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## **The Effects of Traumatic Brain Injury on Empathy and Quality of Life**

Nicholas James Pek

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## EFFECTS OF TBI ON EMPATHY AND QOL

**Abstract**

Physical, emotional, cognitive, and social problems can all result from a traumatic brain injury. The focus of this present research was to investigate individuals with moderate-to-severe TBI who lack empathy and how that lack in empathy might impact their quality-of-life. Individuals with moderate-to-severe TBI between ages 18 and 65 (N=39) completed questionnaires including the Quality of Life after Brain Injury (QOLIBRI) and Empathy Quotient (EQ) as part of a larger study. A correlational analysis was completed between the total scores on the EQ and total scores on the QOLIBRI before splitting the participants into groups. A relationship between total scores on the EQ and QOLIBRI ( $r(1,37) = .398, p = .012$ ) was established after completion of the analysis. Based on their EQ scores, the participants were divided into three groups: below-average empathy (N=9), average empathy (N=16), and above average empathy (N=14). There was a statistically significant difference in the total QOLIBRI scores across the three empathy groups ( $F(2, 36) = 5.037, p = .012$ ). Post-hoc analysis, indicated those with lower EQ scores also reported lower QOLIBRI scores. This work provides evidence that those with low empathy may have a worse quality of life after brain injury relative to those with higher levels of empathy. Understanding the relationship between empathy and quality of life for individuals with brain injury can inform professionals where to target interventions such that improvements in empathy may also increase quality of life.

*Keywords:* traumatic brain injury, empathy, quality of life, neuropsychology, rehabilitation

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MONTCLAIR STATE UNIVERSITY

The Effects of Traumatic Brain Injury on Empathy and Quality of Life

by

Nicholas James Pek

A master's Thesis Submitted to the Faculty of

Montclair State University

In Partial Fulfillment of the Requirements

For the Degree of

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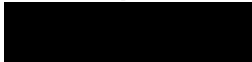
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EFFECTS OF TBI ON EMPATHY AND QOL

THE EFFECTS OF TRAUMATIC BRAIN INJURY ON EMPATHY AND QUALITY OF LIFE

A THESIS

Submitted in partial fulfillment of the requirements

For the degree of Master of Arts

by

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Montclair State University

Montclair, NJ

2023

EFFECTS OF TBI ON EMPATHY AND QOL

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## EFFECTS OF TBI ON EMPATHY AND QOL

### **Introduction**

Navigating the social world is requisite because humans are social beings, and we need to form and contribute to relationships. If humans do not possess some form of a relationship, it can cause the quality of one's life to be insufficient and can leave them prone to psychiatric problems (Mushtaq et al., 2014). A traumatic brain injury (TBI) causes various life changes, impacting one's physical, emotional, and social ability. According to the Centers for Disease Control (CDC), in 2019 alone, there were approximately 223,135 TBI-related hospitalizations, and in 2020 there were 64,362 TBI-related deaths (2022).

Following a TBI, rehabilitation efforts focus on physical and cognitive skills, while social skills are often not emphasized (Barman et al., 2016). Social perception, social understanding, and social decision-making have all been studied as social cognitive impairments in previous research on brain injury (Mutlu et al., 2019). Each social component describes a different aspect of social cognition: social perception entails perceiving faces and emotional expressions; social understanding implies perceiving others' cognitive or affective states; and social decision-making involves formulating actions while keeping in mind others' feelings (Arioli et al., 2018). The ability to share and comprehend another person's emotions or mental states is empathy, which is part of social cognition (Milders, 2018). Empathy is a social skill that can be impacted by brain injury and has repercussions for the individual, their peers, and their family members (May et al., 2017). The quality of an individual's relationships, which can affect their entire quality of life, might suffer if they cannot empathize with others, including their boss or significant other (Koskinen, 1998). Empathy is a key factor in determining the quality of a relationship, and empathy is necessary to be able to act in a way that respects the opinions and feelings of others (Riess, 2017). Empathy allows for proper integration in a world governed by interactions with others and having the appropriate skill set is key for navigating the social landscape (Decety et

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al., 2015). The current study defines traumatic brain injury, empathy, and quality of life before examining how these constructs impact an individual's quality of life after brain injury.

