



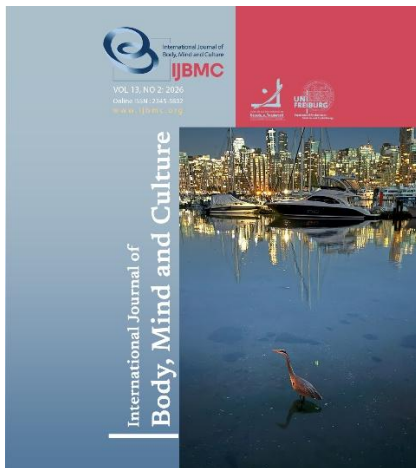
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Modeling Posttraumatic Growth Based on Intelligence Beliefs and Cognitive Biases: The Mediating Role of Mentalization in Patients with Multiple Sclerosis

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ABSTRACT

Objective: The present study aimed to model posttraumatic growth (PTG) based on intelligence beliefs and cognitive biases, with mentalization serving as a mediating mechanism in patients with multiple sclerosis (MS).

Methods and Materials: This descriptive correlational study using path analysis was conducted in 2025. The statistical population consisted of MS patients residing in Tehran, from whom 274 participants were selected through purposive sampling. Data were collected using the Posttraumatic Growth Inventory (PTGI; 1996), Implicit Theories of Intelligence Scale (2006), Cognitive Bias Questionnaire (1997), and Mentalization Questionnaire (MZQ; 2017). Data analysis was performed using Pearson correlation coefficients, path analysis, and bootstrapping procedures in SPSS 27 and AMOS 24.

Findings: The results indicated that intelligence beliefs had a significant positive direct effect on mentalization ($\beta = 0.34, p < .001$) and PTG ($\beta = 0.27, p < .001$), whereas cognitive biases had significant negative direct effects on mentalization ($\beta = -0.28, p < .001$) and PTG ($\beta = -0.22, p < .001$). Furthermore, mentalization positively predicted PTG ($\beta = 0.37, p < .001$). Bootstrap results confirmed the mediating role of mentalization in the relationship between intelligence beliefs and PTG ($\beta = 0.15, 95\% \text{ CI } [0.08, 0.23]$) and between cognitive biases and PTG ($\beta = -0.13, 95\% \text{ CI } [-0.21, -0.06]$). The proposed model demonstrated a good fit to the data (CFI = 0.95, GFI = 0.93, RMSEA = 0.056).

Conclusion: The findings suggest that patients with MS who hold incremental intelligence beliefs and exhibit lower levels of cognitive bias are more likely to experience posttraumatic growth, with mentalization acting as a key protective and explanatory mechanism. Therefore, clinical interventions aimed at fostering incremental intelligence beliefs, reducing maladaptive cognitive biases, and strengthening mentalization capacities may facilitate psychological adaptation and posttraumatic growth in individuals with multiple sclerosis.

Keywords: Posttraumatic Growth, Intelligence Beliefs, Cognitive Biases, Mentalization, Multiple Sclerosis.

Introduction

Multiple sclerosis (MS) is a chronic disease of the central nervous system characterized by progressive demyelination and disruption of neural signal transmission (Oh, 2026). The disease typically emerges during early to middle adulthood and can lead to a wide range of physical symptoms, including chronic fatigue, motor dysfunction, visual disturbances, and balance impairment. Due to its unpredictable course and frequent relapses, individuals with MS often experience persistent uncertainty in their daily lives. Consequently, MS should not be viewed solely as a neurological disorder but rather as a complex condition associated with substantial psychological and social consequences (Marrie et al., 2026). Individuals living with MS frequently encounter profound changes in their lifestyle, social roles, and self-perception. Facing physical limitations, the possibility of dependency on others, and concerns about disease progression may impose significant psychological burdens (Breheny et al., 2026). Empirical research indicates that anxiety, depression, feelings of helplessness, and reduced hope for the future are among the most common psychological outcomes experienced by this population (Gómez-Ballesteros et al., 2025). Nevertheless, the experience of illness does not inevitably lead to psychological deterioration; many individuals report positive changes in their attitudes and coping strategies as they gradually adapt to the disease.

In recent years, scholarly attention has increasingly shifted from focusing exclusively on the negative consequences of chronic illness toward examining patients' adaptive capacities and their potential for psychological growth. From this perspective, confronting severe life stressors may provide some individuals with an opportunity to reconstruct meaning, reassess personal values, and strengthen internal psychological resources (Y. Huang et al., 2025). Within health psychology, developmental perspectives have suggested that exposure to life-threatening events does not necessarily result in enduring negative outcomes. For some individuals, confronting severe crises can lead to a profound reconstruction of belief systems, a redefinition of personal priorities, and the development of a renewed perception of personal capabilities (Kim et al., 2025). This phenomenon is commonly referred to as posttraumatic growth.

