Bachelor's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Social and Educational Sciences
Department of Psychology

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The associations between Metacognitive Beliefs and Persistent Post-Concussion Symptoms

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Supervisor: Johanne Rauwenhoff
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PSY2910

Candidate number: 10002

Trondheim, spring 2024

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Preface

This bachelor project, planned by the supervisor was titled "Metacognitive beliefs in people with persistent post-concussion symptoms following mild traumatic brain injury". The project was conducted as part of a larger intervention study, with data collection already completed. Within the research group, student contributions involved data entry and scoring of the questionnaires and neuropsychological tests using SPSS, with guidance from the supervisor and a student assistant.

The supervisor provided introduction courses that offered insight into previous research, data collection methods- and the overachieving goals of the intervention study. The supervisor provided themes for possible research questions, however the formulation of the research question and analysis methods was independently chosen with approval from the supervisor. The writing process and data analysis were primarily independent, although feedback from fellow students and the supervisor played a valuable role. Feedback was exchanged through written comments and subsequent discussions within the research group.

I wish to thank my supervisor for guidance, advice, and feedback throughout the semester. Thank you for the constructive criticism, and the engagement in this study. I further wish to thank the student assistant for helping with the data entry. I also want to express my gratitude to the fellow students I have worked with. Thank you for all the academic advice, humor, social support, and motivation you have provided this semester. You have made this project far more motivating and enjoyable, helping me through writing blocks and encouraging me during challenging times.

Abstract

Among 15-30% of those with a mild traumatic brain injury (mTBI) develop Persistent Post-Concussion Symptoms (PPCS). This encompasses a range of emotional, cognitive, and somatic deficits, significantly impacting patients' social, psychological, and economic well-being. Despite previous studies failing to identify psychological predictors for PPCS, little research has examined its association with positive and negative metacognitive beliefs. This study aimed to investigate the relationship between metacognitive beliefs and somatic, emotional, and cognitive PPCS. Specifically, it aimed to examine the relationship between levels of metacognitive beliefs and PPCS and asses how negative and positive metacognitive beliefs relate differently to these symptoms. A sample of patients diagnosed with Post-Concussion Syndrome ($N = 15$) completed the Metacognitive Questionnaire (MCQ-30) and the Rivermead Post-Concussion Questionnaire (RPQ). Spearman's Rho correlation analysis examined the association between negative and positive metacognitive beliefs and emotional, somatic, and cognitive PPCS. Analysis of variance (ANOVA) and Kruskal-Wallis tests assessed differences in PPCS dimensions among low, medium, and high scorers on the MCQ-30. Post-hoc power analysis evaluated the statistical power of the analyses. Results revealed no significant correlations between negative or positive metacognitive beliefs and emotional, somatic, or cognitive PPCS. Similarly, no significant differences were found in PPCS dimensions based on MCQ-30 scores. Post-hoc power analysis indicated insufficient statistical power for all analyses, likely influencing the results.

Sammendrag

Mellom 15-30% av de med mild traumatisk hjerneskade (mTBI) utvikler vedvarende post-commotio symptomer (PPCS). Dette omfatter et spekter av emosjonelle, kognitive og somatiske utfall, som betydelig påvirker pasienters sosiale, psykologiske og økonomiske velvære. Tidligere studier har ikke identifisert psykologiske prediktorer for PPCS, og lite forskning har undersøkt sammenhengen det deler med positive og negative metakognitive antakelser. Denne studien hadde som mål å undersøke forholdet mellom metakognitive antakelser og somatiske, emosjonelle og kognitive PPCS. Spesifikt hadde den som mål å undersøke forholdet mellom nivåer av metakognitive antakelser og PPCS, og å vurdere hvordan negative og positive metakognitive antakelser forholder seg forskjellig til disse symptomene. Et utvalg pasienter diagnostisert med post-commotio syndrom ($N = 15$) fullførte Metacognitive Questionnaire (MCQ-30) og Rivermead Post-Concussion Questionnaire (RPQ). Spearman's Rho korrelasjonsanalyse undersøkte sammenhengen mellom negative og positive metakognitive antakelser og emosjonelle, somatiske og kognitive PPCS. Variansanalyse (ANOVA) og Kruskal-Wallis tester vurderte forskjeller i PPCS-dimensjoner blant individer med lav-, middels- og høy-skåre på MCQ-30. Post-hoc power-analyse evaluerte den statistiske styrken til analysene. Resultatene viste ingen signifikante korrelasjoner mellom negative eller positive metakognitive antakelser og emosjonelle, somatiske eller kognitive PPCS. På samme måte ble det ikke funnet noen signifikante forskjeller i PPCS-dimensjoner basert på MCQ-30 skåre. Post-hoc power-analyse indikerte utilstrekkelig statistisk styrke for alle analyser, noe som sannsynligvis påvirket resultatene.

The associations between Metacognitive Beliefs and Persistent Post-Concussion Symptoms

Traumatic brain injury (TBI) stands as one of the most prevalent neurological disorders, presenting a complex array of brain dysfunctions or detectable damage resulting from head trauma (Manley & Maas, 2013; Vos et al., 2012). Most of the patients arriving at emergency rooms don't exhibit intracranial injuries, but rather present symptoms indicative of a concussion, also termed as a mild traumatic brain injury (mTBI). While mTBI carries a low mortality risk and most people recover well spontaneously, certain individuals may develop *persistent post-concussion symptoms* (PPCS). These symptoms encompass somatic, emotional, and cognitive domains, such as headaches, irritability, and concentration difficulties that last longer than the expected recovery time (Manley & Maas, 2013; Popov et al., 2022;). PPCS impacts various aspects of a patient's life, including economic challenges in returning to full-time work, physical well-being, and social interactions (Varner et al., 2021).

The causes of PPCS are extensively debated, and a comprehensive understanding of the concept remains elusive. Taking a biopsychosocial perspective on PPCS emphasizes the complex interaction among biological factors (such as gender differences and sleep patterns), psychological factors (such as stress), and social factors (such as family support), all influencing the onset and development of symptoms. This perspective underscores how psychological factors and their management can significantly influence both the biological and social aspects of PPCS (Polinder et al., 2018). For instance, maladaptive coping strategies, such as rumination about problems may heighten the risk of biological vulnerabilities, where rumination leads to disruptions in sleep patterns. This disruption might further lead to social vulnerability where the person has reduced energy for interaction with family and friends (Register-Mihalik et al., 2020). This interaction heightens the risk for both cognitive, emotional, and somatic symptoms that are incorporated in PPCS.

When examining these symptoms individually, such as fatigue, headache, memory deficit, and concentration problems, *metacognitive therapy* (MCT) has shown promising effects in various sample groups (Hagen et al., 2017; Nordahl & Wells, 2018; Normann et al., 2014; Ochoa et al., 2017). However, there remains a notable gap in understating how MCT impacts these symptoms together and in mTBI samples. To establish an effective approach with this intervention, it is essential to map out how components of metacognition relate to PPCS. This study endeavors to address this gap in the literature by providing an overview of metacognition and metacognitive therapy, as well as an overview of PPCS, its development, and its intervention methods so far. The study then examines how different components of metacognition relate to PPCS and if higher levels of maladaptive metacognitions are related to higher levels of PPCS. Furthermore, the results are discussed in comparison to earlier research findings. Finally, the study discusses the advantages, limitations, potential directions for future research, and possible clinical implications of the results.