### **Background Information**

#### *I. What is a Traumatic Brain Injury (TBI)?*

According to the Brain Injury Alliance of America, a traumatic brain injury (TBI) is a disturbance in brain function or other signs of brain pathology produced by an external impact that can be classified as open or closed traumatic damage (Harrison-Felix, 1996). The common causes of TBI are falls, assaults, motor vehicle accidents, and sports injuries such as concussions. One of the most frequent causes related to brain injuries in young adults is their involvement in motor vehicle accidents (Hyder, 2007; Myburgh et al., 2008). TBI is the most common way of death or manner of becoming disabled in the United States of America, with a severity ranging from mild to severe TBI (Georges & Das, 2023). The severity determines the type and amount of treatment an individual needs for example, someone with a severe TBI may need long treatment periods from various health professionals (Georges & Das, 2023). TBI can cause both short-term and long-term health problems ranging from physical limitations to cognitive disabilities that can impact a person's activities of daily living (Georges & Das, 2023). Activities of everyday life are actions that neurotypical people perform regularly. These tasks include getting out of bed, showering, cooking, and using the bathroom. If the individual has substantial physical limitations, family members or professionals may need to take care of them to ensure they can meet the necessities for sustenance. Cognitive abilities are also impacted after brain injury, for example, attention and focus, processing, memory, communication, planning, and impulse control can all be affected due to a brain injury (Novack & Bushnik, 2009). Also, cognitive impairments can make it difficult to complete everyday tasks, which may require assistance from

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family members or a professional. interventions are continually have been created and studied to remediate the cognitive deficiencies caused by traumatic brain injury. Society requires research and development of additional rehabilitation therapies to help with the numerous cognitive and social cognitive abilities necessary to return to maximal functioning.

There is a great deal of variation in the symptoms of traumatic brain injuries. The Glasgow Coma Scale (GCS) and the Post-Traumatic Amnesia Scale (PTA) are used to determine the severity of traumatic brain injury and assist with predicting long term outcomes. The GCS measures a patient's responsiveness following the traumatic injury, while the PTA measures the degree of post-traumatic amnesia (Teasdale and Jennett, 1974; Russell et al., 1940).

Rehabilitation efforts target maximal recovery of functions with the goal of allowing the patient to get back to everyday life activities . The GCS and PTA used to measure physical and cognitive effects due to traumatic brain injury and is validated. Neuropsychological testing is integral for understanding the cognitive deficits that come with suffering from a traumatic brain injury to target which areas the cognitive rehabilitation needs to encompass (Tsaousides and Gordan, 2009). This type of testing examines various aspects of cognitive function including intelligence, memory and learning, psychomotor function, processing speed, executive function, attention, and language. Each of these domains of cognitive function involves different types of neuropsychological measures specifically designed to target that specific aspect. A review of 112 studies concluded that interventions should be researched and developed targeting attention, memory, social communication skills, and executive functioning (Cicerone et al., 2011). There is sufficient evidence that cognitive rehabilitation needs to be researched further to understand what could potentially enhance cognitive function.

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A person may have greater effects from moderate and severe TBI, which may include physical and cognitive impairments. A period of altered awareness lasting between one to seven days is considered moderate, while more than seven days are deemed severe (Williamson et al., 1996). The restrictions and deficits vary from person to person because most limitations can arise from medical interventions or the recovery process (CDC, 2022). Each severity will need a different type of rehabilitation because the deficits will be dissimilar from one individual to another, making it complex to develop one that targets all the aspects of deficiency. Individuals suffering from moderate to severe TBI are the target interest of the current research study because the literature shows that other limitations that arise from TBI involve deficits in social cognition, specifically a lack of empathy (Nijse et al., 2019; Westerhof-Evers et al., 2019; Milders, 2018).

### *II. What is Empathy?*

Empathy is defined as the capacity to perceive the feelings of others and act with their beliefs in mind. Empathy comprises two unique processes, according to Cuff, Brown, and Taylor (2016): affective empathy, which is the emotional reaction to another person's feelings, and cognitive empathy, which entails comprehending the other person's point of view. To effectively navigate the social environment, emotional and cognitive empathy must coexist (McDonald and Genova, 2021). Moreover, empathy encompasses both empathy for oneself and others and while some people struggle with self-empathy, which may in turn affect their empathy for others (Krol and Bartz, 2021). According to research, empathy is requisite to social interactions and relationships because it fosters mutual trust and rapport (de Vignemont and Singer, 2006).

