about how he felt.

The intervention was not finished as scheduled; however, the participant was very motivated to participate in the study and reported that the content of each session had contributed to his daily life. NS reported that he gained some insight into what to do to control his anger reactions and aggressive behaviors. For example, he reported using the strategy of taking a cold shower or throwing water on his face. This helps him to have more time to think and plan how he would respond to stressful situations. He also described that the role-play in session three and the anger logs helped him to realize how his reactions were exaggerated in some situations and how other people could feel.

About the online tools used, NS did not report any difficulties. He said that he read the session material frequently and also read the anger logs that he wrote. According to him, the materials encourage him to try new strategies and to think about his behaviors. However, NS reported that he would like to have written the content of the sessions in a notebook. The participant reported that the 90-minute session time was feasible and did not make him feel tired.

Adaptation refinement

According to partial data collected, the remote method seemed to have been beneficial to the participant even with fewer sessions. There were no major technological barriers to the progress of the sessions. After analyzing the participant's feedback, two changes were made

in the program: a) The participant would receive a structured guideline and a video tutorial about the intervention platform both on his cellphone and on his computer, b) after every session, a summary of the main points of the session would be added to the Google Drive folder.

The advantage of the online format was that the participant had no chance of "leaving the folder at home", and the clinician could follow the changes the person had made to the materials and the completion of home activities. The platform chosen for the intervention at the first moment was Google Meet, but the participant reported that he could not hear well when the screen was shared. We tested the Skype platform which was chosen for its accessibility. The perception of the participant was essential in the evaluation and development of the methodology of the program used in the multiple case study.

Discussion

The number of people affected by brain injuries is high, which is considered an economic and social problem. Cross-cultural adaptations of interventions present an alternative to deliver standardized and effective care to the population across the world, especially for countries without access to research and financial investments. Despite the importance of this method, the adaptation must be sensitive to important elements of specific cultural references of psychopathology (Hall et al., 2016), understanding the social impacts and stigma of this condition.

Understanding the culture is essential to provide a safe space where the clients feel understood based on their values, customs, and traditions. These aspects are the foundation for comprehending the client's needs, strengths, limitations, and coping strategies (Pereira et al., 2017). Even in a focused intervention, such as anger management programs, cultural sensibility is important to the engagement of the treatment. Especially because aggressive behavior and anger outbursts can be a sign of the difficulty to integrate and accept the

changes and life differences after a brain injury. The culture is vital in the process of building a new sense of identity (Pereira et al., 2017).

Therefore, the importance of the role of culture in neuropsychological intervention programs is undeniable. A meta-analysis showed that culturally adapted interventions had a better response in psychopathology than other interventions or no intervention (Hall et al., 2016). This study suggested that culturally adapted programs proved to be a good option as an intervention tool for clinicians.

People with TBI appear to have a common experience based on the frequently observed sequelae (Simpson et al., 2000). It can also be hypothesized similar characteristics of the premorbid personality, such as impulsiveness. Although the expression and the triggers of anger may differ across cultures, standardized techniques in problem-solving and self-awareness may be universally beneficial. An example of this hypothesis is the "STOP-Return" technique of the program adapted in this current research. The step-by-step of the intervention could be the same. However, the problems and solutions that the participants would decide on are individualized and are influenced by cultural and personal factors. Therefore, the ASMT program was considered adaptable to the Brazilian culture without modification in its core elements of the intervention.

In addition, teleneuropsychology had been gaining prominence in clinical practice. Research evaluating the effectiveness and comparing the results of face-to-face and online interventions is increasingly urgent. The reported pilot study provided the foundation to the next multiple cases study that intended to investigate not only the cultural adaptation of the ASMT program but also the usability of the program in its online version. Considering that the pandemic increased social interaction among family members and limited participation in rehabilitation centers as well as in leisure environments, the author believed that the anger

management intervention had an essential impact on the interaction of families with people with TBI in this atypical period.

The pilot study, despite having covered only the first three sessions, showed that online tools and the language of the intervention were adequate for the Brazilian culture. Based on this result, the program was considered appropriate for the next step of the dissertation study: multiple case studies to determine if the proposed program adaptation would be perceived by clients and their families as facilitating participants' engagement and positive outcomes.

Chapter 4 – Exploring Participant's Perception of the ASMT

Aggressive action is closely intertwined with the feeling of frustration. As human beings have both physiological and psychological needs to be satisfied and when there is an interruption or a blockage of this satisfaction, the aggressive reaction appears as a strong response to uncomfortable events (McNeil, 1959).

Frustration can be related to the discrepancy between an individual's desire to solve a problem and his ability to do so (McNeil, 1959). Thus, people with TBI have to deal with the sense of frustration at not being able to accomplish the same things in the same way. This simple fact would be enough to increase aggressive episodes, however, there are organic and chemical brain changes that can also negatively influence frustration tolerance. As early as 1994, Miller related post-TBI aggression to temporal and frontal damage. With technological advances, research has demonstrated the participation of a complex neural network in aggressive behavior (Alia-Klein et al., 2020; Bartholow, 2018; Puiu et al., 2020). In general, executive dysfunction caused by brain injury leads to a decrease in frustration tolerance and an overreaction to daily situations, increasing the chance of violent and aggressive responses (Miller, 1994). Therefore, the experience of frustration and anger reaction is related to multiple sources.

Furthermore, aggressive reactions can also be motivated by the need to resolve anxiety-filled situations. Aggressive action, in this instance, relieves anxiety by making the person feel like an active participant in his or her destiny (McNeil, 1959). Likewise, aggressive outbursts, according to the *Diagnostic and Statistical Manual of Mental Disorder* V (DSM-V), can also express depressive symptoms. Therefore, when referring to emotional reactions after acquired brain injury, especially aggressive reactions, it is necessary to be careful in identifying the possible sources and dynamics of this behavior. A study by Johansson and colleagues (2008), which focused on a biopsychosocial model of post-morbid

aggression with TBIs, showed anger is not an isolated phenomenon and is more probable to occur when physical and emotional comorbidity are elevated. Sensory disturbances may also play a role in post-injury irritability. This research pointed out the urgency of a multidimensional perspective in anger intervention, as aggressiveness is not a one-dimensional concept.

According to the American Psychological Association, when anger management is out of control, the person may feel like they are at the "mercy of unpredictable and powerful emotion". In order to empower patients to feel more in charge and to improve the quality of relationships, anger management programs should be developed and delivered to clinicians for greater mastery of effective techniques.

Initially, the present study proposed a group intervention for anger management with a quasi-experimental design, including the analysis of quantitative and qualitative data to create and verify the impact of an anger group intervention program with people following TBI. The quasi-experimental study method, according to Gil (2008), is characterized by its methodological rigor and is different from experimental studies for it does not present the random distribution of participants.

Participants would be divided for convenience into two groups of 10 individuals each. Both groups would be assessed by a neuropsychological battery of questions in order to characterize the cognitive profile (memory, attention, inhibitory control, cognitive rigidity, verbal fluency) of participants and the emotional aspect of anger (expression of anger). The first group would participate in intervention sessions on anger management and the second group would participate in a psychoeducation meeting on emotional factors after an ABI. After the group intervention and six months after the control group psychoeducation meeting, an interview would be conducted with all participants to

investigate each participant's perception of the impact of the intervention on anger management. The same interview would be conducted with a family member or SO.

Because of the impossibility of this research design due to the COVID-19 pandemic, the researchers in this study chose to adapt an existing anger management program to the Brazilian context and to an online modality. The methodology was suitable for the Multiple Case Study, in which a literal and theoretical replication strategy is possible (Yin, 2015). The methodological changes were approved by the ethical committee.

This study aimed to investigate the perceived effectiveness of the *Anger Self-Management Training (ASMT)* by participants and their significant others in the Brazilian population and the online modality, using mixed methods. Quantitative and qualitative data were collected from questionnaires and interviews with participants and significant others and from videos of the sessions.

Method

Study Design

This research was an exploratory multiple case study evaluating the clients' perceptions of the effectiveness of the adapted version of the ASMT program for the Brazilian population as well as the online methodology. The ASMT program consists of 8 individual psychoeducational sessions for people with traumatic brain injury, with the main focus on improving self-monitoring and self-awareness of anger. Each session, lasting 60 to 90 minutes, includes presentation and training of techniques and strategies (Table 7) that aim to increase the participant's repertoire to deal with conflict and frustrating situations (Hart et al., 2012, 2017). (For more details about the program adaptation, see chapter 3.)

Table 7 Description of strategies taught during the ASMT program

Strategies	Description
Self-monitoring	Identifying anger cues in body, behavior, and thinking. This strategy aims for the participant to become more aware of his/her anger.
Other Feelings	Identifying other emotions that occur along with anger. The goal is to help the participant recognize the feelings that accompany anger for communicating more effectively.
Calming Strategy	Listing strategies that calm the person down and how to use them at the first signs of anger.
Time Out Technique	Five steps (STOP-Return) that help improve planning and problem-solving. The participant is taught how to read anger signals to take the time out of the situation and elaborate a response.
The Mirror Technique	Learning ways to talk or think in a positive way instead of a negative way.
Active Listening	Listening attentively without interrupting, restate as accurately as possible what the other person has said, and check to make sure it is understood.

The case study consists of the in-depth study of a few objects, in a way that allows detailed knowledge about what is being studied (Gil, 2008). In a Multiple Case Study, a literal and theoretical replication strategy is possible (Yin, 2015). That is, each case is selected to predict similar results or contrasted results because of specific known reasons. In this study, two adults with TBI were assessed on measures of anger at three-time points: pre-intervention, middle-intervention, and post-intervention. Qualitative data were collected from interviews with the participant and Significant Others (SO) and videos of the sessions. The study was approved by the Ethical Committee of the Federal University of Parana (CAAE: 20174219.2.0000.0102) and written consent was obtained from all participants. A mixed methodology was utilized to enable the researchers to obtain multiple perspectives of the participant and the SOs. Analyzed data from the different sources of information in the study were triangulated to confirm the findings.

Setting

The study was part of *Projeto CEREI* (*Centro de Estudos em Reabilitação e Interdisciplinaridade* — Center of Studies in Rehabilitation and Interdeisciplinarity). CEREI, created in 2007, is a free community rehabilitation program for adults with brain injuries offered by a public university (Federal University of Paraná) in southern Brazil. In addition to serving the community, it provides student training and allows academic researches on the rehabilitation process of adults with disabilities due to brain injury. Because of the circumstance of social isolation, CEREI's services, including the ASMT program, have been adapted to an online version respecting the norms of the World Health Organization (WHO) and the Federal University of Paraná (UFPR).