Theoretical Background

Metacognitive Beliefs

Metacognition can be defined as "cognition about cognition" (Wells A., 2009. cited in Normann et al., 2014, p.402). It involves regulation and awareness of one´s current cognitive state, and the evaluation of the importance of thoughts and memories (Huntley & Fisher, 2016). Metacognitive beliefs are furthermore the beliefs of how metacognitive thoughts affect oneself. These beliefs further divide into two general types, negative and positive. Positive metacognitive beliefs often center around one's attempt to assert control over one´s symptoms. This could be beliefs such as "To identify the cause, I need to ruminate about my problems" or "If I think about this enough, I can reduce my symptoms". Negative metacognitive beliefs are however centered around themes such as uncontrollability,

rumination, and interpersonal consequences. This could be thoughts such as “If I continue ruminating, people will distance themselves from me” or “I can´t stop repeating my thoughts” (Hagen et al., 2017) . In multiple studies, negative metacognitive beliefs have shown a higher impact on mental illnesses than positive metacognitive beliefs (Huntley & Fisher, 2016; Jacobsen et al., 2020; Wells, 2013). This trend has also been seen in symptoms such as fatigue, pain intensity, pain catastrophizing, irritability, concentration, and memory deficit which are encompassed in PPCS (Fernie et al., 2019; Irak & Çapan, 2018; Jacobsen et al., 2016; Li et al., 2023; Love et al., 2018; Potter et al., 2016; Schütze et al., 2019, 2020; Ziadni et al., 2018). It has further been explained that negative metacognitive beliefs shift cognition from a potential asset to a subjective hazard, resulting in feelings of acute danger (Huntley & Fisher, 2016)

Metacognitive Therapy

In the context of metacognitive therapy (MCT), metacognitive beliefs play a pivotal role in the development and maintenance of psychological disorders where it contribute to maladaptive coping strategies (Wells, 2013). Grounded in models such as the metacognitive model of depression and the Self-Regulatory Executive Function (S-REF) model, MCT elucidates how biased metacognitions contribute to Cognitive Attentional Syndrome (CAS). This syndrome encompasses worry, rumination, heightened self-focused attention, and counterproductive coping strategies, all stemming from negative and positive metacognitive beliefs (Huntley & Fisher, 2016). The S-REF model posits that both positive and negative beliefs influence cognitive and behavioral patterns, contributing to maladaptive coping strategies and the persistence of psychological disorders. Metacognition guides attention toward information congruent with the disorder, adopts inappropriate goals, employs unhelpful coping strategies like worry or rumination, and utilizes coping mechanisms such as thought suppression (Wells, 2013).

Metacognitive therapy (MCT) has gained significant traction in recent years, offering a distinct approach compared to cognitive behavior therapy (CBT). Unlike CBT, which focuses on challenging the content of negative thoughts, MCT directs attention to the process of thoughts. It acknowledges negative thoughts as normal and transient, emphasizing the management and observation of these cognitive processes to mitigate worry and rumination (Normann et al., 2014).

MCT has demonstrated efficacy in treating anxiety and depression, surpassing waitlist control groups and CBT interventions (Hagen et al., 2017; Nordahl & Wells, 2018; Normann et al., 2014). Wells and Cartwright-Hatton (2004) further show that metacognitive beliefs can help differentiate patients with General Anxiety Disorder from other anxiety disorders and help predict symptoms such as pathological worry, test anxiety, and depression. There is however a lack of studies on how metacognitive beliefs can predict or affect PPCS.

Persistent Post-Concussion Symptoms

PPCS exhibit a complex nature, lacking consistent and predictable clustering. These symptoms are not exclusive to traumatic brain injury (TBI) and have been frequently observed in cases of whiplash injuries, post-traumatic stress disorder, and even among healthy adults and children (Popov et al., 2022; Rathbone et al., 2015).

The concept of PPCS has evolved over time, initially conceptualized as a syndrome with specific diagnostic criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and International Classification of Diseases (ICD-10) . DSM-IV defines it as post-concussional disorder, necessitating the presence of three or more symptoms persisting for at least three months. These symptoms include fatigue, disrupted sleep, headaches, vertigo or dizziness, irritability, anxiety or depression, changes in personality, and apathy or spontaneity (American Psychiatric Association, 1994, as cited in Rathbone et al., 2015). Conversely, ICD-10 defines it as a postconcussional syndrome (PCS), and also

requires a minimum of three symptoms but replaces the latter two with impairment of concentration and mental task performance, memory impairment, and intolerance to stress, emotional excitement, or alcohol abuse following head trauma (World Health Organization, 2009). However, because of the complexity of the symptoms and the non-specificity of the syndrome there has been a shift towards adopting the term persistent post-concussion symptoms (Popov et al., 2022).

While the majority of individuals with mTBI typically recover within 7-10 days, a notable percentage, ranging from 15-30%, go on to experience PPCS. Patients dealing with PPCS continue to grapple with symptoms even three months post-incident, leading to stress, disability, and hindrances in resuming full-time employment. Approximately 20% of those affected by PPCS struggle to return to full-time work within the first year (Popov et al., 2022; Ponsford et al., 2019). For individuals still grappling with PPCS after a year, there are reported impairments in life satisfaction and psychological well-being (Emanuelson et al., 2003)

Development of PPCS

There have been considerable disagreements and discussions around the factors contributing to the development of PPCS in some individuals but not in others (Polinder et al., 2018). Traditionally, the mechanism of PPCS was attributed to diffuse mechanical injury to the nerve cells, caused by shear stress and tissue deformation in head trauma (Rathbone et al., 2015). However, multiple studies have compared mTBI patients with controls lacking a history of head injury, revealing a high prevalence of similar symptoms in both groups. Additionally ,several studies have also highlighted a pronounced "good-old-days bias" in research on mTBI patients. This bias implies that participants tend to overestimate the actual degree of change post-head trauma and report fewer pre-injury symptoms than control groups, implying that psychological factors are highly relevant for the development of PPCS (Davis,

2002; Iverson & Lange, 2003; Lange et al., 2010).

The occurrence of PPCS in patients has been clearly linked to the biopsychosocial model (Polinder et al., 2018). Rather than being solely contingent on the severity of the brain injury, the occurrence of PPCS involves cognitive, emotional, behavioral, and social risk factors (Register-Mihalik et al., 2020). Strong predictors of post-concussive symptoms at the six-month mark include the number of years of education, pre-existing psychiatric disorders, neck pain, and prior traumatic brain injuries. Additionally, factors such as the patient's subjective perceptions of their brain injury, their behavioral responses, the utilization of passive and avoidant coping styles, and emotional distress in response to the injury contribute significantly to the presence of post-concussive symptoms (Plass et al., 2019). Looking at the somatic, emotional, and cognitive symptoms of PPCS, there are multiple studies on how these relate to metacognitive beliefs.

Somatic, Emotional, and Cognitive Symptoms in relation to Metacognitive Beliefs

The somatic part of PPCS refers to symptoms such as headaches, fatigue, tiredness, problems with sleep, and heightened sensitivity to light and noises (King et al., 1995). Faedda et al. (2017) show that metacognitive skills and various factors, such as depression, anxiety, and social interaction have a significant impact on treating headaches. Metacognitive beliefs have further been linked to a greater tendency towards pain catastrophizing, general emotional distress for people experiencing pain, worsened health anxiety, somatic complaints, somatization, and poor sleep quality, underscoring its relevance to the somatic part of PPCS (Carciofo, 2020; Hoffman et al., 2020; Yavuz et al., 2019; Ziadni et al., 2018).

When it comes to emotional PPCS, which encompasses irritability, depression, restlessness, and frustration (King et al., 1995), multiple associations have been found between these factors and metacognitive beliefs. Metacognitive beliefs have been linked to symptoms of depression, anxiety, and irritability in various samples (Fernie et al., 2019; Li et

al., 2023; Schütze et al., 2019). Negative metacognitive beliefs, positive metacognitive beliefs, cognitive confidence, and cognitive self-consciousness have also been able to predict depression in a sample of 1304 adults in the United Kingdom (Spada et al., 2008).

Furthermore, there has also been shown a link towards some of the cognitive parts of PPCS, which encompasses longer thinking time, problems with concentration, and memory deficits. Metacognitive beliefs have been linked to personal beliefs about memory, actual memory performance, and concentration (Irak & Çapan, 2018; Love et al., 2018). Irak and Capan (2018) showed that metacognitive beliefs about cognitive confidence predicted one´s personal beliefs about memory and actual memory performance. This was also found to be a significant predictor of actual recall performance.

All these findings indicate associations between metacognitive beliefs and all three domains of PPCS. This further indicates the high relevance of metacognitive beliefs for further PPCS interventions.

Interventions for PPCS

Evidence for good working interventions for PPCS is strongly needed. While there are indications that anti-depressants may help prevent depressive disorders post-TBI, further investigation is warranted due to the small sample size in the study (Jorge et al., 2016). There are also limited studies on non-pharmacological interventions. The effect of CBT on PPCS has shown to only be marginal, and focusing on problem orientation and problem-solving skills through telephone counseling has shown some improvement but is in need of more evidence (Bell et al., 2008; Polinder et al., 2018; Potter et al., 2016). Exploring the relationship between metacognitive beliefs and PPCS might conduct a further discussion on whether metacognitive therapy could account for a well-needed intervention.