Moreover, empathy supports prosocial actions like assisting those in need (Batson et al., 1991). Empathy significantly affects a person and society since it involves sharing experiences,

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needs, and desires with others and acts as an emotional conduit that promotes prosocial conduct (Riess, 2017). In contrast, a lack of empathy has been linked to undesirable results, such as violence and antisocial behavior (Eisenberg and Eggum, 2009). Those who lack empathy may be viewed as egocentric, rude, and heartless (Paulhus et al., 2002). The lack of capacity to understand another actions or sentiments may prevent people from having meaningful relationships. Empathy must be recognized and displayed for social interactions to be successful (Lysaker et al., 2013). Aggressive, antisocial, and offensive behaviors are associated with a lack of empathy (Jolliffe & Farrington, 2004). Empathy can be a key ability for people to navigate social situations and successfully create lasting relationships with others. Individuals tend to lean towards specific jobs based on how empathetic they are or away from those who do not demand empathy as a social ability (Riess, 2017). Since people must often engage with other coworkers and may find it challenging to connect with them if they lack adequate empathy, socializing is a requisite part of managing the working environment. People must engage with both their employers and coworkers, but they also need to be empathic if they work in a field that requires interaction with others.

### *III. TBI and Empathy*

A long-term consequence of traumatic brain injury is changes in social behavior, particularly difficulties with empathy (Ryan et al., 2016). In the literature, loss of empathy in TBI is well accepted among the research community, but little research has investigated the impact on other social outcomes (McDonald et al., 2015). Empathy is a principal component of social cognition and is thought to be the ability to experience the emotional state of others (Milders, 2018). An empathic individual can understand other people's viewpoints and relate to their experiences (Eslinger et al., 2002). A person's ability to empathize with others may suffer, and as

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a result, they may come off as emotionally callous or unable to grasp situations and communicate as a result (Greenwood et al., 2002; Wood et al., 2005). A lack of empathy can negatively affect interpersonal interactions and the well-being of someone with a traumatic brain injury. Both results might result in a greater likelihood of social isolation or fewer social contacts (Engberg et al., 2004). For someone with a traumatic brain injury, social isolation may worsen their psychological and behavioral problems.

De Sousa et al. (2011) demonstrated that traumatic brain injury reduces empathy in their investigation. The processes comprised administering physiological tests and combining them with assessments of one's empathy. This study's primary goal was to see if there were any differences between those who had TBIs and people who did not. Of the 43 people, 21 had severe TBI and stated that their injury prevented them from feeling empathy for others. The researchers discovered a significant difference between individuals with TBI and healthy control groups on the Balanced Emotional Empathy Scale (BEES). The TBI group scored much lower on emotional empathy than the healthy controls, indicating that TBI patients demonstrated difficulty sympathize emotionally with others.

Another study investigating the impacts of traumatic brain injury on empathy found that individuals suffering from a severe TBI showed a decrease in brain volume which correlated with low levels of empathy (Rushby et al., 2016). Also, a study conducted by Woods and Williams (2008) compared participants suffering from TBI to healthy controls on their Balanced Emotional Scale (BEES) scores. The researchers found a frequency of 61% of the TBI population having lower levels of empathy compared to the healthy controls, only having 31% of low empathy scores. Overall, the literature on the effects of traumatic brain injury on empathy has shown that TBI causes deficits in social cognition in moderate to severe TBI (de Sousa et al.,

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2011; Rushby et al., 2013; McDonald, 2013). Further research is needed to further add to the literature on the effects of TBI on empathy because it will allow for validation of the current study and influence future research direction. The present research can be carried out further to learn more about empathy, and quality of life following brain injury.

### *IV. Measuring Empathy using the Empathy Quotient (EQ)*

The Empathy Quotient (EQ) is a self-report assessment that measures the ability to identify, understand, and respond to the feelings and mental states of others. This questionnaire was initially created to test empathy in people on the autism spectrum. Simon Baron-Cohen and his colleagues created the EQ. in 2004, which has been supported by research (Baron-Cohen & Wheelwright, 2004; Wakabayashi et al., 2006). The 60 questions that make up the EQ measure various empathy-related characteristics, including emotional contagion, perspective-taking, and care for others. Increased social skills, higher prosocial behavior, and lower levels of violence and psychopathy have all been linked to high EQ scores (Baron-Cohen & Wheelwright, 2004; Muncer & Ling, 2006).