Participant recruitment

Participants were recruited from the waiting list for the CEREI Project and regional hospitals by asking clinicians for referrals. Potential participants were approached by the principal researcher who explained the details of the research. It was highlighted that participation was voluntary and would not impact their current or future performance in the CEREI Project.

The inclusion criteria stipulated were:

a) Age ≥16 at the time of injury (to minimize variability due to the impact of TBI on the developing brain);
b) TBI occurring a minimum of 6 months before enrollment (to minimize the effects of spontaneous recovery on the outcome measures);
c) Indication from self- or proxy report that participant has problematic anger/irritability that is new since the injury or worse than before the injury;
d) Initial Glasgow Coma Scale score less than 13;
e) Aged 18-36 years;

f) Adequate cognitive and communication ability to provide informed consent and participate in the intervention, such as preserved reading and writing skills;
g) Medication stabilized;
h) With at least 4 years of formal schooling;
i) Access to a computer with internet in a reserved place;
j) Computer familiarity.

The exclusions criteria were:

a) Psychiatric condition or substance abuse that could interfere with treatment effects;
b) Aphasia;
c) Current involvement in psychotherapy; and
d) Previously severe disruptive behavior.

Significant others

The participants were encouraged to invite one person to participate in the program along with them. The SO attended 3 of the 8 sessions (the 1st, 4th, and 8th). After the participant had completed the program, a semi-structured interview was conducted with the SO. The interviews consisted of the following questions: How do you think he/she is dealing with anger in general? Do you think the way he/she is handling their anger has changed since the program started? What strategies do you see he/she use? Have you noticed changes in the relationship with him/her? What did you think of your participation in three sessions of the program? How do you evaluate the experience of the intervention in the online methodology? Is there anything else you'd like to add?

Measures

All participants were assessed using the following neuropsychological instruments:

Table 8 Neuropsychological Assessment Instruments

Instruments	Cognitive function	Measure
Wechsler Adult Intelligence Scale (WAIS-III)	Intelligence and global cognitive ability	Point scoring system
Phonemic and Semantic Verbal Fluency	Phonemic and Semantic Verbal Fluency Language Executive Functions	Point scoring system
Rey Auditory Verbal Learning Test (RAVLT)	Verbal learning Auditive episodic memory Retroactive inhibition	Time and Point scoring system
Five Digit Test (FDT)	Flexibility cognition Inhibition	Time and Point scoring system
Trail Making Test A and B	Visual attention Task switching Psychomotor speed	Time
Hospital Anxiety and Depression Scale (HADS)	Symptoms of anxiety and depression	Point scoring system
Brief Anger-Aggression Questionnaire (BAAQ)	Manifestations of anger	Point scoring system
State-Trait Anger Expression Inventory-2 (STAXI-2)	Expression of anger as a state and trace	Point scoring system

Wechsler Adult Intelligence Scale (WAIS-III)

WAIS-III aims to evaluate the intellectual capacity and overall cognitive functioning of the individual. It retains the 14 traditional subtests and yields Verbal, Performance, and Full-Scale IQs along with four secondary indices: Verbal Comprehension, Working Memory, Perceptual Organization, and Processing Speed (Wechsler, 2001).

Phonemic and Semantic Verbal Fluency

It evaluates the executive functions, semantic memory, and language. The first part of phonemic verbal fluency of the test evaluates the spontaneous evocation of words that start with a specific letter (in the case of this research, F, A, and S). Semantic verbal fluency is evaluated by the production of words within two categories (animals and clothing). In both parts, the production time is limited to one minute for each item, except the clothing category which is available for two minutes. The scores are measured in phonemic verbal fluency by the sum of correct words starting with the three letters, and in semantic verbal fluency, by the sum of correctly reported words for each category. Proper nouns, wrong words, variations, and repetitions are not considered correct (Mitrushina et al., 2005).

Rey Auditory Verbal Learning Test (RAVLT)

The RAVLT is widely used to evaluate verbal learning and memory, including proactive inhibition, retroactive inhibition, retention, encoding versus retrieval, and subjective organization. The test consists of a list of 15 high-frequency words in Brazilian Portuguese (list A), which are read by the applicator aloud to evaluate them. The same sequence is read 5 times. After the fifth attempt (A5), an interference list, also composed of 15 nouns (list B), is read to the participant and the same orientation is made (attempt B). After attempt B1, the participant is asked to remember the words from list A, without it being resubmitted at that time (attempt A6). After a break, the participant is asked to recall all retention of information, and recognize 15 words from list A in the middle of 35 distractors (Paula & Malloy-Diniz, 2018).

Five Digit Test (FDT)

It assesses cognitive processing speed, the ability to focus and refocus attention, and the ability to cope with interference. It is composed of four parts — two of them related to

automatic processes and the other two related to controlled processes. The first component (reading) demands subjects to name numbers from 1 to 5 as fast as they can. On the second component (counting), they need to describe quantities from 1 to 5. The third component (choosing) involves a selective attention trial, where the subjects cannot read the numbers, but rather tell how many numbers are present in each stimulus, in an incongruent condition. The last component (shifting) is similar to the choosing trial, but before each of the five stimuli, there is one in which the subject has to read the stimulus numbers (Sedó, 2015).

Trail Making Test A and B (TMT A-B)

TMT is used to evaluate visual search, attention, mental flexibility, motor function, and executive function. Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1-25, and the patient has to draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1-3) and letters (A-L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.) (Mitrushina et al., 2005).

Hospital Anxiety and Depression Scale (HADS)

HADS is a self-assessment scale of 14 items on a 4-point Likert scale (range 0-3). The scale aims to measure symptoms of anxiety and depression (7 items for each subscale). The total score is the sum of the 14 items, and for each subscale, the score is the sum of the respective seven items (ranging from 0-21) (Silva et al., 2006).

Brief Anger-Aggression Questionnaire (BAAQ)

BAAQ is a 6-item questionnaire that assesses extreme behavioral manifestations of anger, including passive-aggression (Maiuro et al., 1987).

State-Trait Anger Expression Inventory-2 (STAXI-2)

STAXI-2 is a self-reported scale that assesses objectively the experience, expression, and control of anger for adults and adolescents, aged 16 years and older. The STAXI-2 measures how often angry feelings are experienced over time. The test is composed of 57 items, which are grouped in scales and sub-scales. The Trait Anger scale measures how often angry feelings are experienced over time. The Anger Expression and Anger Control scales assess four relatively independent anger-related traits: a) expression of anger toward other persons or objects in the environment (Anger Expression-Out); b) holding in or suppressing angry feelings (Anger Expression-In); c) controlling angry feelings by preventing the expression of anger toward other persons or objects in the environment (Anger Control-Out); and d) controlling suppressed angry feelings by calming down or cooling off (Anger Control-In) (Spielberg, 2010).

Procedures

All participants and SOs provided informed consent. After consent and T1 assessment, the participants received training on the use of Google Drive and the tools that would be used during the program, such as Google Forms. At the end of this training, the participants received a step-by-step video guide on how to use Google Drive. Both participants had prior knowledge of how to use Skype.

The individual intervention was conducted by one main researcher (Clinical Psychologists with experience as brain injury case managers). The day and time of the appointment were agreed upon between the participant and the clinician, and at the scheduled time the clinician called the participant via Skype. All sessions held were recorded, with the consent of the participants, using the *OBS Studio* program. The interviews with participants at the end of the program were conducted by Skype, while the SO preferred to be interviewed by phone.

At the baseline, the full battery of neuropsychological tests was administered. The T2 (interim) and T3 (posttreatment) assessments included the two anger measures administered to participants.

Data analysis

The documentation of participants is analyzed according to the Method Triangulation, proposed by Minayo, Assis e Souza (2005), which is characterized as a quantitative and qualitative approach, based on the theorization of the context and content of the program to be evaluated, the observation and analysis of the visible and underlying dynamics of the individuals involved in the process. The evaluation of social programs, according to the authors, consists of a set of scientific-technical activities that seek to attribute value of efficiency, effectiveness to the processes of intervention. It seeks to integrate the analysis of structures, processes, and results to understand the relationships involved in the implementation of actions and the perspective of different actors on the project.

This method proposes a dialectical posture that seeks to understand beyond objective data (indicators, frequency distribution, and others are inseparable and interdependent), and subjective data (meanings, intentionality, interaction, participation). One of the principles of this method is complex causality, which overcomes the linearity between cause and effect, considering the dynamism of reality.

The authors suggest some steps of method triangulation evaluation: (1) Creation of indicators, that is, linking a theoretical concept with practical reality. They should be contextual and relational (2) Definition of information sources — each selected indicator should be known theoretically and in its concrete expression. (3) Development of research tools. The qualitative approach is appropriate to deepen the history; capture the relational dynamics; understand the representations and symbols, and also give attention to evasive signals that cannot be understood by formal means. The instruments should cover the analysis

of the program, which refers to the target group reached, the implementation of the planned actions, the organizational environment, and the involvement of the actors. (4) Information analysis, based on data ordering, classification, and analysis itself. This method allows to confront the general and specific objectives and results, verify the goals of each stage of the process, the effects, and the quantitative and qualitative impacts of the intervention.

The choice of this method is justified by the possibility of including and analyzing different sources of information considered important for the objective of the research. We analyze these sources of information: quantitative data (STAXI-2 and BAAQ), interviews with the participant and SO, evolution of change from a technique presented in the program.

Results

The participants were two men with a history of traumatic brain injury, both reported worsening aggressive reactions after the brain injury. Neither participant received any therapeutic input related to anger management training before the ASMT group. In this session, the results are presented for each case.

Case one

Background and clinical history

IL is a 30-year-old left-handed male who sustained a severe TBI (Glasglow 3) after a car accident in 2016. Magnetic resonance imaging revealed lesion foci affecting cortex and white matter in the frontal and temporal lobes, more extensively in the right lobe. IL was hospitalized in the intensive care unit in a public hospital in the city for 10 days and, after 3 days in the room, still unconscious, he was discharged. According to his sister, his main caregiver, he was comatose and unresponsive for one year. In 2019 he was referred to the CEREI program where his first neuropsychological assessment was performed after the accident. IL presented impulsive and inappropriate behavior, such as trying to hug professionals and asking questions about their intimate lives. Even after being corrected, he

remained with the same behaviors. He attended 3 sessions of the cognitive rehabilitation group but dropped out with the justification that he did not like to have contact with people with difficulties like his.