Purpose of the Present Study

Due to the lack of interventions for PPCS, and its high impact on people's economic situation and health, there is a need for further investigation. Additionally, given the observed association between negative- and positive metacognitive beliefs and all three aspects of PPCS, it is crucial to examine whether and what types of metacognitive beliefs are associated with PPCS. This is to further explore the potential of metacognitive therapy as an effective treatment for PPCS. While prior research has examined the association between metacognitive beliefs and somatic, emotional, and cognitive deficits separately, no prior investigation has explored this relationship within PPCS samples. The present study employs the Metacognitive Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004) and the Rivermead Post-Concussion Questionnaire (RPQ; King et al., 1995) to explore how positive and negative metacognitive beliefs differ in their relationship to PPCS, and what the overall relationship between metacognitive beliefs and PPCS is.

H^1 : Positive and negative metacognitive beliefs are differently related to persistent post-concussion symptoms.

Prediction 1a: Negative metacognitive beliefs have a stronger association with somatic persistent post-concussion symptoms compared to positive metacognitive beliefs.

Prediction 1b: Negative metacognitive beliefs have a stronger association with emotional persistent post-concussion symptoms compared to positive metacognitive beliefs.

Prediction 1c: Negative metacognitive beliefs have a stronger association with cognitive persistent post-concussion symptoms compared to positive metacognitive beliefs.

H^2: Those with more metacognitive beliefs experience more persistent post-concussion symptoms.

Prediction 2a: Higher levels of metacognitive beliefs are related to higher levels of somatic persistent post-concussion symptoms.

Prediction 2b: Higher levels of metacognitive beliefs are related to higher levels of emotional persistent post-concussion symptoms.

Prediction 2c: Higher levels of metacognitive beliefs are related to higher levels of cognitive persistent post-concussion symptoms.

Method

Participants

A total of 17 participants with mTBI were recruited for this study. Diagnosis of mTBI was confirmed based on the World Health Organization (WHO) criteria, and PCS diagnosis was made by a doctor using the ICD-10. A total of 15 participants (88%) completed all the questionnaires utilized in the research, two persons were excluded after the in- and exclusion criteria were checked. 8 of the participants identified as female (53%) while 7 of the participants identified as male (47%). The age of the participants ranged from 19 to 56 years old, with the mean age being 38.87 years old (*SD* = 12.46).

The inclusion criteria were that the participants should be between 16 and 60 years old and have sustained a traumatic brain injury. Exclusion criterions encompassed non-fluency in the Norwegian language, non-residence in Norway, major trauma with a high risk of disability lasting more than 3 months, incidental intracranial findings in acute MRI indicating significant issues, severe psychiatric, neurological, or medical diseases, alcohol or drug abuse affecting adherence to the research protocol, intellectual disability, autism, or other severe developmental disorders. Additional exclusion criteria comprised prior complicated traumatic

brain injury, stroke, or other acquired brain injuries, progressive neurological disorders, advanced cancer, heart disease, respiratory disease, or other somatic diseases that interfere with function. Co-occurring psychiatric disorders necessitating referral to specific treatment according to existing guidelines also led to exclusion from the study.

Design and Procedure

This study employed surveys to address the research question. Purposive sampling techniques were utilized to recruit participants from a larger intervention study and an outpatient brain injury rehabilitation clinic at St. Olavs Hospital in Trondheim. The purposive sampling involved careful consideration of extensive participation criteria to ensure the inclusion of the specific sample. Specifically, participants were identified through the Trondheim mTBI follow-up study, and doctors identified potential candidates. Interested individuals were then provided with detailed information about the study. Subsequently, the inclusion and exclusion criteria were assessed, and upon meeting these criteria, participants provided informed consent. The purpose of the study was described to the participants as to explore the feasibility, acceptability, and effects of metacognitive therapy in patients experiencing prolonged post-concussive symptoms following mild traumatic brain injury

Commencing in March 2016 and concluding in December 2021, with an inclusion period from February 2015 to April 2019, the study consisted of three baseline assessments, each involving the completion of three to five questionnaires. A pre-intervention measure encompassed the completion of 14 questionnaires and six neuropsychological tests. Ten sessions of metacognitive therapy followed, with three questionnaires administered during this phase. Subsequently, post-intervention measures were taken, along with assessments at 10 weeks and six months after the last session. The questionnaires and neuropsychological tests administered post-intervention, 10 weeks after, and six months after mirrored those collected in the pre-intervention phase.

The bachelor project focused however on investigating the relationship between PPCS, metacognitive beliefs, psychological processes, and neuropsychological functioning. Because of that, only the data gathered during the pre-intervention phase were analyzed utilizing two specific questionnaires.

Ethics

The study received ethical approval from the Regional Committee for Medical Research Ethics Central Norway and was registered on ClinicalTrials.gov (NCT02690584) on 24/02/2016 (see appendix). Participants provided their consent by signing a written form. Adherence to the regulations outlined in the EU General Data Protection Regulation (GDPR) was ensured during the handling of collected data. The data collected during the study was stored in NICE-1, which is NTNU´s platform for storing shielded data.

Measurements

The questionnaires used in this study encompassed items related to various metacognitive beliefs and the severity of post-concussion symptoms.

Metacognitive Beliefs

Metacognitive beliefs were assessed using the short version of the Metacognitive Questionnaire (MCQ). MCQ was originally developed in 1997 by Cartwright-Hatton and Wells, while the short version MCQ-30 was further refined in 2004 (Cartwright-Hatton & Wells, 1997, 2004). Comprising 30 items, the MCQ-30 measures five factors of metacognitive beliefs, including cognitive confidence, positive beliefs about worry, cognitive self-consciousness, negative beliefs about the uncontrollability and danger of worry, and the need to control thoughts. The subscales examined in this thesis were positive beliefs about worry and negative beliefs about the uncontrollability and danger of worry. Participants responded to each question on a 4-point Likert scale, ranging from 1 ("Do not agree") to 4 ("Agree very much"). A higher score indicates higher levels of metacognitive beliefs.

Persistent Post-Concussion Symptoms

PPCS were measured using the RPQ. The RPQ was initially designed to assess symptom severity following TBI (King et al., 1995). It comprises 16 questions covering post-concussion symptoms such as headaches, nausea, sleep disturbance, frustration, and poor concentration. These symptoms are further categorized into three factors: emotional, cognitive, and somatic. Respondents rated each item on a 5-point Likert scale, comparing the symptoms before and after the accident. A score of 0 indicated no experience of the symptom before or after the accident, 1 indicated that the symptom was not more problematic now than before the accident, and 5 indicated that the symptom was a severe problem now

Statistical Analysis

Descriptive statistics including mean, standard deviation, range, and frequency were computed for the sampled data. Missing items of the MCQ-30 were substituted with the group mean on the item, to ensure that the questionnaire remained representative. Reliability analysis was also conducted for MCQ-30 total score, MCQ-30 Negative Beliefs about the uncontrollability and danger of worry, MCQ-30 Positive beliefs about worry, RPQ Total Score, RPQ Somatic Symptoms, RPQ Emotional Symptoms, and RPQ Cognitive Symptoms.

To assess the strength of the relationship between negative and positive metacognitive beliefs regarding post-concussion symptoms, Spearman's rank-order (Spearman's Rho) correlations were conducted between RPQ Cognitive Symptoms, RPQ Emotional Symptoms, RPQ Somatic Symptoms, MCQ-30 Negative Beliefs about the uncontrollability and danger of worry and MCQ-30 Positive Beliefs about worry. Spearman's Rho was chosen due to non-normal distribution and the presence of outliers in the variables. The normality of the residuals was checked using the Shapiro-Wilks test while outliers and linearity were checked using scatterplots. Homoscedasticity was further checked using Levene´s test.

Furthermore, to investigate potential differences in the level of symptoms experienced

based on participant´s scores on metacognitive belief, an Analysis of Variance (ANOVA) was performed. The independent variable was the MCQ-30 Total score, categorized into three groups based on whether participants scored in the lower third, in the middle, or the higher third of the sample. The dependent variables were RPQ Cognitive Symptoms, RPQ Emotional Symptoms, and RPQ Somatic Symptoms. The requirement for equal variance was not fulfilled, and therefore the Welch F-ratio was reported. This was checked using Levene´s test, while normality was checked using the Shapiro-Wilk test. Because of the lack of significant results, no post-hoc test was conducted.