### *V. What is quality of life?*

Quality of life is an individual's overall well-being and satisfaction with various aspects of their life, such as physical health, emotional well-being, social relationships, and material possessions (WHO, 2021). Quality of life is a multidimensional concept influenced by various factors, including socioeconomic status, access to healthcare and education, and environmental factors (Koohsari et al., 2021). Therefore, understanding and improving quality of life is key to promoting health and well-being at both the individual and societal levels. Studying quality of life is necessary because it allows for a better understanding of the factors contributing to overall well-being and satisfaction in life. By studying the quality of life, research can identify which

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factors are most important to people and how they interact with each other. Understanding the quality of life is important for designing policies and interventions that promote well-being and prevent health problems. For example, by studying the quality of life, researchers can identify the social and economic factors contributing to health disparities and develop strategies to reduce them.

Additionally, by understanding the factors that influence the quality of life, healthcare providers can tailor their treatments better to meet the needs and preferences of their patients. Furthermore, studying the quality of life can provide valuable insights into the impact of various social, economic, and environmental factors on individual and community well-being. This information can inform policy decisions related to healthcare, urban planning, and environmental management. In short, studying the quality of life is beneficial for improving our understanding of what makes life worth living and designing interventions to enhance the well-being of all individuals and communities.

### *VI. Quality of life after traumatic brain injury*

Quality of life after brain injury can be impacted by the individual's physical, cognitive, and emotional limitations that may follow. Physical limits might range from limb paralysis to persistent headaches and seizures following an accident. Poor organizational abilities, a lack of restraint, and problems with learning and remembering are all examples of cognitive impairments. Emotional limitations can range from the inability to establish and sustain social or romantic connections to failing to distinguish between facial expressions to feeling unhappy. According to Fann et al. (2009), around 50% of TBI patients have depression during the first year after the injury. Each of the limitations mentioned above has some impact on a person's quality of life after sustaining a traumatic brain injury. Nevertheless, because there is such vast



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diversity in symptomatology in brain injury, not all the deficits stated necessarily have the same influence on every individual.

The literature on quality of life following traumatic brain injury included studies investigating potential predictors of quality of life long term. According to Rauen et al., severity of injury may be a potential indicator of quality of life up to 10 years following brain damage. According to the researchers (2020), most of the 135 study participants demonstrated a low quality of life following traumatic brain injury; however, the results revealed a weak correlation between severity and quality of life. Another study looked at people's abilities up to five years following brain damage and the impact it had on their quality of life using the quality of life after brain injury overall scale (QOLIBRI-OS) . According to Nelson et al. (2023), those who had mild TBI (mTBI) were far more independent than people who experienced moderate to severe TBI (msTBI) signifying they can be more autonomous in daily life. At the 5-year mark, participants with msTBI also showed signs of being significantly less independent than the year before their injury which had an impact on their quality of life. In addition, Dijkers (2004) discusses the methodologies used in the research and the results of various studies on the quality of life following traumatic brain injury. The study's findings showed that the TBI participants believed their quality of life was higher before the injury and poorer afterward. Comprehension of the nature of traumatic brain injuries' effect on the overall quality of life, further research must be done.

### *VII. Measuring Quality of Life After Traumatic Brain Injury using the QOLIBRI*

The Quality of Life after Brain Injury (QOLIBRI) questionnaire is widely used to assess the quality of life in individuals who have sustained a traumatic brain injury. The QOLIBRI questionnaire consists of six subscales: cognitive, physical, emotional, social, self, and overall

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quality of life. Research has demonstrated that the QOLIBRI questionnaire has high internal consistency, test-retest reliability, and construct validity, indicating that it is a reliable and valid measure for assessing the quality of life in individuals with TBI (von Steinbuechel et al., 2010). Furthermore, the QOLIBRI questionnaire is a valuable tool for clinicians and researchers to assess the quality of life in individuals with TBI and can be utilized to evaluate the effectiveness of interventions to improve quality of life. For example, one study found that the QOLIBRI was a valid and reliable measure for assessing the long-term quality of life outcomes of individuals with traumatic brain injury (Dijkers, 2004). Another study demonstrated that the QOLIBRI detected significant changes in quality of life following a comprehensive rehabilitation program for individuals with traumatic brain injury (Hunt et al., 2019). The QOLIBRI has also been used in studies examining the impact of traumatic brain injury on specific domains of quality of life, such as social participation and emotional well-being (Vikane et al., 2017). In conclusion, the QOLIBRI has been shown to be a valid a reliable way of measuring the quality of life specific to individuals with brain injury.