The patient was undergraduated in mechanical engineering and had a dynamic social life, despite having a small group of friends. IL lives with his parents and an older sister. He used to work in a mechanic's shop, but after the injury, he was retired on disability and receives financial aid from the government. According to a family member, IL had agitated and restless behavior during childhood and had difficulty standing still. The participant, according to his family, had an agitated personality and impatient profile before the brain injury, but rarely had angry outbursts. IL had no history of head trauma, neurologic deficit, psychiatric illness, or alcohol or substance abuse.

IL spontaneously described frequent irritability and difficulty in managing anger since his brain injury. According to family and IL reports, the angry outbursts occurred without warning and were usually directed at the sister who lives with him. During these outbursts, the patient would sometimes yell, or even be physically aggressive. IL explained that, before the accident, he drove off when he felt irritated with a family member. Now, since he cannot drive, when he feels irritated, he tries to go to his room before he has aggressive reactions. When asked what causes such anger outbursts, he answered that he feels angry that his sister is responsible for managing the money he receives from government assistance. He also reports that he gets irritated by loud noises and conversations.

The sister reports that before the injury they were very close and there were no fights or arguments between them. She said that the fights started when he began to regain consciousness and realized that she was the one who was responsible for his money. Since IL has lost the movement of his dominant hand, his sister is also legally responsible for his signature. According to her, he currently has angry outbursts daily.

Behavior during intervention

IL proved interested and collaborative with the intervention. Since IL did not have a computer, his older sister, who did not live with him, brought her laptop on the days of the sessions. At first, IL had some difficulty accessing the Skype platform, and the researcher's support was necessary until he adapted to his sister's computer. After a period of adaptation, IL had no problems accessing the sessions at the scheduled time.

Frequently IL requested the researcher to repeat the explanations. Because of the identification of this difficulty, the researcher interrupted the session more regularly to ensure that IL was following the content of the session. Some adaptations were made to ensure the participant's better understanding, such as speaking more slowly and using short sentences.

In the opening minutes of every session, the Anger Logs were reviewed in order to identify patterns of the feeling and expression of anger. IL had great difficulty remembering the details of the situations that anticipated his angry outbursts and had non-specific accounts of the situations. In some sessions, as a strategy for identifying anger patterns, the researcher invited the SO to help IL remember the conflict situation. This memory difficulty impacted IL's ability to gain insight into her aggressive reactions.

IL did not show any aggressive reactions, displays of anger, or discomfort during the sessions. On the contrary, he was calm, even when we went over the angry outbursts. Therefore, no anger management intervention was needed at the time of the sessions.

Neuropsychological assessment

IL presents average general cognition and occasional difficulties in mnemonic functions, especially in the verbal modality and executive functions, such as difficulty with organization, planning, and cognitive flexibility. However, he presents attentional, perceptual, linguistic, and working memory processes and inhibitory control within the average range.

Table 9 Neuropsychological assessment conducted with IL.

Domain	Test	Raw score	Z Score and comments
Verbal learning	RAVLT	9	-1,89
Semantic verbal fluency	Verbal Fluency	11	-2,02
Phonemic verbal fluency	Verbal Fluency	12	-2,92
Abstract thinking skill	Similarities	NA	NA
Recognition memory	RAVLT	9	-3,91
Long term memory	RAVLT	4	-3,43
Inhibition	FDT	3	1,42
Flexibility cognition	FDT Trial B	36 NA	-1,12 NA
Working memory	Digit Span Forward Digit Span Backward Arithmetic Letter-Number Sequencing	8 7 14 9	Normal Normal Normal Normal
Visual-motor skills	Block Design Trial A	33 NA	Normal NA
Perceptual organization skills	Matrix Reasoning	17	Normal
Symptoms of Anxiety	HADS	7	Improbable
Symptoms of Depression	HADS	3	Improbable

Note: FDT = Five Digit Test; HADS = Hospital Anxiety and Depression Scale; RAVLT = Rey Auditory Verbal Learning Test.

STAXI-2 and BAAQ

Table 10 shows the results on the STAXI-2 subscales of IL at three-time points: pre, mid, and post-intervention. Scores equal to or above 65 indicate that anger management can interfere with a person's optimal functioning.

The analysis of the quantitative data shows that IL showed a decrease in his anger temperament (T-Ang/T). This subscale measures impulsivity and lack of anger control. The improved score indicates that IL exhibits a lower anger temperament, indicating greater tolerance to provocation. The improvement in Anger Control-Out (AC-O) and Anger Control-In (AC-I) items corroborate this result indicating that IL spends less amount of energy controlling anger expression and less energy to calm down. So, although he continues to experience anger in a similar frequency to the beginning of the intervention (T-Ang), he needs less energy to calm down and control aggressive reactions. However, the feelings of anger appear to be more intense than at the beginning of the intervention (AX Index).

In contrast, the increase in scores on Trait Anger/Angry Reaction (T-Ang/R), Anger Expression-Out (AX-O), and Anger Expression-In (AX-I) indicate that IL is more sensitive to criticism and negative evaluation, increasing considerably the expression of his anger with aggressive behaviors directed at other people or objects in the environment. In addition, IL also appears to repress intense angry feelings more often.

The BAAQ is more sensitive to extreme behavior responses of anger (Hart et al., 2015). The raw score mean in a normal population is about 4 (SD ±3) (Maiuro et al., 1987). The participant's BAAQ score was 11 at the pre-intervention and 13 post-intervention. This result indicates the tendency of IL to extreme anger reactions continues after he participates in the program.

Table 10 IL's anger scores at three testing points.

	Score T		
	Pretreatment	Middletreatment	Posttreament
T-Ang	70	66	70
T-Ang/T	70	67	60
T-Ang/R	65	61	76
AX-O	48	67	70
AX-I	65	80	78
AC-O	41	39	36
AC-I	48	42	40
AX Index	62	74	76
BAAQ	11	7	13

Note: AC-I = Anger Control-In; AC-O = Anger Control-Out; AX-I = Anger Expression-In; AX-O = Anger Expression-Out; AX Index = Anger Expression Index; BAAQ = Brief Anger-Aggression Questionnaire; T-Ang= Trait Anger; T-Ang/T = Trait Anger/Angry Temperament; T-Ang/R = Trait Anger/Angry Reaction.

Qualitative results

Interview with the participant

The interview was conducted by the main researcher three weeks after the last intervention session. IL reported that, after his participation in the program, the way he dealt with his anger had improved: "Today I still have some arguments with my sister. But I manage not to curse or hit her. I just talk about what makes me angry". He reports that he uses self-monitoring very often: "I can see the signs appearing. I didn't know how to do that before. And it has helped me a lot because when I breathe, I get out of the place a little bit".

IL explains that the STOP-Retorne strategy has helped him with his sister, especially when he could not understand what she was saying: "When I cannot understand what she is saying, I use STOP. I don't warn her that I'm going out, but she knows. Then I can come back and talk". One of IL's complaints was that he couldn't understand his sister when she talked about managing his money. He said that being alone, drinking water, and watching funny videos on Youtube help him calm down and then get back to the situation.

IL also shares that he had been trying to express himself more positively, especially when other people make complaints. About the active listening technique, he said he had been able to listen more to the other person without interrupting. He said that these techniques he learned have helped him to control his anger.

About the online methodology of the intervention, he said he felt no difference in bonding and learning the techniques: "It didn't hurt at all, I didn't have any difficulty about it". He said that he found Google Drive easy to use and that he was able to download the materials and sometimes reread the documents. In the end, IL stated: "I would like sessions to be presential, so I could meet you in person". IL and I met in person a few times in 2019 during his participation in the CEREI project when I performed his neuropsychological evaluation. During that time, IL displayed some inappropriate behaviors, such as attempting physical contact at the end of sessions. This behavior remained until the end of the evaluation, even though I explained that it was not appropriate.

Interview with SO

The interview was also conducted three weeks after the end of the intervention. IL's mother, who participated in the sessions, reported that he no longer had angry outbursts: "I can see that he is struggling, he does not have angry outbursts or leaves the environment abruptly and aggressively. He is doing much better".

When asked if she could state that IL was talking about his feelings more openly, she said that IL had always been an introverted person and never liked to talk about his life: "Even before the accident, there was no point in asking him anything, because he wouldn't answer".

But although he doesn't talk about his feelings, she noted that he is talking more positively about what irritates him: "He is much better now, he just says 'mind the noise' and

doesn't say anything else. He does not overreact as he used to do before". The SO also said that she used the STOP sign only once (the sign was agreed upon in session to alert IL that he was getting angry and that it would be better to have a time out of the situation to calm down). After this episode the SO reported that she no longer uses the STOP sign, as she did not feel the need.

IL's mother also said that she noticed him making an effort to actively listen to what people said: "I notice that he tries to understand before he responds. And if he does respond, it's not in an aggressive way like it was before". She also added that he was trying to report in his own words what other people said and this has facilitated communication between the family and him.

About her participation in the 3 sessions, she said: "I enjoyed participating. I feel it has helped. It's hard for us to understand what happened. Before, nobody had ever explained why he had those aggressive reactions. The sessions helped me understand and deal with it as well. It helped me understand him better. And I need to understand him to be more patient".

Finally, about the online modality of the intervention, she said she found it positive, especially at this time when he could not leave home.

Case two

Background and clinical history

RB is a 24-year-old right-handed male who sustained a severe TBI (Glasglow 3) after being run over on his way back from university in July 2019. Magnetic resonance imaging performed in 2021 revealed areas of lesions in temporobasal regions and multiple small foci of old hemorrhagic contusions in frontal regions in greater numbers in the right cerebral hemisphere. RB was hospitalized in the intensive care unit in a public hospital in the city for 10 days, and after that, he spent 3 months in a hospital room.

The patient was in the second year of the Computer Systems course and had a dynamic social life, with a large group of friends. RB continued to work at the same company where he worked before his injury. He is a support analyst, and his main role is to provide after-sales services. RB's family member reported that he had always been quiet and liked to stay in his room playing games or watching TV when he was home. Before the injury, he had a busy routine with studies and work, so they did not share many moments at home. There was no evidence of anger dyscontrol problems before the injury and he had no previous history of head trauma, neurologic deficit, psychiatric illness, or alcohol or substance abuse.