Because of the small sample size and the violations of assumptions for the one-way ANOVA, a Kruskal-Wallis test was also conducted to explore differences in RPQ Somatic Symptoms, RPQ Emotional Symptoms, and RPQ Cognitive symptoms for those scoring in the lower third, in the middle and the higher third of the MCQ-30.

Post hoc power analyses were conducted for the correlation and ANOVA analysis, using G*Power. To calculate the effect sizes for ANOVA, $\eta 2$ was converted to Cohen´s f.

The Spearsman´s Rho correlation, ANOVA, and Kruskal Wallis test were performed using IBM SPSS Statistics version 27.

Results

Participants

The demographic and injury information of the participants are presented in Table 1. The psychometric properties of MCQ-30 and RPQ for the sample are presented in Table 2.

Table 1

Demographic characteristics and injury information of the participants

Demographic variables and injury information	*n*	%
Marital status		
Married	8	53.3
Partner	2	13.3
Living together	3	20
Living alone	2	13.3
Years of education		
12	1	6.7
13	1	6.7
16	3	20
17	2	13.3
18	4	26.7
19	1	6.7
Missing	3	20
Employment		
Working/studying full time	6	40
Full sick leave	2	13.3
Working/studying reduced hours	5	33.3
Missing	2	13.3
Reason of injury		
Traffic accident	6	40
Fall from own height	3	20
Fall from two to five meter	3	20
Collision with glass wall	1	6.7
Sport accident	2	13.3
MRI scan		
Traumatic injury grade 1	1	6.7
Normal	7	46.7
Not performed	5	33.3
Unknown	2	13.3
CT scan		
Subfacial fracture	1	6.7
Normal	8	53.3
Not performed	3	20
Unknown	3	20

Note. $N = 15$.

Table 2

Psychometric Properties for MCQ-30 and RPQ, Scales and Subscales

Scale	M	SD	Range	Cronbach's α
Metacognitive beliefs total score	54.2	15.3	35–89	.92
Negative Beliefs	11.3	4.4	6–20	.83
Positive Beliefs	8.3	2.8	6–15	.83
Post-Concussion Symptoms total score	27.6	10.6	11–50	.84
Somatic Symptoms	14.6	6.8	4–26	.77
Emotional Symptoms	5.9	3.2	0–12	.76
Cognitive Symptoms	7.1	3.3	2–12	.75

Note. N = 15. MCQ-30 = Metacognitive Questionnaire. RPQ = Rivermead Post Concussion Questionnaire. The MCQ-30 had five subscales of which two were used. The Rivermead Post-Concussion Questionnaire had three subscales.

Correlation Analysis

Table 3

Spearsman´s Rho for negative metacognitive beliefs, positive metacognitive beliefs and RPQ subscores on PPCS

Variable	1	2	3	4	5
1. Positive beliefs	—				
2. Negative beliefs	.64*	—			
3. Emotional symptoms	.42	.22	—		
4. Somatic symptoms	.03	.34	.15	—	
5. Cognitive symptoms	.03	.27	.19	.74**	—

Note: N = 15. RPQ = Rivermead Post Concussion Questionnaire. PPCS = Persistent Post Concussion Symptoms

** $p < .01$, * $p < .05$.

A bivariate Spearsman´s Rho correlation analysis was conducted to investigate the relationship between positive metacognitive beliefs, negative metacognitive beliefs, emotional PPCS, somatic PPCS, and cognitive PPCS. The correlation coefficients between the variables are presented in Table 3.

The results revealed a significant positive correlation between positive metacognitive beliefs and negative metacognitive beliefs, $r(15) = .64$, $p < .05$ and between cognitive PPCS and somatic PPCS, $r(15) = .74$, $p < .01$. However, no significant correlation was observed between positive metacognitive beliefs and emotional PPCS, $r(15) = .42$, $p = .119$, somatic PPCS, $r(15) = .03$, $p = .914$ or cognitive PPCS, $r(15) = .03$, $p = .913$. Similarly, there was no significant correlation between negative metacognitive beliefs and emotional PPCS, $r(15) = .22$, $p = .442$, somatic PPCS, $r(15) = .34$, $p = .22$ or cognitive PPCS, $r(15) = .27$, $p = .337$. Furthermore, there was no significant correlation between somatic PPCS and emotional PPCS, $r(15) = .15$, $p = .590$.

ANOVA

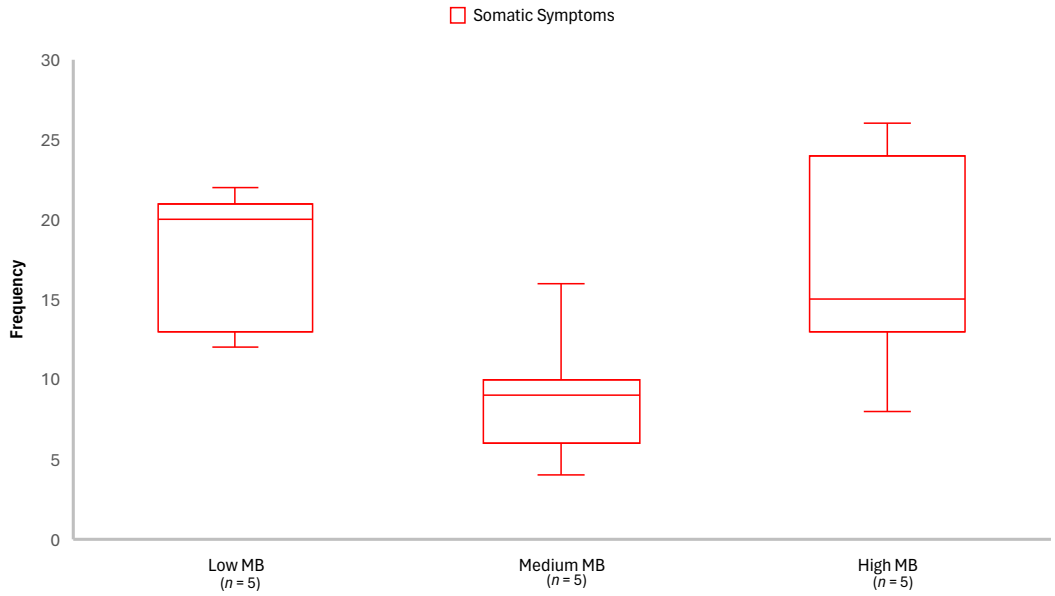
The requirements for equal variance were not fulfilled, and because of that, the Welch F-ratio is reported. A one-way ANOVA showed that there were no significant differences between those who experienced high, medium, or low metacognitive beliefs regarding experienced cognitive PPCS, $F(2,7.76) = 0.27$, $p = .769$, emotional PPCS, $F(2,7.85) = 0.65$, $p = .550$, or somatic symptoms PPCS, $F(2,7.73) = 4.48$, $p = .051$.

Kruskal-Wallis Test

The Kruskal-Wallis test showed no significant differences in somatic PPCS, $H(2) = 4.87$, $p = .087$ between those scoring low, medium, and high on metacognitive beliefs (see Figure 2). This was also shown for emotional PPCS, $H(2) = 0.77$, $p = .679$ (see figure 3), and cognitive PPCS, $H(2) = 0.76$, $p = .686$ (see figure 4).