### *VIII. Empathy and Quality of Life*

The presence of empathy has been associated with quality of life in the general population. As described above, empathy is associated with emotional intelligence and social skills leading to building solid relationships with others, allowing them to feel fulfilled and have a sense of purpose. Also, empathy decreases the individual's chances of feeling socially isolated and lonely and increases self-esteem and confidence (National Academy of Sciences, 2020). Receiving empathy lowers stress and depressive symptoms while allowing the recipient to feel connected to and supported by the empathizer (Moudatsou, 2020). Empathy can improve the quality of healthcare and other services by promoting patient-centered care and a more humanistic

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approach to treatment (Moudatsou, 2020). Implementing the humanistic approach to the health care systems allows physicians to better understand their patients and how they treat them because the humanistic approach focuses on the individual's thoughts, beliefs, and overall intentions (Lee Roze des Ordons, 2018). Since physicians better understand their patients will allow them to be more effective in their diagnosis and treatment of the individual (Say, 2003). When doctors treat their patients more effectively, it has a cascading effect since patients will feel more cared for if they are more compassionate (Derksen et al.,2013). Also, showing empathy towards their patients may influence the recipient to be more empathetic, improving their abilities to socialize and create long-lasting relationships (Moudatsou, 2020). As their social life expands, they will judge their quality of life more favorably, making life significantly more joyful than a life spent in social isolation and loneliness (National Academy, 2020). Overall, empathy is a required human component of human connection and can dramatically contribute to an individual's well-being and quality of life.

It is hypothesized that those with below-average empathy will report reduced quality of life compared to those with average or above-average empathy. The overarching goal of this study is to examine the possibility that a lack in empathy may have an impact on TBI patients' quality of life. If this study's results are positive, there may be grounds for practical implementation. That is, if it is demonstrated that having higher levels of empathy increases the quality of life, it may be possible to put in place interventions that increase empathy levels, all while enhancing quality of life. It is important to further our understanding that traumatic brain injuries can result in social deficiencies, including deficits in empathy.

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### Methods

#### *Experimental Overview*

This research utilized previously collected data as part of an ongoing randomized control trial treating emotional processing impairments in individuals with TBI conducted at the Kessler Foundation in East Hanover, New Jersey. Data was already de-identified in the database for this research study. No new data was collected in the current study.

#### *I. Participants*

The sample population for this research study (N=39; 33 males and 6 females) consisted of individuals with documented moderate to severe TBI, as defined by the TBI Model Systems criteria (Harrison-Felix, Newton, Hall, & Kreutzer, 1996). Individuals were recruited from participants who previously participated in research studies, chosen through online recruitment sites or as outpatients from the rehabilitation center. Participants in this study had to be at least one-year post-injury and between the ages of 18 and 65 to account for the effects of aging and brain development. Participants were excluded from the study if they had neurological conditions other than brain injuries, such as epilepsy or multiple sclerosis, substantial substance misuse, or a history of schizophrenia and bipolar disorder. For this investigation, there were no handedness specifications.

For the current study, the sample was subdivided into three groups based on performance on the Empathy Quotient (EQ) and following the scoring criteria established by Simon Baron-Cohen and Sally Wheelwright (2004). The scoring for the EQ ranges from 0 to 80 points, with higher scores indicating greater levels of empathy. Below-average empathy was classified for scores of 0-32, average empathy consisted of scores 33-52, and above-average empathy consisted of scores 53-80. For the current study, the three groups were below-average levels of empathy (EM-;  $N=9$ ), an average level of empathy (EM+;  $N=16$ ), and above-average empathy

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(EM++;  $N=14$ ). There was no statistically significant difference between the three groups on age ( $p=.338$ ), education level ( $p=.724$ ), severity of injury ( $p=.692$ ), or intelligence levels as measured by the Vocabulary subtest from the Wechsler Abbreviated Scale of Intelligence (WASI) ( $p=.484$ ) (See Table 3).

### *II. Procedures*

Participants answered questions about their demographics, TBI, and other medical issues during an initial telephone screen that complied with HIPAA regulations. All participants will provide signed informed consent once eligibility was determined for participation. Participants were then scheduled for their assessment sessions which consisted of emotional processing, psychological, neuropsychological, and functional measures.