RB lives with his parents, and since the brain injury, the patient had significant anger outbursts that included verbal aggression and threats towards his parents. RB reported noticing that he became more easily irritated, and was unable to change the focus of his thoughts. RB reported that he used to lose his patience when someone doubted his potential and/or thought he was incapable. In situations where people try to help him too much, he said he felt irritated and easily had angry outbursts. He expresses his anger by cursing the person, but he was not physically aggressive. One strategy he used to calm himself down is to listen to music because it helped him think about different things and forget what made him angry at the first moment.

The main person to whom the patient had aggressive reactions was his father. RB reported that the simple fact of his father looking at him made him angry because he felt that he was judging him, and also that his father was always willing to help him. After the brain injury, RB lost the movement of his right hand and his father became responsible for signing documents in his place. RB and his father's previous relationship had been conflicted, mainly because of different religious views. But before the injury, the aggressive reactions did not exist — RB used to isolate himself in his room and avoid long conversations with his father.

Behavior during intervention

RB showed interest in the intervention from the first contact. As he worked using the computer daily, he had no difficulty accessing the Skype platform and Google Drive. RB was always present at the scheduled session time and completed the Anger Logs weekly. However, the place where the computer was installed in his house was an open room, with no door, which made him uncomfortable to share some feelings about his father out loud. At these times, RB spontaneously typed what he wanted to say into the Skype chat or whispered in a very low voice.

Since the room was open, there were few moments when RB's father walked in. At these times RB was visibly irritated. When this occurred, I used to point out the physical reactions that indicated he was starting to get angry. At that point, I would direct him to some strategy to calm himself down, such as drinking water. During the sessions, we worked out ways to avoid parents interrupting him at important moments. We talked about him leaving an object that signaled that he was busy, and ways that he could respond when he was interrupted by someone.

In general, RB followed the content of the sessions well and had several insights like, "How come I never thought of that before?". In his communication, RB used to swear a lot as a way to express himself. In addition, since the first meeting, RB had frequent laughing fits, and it was necessary to pause the session for him to recover and focus again on what was being said. The SO related that these laughing fits became frequent after the brain injury.

Neuropsychological assessment

RB's neuropsychological assessment reveals average general intelligence, but with significant difficulty in the verbal area. In addition, RB has an executive deficit, with poor inhibitory control skills and cognitive flexibility. In contrast, RB benefits from cues to retrieve verbal information and presents perception and visual-motor skills preserved.

Table 11 Neuropsychological assessment conducted with RB.

Domain	Test	Raw score	Z Score and comments
Verbal learning	RAVLT	15	-0,29
Semantic verbal fluency	Verbal Fluency	13	-1,65
Phonemic verbal fluency	Verbal Fluency	11	-3,01
Abstract thinking skill	Similarities	29	Normal
Recognition memory	RAVLT	12	-0,55
Long term memory	RAVLT	3	-2,79
Inhibition	FDT	24	-1,11
Flexibility cognition	FDT Trial B	33 113	-0,84 -1,57
Working memory	Digit Span Forward Digit Span Backward Arithmetic Letter-Number Sequencing	8 4 15 9	Normal Impaired Normal Normal
Visual-motor skills	Block Design Trial A	40 37	Normal -0,55
Perceptual organization skills	Matrix Reasoning	23	Normal
Symptoms of Anxiety	HADS	3	Improbable
Symptoms of Depression	HADS	6	Improbable

Note: FDT = Five Digit Test; HADS = Hospital Anxiety and Depression Scale; RAVLT = Rey Auditory Verbal Learning Test.

STAXI-2 e BAAQ

At the baseline, the only score above 65 was on the subscale Anger Expression-Out (AX-O) (see Table 12) indicating that RB often expressed his anger with aggressive

behaviors directed at other people or objects in the environment. The decrease in this score demonstrates that after he participated in the ASMT program, the number of anger outbursts decreased considerably, suggesting that expressing feelings of anger did not have as impactful interference on his life functioning as before. The frequency (T-Ang) and intensity (AX Index) of feeling angry also decreased.

However, analysis of the AC-O and AC-I indices indicates that RB needs to spend more amount of energy controlling and preventing anger expression and be able to reduce anger as soon as possible. It is important to keep an eye on these scores, as they may reduce the need for assertive responses that would generate conflict resolution and/or frustrating situations.

The analysis of the BAAQ questionnaire shows that before the intervention RB was not prone to extreme aggressive reactions. The chances of intense behavior responses of anger decreased even more after the ASMT program.

Table 12 RB's anger scores at three testing points.

	Score T		
	Pretreatment	Middletreatment	Posttreament
T-Ang	40	40	31
T-Ang/T	54	54	39
T-Ang/R	31	31	31
AX-O	71	65	58
AX-I	46	48	36
AC-O	42	41	63
AC-I	45	40	64
AX Index	58	62	34
BAAQ	5	9	2

Note: AC-I = Anger Control-In; AC-O = Anger Control-Out; AX-I = Anger Expression-In; AX-O = Anger Expression-Out; AX Index = Anger Expression Index; BAAQ = Brief Anger-Aggression Questionnaire; T-Ang= Trait Anger; T-Ang/T = Trait Anger/Angry Temperament; T-Ang/R = Trait Anger/Angry Reaction.

Qualitative results

Interview with the participant

The interview was conducted by the main researcher three weeks after the last intervention session. RB reported that his anger approach had improved a lot since he participated in the ASMT program. He said that he tried to understand other feelings involved in situations: "I do that thing of thinking before I speak, of leaving the situation and coming back later. I've been trying to think before I react".

According to him, the strategies that helped the most were: Self-Monitoring, the Feelings Checklist, STOP-Return, and Active Listening. He said he had used self-monitoring often: "Every time I notice a situation that can generate anger, I use this technique. I can monitor and identify what I am feeling". And he adds, "The other feelings allowed me to realize what I felt beyond anger in the relationship with my father".

Regarding the other feelings technique, he reported that it helped him realize the motivation of the anger with his father: "Before, I used to get angry with my father because I didn't know that he was having a concern about me. I used anger as a first response feeling, but I didn't pay attention to the other feelings. I imagined that he was thinking I was incapable, and this made me angry with him. Today I realize that I would feel something akin to concern if I were in his place, so I have been trying not to be rude to my father anymore".

He says he did not need the STOP-Return strategy because he had not been feeling angry: "I've used it just a few times, it's not necessary. When I used it, I was one step away from assaulting my father. This technique helped me not to assault him". About calming strategies, he said that listening to music helped him a lot. Every time he realized he was getting angry, he listened to music. In this way, he didn't need to go so far as to use the time technique.

The strategy he used the least is the Mirror Technique. RB told us that he didn't need to use it. As for the Active Listening technique, RB reported that it helped him a lot and suggested that it was introduced at the beginning of the program: "Before I use the other strategies, I try to listen to what the other person thinks. I think that before you learn to deal with anger, you need to know what is causing that anger. And the only way to do that is by listening to people.". RB reported how this technique had helped him in his work, and that it helped him perceive people differently.

RB reported, therefore, that the program had changed the way he related to others: "Now I have strategies to control my anger and analyze whether anger is relevant in that situation. I have realized that it rarely is".

In addition, he said that the program had helped him understand more about TBI. RB had had his brain injury two years before: "I know that after 5 years from the brain injury, what I couldn't recover won't come back". He said that the way he was adjusting to TBI could improve, but he would be waiting for these next few years.

When asked about the online modality of the intervention, he said that it worked perfectly and that he didn't miss the face-to-face interaction, "Nothing against you, but online is more convenient". About the Google Drive folder, he said that he adapted well and liked the online tool because he knew he had access whenever he wanted, without the risk of losing the material.

Interview with SO

RB's significant other who participated in the intervention was his mother. The interview was also conducted three weeks after the end of the intervention. She reported that in the past few weeks then, he had not had any episodes of angry outbursts: "He is very quiet,

he hasn't attacked anyone verbally anymore. He is calmer. He hasn't yelled as he used to do. The euphoria and the aggressions have stopped”.

She reported that he never used to talk and share things about his life, even before his brain injury. But since the accident, living together used to be unbearable: "He still doesn't say what bothers him, but sometimes he comes and sits with us, exchanges a few words. He is more smiling and cheerful, you know? There was a time when living with him was unbearable. But now he is changing. He is no longer as angry as he was before. I hope it stays that way”.

When asked about what has changed, she said: "I can't explain exactly, but he's more introverted. If we talk to him, and he can't talk, he just says, 'I can't talk now’. And we come back afterward. Our relationship has improved. One is cooperating with the other and that has avoided discomfort and yelling".

She said she considered his participation in the program very positive, and that even the relationship with his father had improved: "Now they can even talk briefly without fighting”. The mother reported that he had always been quiet and reserved: “We didn't use to talk about his life because he didn't share anything. But before the TBI, he had never been aggressive like he became after the accident”.

The mother described that the interaction with RB had been restricted before, and then, after the program, the interaction, although improved, was still restricted to what was necessary: "Coexistence has improved, but it is minimal. I don't insist on talking anymore. Before the accident, we didn't have many moments together. He was always studying and working, so he used to leave home early and only come back at night. After the accident, we found out that he had failed in several subjects and was delaying his university course. He was cheating on us. We believed that he was dedicated to college, and then we found out that it was a lie. Today we talk when it is strictly necessary”.

When asked about the online intervention being, she said: "It is good for we don't need to go anywhere. He is at home and talks directly to you. His father and I don't need to go together and wait for him. He has more autonomy".

Discussion

The results of the present study indicate that intervention focused on anger management can have positive effects on the quality of social relationships in the person with TBI by regulating aggressive response. Psychoeducation about anger and traumatic brain injury was an essential starting point for understanding the changes experienced after a lifelong acquired brain injury.

Neuropsychological rehabilitation aims to provide as much autonomy and functionality as possible for the person with ABI. In addition to cognitive training, NR gives access to information about common clinical features and offers a safe environment for the elaboration of expression and impact on the person's life. The ASMT program adapted for Brazil demonstrated to be effective for the development of strategies and training of techniques to deal with anger management.