Figure 2

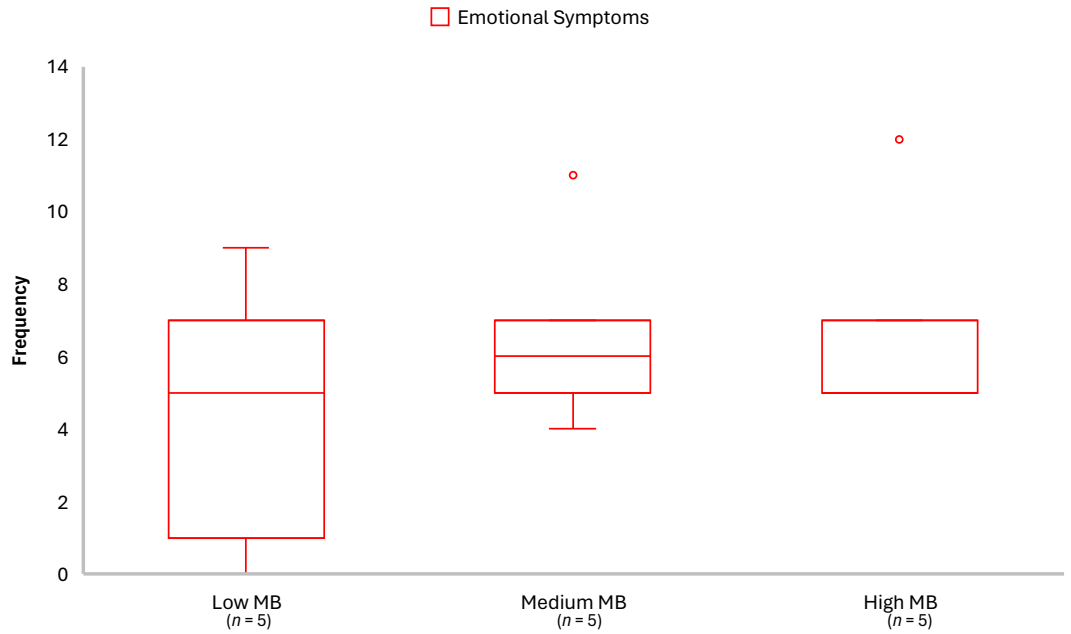
Kruskal-Wallis test results on somatic persistent post-concussion symptoms



Note. N = 15. MB = Metacognitive Beliefs. The figure demonstrates that there is no significant difference in somatic persistent post-concussion symptoms between those scoring low on MB, medium on MB, or high on MB. No outliers were found in any groups. Low MB had a mean of 9.90 in somatic persistent post-concussion symptoms. Medium MB had a mean of 4.40 in somatic persistent post-concussion symptoms. High MB had a mean of 9.70 in somatic persistent post-concussion symptoms.

Figure 3

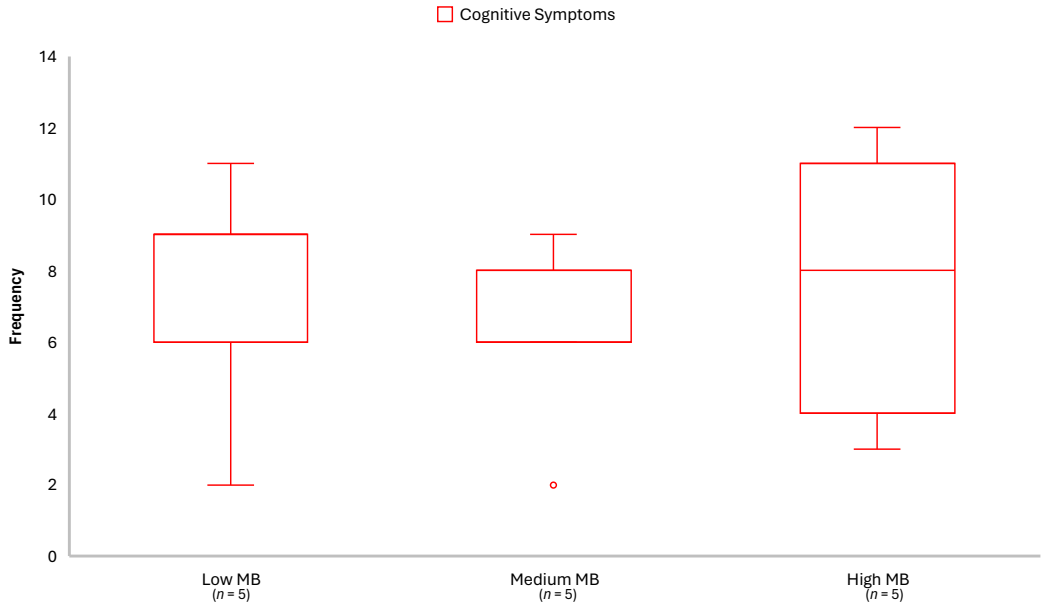
Kruskal-Wallis test results on emotional persistent post-concussion symptoms



Note. $N = 15$. MB = Metacognitive Beliefs. The figure demonstrates that there is no significant difference in emotional persistent post-concussion symptoms between those scoring low on MB, medium on MB, or high on MB. Medium MB had one outlier. High MB had one outlier. Low MB had a mean of 6.60 in emotional persistent post-concussion symptoms. Medium MB had a mean of 8.60 in emotional persistent post-concussion symptoms. High MB had a mean of 8.80 in emotional post-concussion symptoms.

Figure 4

Kruskal-Wallis test results on cognitive persistent post-concussion symptoms



Note. $N = 15$. MB = Metacognitive Beliefs. The figure demonstrates that there is no significant difference in cognitive persistent post-concussion symptoms between those scoring low on MB, medium on MB, or high on MB. Medium MB had one outlier. Low MB had a mean of 8.60 in cognitive persistent post-concussion symptoms. Medium MB had a mean of 6.60 in cognitive persistent post-concussion symptoms. High MB had a mean of 8.80 in cognitive persistent post-concussion symptoms.

Post-hoc Power Analysis

Post-hoc power analysis was conducted for the Spearman's Rho correlation analysis with an alpha of .05, a sample size of $N = 15$, and an effect size of $r = .27$ as shown for negative metacognitive beliefs and cognitive symptoms of PPCS. The post-hoc power analysis revealed a statistical power of $\beta = .17$. Counting for an effect size of $r = .42$ instead, as shown for positive metacognitive beliefs and emotional symptoms of PPCS, the post-hoc power analysis revealed a statistical power of $\beta = .38$. Furthermore, counting for the effect

size of somatic symptoms of PPCS and negative metacognitive beliefs (r = .34), the post hoc power analysis revealed a statistical power of β = .25.

Post-hoc power analysis was also conducted for the ANOVA analysis. The alpha was set to .05, a sample size of N = 15 divided into three groups (n = 5 for each group) and an effect size of f = .20 as shown for cognitive PPCS. The post hoc power analysis showed a statistical power of β = .09. When counting for an effect size as shown for emotional PPCS (f = .38), the post hoc power analysis showed a statistical power of β = .20. Furthermore, counting for an effect size of f = .76, as seen in somatic PPCS, the post hoc power analysis showed a statistical power of β = .64.

Discussion

This study aimed to investigate the relationship between metacognitive beliefs and PPCS. Specifically, it aimed to explore whether differences exist between individuals with more negative versus positive metacognitive beliefs regarding PPCS and if people with higher levels of metacognitive beliefs experience more PPCS. This investigation aimed to contribute to the literature about the potential effectiveness of metacognitive therapy as a treatment for PPCS and identify which types of metacognitive beliefs might be most relevant.

The results from the current study did not indicate any significant relationship between either negative or positive metacognitive beliefs and emotional, somatic, or cognitive PPCS. There was not found any significant difference between those scoring low, medium, or high on metacognitive beliefs regarding emotional, cognitive, or somatic PPCS either. The results also indicated that none of the analyses had acceptable power for detecting an effect. However, the results did indicate interesting patterns that could be further researched with a bigger sample size.

Somatic Symptoms and Metacognitive Beliefs

The first hypothesis assumed that positive and negative metacognitive beliefs are differently related to persistent post-concussion, with prediction 1a stating that negative metacognitive beliefs have a stronger association with somatic PPCS compared to positive metacognitive beliefs. This prediction was not supported. The results indicated a stronger association between negative metacognitive beliefs and somatic PPCS than with positive metacognitive beliefs as expected. However, this finding was not significant.

The second hypothesis assumed that those with more metacognitive beliefs experience more persistent post-concussion symptoms, with prediction 2a stating that higher levels of metacognitive beliefs are related to higher levels of somatic persistent post-concussion symptoms. This prediction was not supported. The results indicated borderline significant results (p = .051), showing surprisingly that the group scoring medium on metacognitive beliefs was also the group scoring lowest on somatic PPCS. The group with low metacognitive beliefs was the group scoring highest on somatic PPCS, which is contradictory to the hypothesis and prediction. It is important to note the low power to detect genuine effects suggests caution in interpreting these findings.