## **Measures**

### *I. Empathy Quotient (EQ)*

The empathy quotient (EQ), a 60-question self-report measure, was initially developed to evaluate empathy in individuals with autism (Baron-Cohen & Cartwright, 2004). Individuals answer on a 4-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (4). The EQ has been utilized for Asperger's syndrome and high-functioning autistic individuals (Baron Cohen and Cartwright, 2004). Also, the empathy quotient has been utilized with neurotypical populations including college students and individuals with average intelligence levels. The test reports normative data and high psychometric properties. For instance, three separate studies using various healthy control samples recruited from psychiatric facilities or through outside advertisements were conducted to determine the effectiveness of the EQ. Lawrence et al. (2004) performed a test-retest reliability assessment which revealed that the empathy quotient has good reliability and validity; this measure has excellent reliability of 0.835 within twelve months. The

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EQ has been utilized with outpatient groups and members of the community, not on inpatient samples. The average EQ score on healthy controls was also remarkably comparable to the score found by the scale's designers, Baron-Cohen, and Cartwright, indicating the scale's high reliability and validity (Lawrence et al., 2004). The EQ has demonstrated significant psychometric data and norms developed by continuous testing in multiple investigations.

### *II. Quality of life after brain injury (QOLIBRI)*

The quality of life after brain injury (QOLIBRI) is a self-report measure evaluating aspects of an individual's quality of life after a brain injury (von Steinbüchel et al., 2010). The test consists of 37 items, which measures quality of life via six subscales – everyday functioning (7 items), physical condition (5 items), relationships and social/leisure activity (6 items), cognition (7 items), self (7 items), and feelings/emotions (5 items). These items were rated on a five-point self-rated Likert scale ranging from – "Not at all/Slightly/Moderately/Quite/Very ." A group of researchers formed the QOLIBRI task force (von Steinbüchel et al., 2010) to develop a quality-of-life questionnaire specific for participants with brain injuries. The task force has tried and tested the functional questionnaire, establishing studies with large sample sizes to agree on what aspects are necessary to add to the scale. The task force conducted numerous studies with different sample sizes measuring internal consistency on different scales and the versions translated into other languages. The first study was done ( $N=1528$ ) with a 49-question questionnaire with seven scales translated into different language versions of the QOLIBRI (Dutch, English, Finnish, French, German, Italian) for purposes of validating this brain injury assessment for administration across various countries (von Steinbüchel et al., 2010). After two years of conducting that validation study, von Steinbüchel and colleagues did a second validation study ( $N=921$ ) to validate the quality-of-life assessment further. By 2009, the QOLIBRI task

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force had the final questionnaire consisting of 37 questions in six scales, with an additional six scale screening item for overall quality of life. A total Cronbach's alpha was computed for all the different language versions of the QOLIBRI, which was 0.95 and ranged from 0.92 to 0.97, which shows that the assessment has strong psychometric properties. Overall, the QOLIBRI has shown sufficient psychometric data and norms established by the task force from continuous testing in numerous studies with large sample sizes.

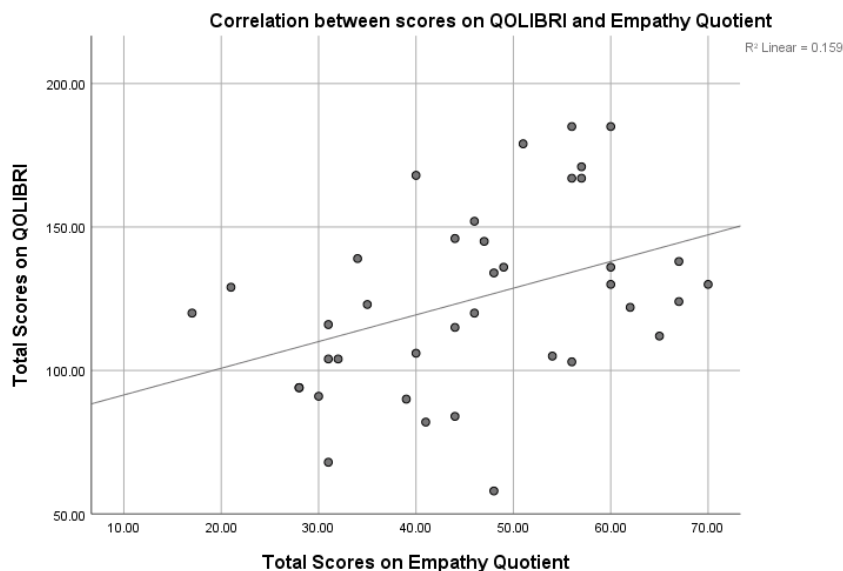
### **Results**

#### *Data Management*

All data management and analysis used SPSS. Built-in validity checks monitored data quality, but data was also visually inspected for accuracy and other errors and verified by a second person.