Clinical Variables

Both participants were young adults, male, at the beginning of their professional and financial lives. The selected sample presented demographic and clinical characteristics compatible with those found in epidemiological studies in Brazil (Carteri & da Silva, 2021). As premorbid characteristics, the two had a busy social life and were financially independent of their family. RB used to drink with friends near the college and go to parties, while IL played ball with friends. Regarding family relationships, both had a more reserved profile and did not share much of their private lives with relatives. Their respective families reported that they were irritable, but did not have aggressive expressions. Therefore, according to reports,

despite experiencing anger frequently in family relationships, they both had a strategy of isolating themselves to avoid conflicts.

However, after the brain injury, the aggressive reactions became highly frequent and directional, especially towards a specific family member. In IL's case, the angry outbursts were directed at his sister who lived with him. They had a history of an amicable relationship before the injury, but conflicts escalated after the TBI to the point where the sister avoided contact with him inside the house. In the second case, RB's focus of anger was directed at his father. They did not have a strong bond before the injury, but there were no fights or arguments between them. After the injury, RB became reactive to any approach or help from his father.

Johansson and coworkers (2008) emphasize the importance of understanding what underlies, precipitates, and maintains the aggressiveness patterns of an individual. In the case of the participants in this research, it was noticed that the person to whom the focus of anger was directed was the one who exercised legal responsibility for the patient after the injury. After a TBI, a person experiences various losses, such as employment, relationships, autonomy, hobbies, cognitive and physical abilities. There is not only a loss of identity in the world but also a loss of identity in the dynamics of relationships. For both participants in the study, the financial and emotional independence from the family appeared to be an important landmark in the relationship, whereas when there is a sudden rupture of this construct, anger against the legal and financial guardian emerges. The ambivalent feelings that arise from this new relationship of dependency are one of the hypotheses raised to explain the focus of anger expression of the participants in this research.

Because of such losses, experiencing an acquired brain injury can trigger a complex grieving process (Coetzer, 2004). Nochi (1998) categorizes into three levels of loss: loss of self-knowledge, loss of self-comparison, and loss of self in the view of others. Poor self-

knowledge is related to memory deficits and understanding their capabilities in the present condition (Nochi, 1998). Memory loss can lead to a lack of understanding of why some activities can no longer be performed by the person. In IL's case, he could not understand why his sister was taking care of his money and he could not keep track of her financial transitions, even after she repeatedly explained. IL was almost a year in a comatose state at home, when he woke up, he found himself in a totally different situation, unable to construct a narrative about his changes. He felt that his sister had stolen his right to take care of his own money. Neuropsychological assessment of IL indicates a major memory processing failure, especially in verbal learning ability. The author stresses the importance of providing a story about their lives to fill in the blanks of memory and also explanations of their current condition.

In this study, the specific focus of the intervention was on feelings of anger and aggressive reactions. Both patients perceived themselves to be angrier, but could not understand why such a change was occurring. According to Nochi (1998), a common experience among people who sustained a TBI is to feel angry at one person without knowing why.

The first part of the ASMT program focused on psychoeducation of brain damages and life changes that contribute to the experience of anger. Therefore, in these first sessions, a narrative about their feelings of anger begins to be constructed. The weekly completion of the Anger Logs was one of the tools that assisted the recognition of anger patterns for further elaboration of triggers and experience of the feeling of anger. However, for people with severe memory deficits, the Anger Log may not work as a tool for self-understanding the feeling of anger, for these patients cannot remember conflict situations. IL had difficulty remembering angry moments for filling in the Anger Logs. And when he did it, there were no details of the event, which made it difficult to identify anger patterns. One strategy used by

the researcher in some sessions was to invite the SO (with IL's permission) to report in detail what had happened and how IL had reacted. After that, it was possible to reflect with IL on the triggers and his reaction to anger. With RB — who did not have a significant memory deficit — this was not necessary. He filled in the Anger Logs right after the moment of anger, and reported in expressive detail, which facilitated review and insights during the session.

Concerning the loss by comparison with who they were in the past, Nochi (1998) reports as an experience of loss of self. This can occur because of changes in social and interpersonal life. Both participants reported physical changes and having less independence as important factors related to being stressors and worries that get worse after a TBI. Changes in appearance and physical ability are common after brain injuries and can also generate this feeling of not identifying and comparing oneself to what one was. In the case of the participants, both had physical sequels from their accidents — IL's skull is flattened on the right side, while RB has difficulty in locomotion, loses his balance easily, and has less movement in his right arm and hand. Anger can arise in the recognition of these losses, both of physical identity and motor skills. RB reported that he had an angry outburst because his father wanted to help him fill a glass of water due to his motor difficulty. This made him very angry, and he told his father that he was able to fill a glass of water and didn't need his help.

The third type of loss experienced, according to Nochi (1998), is the loss of self in the eyes of others. The above example represents the feeling RB had for his father. In the final interview, RB explained that his father wanted to help him all the time, and he felt that his father saw him as incapable. That made him angry: "When he looked at me, I thought he was judging me".

It seems, therefore, that being dependent on others generates mixed feelings in the person who has the brain injury. Considering that the person is experiencing a mourning process and developing a new self-perception, the relationship of care and dependence on a

caregiver can develop a catastrophic process. The person responsible for caring becomes the villain in the unconscious process of determining responsibility for this new condition of existence. Externalized anger, therefore, can be a way to experience this mourning over losses.

RB reports that one of the things that helped him was the Other Feelings technique because it made him identify how he felt and his father's feelings, such as worry. RB concludes that maybe he would feel something similar if he were his father. It appears that RB was, through the techniques learned, developing greater self-awareness about himself and his anger, enabling a sense of empathy with his father. Therefore, it is possible that the decrease in feelings of anger and aggressive responses is replaced by a feeling of gratitude for that relationship. In the case of IL, because of a greater cognitive limitation, the participant does not verbally elaborate on this change. However, his sister reported that after he participated in the program, he started to bring snacks to her, call her by her name, and show more concern for her. As it turns out, both of them in different ways managed to re-signify a relationship that was the focus of angry feelings. So perhaps this path of elaborating a sense of gratitude can be achieved even by people with more severe cognitive sequelae.

A study that investigated the sense of identity among people with TBI found that a better perception of change is linked to higher levels of depression and grief (Carroll & Coetzer, 2011). None of the participants showed significant symptoms of depression or anxiety, which may indicate a lower level of perception of their losses before the intervention started. However, there should be further studies relating aggressive reactions and the grieving process after acquired brain injury to better understand the role of anger in this process.

Anger after brain injury has several negative unfoldings on the individual and social levels. The aggressive reactions of the person with TBI cause people to withdraw and avoid

contact. It is already common for people after TBI to suffer from social isolation because of all the cognitive, physical, and emotional changes. The breakdown of the relationship with the caregiver or family members who live together represents another breakdown of interpersonal ties in the person's life. It is therefore important that clinicians understand that anger can represent a form of mourning in which the person cannot internalize the aggressiveness to elaborate the loss and their new condition.

Thus, there is still much to be studied and understood about the grieving process after brain injury. However, the understanding of what was lost and the new construction of a sense of self seems to be related to a more positive experience and reduction of grief, and, consequently, a better emotional adjustment in the brain-injured individual (Coetzer, 2004).

The systematic review article (see chapter 2) pointed out that most of the studies conducted on anger management focus on increasing self-awareness about anger. The intervention program proposed in this study provides methods that allow greater insight into anger patterns and aggressive reactions. According to the reports in the final interview, both participants achieved a greater ability in self-monitoring and self-awareness of anger.

A preliminary investigation about the efficacy of the ASMT program showed a significantly lower level of anger, especially at the sub-scales Trait Anger (T-Ang) and Outward Expression of anger (AX-O) after the end of the intervention (Hart et al., 2012). A multicenter randomized controlled trial was conducted to verify the results found in the premier study. Was not observed a superior response at the self-reported measures (STAXI-2 and BAAQ) demonstrated in the pilot trial. However, compared to the control group that received a non-anger-specific intervention but focused on the effects of TBI, the ASMT group had a significantly positive response on the STAXI-2 T-Ang scale. The authors hypothesize that improved awareness of triggers and anger may cause a change in the interpretation of why a person is affected by feelings of anger (Hart et al., 2017).

In the sample of this study, RB showed a decreased T-Ang score, indicating a lower tendency to interpret situations as unfair, which may lead to a lower anger reaction. For IL, the T-Ang scale maintained the same value after treatment, but the Trait Anger/Angry Temperament (T-Ang/T) had a significant improvement. This may indicate that although IL still interprets some situations as unfair (T-Ang), he does not readily and impulsively express his feelings of anger (T-Ang/T). This may be due to the higher level of self-monitoring and awareness of anger — which are the focus of the program mainly in the first sessions. In the final interview, IL reported that he could well perceive the signs of anger appearing — what he could not do before the program. He added that, when he noticed these signs, he would "give his head a break", take a deep breath or leave the environment. IL's self-report is consistent with the SO's and sisters' descriptions. They said in the final interview that previously IL had angry outbursts without any warning or demonstration of dissatisfaction. After the treatment, they realized that, when he was upset, he got up calmly and left the room, returning after a while. Therefore, the findings of this study are in agreement with the results found in previous studies (Hart et al., 2012, 2017), indicating that the program is effective in improving anger self-monitoring and self-awareness.

One of the hypotheses raised is that understanding the consequences of aggressive reactions also contributed to a decrease in T-Ang/T scales. Both participants during the intervention program had one episode in which anger was very explicit with attempted physical assault on the person who was involved (in both cases it was the person they had the greatest focus of anger on). Two points are important in these situations. The first was that both participants texted the researcher. IL texted the day after the angry outburst saying that he had tried to hang his sister, but could not explain why. RB texted right after he tried to hit his father, asking what he should do. In the first case, the researcher invited the SO to participate and explain the context in which the aggression happened, for IL could not

remember it. And from the family member's account, IL was able to talk about how he felt in the situation. In RB's case, the researcher responded on the spot with audios recalling the strategies we had studied before. Early the next morning, RB sent another message saying that he apologized to his father and offered him a meal to "make it up".

The fact that the participants contacted the researcher shows that there was a well-established therapeutic alliance and that they comprehended that the recommendations and techniques taught in the program could be applied in social settings and situations of extreme anger. Both of them understood that the program could be helpful in those situations. Although they were not able to control their aggressive expression at the moment, they were both aware that it was an overreaction and they sought the therapist for resources. These episodes happened between the fourth and sixth sessions. This may indicate that the therapeutic bond can be built in the first sessions and that although they were learning the techniques, they still needed to learn how to implement them in extreme situations.