The results from the first hypothesis and prediction 1a showed the same pattern as earlier research while results from the second hypothesis, and prediction 2a were contradictory to earlier research, however none of the results were significant. Even though there is a lack of studies regarding metacognitive beliefs' relationship with somatic symptoms in mTBI patients, there are multiple studies that have researched the relationship between somatic problems and metacognitive beliefs. For instance, Schütze et al. (2019, 2020) have focused on pain-related metacognitive beliefs and revealed significant weak to moderate positive correlations with pain. These results indicated that both negative and positive metacognitive beliefs, and metacognitive beliefs in general had positive significant

association with pain intensity, pain interference (how much pain interferes with daily life), pain catastrophizing (thoughts about how pain will lead to the worst possible consequences) and pain intrusion (experience of pain interrupting or intruding with activities, cognition, and emotional states). Schütze et al. further showed that these variables had a stronger positive correlation to negative pain metacognitions compared to positive pain metacognitions. Further, a study by Zialdini et al. (2018) researched three of the subscales for metacognitive beliefs in relationship to daily pain intensity and pain catastrophizing. This study showed a weak positive association between negative metacognitive beliefs and the need to control thoughts regarding pain intensity, and a medium-strong relationship regarding pain catastrophizing.

Fernie et al (2019) studied samples with chronic fatigue syndrome and widespread musculoskeletal pain, also known as fibromyalgia. They demonstrated significant weak positive association between positive metacognitive beliefs and fatigue, as well as moderate positive association between negative metacognitive beliefs and fatigue. There was also a strong significant association between lack of cognitive confidence and fatigue. The same study showed a weak significant positive relationship between fibromyalgia, and positive metacognitive beliefs. There was a strong positive relationship between negative metacognitive beliefs and fibromyalgia, and moderate to strong positive correlations to the other subscales of metacognitive beliefs. Multiple subscales of metacognitive beliefs have also been related to sleep quality (Carciofo, 2020).

In summary, the pattern of the correlations was in line with the findings from existing literature, indicating that negative metacognitive beliefs have a stronger association with somatic symptoms such as fibromyalgia, fatigue, and further aspects of pain. Even though there was no significant correlation in this study, it indicates a variance between the metacognitive beliefs that could be further investigated in larger samples. The results were

contradictory to earlier research when looking at the second hypothesis, where those scoring low on metacognitive beliefs experienced most somatic PPCS, but not significantly. Looking at earlier research, multiple subscales of metacognitive beliefs have been positively correlated with somatic symptoms such as sleep quality, fatigue, and aspects of pain (Carciofo, 2020; Fernie et al., 2019; Schütze et al., 2019, 2020; Ziadni et al., 2018). It is however important to note the variability in the strength of the correlations across different studies. This variability may stem from differences in the questionnaires utilized, sample characteristics, and the specific somatic symptoms analyzed. Importantly, while the previous studies mentioned involve the somatic symptoms seen in persistent post-concussion, they do not involve them in one variable together. This could also explain the lack of significant results and the contradictory findings.

Emotional Symptoms and Metacognitive Beliefs

Prediction 1b assumed that negative metacognitive beliefs have a stronger association with emotional PPCS compared to positive metacognitive beliefs. This prediction was not supported by the results. There was surprisingly, a stronger non-significant correlation between positive metacognitive beliefs and emotional PPCS compared to negative metacognitive beliefs. Prediction 2b assumed that higher levels of metacognitive beliefs are related to higher levels of emotional persistent post-concussion symptoms. This prediction was not supported either. There was a non-significant slight increase in emotional PPCS among those with medium to high levels of metacognitive beliefs compared to those with low metacognitive beliefs.

As for somatic PPCS, there is a lack of studies regarding the relationship between metacognitive beliefs and emotional PPCS. However, looking at earlier research regarding the items that the emotional PPCS variable includes and their relationship to metacognitive beliefs, the lack of significant results and the different relationships with positive and negative

metacognitive beliefs are surprising. It has been shown that both positive and negative pain-related metacognitions have a positive significant relationship with depression and anxiety. Positive pain-metacognitions showed a weak association, while negative pain-metacognitions showed a moderate association (Schütze et al., 2019). Additionally, although anxiety is not directly a part of the items that emotional PPCS incorporates, it does relate to restlessness which is a part of the symptoms (World Health Organization, 2019). The same study by Shütze et al (2019) showed a significantly weak positive relationship between anxiety and positive pain metacognitions, and a moderate positive relationship to negative pain metacognitions. Anxiety and depression have further been shown to have a low to medium positive significant associations with positive metacognitive beliefs in samples with chronic fatigue, fibromyalgia and diabetes, and a medium to high positive associations with negative metacognitive beliefs (Fernie et al., 2019). Furthermore, research has also indicated that there is a significant positive moderate correlation between irritability and positive metacognitive beliefs, and a strong positive correlation to negative metacognitive beliefs in Chinese adolescent (Li et al., 2023). MCT has also been shown to be superior compared to CBT when looking at depression and anxiety, and more effective than psycho-education when it comes to lowering frustration for people with recent onset psychosis (Ochoa et al., 2017; Wells, 2013).

Contrary to the findings of this research, previous studies have consistently shown stronger correlations between negative metacognitive beliefs and the components of emotional PPCS compared to positive metacognitive beliefs. The lack of statistical power might account for this contradiction to earlier literature and the lack of significant results.

Cognitive Symptoms and Metacognitive Beliefs

Prediction 1c assumed that negative metacognitive beliefs have a stronger association with cognitive PPCS compared to positive metacognitive beliefs. The results did not support the prediction. There was a stronger association between cognitive PPCS and negative

metacognitive beliefs compared to positive metacognitive beliefs, but this finding was not significant. Prediction 2c further assumed that higher levels of metacognitive beliefs were related to higher levels of cognitive PPCS. This prediction was not supported either. Despite not being significant, we found that those scoring medium on metacognitive beliefs had the lowest mean of cognitive PPCS and those scoring highest on metacognitive beliefs scored the highest on cognitive PPCS. The analysis for cognitive PPCS had the lowest statistical power compared to the analysis made for emotional- and somatic PPCS.

As for the other types of symptoms, there is a lack of research on how metacognitive beliefs and cognitive PPCS relate to each other in mTBI patients. Earlier studies have seen significant associations between metacognitive beliefs and memory impairment in chronic fatigue sample, concentration for triathletes and seen as a predictor for both beliefs about memory and memory performance (Irak & Çapan, 2018; Jacobsen et al., 2016; Love et al., 2018). However, there has not been reported as big of a difference between effect sizes for positive and negative metacognitive beliefs regarding the individual cognitive symptoms involved in PPCS, compared to the symptoms for emotional and somatic PPCS. Negative and positive metacognitive beliefs reported the same effect size for concentration in triathletes while weak positive significant associations have been found for negative metacognitive beliefs- and not positive metacognitive beliefs regarding neuropsychological test for shifting attention and working memory task (Kraft et al., 2017; Love et al., 2018). However, memory impairment and memory performance have been more strongly associated with other subscales of metacognitive beliefs than positive and negative metacognitive beliefs (Irak & Çapan, 2018). Further, there has been reported a significant medium positive association

between negative metacognitive beliefs and subjective cognitive failure, with items related to everyday slips or errors in perception, memory, and motor functions. This was not found with positive metacognitive beliefs. However, it is important to note that elderly participants reported less subjective cognitive failure, even though they experienced more objective cognitive failure (Mecacci & Righi, 2006).

The findings of this study indicated slim to none, non-significant association with positive metacognitive beliefs and cognitive PPCS, and a weak non-significant association with negative metacognitive beliefs. This is not surprising based on earlier research, where multiple studies have reported non-significant relationship between positive metacognitive beliefs and aspects of cognitive PPCS. However, contradictory to earlier research we were not able to find any significant group differences regarding levels of metacognitive beliefs and grade of cognitive PPCS. This was surprising since earlier research has seen associations with higher scores on multiple subscales of metacognitive beliefs and deficits in attention, memory capacity, concentration, and subjective cognitive function (Irak & Çapan, 2018; Jacobsen et al., 2016; Kraft et al., 2017; Love et al., 2018).

We did find an interesting pattern for the group differences. Even though no differences were significant, both somatic and cognitive PPCS showed that those scoring medium on metacognitive beliefs experienced the least symptoms. This pattern has not been observed in earlier research regarding somatic symptoms or cognitive symptoms. If further research observes the same pattern, one might argue that people with medium levels of metacognitive beliefs might engage in monitoring their thoughts and experiences to some extent. This allows them to acknowledge cognitive and somatic symptoms, but not to the degree where it becomes overwhelming. It might also indicate a possible cognitive flexibility, where a balanced perspective leads to avoiding excessive worry and rumination, but still not dismissing their cognitive experience. Cognitive flexibility has in multiple studies indicated to

moderate people's psychological well-being when being exposed to traumatic experiences (Fu & Chow, 2017; Joseph & Gray, 2011; Palm & Follette, 2011). With regards to previous research indicating that people with mTBI often overestimate the change of symptoms post-trauma, this type of cognitive flexibility might protect from the psychological distress that follows the traumatic experience, which makes people report higher symptoms compared to control groups (Lange et al., 2010).