First, a simple regression analysis was used to test if the total score on EQ significantly predicted participants' score on the QOLIBRI. The results of the regression indicated the EQ explained 15.9% of the variance of the QOLIBRI ( $R^2=.159$ ,  $F(1,37)=6.979$ ,  $p = .012$ ) (See Table 1). It was found that total score on EQ significantly predicted total score on QOLIBRI ( $\beta = .398$ ) (See Table 2A). The relationship between the independent and dependent variable is a positive relationship between both variables (See Figure 1).

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**Figure 1.**

Next, the sample was subdivided into 3 groups based on performance of their EQ. The demographic information of the sample can be found in Table 3. A ANOVA was performed to examine the relationship of empathy and quality of life in individuals with TBI, specifically whether QOLIBRI scores would differ between the three empathy groups (EM-, EM+, EM++) . A one-way ANOVA revealed a statistically significant difference in total QOLIBRI scores between the three empathy groups ( $F(2, 36) = 5.037, p = .012$ ). (See Table 4) When examining the subscales of the QOLIBRI, a significant difference was noted for the Self ( $F(2, 36) = 6.806, p = .003$ ) and Daily Life ( $F(2, 36) = 9.182, p = .001$ ) subscales. In contrast, a trend toward significance was noted for the Cognitive ( $F(2, 36) = 2.792, p = .075$ ) and Social ( $F(2, 36) = 2.710, p = .080$ ) subscales. The Emotion and Physical Subscales were not significant. Tukey's HSD Test for multiple comparisons set at an alpha of 0.05 found that there was a significant difference in QOLIBRI scores between the below-average empathy group (EM-) and the above-average empathy group (EM++) ( $p = .017, 95\% \text{ C.I.} = -64.72$ ). There was a statistically significant difference between below-average and above-average levels of empathy ( $p = .021$ ).



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Overall, a significant effect was discovered after the statistical analyses, which means that individuals with above-average empathy (EM++) reported a higher quality of life compared to the below-average empathy group (EM-). The average empathy group did not differ significantly from either other group.

After conducting the experimentation and the statistical analyses, individuals' low scores on the empathy quotient reflected their overall quality of life. Individuals in the below-average empathy group (EM-) report a poor quality of life compared to individuals in the average group (EM+) and above-average empathy group (EM++). After conducting the Tukey HSD multiple comparisons, it is apparent that out of the six subscales of the QOLIBRI, there was a significant difference between the three groups on the Self and Daily scales. Also, the cognitive and social scales were on a trend toward significance, and the emotional and physical scales did not show significance.

### **Discussion**

The current study focused on the relationships between empathy and quality of life in individuals with moderate to severe traumatic brain injury. The key results of this research study are that individuals who reported below-average empathy (EM-) did report having poorer quality of life after brain injury than the other two empathy groups (EM+, EM++). The results indicate that reduced empathy in individuals with moderate to severe TBI could contribute to reduced quality of life. Results are consistent with the literature reporting a reduction in quality of life for some individuals with TBI. Understanding the factors that contribute to reduced quality of life after TBI is a first step in being able to identify and develop strategies to improve quality of life.

The current study indicates that a particular subset of brain injury patients may have a poor quality of life due to empathy deficits. If reduced empathy contributes to poorer quality of life

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then targeting ways to improve empathy may be able to also improve quality of life. If caregivers or healthcare professionals are aware of the social limitations that a traumatic brain injury could bring, they may be better positioned to provide guidance to caregivers of TBI patients. Overall, the findings contribute to the body of information regarding the social deficiencies in TBI. The research findings may also be helpful to offer a path for a treatment for quality-of-life deficits brought on by brain injury.