The second relevant point is that, from these events, it was possible to talk tangibly about the legal and social consequences of anger, which may also have contributed to the decrease in the scale that evaluates the readiness of angry responses to situations with little provocation (T-Ang/T).

Relative to the AX-O scale (the other STAXI-2 scale analyzed in previous studies), RB showed a significant improvement post-treatment. The opposite happened with IL — his outward anger expression rates increased. One hypothesis is that participation increases awareness of anger reactions and also develops a greater sensitivity to identifying expressions of anger. When we look qualitatively at the AX-O scale items, there are two items (out of eight) that refer to the expression of anger not necessarily negative. For example, item 31("If someone bothers me, I tend to tell them how I feel") refers to the ability to express what makes the person unhappy. This is one of the skills trained during the program, in which IL

scored a higher score on the frequency of expression. The other six items characterize the negative expression of anger, such as "I say nasty things" or "I argue with others", in which IL also had higher scores — which can be justified by greater awareness since at T1 he answered "rarely" for these two items.

Self-awareness is a complex process that involves good brain functioning, especially of the executive system. Deficits in self-awareness beyond physical brain damage may also involve psychological components of rejection of painful self-perceptions (Prigatano, 1997 in Coetzer, 2004), which can make self-report scales unreliable to observed clinical changes.

Some studies in this area have had as a marker of success the frequency of occasions of aggressive behavior (O'Leary, 2000; Rochat et al., 2016; Uomoto & Brockway, 1992). This is one of the alternatives to assess the effectiveness of interventions, but it also has important limitations, such as assessing only the visible reaction of anger without considering the experience of anger temperament. Based on this study, semi-structured interviews with the participant and the SO seem to serve as a reliable source of information on the effect of the anger intervention. However, it is known that with larger samples the interview may become unfeasible.

Another clinical similarity between the participants is the location of the brain lesion. Damage to the right frontotemporal lobe is related to increased irritability post-injury (Puiu et al., 2020). Persinger (1993) indicates that alterations in the functioning of the temporofrontal lobe would also be related to alterations in the sense of self because of the association with the linguistic processes involved in the conceptualization of the self. Regarding pharmacological intervention, none of the participants used emergency medication for times of aggressive outbursts. At the time of the program, RB was not taking any medication. IL was taking clobazam, escitalopram oxalate, and divalproatro sodium. According to family members, the first two drugs were prescribed because of their calming properties.

ASMT Program

The ASMT is an American program developed for providing education about anger management after moderate to severe TBI. Its philosophy is to normalize the feeling of anger, understanding that the management of emotions is hampered by deficits in self-awareness and limitations in conflict resolution after brain injury. The program proposes activities and techniques to broaden the understanding of anger interpretation and expand the repertoire of behavioral responses (Hart et al., 2015).

Cultural adaptations in psychology interventions have been extensively discussed during the past 20 years. The literature stresses the importance of testing for possible differences between clinical groups (Hall et al., 2016). In the case of the ASMT program, it was developed specifically for people with a history of moderate to severe traumatic brain injury. This population has some typical cognitive, physical, emotional, and sensory deficits (Simpson et al., 2000; Wilson, 2008). In addition to the changes caused directly by the injury, surviving a TBI also encompasses the experience of changes in living situations, loss of significant relationships, reduced independence, etc (Hart et al., 2017). The abrupt disruption of identity in the world causes various emotional reactions. Pereira, (2011) highlighted four emotional aspects commonly found after TBI: self-awareness, anxiety, depression, and anger outbursts. Although this is a program developed for the North American society, there are specificities similar to this population beyond cultural differences between Brazil and the USA.

Considering this common ground, our results suggest that the ASMT program, after translation and adaptation (see chapter 3), can be effective for Brazilians experiencing anger misadjustment after TBI. The sample in this study was made up of highly-educated white people — which can be considered a limitation since it does not represent the reality of many people in Brazil. However, despite the intervention being culturally adapted or not, the

experience and sensibility of the clinician proves to be indispensable in the neuropsychological rehabilitation process, in order to consider the particularities of each individual and family dynamics (Simpson et al., 2000). In the case of IL, for example, who had a greater cognitive limitation with significant memory and verbal skill deficits, some modifications in the presentation of the content were made, such as repeating the same sentence more often, using short sentences, and frequently checking if he understood. Because of these modifications, the session with IL tended to last longer than the sessions with RB. One suggestion based on this experience is to have a flexible duration of the program, in which patients with greater cognitive deficits (especially memory deficits) could have more sessions for consolidating and training the techniques. Some studies have adhered to this flexibility in anger management programs (Medd & Tate, 2000; Uomoto & Brockway, 1992).

Another situation is when the participant displays anger during the session. The ASMT program manual has no protocol to be followed. This research was developed online, therefore these moments became even more challenging. Our conduct when the participant began to show signs of anger during the session was to point out to him that it was possible to notice that he was having physical and/or behavioral changes that indicate that he was beginning to get angry. In this way, you can bring the patient into the session's here and now and reduce the chances of escalating anger. For this, the clinician must be aware — even in the online modality — of any unusual changes the participant reveals. After scoring these signs, it is possible to guide the participant to use the strategies taught in the program. During this study, this was required to be done twice with participant RB, proving to be an effective way to deal with anger in the session and an opportunity to devise conflict resolution strategies.

Finally, we also suggest — especially for participants with significant memory deficits — that, at the end of the session, patients have some time to write down what they have learned and how they can use it in their lives. It is hypothesized that this manual recording process serves as a journal, which the person can access to supplement the materials available in the folder. This is especially interesting in the online modality, allowing a physical tool to access the content. If patients are unable to write, it is recommended that they record themselves on a cell phone.

Advantages and disadvantages of the online methodology

The results of this study show that the adaptation of the program for the online modality was successful. An online folder was shared via Google Drive and participants could easily access the session materials and Anger Logs. To the best of the authors' knowledge, this is the first study using a tool to create an online folder that enables interaction between therapist and patient with TBI. The studies developed to date in this area describe online encounters but do not refer to online storage of support materials, homework assignments, or logs (Lawson et al., 2020; Tsaousides et al., 2014). One study reports that a workbook was available for participants, who used it during and between sessions (Tsaousides et al., 2017).

A systematic review conducted in 2018 identified that the most common delivery tool for telerehabilitation was telephone-based (Ownsworth et al., 2018). Due to the COVID-19 pandemic and the widespread use of online tools, including the healthcare field, it is believed that these new forms of remote interaction for neuropsychological rehabilitation have emerged in this period.

One advantage of telerehabilitation identified in this study was the accessibility of the service during the pandemic period, considering that there was an increase in family togetherness and stress. In addition, both participants and family members reported as

positive the greater autonomy of the person with TBI to participate in the sessions, with no need for the family to be involved in locomotion and scheduling. This also has a positive financial impact because there are no transportation costs.

Another positive point identified by the researcher was the online folder that made it possible to track the completion of anger logs and homework activities. If the researcher identified that the anger logs had not been completed, she could send reminders by message. In addition, there are no chances of the participant forgetting the material at home, which facilitates the progress of the sessions. The participants also reported that they liked this form of storage, precisely because they know that they can access the materials whenever they want via their cell phones or computers.

Some possible disadvantages are lack of access to the internet, lack of familiarity with the computer or the tools used. The family of one potential research participant did not want to go online because they were afraid that the interaction with the computer might generate more anger in the person. Therefore, specifically with people who have angry outbursts, the frustration of not being able to access and use the program's tools can generate negative consequences. No complaints regarding this possible problem were identified with the participants in this research. Strategies used to avoid this included sending video tutorials and training meetings for the tools. In addition, the researcher was available by phone for guidance when needed.

Conclusion

This study aimed to estimate the effectiveness of adapting the ASMT program to Brazil and the online modality according to the clients and their families' perceptions. Specifically, regarding the cultural adaptation, the program appears to be suitable for the Brazilian population in terms of applicability of techniques and content understanding. The qualitative results showed that both participants benefited positively from the intervention,

achieving improvements in family relationships. In contrast, quantitative analysis of the STAXI-2 scales and the BAAQ questionnaire showed contradictory results for one of the participants, with increased scores in items assessing anger experience and expression. Although some of the results are in agreement with the literature and can be explained by increased anger self-awareness, further studies should be conducted with a larger sample size for the sake of clarity. In addition to the small sample size, another limitation of the study is the lack of follow-up to verify whether the results were maintained after the intervention ended.

This study also points to the need for further investigation of the relationship between the grieving process and aggressive reactions, especially when the focus of anger is directed at a specific person after the injury. One of the hypotheses raised in this research is that the experience of anger may be linked to the perceived bond of dependency and care. However, not many studies relating to these issues have been found in the literature.

Regarding the online adaptation, the program has proven to be able to be carried out remotely. The results did not indicate any losses concerning the understanding and training of the techniques. However, since there was no comparison group with the face-to-face methodology, it is not possible to know precisely whether the online modality has any impact on the effectiveness of the program.

This research presented encouraging results in a small sample size, which encourages future research in the area of cultural adaptation for Latin America and the area of teleneuropsychology. Such research would benefit from increased participant numbers, the inclusion of a control group, and different markers of program effectiveness evaluation.

Chapter 5 - Conclusion

The present study aimed to investigate the effectiveness of interventions focused on anger management following TBI. Increasingly the development of programs adapted to the Brazilian population is more urgent, as there is a high incidence of people with TBI in the country and there are no studies conducted on anger management. This study seeks to provide information and intervention tools to assist professionals working with these people.

Considering the emergence of developing programs adapted to the Brazilian population and the current context worldwide, the present dissertation was composed of three studies related to anger following TBI: 1) Systematic Review of Literature; 2) Adaptation of ASMT program for the Brazilian population and the remote method; 3) Multiple Case Study. The first study consisted of a systematic literature review that aimed to examine the current evidence on anger management interventions following ABI. The analyses of the 10 selected works identified that intervention programs focused on strategies for anger management lead to positive results for anger control. However, besides a paucity of studies in this area, there are methodological differences between the studies and heterogeneous characteristics of ABI participants.

Although the results of the studies showed a trend toward improved anger in people with TBI after the proposed interventions, there was still much to be investigated in this area. Since few studies featured control groups, investigation of the effectiveness of components of an anger-focused intervention is essential. In addition, the methodology for measuring experience and frequency of anger differs greatly among the studies. It would be important to conduct studies that compare different qualitative instruments and methods to measure anger as a guide for future investigations.