Advantages

There are several advantages within this study. First, there were quite strict inclusion and exclusion criteria, which made the validity of the research greater. To exclude participants with severe psychiatric, neurological, or medical diseases lowers the risk for strong confounding variables. Furthermore, there was almost equal representation between men and women in this sample which enhances the generalizability of the study and minimizes the risk for gender biases (Verdonk et al., 2009). The two questionnaires used in this research, both measuring PPCS and metacognitive beliefs are standardized instruments with good reliability and validity in this sample and in earlier research (Wells & Cartwright-Hatton, 2004; Zeldovich et al., 2022). This also makes it easier to replicate the study for further research.

There is a big existing gap in the literature about metacognitive beliefs in mTBI patients and no existing literature about the relationship between metacognitive beliefs and PPCS. While the study is based on previous comparable research, it involves a new clinical group that is in need of development and adjustment of interventions. This study gives guidelines and highlights the importance of studying the phenomenon further with a larger sample. Because of the high reliability and validity of the instruments used, and the low economic cost of using surveys compared to other research methods, this research gives a base for larger studies to build upon (Roopa & Rani, 2012). Furthermore, using subscales of PPCS, and not the total score acknowledges the variability and heterogeneity inherent in the

PPCS experience (Polinder et al., 2018).

The use of both ANOVA and Kruskal-Wallis tests to explore the second hypothesis provide guidelines for further research, gives a more comprehensive understanding, and allow us to cross-validate the results. The ANOVA provides guidelines for efficient comparisons between multiple groups while still controlling for type-I error, while the Kruskal-Wallis tests gives more robust results when assumptions of normality, homogeneity of variance, and outlier-free data are violated (Field, 2018).

Furthermore, the post-hoc power analysis gives insight into the study design, making it clear on the stability of the results and easier to identify limitations of interpretation in the study. Furthermore, the analysis gives guidelines for future studies about sample size and effect size estimation in regard to consideration for the threshold for statistical power.

Limitations & Further Studies

The biggest limitation of this research is the small sample size (N=15), amplifying the likelihood of a type II error. There were not found any relevant significant results in the study, and no evidence for the null hypothesis to be rejected. However, this should not stop further studies to research the concepts. The heightened risk for type II error in this study emphasizes the necessity for a larger sample size to enhance statistical power. With increased participants, studies can offer more precise estimations of population characteristics, reducing sampling error and advancing our understanding of the subject (Field, 2018). None of the analyses had acceptable power for detecting an effect which further suggests caution in interpreting the findings from this study.

Furthermore, this study was based on a larger intervention study that involved three baseline assessments, one pre-intervention measure, ten sessions of metacognitive therapy, post-intervention measures, and an assessment at 10 weeks and six months post-intervention after the last session. In all, the larger intervention study was time-consuming and relied on

the fact that the participants agreed to undergo metacognitive therapy, which might be a factor for the small sample size. It may also reflect a bad generalization for the population, where only those open for metacognitive therapy are measured. Adding to the time-consuming variable, the participants completed up to 14 questionnaires and took six neuropsychological tests. However, not all questionnaires and tests were relevant and could be used in this research and some of the questionnaires had missing responses from the participants. Further research should conduct studies that are not as time-consuming and dividing as this.

It should also be acknowledged that the “good-old-days” bias has a probability of affecting the results in this study. The "good-old-days" bias, where individuals perceive themselves as healthier in the past, could influence the results of this study (Lange et al., 2010). The questionnaire used, asks participants to compare symptom severity before and after the accident, potentially leading to an underestimation of past symptoms. This bias has been observed in mTBI samples, where individuals recall fewer pre-injury symptoms than typical for healthy adults (Davis, 2002). Negative events may exacerbate this bias due to negative expectations. Given the nonspecific nature of PPCS, any negative event might lead to increased reporting of current symptoms and fewer reported past symptoms. Combining this bias with expectations of post-mTBI symptoms could strongly impact symptom reporting (Gunstad & Suhr, 2001, 2004). Using a questionnaire like the British Columbia Post Concussion Symptom Inventory (BC-PSI), which measures symptom intensity and frequency, may provide a more accurate assessment. Comparing results with control groups could help to further understand the bias's effect. However, this is a risk and something to consider since all of the data was collected using subjective self-report measures.

Further studies should also employ Multivariate analysis of variance (MANOVA) instead of doing multiple ANOVAs when having multiple dependent variables. Doing multiple ANOVAs instead of one MANOVA facilitates a type-I error (Field, 2018). Because

of the limited small sample size, it was not possible to do a MANOVA without violating the assumptions and therefore multiple ANOVAs were still used. The independent variable of the ANOVA, the three groups on metacognitive beliefs was also divided based on the sample score. However, further research should use cut-off scores for the groups that mirror what low, medium, and high metacognitive scores are in the population norm and not just what they are in the sample. This was not possible to conduct in this research because of the lack of participants. Furthermore, previous research has demonstrated substantial variation in the effect sizes of the subscales for metacognitive beliefs. Utilizing all the subscales of the MCQ-30, and not dividing the total score into three groups could offer deeper insight into the specific metacognitive processes underlying PPCS.

Even though the measurement for emotional, somatic and cognitive PPCS had acceptable internal consistency, having items such as irritability, restlessness, depression and frustration in one variable might also account for the contradictions to earlier research. There might be a bigger difference between positive and negative metacognitive beliefs in regard to depression and restlessness compared to frustration and irritability. Further studies might consider seeing the relationship between all independent items of PPCS and metacognitive beliefs, because of the variation in effect sizes between studies that were mentioned earlier. This could further help with individualizing MCT.

Further research should also investigate the relationship between cognitive flexibility and metacognitive beliefs, where the pattern of our non-significant analysis showed lower somatic and cognitive PPCS for those scoring medium on metacognitive beliefs. This, is to further investigate if having too little metacognitive beliefs contributes to a vulnerability for developing somatic or cognitive symptoms.

Clinical Implications

Even though there were not found any significant associations in this study, the

analysis shows big differences in effect sizes between positive metacognitive beliefs and negative metacognitive beliefs in regard to somatic, emotional, and cognitive PPCS. This needs to be further studied with a larger mTBI sample.

Because MCT works from the S-REF model, it encompasses worry, rumination, and counterproductive coping strategies based on negative and positive metacognitive beliefs (Huntley & Fisher, 2016). MCT then focuses on observing and managing these thoughts (Normann et al., 2014). If further studies see the same trend as in this research, MCT would be more effecting on focusing on negative metacognitive beliefs for patients mainly experiencing certain domains of symptoms. Namely, our findings indicate that there is a big difference regarding the association between negative and positive metacognitive beliefs and PPCS, where positive metacognitive beliefs and both somatic and cognitive PPCS have nearly no correlation. Therefore, should the focus mainly lie on negative metacognitive beliefs when treating these kinds of symptoms. No analysis was significant, however, it showed the same trend where there are differences in associations based on what kinds of symptoms are experienced. This might contribute to the fact that few studies have seen a good effect on intervention for PPCS. Because of the wide variation and complexity of the symptoms, it might be more effective to investigate what kind of symptoms the participant is struggling with (e.g. cognitive PPCS, emotional PPCS, or somatic PPCS) and then adjust the intervention. This involves acknowledging whether metacognitive therapy is an appropriate method and if so, what metacognitive therapy should focus on (e.g. negative or positive metacognitive beliefs). Because of the variation, the same intervention might not be as effective for someone experiencing mostly emotional symptoms, as for one experiencing mostly somatic symptoms. This has been seen in other intervention methods for PPCS, where tele counseling has been most efficient for somatic PPCS, and least for emotional PPCS (Bell et al., 2008). However, there is a lack of studies that compare the difference in pre- and post-

interventions between the different types of PPCS, and only look at the general difference for PPCS. This might also account for the lack of significant medium to high effect sizes for non-pharmacological intervention in PPCS, where it might be differences in effect sizes for emotional, somatic, and cognitive PPCS.