The current research has limitations, including a small sample size, a lack of equal gender distribution or diverse ethnic groups, an empathy questionnaire not explicitly created to measure empathy in TBI, and the lack of independent administration of the questionnaires. Since only moderate to severe TBI were used for this investigation, a disadvantage of the current research study is that the sample size is smaller, and the population cannot be generalized to individuals with brain injury with more mild injuries. The research study did not begin with collecting demographic data such as race and ethnicity; therefore, the results cannot be applied to people of other ethnic backgrounds. Another drawback is that there is no information on the application of the EQ in TBI. The EQ was developed to measure empathy in people with autism spectrum disorder (ASD). The EQ is an accurate measure of empathy, but there is minimal research on its use in traumatic brain injury to assess the quality of life after brain injury. Instead of being given out at baseline and the other at follow-up, both questionnaires were given out simultaneously. Furthermore, a significant limitation is that there was no pre-injury data on each participant specifically; it is unknown as to what type of person each participant was before their brain injury because they could have lacked empathy and had poor quality of life before the injury. The design of a more extensive sample size study that includes people of all severity levels, the collection of demographic data on race and ethnicity, and the administration of a baseline and

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follow-up questionnaire are some suggestions for further research. Recruiting a larger diverse sample would allow the investigation to be more generalizable to a population such as various racial backgrounds and individuals with mild TBI. Introducing participants with mild TBI could allow for more questions to be answered regarding understanding the effects of mild TBI on empathy and quality of life. Even though mild TBI might not be as detrimental as moderate or severe TBI, some social deficits may arise due to the injury. Critics may question the gender balance of the sample, but it is shown according to epidemiological data that suggests men are approximately 40% more likely to suffer a TBI compared with women in the general adult population (Faul & Coronado, 2015; Coronado et al., 2012). Epidemiological studies of TBI, mostly relying on emergency department and hospitalization records, consistently report higher incidence in men (CDC, 2003; CDC, 2014; CDC, 2019; Frost et al., 2013) sometimes explained by the higher propensity of men to be involved in physical altercations, military service, and contact sports. In most observational and clinical studies of TBI, women represent ~30% or less of subjects (Biegon, 2021). Overall, it is common that TBI studies are dominated by male participants because they are approximately 40% more likely to suffer a TBI compared to females because of riskier lifestyles

Furthermore, the EQ should be administered at baseline and QOLIBRI at the follow-up to allow for more concrete conclusions on whether a lack of empathy leads to poorer quality of life after brain injury. Understanding the impacts of traumatic brain injury on empathy and quality of life could open the doors to more research on aspects of social cognition that are impacted by brain injury. It would be intriguing to explore this topic further because empathy is a key element of theory of mind, a cognitive ability crucial for navigating the social environment.

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## Appendix A

## Tables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.398	.159	.136	29.441185	.159	6.979	1	37	.012

Model	Sum of Squares	df	Mean Square	F	P
Regression	6037.661	1	6037.661	6.979	.012
Residual	32007.108	37	865.057		
Total	3844.769	38			

Model	B	Std. Error	Standardized Coefficients Beta	t	P
Constant	.930	16.852		4.876	.000
EQ Total Baseline	.930	.352	.398	2.642	.012

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	EM- Below-Average Empathy N= 9	EM+ Average Empathy N= 16	EM++ Above-Average Empathy N= 14	P
Age <i>Mean (SD)</i>	50.78 (13.56)	46.44 (13.47)	42.64 (10.90)	.328
Education <i>Mean (SD)</i>	14.11 (2.03)	14.18 (1.64)	14.50 (2.21)	.869
Time since injury (months) <i>Mean (SD)</i>	122.86 (85.73)	131.58 (149.29)	91.15 (57.09)	.619
Gender <i>Mean (SD)</i>				
WASI Vocabulary SS <i>Mean (SD)</i>	7.0 (2.60)	12.19 (11.31)	10.64 (10.88)	.457

	EM- Below-Avera ge Empathy N= 9	EM+ Average Empathy N= 16	EM++ Above-Ave rage Empathy N= 14	P	Tukey HSD Test – Multiple Comparisons
Total Score <i>Mean (SD)</i>	44.07 (12.32)	58.49 (22.36)	70.31 (19.32)	.012	.009
Cognitive <i>Mean (SD)</i>	43.25(15.41)	59.60 (28.38)	69.39 (27.94)	.075	.060
Self <i>Mean (SD)</i>	35.71 (15.57)	58.26 (28.08)	72.45 (21.08)	.003	.001
Daily Life <i>Mean (SD)</i>	38.49 (22.85)	48.88 (26.81)	76.53 (16.62)	.001	.001
Social <i>Mean (SD)</i>	45.37 (25.04)	63.28 (21.15)	68.27 (25.25)	.080	.063
Emotions <i>Mean (SD)</i>	57.78 (24.25)	66.25 (33.99)	71.79 (29.65)	.566	.535
Physical <i>Mean (SD)</i>	53.89 (15.16)	57.19 (30.66)	62.14 (31.11)	.778	.773