Posttraumatic growth refers to the positive psychological changes that arise from individuals' cognitive and emotional efforts to cope with highly stressful or traumatic experiences. These changes extend beyond a simple return to pre-trauma levels of functioning and instead represent a qualitative transformation in how individuals perceive themselves, others, and the world. Through this process, individuals not only adapt to the consequences of trauma but also reexamine their prior meaning structures and, in certain domains, achieve a deeper level of psychological integration than existed before the crisis (S. Huang et al., 2025). Developmental perspectives within health psychology have increasingly emphasized that experiencing life-threatening events does not necessarily result in enduring negative psychological consequences. For some individuals, confronting severe crises may lead to a profound reconstruction of belief systems, a redefinition of personal priorities, and the emergence of a renewed perception of personal capabilities (Kim et al., 2025). This phenomenon is known as posttraumatic growth. Posttraumatic growth refers to the positive psychological changes that arise from individuals' cognitive and emotional efforts to adapt to highly stressful or traumatic events. These changes reflect more than a simple return to pre-trauma functioning; rather, they signify a qualitative transformation in how individuals perceive themselves, others, and the world. As part of this process, individuals not only manage the consequences of trauma but also reexamine their preexisting meaning structures and, in some domains, achieve a level of inner coherence that did not exist prior to the crisis (S. Huang et al., 2025).

The dimensions of posttraumatic growth commonly include an enhanced sense of personal strength, deeper interpersonal relationships, increased appreciation of life, expanded spiritual awareness, and the discovery of new life possibilities. These dimensions indicate that posttraumatic growth is not a unidimensional construct; instead, it represents a multifaceted process encompassing cognitive, emotional, and interpersonal transformations (Nisyraiou et al., 2025). Within the context of chronic illnesses such as multiple sclerosis, conditions often arise that trigger cognitive reflection and reevaluation. A diagnosis of a progressive neurological disease challenges fundamental assumptions regarding control, predictability, and

stability in life. Such challenges may open pathways for reconstructing personal meaning frameworks. Therefore, posttraumatic growth in individuals with MS should not be considered a random outcome but rather the product of a complex interplay among cognitive appraisals, emotional regulation processes, and individuals' internal psychological capacities (Gil-González et al., 2022).

However, not all individuals experience posttraumatic growth to the same extent. Variations in belief systems, information-processing styles, and the capacity to understand one's own and others' mental states may significantly shape both the degree and the quality of growth. Accordingly, examining the cognitive and metacognitive factors associated with posttraumatic growth in patients with multiple sclerosis is crucial for clarifying the mechanisms that guide psychological development following illness (Kuzu Kumcu et al., 2024). Among these cognitive variables, intelligence beliefs have emerged as an important construct influencing how individuals confront challenges, evaluate their abilities, and interpret illness-related experiences (Maghool et al., 2023).

Intelligence beliefs refer to the cognitive frameworks through which individuals interpret the nature and malleability of their intellectual abilities. These beliefs determine whether individuals view intelligence as a fixed, immutable trait or as a dynamic capacity that can be developed. In theoretical literature, these orientations are typically classified as entity (fixed) beliefs and incremental beliefs, respectively (Taqavi & Ahmadi, 2023). Individuals who endorse a fixed view of intelligence tend to regard cognitive abilities as predetermined characteristics. When faced with failure or difficulty, they are therefore more likely to interpret such experiences as indicators of inherent limitations. In contrast, individuals who hold incremental beliefs perceive poor performance as temporary feedback and an opportunity for learning and strategic adjustment (Alizadeh & Farid, 2026). These differing interpretations have meaningful implications for emotional regulation, persistence in the face of psychological stress, and individuals' responses to threatening or challenging life events (Meyer-Armdt et al., 2022).