Modulating the intervention based on the difference in symptoms within the disorder has been seen as a better strategy, with a steeper reduction of symptoms pre to post-treatment in both depression and anxiety in youths than standardized interventions (Weisz, 2012). Based on the differences in effect sizes, earlier research, and the benefits for other symptoms when going away from the "one size fits all" approach, this might be a key factor for conducting an effectful intervention method for a complex phenomenon such as PPCS.

Conclusion

This study was conducted to elevate the knowledge of the association between metacognitive beliefs and PPCS. Results from the study did not display any associations between positive and negative metacognitive beliefs regarding emotional, somatic, or cognitive PPCS. The results did not find any significant difference between those scoring low medium or high on metacognitive beliefs regarding the different PPCS. As discussed, this could be because of the limited sample and the fact that none of the analyses held up to the threshold for acceptable statistical power. Further research should prioritize larger sample sizes, easier sampling methods, and the inclusion of control groups to uncover the relationship between metacognitive beliefs and PPCS. Understanding this relationship could pave the way for individualizing MCT, potentially offering greater efficacy in addressing PPCS compared to current non-pharmacological interventions, which have shown limited effectiveness thus far.

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Appendix

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	E-post:	Telefon:	Vår dato:	Vår referanse:
REK midt	Ramunas Kazakauskas	rek-midt@mh.ntnu.no	73597510	06.02.2024	11580

Alexander Olsen

Prosjektsøknad: Psykologisk behandling for pasienter med vedvarende plager etter lette hodeskader (mild TBI)
Søknadsnummer: 2015/1456
Forskningsansvarlig institusjon: Norges teknisk-naturvitenskapelige universitet
Samarbeidende forskningsansvarlige institusjoner: Norges teknisk-naturvitenskapelige universitet

Prosjektsøknad: Endring godkjennes

Søkers beskrivelse

Traumatisk hjerneskade er en av de vanligste årsakene til morbiditet blant unge voksne. Hvert år legges ca. 4000 personer med TBI inn i norske sykehus, og ca. 80% av alle hodeskader klassifiseres som lette. De fleste pasienter med lette hodeskader gjenvinner sin funksjon innen 3 mnd. En undergruppe utvikler langvarige plager, noe som betegnes som post commotio syndrom (PCS). Det finnes ingen evidensbaserte bahandlingsmetoder for slike plager. Vårt nye prosjekt bygger på en pågående kohortstudie hvor pasienter med lette hodeskader følges tett og går gjennom en omfattende kartlegging det første året etter skaden. De som utvikler vedvarende plager som varer over 12 mnd. vil i vår nye studie bli invitert til å være deltakere i et åpent behandlingsstudie hvor vi skal undersøke effekten en psykologisk behandlingsmetode (metakognitiv terapi). Studien er den første i sitt slag i Norge, og vil kunne danne grunnlag for større framtidige intervensjonsstudier.

Vi mottok din søknad om prosjektendring 02.02.2024. Søknaden er behandlet av sekretariat for REK midt på delegert fullmakt fra komiteen, med hjemmel i forskningsetikkforskriften § 7, første ledd, tredje punktum. Søknaden er vurdert med hjemmel i helseforskningsloven § 11.

REKs vurdering
Du søker om å legge til en ny medarbeider i prosjektet.

Vi har ingen innvendinger til dette.

Vedtak
Godkjent.

Sluttmelding

Prosjektleder skal sende sluttmelding til REK på eget skjema via REK-portalen senest 6 måneder etter sluttdato 01.10.2027, jf. helseforskningsloven § 12. Dersom prosjektet ikke starter opp eller gjennomføres meldes dette også via skjemaet for sluttmelding.

Søknad om endring
Dersom man ønsker å foreta vesentlige endringer i formål, metode, tidsløp eller organisering må prosjektleder sende søknad om endring via portalen på eget skjema til REK, jf. helseforskningsloven § 11.

Klageadgang
Du kan klage på REKs vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes på eget skjema via REK portalen. Klagefristen er tre uker fra du mottar dette brevet. Dersom REK opprettholder vedtaket, sender REK klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering, jf. forskningsetikkloven § 10 og helseforskningsloven § 10.

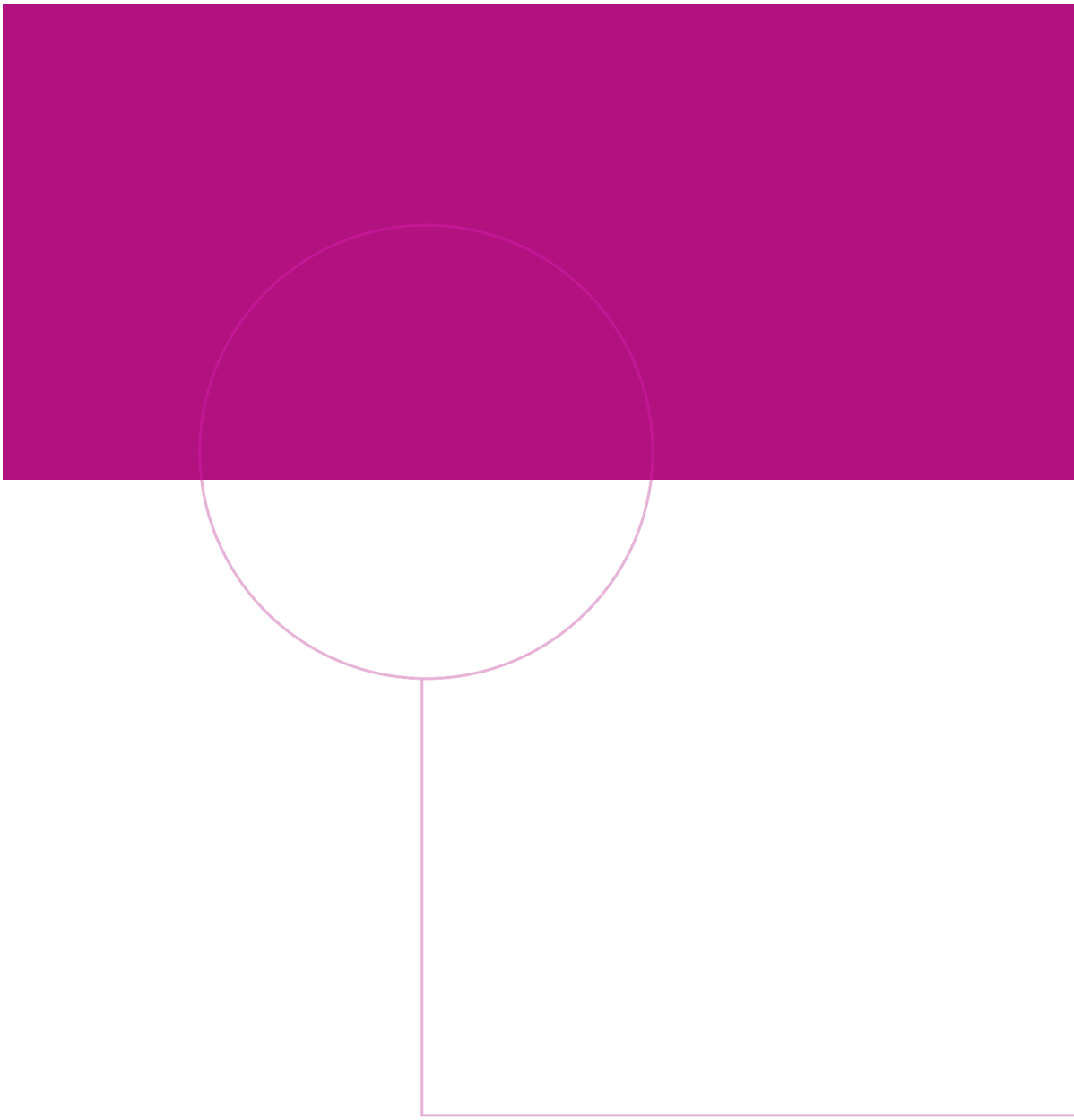
Med vennlig hilsen

Hilde Eikemo
Sekretariatsleder

Ramunas Kazakauskas
Rådgiver

Kopi til:

Norges teknisk-naturvitenskapelige universitet
Norges teknisk-naturvitenskapelige universitet
Johanne Rauwenhoff



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