The second study described the process of adapting the Anger Self-Management Training (ASMT) — an American intervention program for TBI — to the Brazilian reality in

an online methodology. A pilot study was conducted to investigate the characteristics of the Brazilian adaptation of ASMT. According to the data collected, the remote method was beneficial to the participant even in a few sessions. There were no major technological barriers to the progress of the sessions. After analyzing the participant's feedback, two changes were made: a) The participant will receive a structured guideline and a video tutorial about the platform for both cellphone and computer; b) after every session, a summary of the main points of the session will be added to the Google Drive folder. In addition, the ASMT program appeared to be appropriate for the Brazilian population without any changes in the core elements of the intervention.

The third study was conducted with two participants to estimate the effectiveness of the adapted ASMT program for the Brazilian population with TBI, and also the online methodology. The participants appeared to benefit from the intervention. The qualitative data showed favorable development of anger management with adherence to the techniques proposed during the program. Quantitative data showed a significant improvement in one participant's scores regarding anger experience and expression. However, the other participant had higher scores when compared to previous tests. As the intervention had a major focus on the development of self-awareness, it was possible that his participation in the program allowed him to have greater insight into his anger. To confirm these hypotheses, further studies should be conducted. Consider that the limitations of this research are related to the sample size and the lack of a control group.

It is argued that the present research has contributed to the context of neuropsychological rehabilitation, the development of the field of teleneuropsychology, and hopefully, the findings will reach clinicians and help train neuropsychologists in Brazil.

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ANNEXES

ANNEX 1: ANGER LOG SESSION 1

ANGER LOG Session 1

Instructions: For each section, check **all** of the information (one or more boxes can be checked) that best describes an incident this week in which you experienced irritability or anger.

When? Day of the week: _____ Date:_____

☐Morning ☐Afternoon ☐Evening

Where?

☐At home ☐At work ☐Other_____

Who Was Involved?

☐Spouse/ Partner ☐Parent ☐Other Family_____

☐Close friend ☐Acquaintance ☐Co-Worker

☐Boss/Supervisor ☐Stranger ☐Other_____

What Happened? Describe the incident as best you can.

_____

_____

_____

Anger Mangement Techniques

Did you use a Calming Strategy? _____ yes _____ no

If you used a calming strategy, describe what you did and whether it helped.

_____

Rate the level of your anger.

0	1	2	3	4	5	6	7	8	9	10
No Anger		Mild Anger			Moderate Anger		High Anger			Very High Anger

Rate how well you think you did at handling your anger.

0	1	2	3	4	5	6	7	8	9	10
Very Poorly			Could have done better			Okay	Pretty Well			Very Well

ANNEX 2: ANGER LOG SESSION 2

ANGER LOG Session 2

Instructions: For each section, check **all** of the information (one or more boxes can be checked) that best describes an incident this week in which you experienced irritability or anger.

When? Day of the week: _____ Date:_____

☐Morning ☐Afternoon ☐Evening

Where?

☐At home ☐At work ☐Other_____

Who Was Involved?

☐Spouse/ Partner ☐Parent ☐Other Family_____

☐Close friend ☐Acquaintance ☐Co-Worker

☐Boss/Supervisor ☐Stranger ☐Other_____

What Happened? Describe the incident as best you can.

_____

_____

_____

How My Body Felt

☐ Revved up: Heart pounding or racing, Blood pressure going up, Adrenaline surge, Ready to burst

☐ Hot: Red, Flushed or Blotchy; Sweating/Perspiring; Boiling

☐ Cold: Chilled, Numb or Frozen

☐ Tense: Muscles tight or shaking; Hunched shoulders; Clenched fist, Clenched jaw/ Grinding teeth; Headache; Strained voice

☐ Churning or upset stomach

☐ Drained out, Exhausted

☐ Other_____

What I Did (my behavior)

- ☐ I yelled or raised my voice
- ☐ I said hostile or insulting things
- ☐ I cursed
- ☐ I hit, ☐ kicked, or ☐ threw *something*
- ☐ I hit, ☐ kicked, or ☐ pushed *someone*
- ☐ I physically hurt *myself*
- ☐ I threatened to hurt or get back at *someone*
- ☐ I avoided dealing with it
- ☐ I just took it and stewed about it
- ☐ I did not cooperate or I did the opposite of what they wanted
- ☐ I imagined getting back at them
- ☐ I cried
- ☐ I couldn't speak
- ☐ Other, *specify*_____

Rate the level of your anger.

0	1	2	3	4	5	6	7	8	9	10
No Anger		Mild Anger			Moderate Anger		High Anger			Very High Anger

Anger Management Techniques:

Did you use a Calming Strategy? _____ yes _____ no
If you used a calming strategy, describe what you did and whether it helped.

_____

Rate how well you think you did at handling your anger.

0	1	2	3	4	5	6	7	8	9	10
Very Poorly			Could have done better			Okay		Pretty Well		Very Well

Did you have any successes in managing your anger this week? If so, describe what happened:

_____

_____

_____

_____

ANNEX 3: ANGER LOG SESSION 3

ANGER LOG Session 3

Instructions: For each section, check **all** of the information (one or more boxes can be checked) that best describes an incident this week in which you experienced irritability or anger.

When? Day of the week: _____ Date: _____

☐ Morning ☐ Afternoon ☐ Evening

Where?

☐ At home ☐ At work ☐ Other _____

Who Was Involved?

☐ Spouse/ Partner ☐ Parent ☐ Other Family _____

☐ Close friend ☐ Acquaintance ☐ Co-Worker

☐ Boss/Supervisor ☐ Stranger ☐ Other _____

What Happened? Describe the incident as best you can.

_____

_____

_____

How My Body Felt

☐ Revved up: Heart pounding or racing, Blood pressure going up, Adrenaline surge, Ready to burst

☐ Hot: Red, Flushed or Blotchy; Sweating/Perspiring; Boiling

☐ Cold: Chilled, Numb or Frozen

☐ Tense: Muscles tight or shaking; Hunched shoulders; Clenched fist, Clenched jaw/ Grinding teeth; Headache; Strained voice

☐ Churning or upset stomach

☐ Drained out, Exhausted

☐ Other _____

What I Did (my behavior)

- ☐ I yelled or raised my voice
- ☐ I said hostile or insulting things
- ☐ I cursed
- ☐ I hit, ☐ kicked, or ☐ threw *something*
- ☐ I hit, ☐ kicked, or ☐ pushed *someone*
- ☐ I physically hurt *myself*
- ☐ I threatened to hurt or get back at *someone*
- ☐ I avoided dealing with it
- ☐ I just took it and stewed about it
- ☐ I did not cooperate or I did the opposite of what they wanted
- ☐ I imagined getting back at them
- ☐ I cried
- ☐ I couldn't speak
- ☐ Other, *specify*_____

Rate the level of your anger.

0	1	2	3	4	5	6	7	8	9	10
No Anger		Mild Anger			Moderate Anger		High Anger			Very High Anger

Anger Management Techniques:

Did you use a Calming Strategy? _____ yes _____ no

If you used a calming strategy, describe what you did and whether it helped.

_____

Did you Give Voice to Your O's? _____ yes _____ no

If you gave voice to your O's, describe what you said and how it worked.

_____

Rate how well you think you did at handling your anger.

0	1	2	3	4	5	6	7	8	9	10
Very Poorly			Could have done better			Okay	Pretty Well			Very Well

Did you have any successes in managing your anger this week? If so, describe what happened:

_____

_____

_____

_____

ANNEX 4: FEELINGS CHECKLIST

FEELINGS CHECKLIST

Think of a conflict or argument that you have had with someone. Circle all the words that describe the feelings you had at that time.

1. Challenged
2. Out of control
3. Resistant
4. Shocked
5. Uncomfortable
6. Mixed Feelings
7. Frustrated
8. Hate
9. Hopeless
10. Pessimistic
11. Hurt
12. Ready to fight
13. Pressured
14. Pissed off
15. Bothered
16. Sad
17. Worried
18. Love
19. Boiling mad
20. Angry
21. Concerned
22. Jealous
23. Irritated
24. Vulnerable
25. Defeated
26. Furious
27. Resentful
28. Explosive
29. Enraged
30. Anxious
31. Burned Up
32. Ignored
33. Disappointed
34. Annoyed
35. Insecure
36. Growth-Oriented
37. Aggravated
38. Depressed
39. Threatened
40. Offended
41. Upset
42. Fearful
43. Confused
44. Dissatisfied
45. Hopeful
46. Disrespected
47. Violent
48. Optimistic
49. Cross
50. Motivated
51. Afraid
52. Attacked
53. Put off
54. Ashamed
55. Livid
56. Deflated
57. Irate
58. Overwhelmed
59. Ticked off
60. Trapped
61. Cranky
62. Peeved

Other:

_____

_____

a _____

A _____

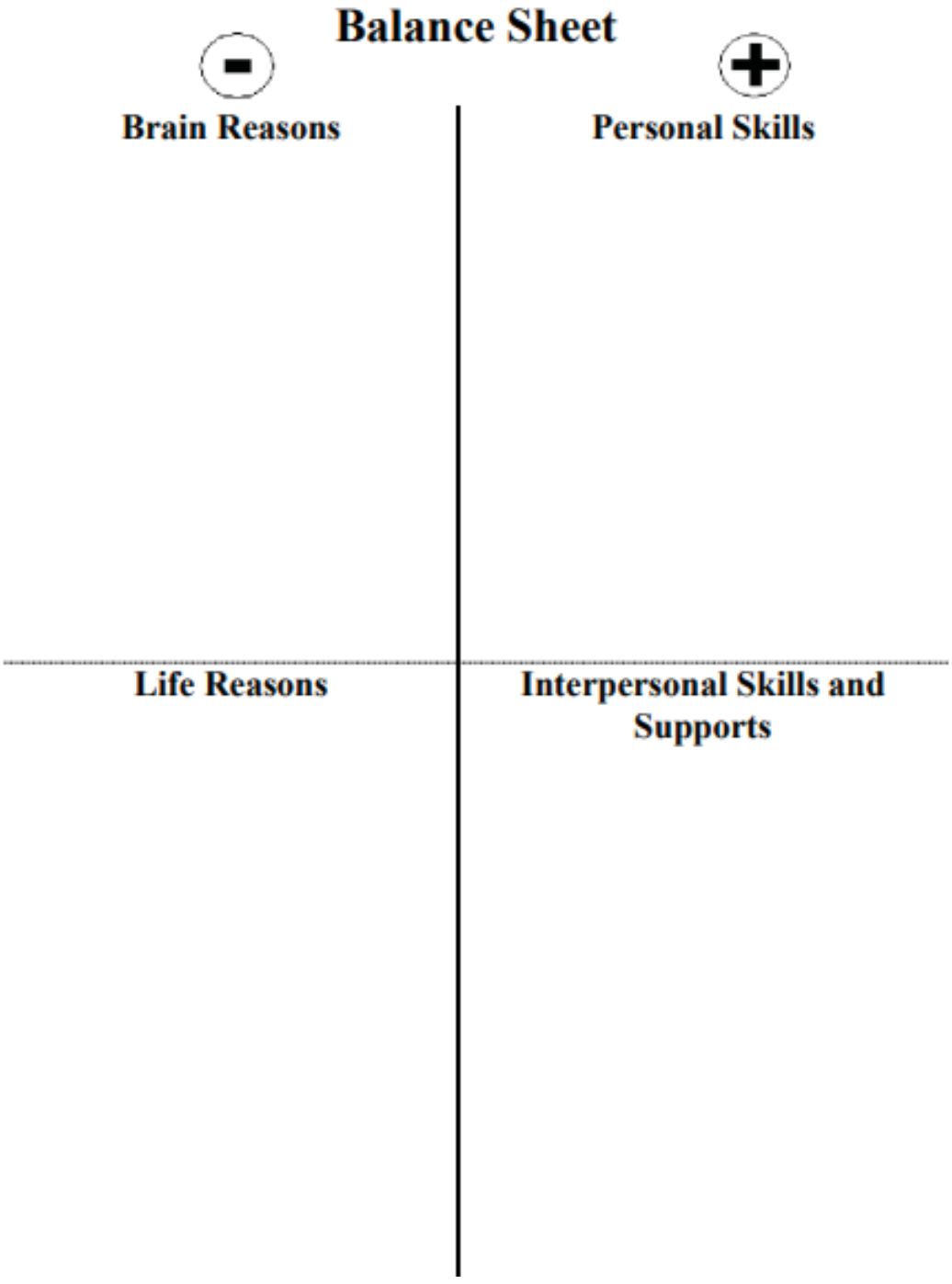
A/a _____

a+A _____

O _____

(a+A)/O _____

ANNEX 5: BALANCE SHEET – HANDOUTS SESSION 1 AND 2



ANNEX 6: CALMING STRATEGIES – HANDOUTS SESSION 1 AND 2

Calming Strategies

I. Self-Talk

- Have a conversation with yourself
- Emphasize giving the other person "the benefit of the doubt" ("Maybe they didn't intend to hurt my feelings....are under pressure...are having problems too."
- Practice positive "can do" talk ("I can handle this..or Now, let's see what would be a positive way to deal with this....")

II. Non-Aggressive Physical Activity

- Walking, jogging, or swimming

III. Distracting Activity

- Gardening, reading, washing the car, going to the park, going to see a funny movie

IV. Talk to Someone

- Cultivate a "support system" to run by your ideas or "rehearse" dealing with things BEFORE you put it into practice

V. Cold Water or Warm Water to the Face or Eyes

- Could be applied directly with the hands, with a wet towel, or with a tissue

VI. Engage in a Hobby

- Writing, collecting things. building models, working on the car

VII. Listen to Relaxing, Non-Aggressive Music

- Develop a "relaxation zone" by making and listening to recordings of some of your favorite music; Use of walkman, head phones, IPOD, etc.

ANNEX 7: FEELING LIST – HANDOUTS SESSION 3

Feelings List

small a's	Large A's
Bothered	Out of control
Angry	Hate
Irritated	Ready to fight
Resentful	Pissed Off
Annoyed	Boiling mad
Aggravated	Furious
Offended	Explosive
Upset	Enraged
Dissatisfied	Burned Up
Cross	Violent
Put off	Livid
Cranky	Irate
Peeved	Ticked off

O = Other Feelings

Shocked	Ignored
Uncomfortable	Disappointed
Mixed feelings	Insecure
Frustrated	Depressed
Hurt	Threatened
Pressured	Fearful
Sad	Confused
Worried	Disrespected
Love	Afraid
Concerned	Attacked
Jealous	Ashamed
Vulnerable	Overwhelmed
Anxious	Deflated
	Trapped

APPENDICES

APPENDIX 1: PARTICIPANT'S BALANCE SHEET

FICHA DO EQUILÍBRIO

-	+
Razões Cerebrais	**Habilidades Pessoais**
Controle emocional	Comer
Solução de problemas	Ouvir Música
Automonitoramento/Autoconsciência	Escrever
Problemas memória	Sair de casa
Cansaço	Ir na irmã
Convulsão	Ficar com os sobrinhos
Sobrecarga sensorial	Assistir TV
	Jogar Computador
	Sinuca
	Ir à igreja
	Automonitoramento
Razões da vida	**Habilidades e Apoios Interpessoais**
Perdas de relacionamentos	Sair dar uma caminhada com a mãe
Sair do emprego	Conversar com a mãe
Menos independência	Ouvir música e dançar com ela
Mudança na renda	Orar juntos
Convulsão	Ouvir Hinos
Preocupações com o futuro	Ir no shopping, mercado, comer
Mudança de humor - mais pra baixo	Poder falar com a mãe
	Conversar com os amigos
	Ida ao culto na igreja com a amiga

Usar os O’s

APPENDIX B: PORTUGUESE VERSION - CALMING STRATEGIES

Estratégias para se acalmar

1. **Conversar com você**
   - Ter uma conversa com você.
   - Dar à outra pessoa "o benefício da dúvida" ("Talvez eles não tenham a intenção de ferir meus sentimentos.... estão tendo problemas também").
   - Pratique uma conversa positiva de "eu consigo fazer isso!" ("Eu posso lidar com isso...ou Agora, vamos ver o que seria uma maneira positiva de lidar com isso....")

2. **Praticar atividade física não agressiva**
   - Caminhar, correr ou nadar

3. **Atividade para distrair**
   - Jardinagem, leitura, lavagem do carro, ir ao parque, ver um filme engraçado

4. **Conversar com alguém**
   - Cultivar um "sistema de apoio" para testar suas idéias ou "ensaiar" lidando com as coisas ANTES de colocar em prática

5. **Passar Água Fria ou Água Quente no Rosto ou Olhos**
   - Pode ser aplicado diretamente com as mãos, com uma toalha molhada, ou com um lenço de papel

6. **Ter um Hobby**
   - Escrever, coletar coisas. artesanato, trabalhar no carro, etc.

7. **Ouvir música relaxante ou não agressiva**
   - Desenvolva uma "zona de relaxamento" fazendo e ouvindo gravações de algumas de suas músicas favoritas; Uso de fones, etc.

APPENDIX C: PORTUGUES VERSION - FEELINGS CHECKLIST

Checklist dos Sentimentos – Pontuação

r = baixo nível de raiva

15. Incomodado
20. Bravo
23. Irritado
27. Ressentido
34. Chateado
37. Provocado
40. Ofendido
41. Aborrecido
44. Insatisfeito
49. Atravessado
53. Rejeitado
61. Irritadiço
62. Impaciente

R = Alto nível de raiva

2. Fora do controle
8. Ódio
12. Pronto para brigar
14. Irado
19. Extremamente furioso
26. Furioso
28. Explosivo
29. Enfurecido
31. Prestes a explodir
47. Violento
55. Possesso
57. Zangado
59. Indignado

_ _

O = outros sentimentos

4. Chocado
5. Desconfortável
6. Sentimentos confusos
7. Frustrado
11. Magoado
13. Pressionado
16. Triste
17. Preocupado
18. Amor
21. Apreensivo
22. Ciúmes
24. Vulnerável
30. Ansioso
32. Ignorado
33. Desapontado
35. Inseguro
38. Deprimido
39. Ameaçado
42. Receoso
43. Confuso
46. Desrespeitado
51. Com medo
52. Atacado
54. Envergonhado
56. Desanimado
58. Sobrecarregado
60. Encurralado

APPENDIX D: ANGER LOG FILLED OUT – ASSIGNMENT SESSION 1

Responses cannot be edited

Diário de Raiva 01

INSTRUÇÃO: Para cada seção, verifique todas as informações (uma ou mais caixas podem ser marcadas) que melhor descrevem um incidente nesta semana no qual você sentiu irritabilidade ou raiva.

Quando?

MM DD YYYY

10 / 16 / 2020

Qual período do dia

- [ ] Manhã
- [x] Tarde
- [ ] Noite

Onde?

- [x] Em casa
- [ ] No trabalho
- [ ] Other: _____

Quem estava envolvido?

- [ ] Esposa/Namorada
- [ ] Amigos
- [ ] Chefe
- [x] Pai
- [ ] Mãe
- [ ] Algum outro familiar
- [ ] Um estranho
- [ ] Colega
- [ ] Other: _____

O que aconteceu? Descreva o incidente da melhor forma que conseguir.

Arrumo a casa sempre, mas quando ele está de folga bagunça tudo e desarruma as coisas, ele saiu e eu limpei a casa quando ele chegou fez as coisas de comida e sujou tudo de novo, num horário que nem eu nem meu irmão iríamos comer, eu estava assistindo e ele colocou música na sala, fiquei com raiva e estressado, vim para o quarto fui à sala quando minha mãe chegou, achei uma sacanagem por eu ter que limpar tudo de novo.

Técnicas de lidar com a Raiva

Você usou alguma estratégia para se acalmar?

- (●) Sim
- ( ) Não

Se você usou uma estratégia para se acalmar, descreva o que você fez e se isso ajudou.

Vim para meu quarto ficar deitado para não ter que ficar vendo meu pai.

Qual era seu nível de raiva?

Nível da sua raiva

0	1	2	3	4	5	6	7	8	9	10
Sem Raiva		Raiva Leve			Raiva Moderada		Raiva Forte			Raiva Muito Forte

- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [x] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [ ] 10

Avalie o quanto você acha que se saiu bem ao lidar com sua raiva.

0	1	2	3	4	5	6	7	8	9	10
Muito mal			Podia ter agido melhor		Me senti ok		Muito bem			Me senti ótimo

- [ ] 0
- [ ] 1
- [ ] 2
- [x] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [ ] 10