Within the context of chronic illness, intelligence beliefs may extend beyond academic or cognitive performance and influence broader aspects of

psychological adaptation. When individuals receive a diagnosis of a condition such as multiple sclerosis, their evaluation of their cognitive capacities and their perceived ability to adapt become particularly salient. Individuals who view their abilities as flexible and developable are more likely to adopt problem-focused coping strategies when confronted with physical limitations and may actively seek new ways to adjust to changing circumstances. In contrast, a fixed mindset may contribute to feelings of helplessness, withdrawal, and reduced efforts to reconstruct one's life following the onset of illness (Derakhshan et al., 2022; Dobson & Giovannoni, 2019). From a developmental perspective, intelligence beliefs may shape how individuals cognitively process the experience of illness. Experiencing posttraumatic growth requires the reconsideration of existing meaning systems and the reconstruction of one's personal narrative. Individuals who believe that change and development are possible may be more willing to redefine their identity under new life conditions. Accordingly, an incremental view of cognitive abilities may facilitate more adaptive interpretations of illness and ultimately promote the experience of posttraumatic growth (Aflakseir & Manafi, 2018).

In other words, intelligence beliefs influence not only academic or occupational functioning but may also shape the trajectory of psychological transformation when individuals encounter health-related crises. Investigating the role of these beliefs in explaining posttraumatic growth among patients with multiple sclerosis may therefore contribute to clarifying the cognitive mechanisms underlying positive psychological adaptation to illness (Aflakseir & Manafi, 2018). Nevertheless, individuals' beliefs are not the only cognitive factors influencing responses to adversity; the ways in which information is processed may also play a crucial role. In this regard, cognitive biases have received considerable attention as mechanisms that shape how individuals interpret events and evaluate stressful situations (Savioni & Triberti, 2020). Cognitive biases refer to systematic patterns in information processing that lead individuals to interpret events and situations in selective and sometimes distorted ways. Although such biases partly reflect the mind's natural tendency to simplify complex information, under certain circumstances they may produce interpretations that

deviate from objective reality. In clinical psychology, cognitive biases are frequently discussed in relation to threat appraisal, the interpretation of ambiguous situations, and the ways in which past experiences are recalled (Vos et al., 2025).

A growing body of research suggests that when individuals encounter stressful situations, they tend to process information through the lens of preexisting schemas and expectations. When these schemas are characterized by negative or pessimistic assumptions, the likelihood of biases such as catastrophizing negative outcomes, jumping to conclusions, or selectively attending to threat-related cues increases (Ataei et al., 2024). Such cognitive patterns can substantially influence how life events are evaluated and play a critical role in shaping emotional and behavioral responses (Haselton et al., 2015). In the context of chronic illness, cognitive biases may substantially influence how individuals perceive their condition and envision their future. For example, an excessive focus on threatening symptoms or the anticipation of extremely negative outcomes may weaken feelings of control and hope, thereby complicating psychological adjustment. Conversely, individuals who demonstrate greater cognitive flexibility and are less susceptible to distorted interpretations tend to exhibit more effective emotional regulation and a greater capacity to reconstruct the meaning of their illness experience (Kuon, 2025). From a developmental perspective, posttraumatic growth depends largely on how stressful experiences are cognitively processed. To derive positive change from a threatening event, individuals must be able to reconsider their initial interpretations and reorganize their understanding of what has occurred. Pronounced cognitive biases may disrupt this reconstructive process by trapping individuals in cycles of negative appraisal and rumination. In contrast, reducing such biases and enhancing interpretive flexibility may create conditions in which illness is perceived not only as a source of distress but also as a catalyst for reexamining personal values and capabilities (Mirabolfathi et al., 2025).

Accordingly, examining cognitive biases in patients with multiple sclerosis may contribute to a better understanding of individual differences in responses to illness. Cognitive biases are associated not only with the severity of perceived psychological distress but also with the processes that may either facilitate or hinder

posttraumatic growth (Saposnik et al., 2022). However, the influence of cognitive factors on psychological outcomes does not always occur directly; rather, these relationships may be explained through additional psychological mechanisms. One construct that may function as a mediating factor in this context is mentalization (He et al., 2025).

Mentalization refers to an individual's capacity to understand and interpret both one's own behavior and that of others in terms of underlying mental states, such as thoughts, feelings, intentions, and beliefs. This cognitive-affective capacity enables individuals to perceive human behavior not merely as a series of observable actions, but as expressions of underlying psychological processes. In essence, mentalization represents a reflective process through which individuals link internal experiences with outward behaviors (Malenka et al., 2026).

This ability plays a crucial role in emotional regulation, mutual understanding in interpersonal relationships, and adaptation to stressful situations. When individuals are able to recognize and reflect upon their own mental states, they are more likely to regulate their emotional reactions in a flexible and adaptive manner. Likewise, the capacity to understand the mental states of others can enhance the quality of social interactions and reduce interpersonal misunderstandings (Arabadzhev & Paunova, 2024). In the context of coping with chronic illness, the capacity for mentalization becomes particularly important. Receiving a diagnosis of a progressive disease such as multiple sclerosis can evoke a wide range of complex emotional reactions, including fear, uncertainty, and despair. Individuals with higher levels of mentalization are generally better equipped to recognize and process these emotional experiences, thereby constructing a more coherent understanding of their illness. This reflective process may facilitate more effective emotional regulation and contribute to improved psychological adjustment (Costa-Cordella & Luyten, 2024).

From a theoretical standpoint, mentalization can function as a mediating mechanism linking cognitive processes to developmental outcomes. Cognitive constructs such as intelligence beliefs and cognitive processing styles, including cognitive biases, influence how individuals interpret life experiences. However, the

extent to which these interpretations translate into outcomes such as posttraumatic growth depends largely on an individual's capacity to reflect upon their own and others' mental states. Mentalization allows individuals to move beyond immediate emotional reactions and reorganize challenging experiences within a meaningful psychological framework (Katzman & Papouchis, 2023).

Accordingly, mentalization may play a pivotal role in the process through which the experience of illness becomes an opportunity for psychological growth. In other words, individuals with a greater capacity to understand and reflect upon mental states may be better able to manage the influence of their cognitive beliefs and information-processing patterns, ultimately facilitating positive changes in their perspectives on life, relationships, and self-understanding. Therefore, examining the mediating role of mentalization in the relationship between intelligence beliefs, cognitive biases, and posttraumatic growth may provide a more comprehensive understanding of the psychological mechanisms underlying positive adaptation among patients with multiple sclerosis (Kuzu Kumcu et al., 2024).

According to the World Health Organization (Organization, 2025), multiple sclerosis (MS) is one of the most common disabling disorders of the central nervous system. It is characterized by immune-mediated attacks on the brain and spinal cord, which may impair cognitive, motor, sensory, emotional, and visual functioning. Current estimates indicate that more than 1.8 million individuals worldwide are living with this condition. The increasing prevalence of MS in many countries, along with its long-term impact on diverse aspects of patients' personal and social lives, has drawn growing attention to the factors that contribute to psychological adaptation in this population.

Despite the expansion of research on the psychological consequences of MS, a substantial proportion of existing studies has focused primarily on pathological outcomes such as depression, anxiety, and reduced quality of life. In contrast, the investigation of positive developmental processes, including posttraumatic growth (PTG), among individuals with MS has remained relatively limited. This is notable given that PTG has been widely examined in populations exposed to severe stressors, including patients with cancer, individuals experiencing divorce, war survivors,

victims of natural disasters, and survivors of sexual assault and violence. Findings from these groups consistently suggest that, alongside psychological distress, individuals may also undergo positive changes across several life domains following highly challenging events. Furthermore, although some studies have explored the role of cognitive variables in patient adjustment, the simultaneous examination of intelligence beliefs and cognitive biases in relation to posttraumatic growth particularly through a mediating mechanism such as mentalization remains insufficiently investigated.

Clarifying these relationships is important for several reasons. First, identifying cognitive and metacognitive factors associated with posttraumatic growth may deepen our understanding of the psychological mechanisms that underlie adaptation to chronic illness. Second, elucidating the mediating role of mentalization may offer a more coherent theoretical framework for explaining how cognitive beliefs influence developmental outcomes. From an applied standpoint, the findings of such research could inform the design and development of psychological interventions aimed at modifying maladaptive intelligence beliefs, reducing cognitive biases, and strengthening mentalization capacity among individuals with multiple sclerosis. Accordingly, the present study was conducted to model posttraumatic growth based on intelligence beliefs and cognitive biases, with mentalization as a mediating variable, in patients diagnosed with multiple sclerosis.

Methods and Materials

Study Design

The present study was applied in terms of its objective and employed a quantitative, descriptive, correlational design using a path analysis approach. The statistical population comprised patients diagnosed with multiple sclerosis (MS) residing in Tehran in 2025. Participants were selected through purposive sampling based on predefined inclusion and exclusion criteria. The sample size was determined using Cohen (2013) formula. Assuming a medium effect size (0.15), a statistical power of 0.80, four latent variables, and a 95% confidence level, the required sample size was estimated to be 225 participants (Cohen, 2013). During the data collection phase, 289 individuals completed the questionnaires.

After applying the inclusion and exclusion criteria, 274 participants were deemed eligible, and the data from all 274 participants were used for statistical analysis. The inclusion criteria were: (a) a confirmed MS diagnosis by a neurologist, (b) age between 25 and 45 years, (c) at least a lower-secondary level of education, (d) a minimum of one year having elapsed since diagnosis, and (e) willingness to participate in the study. The exclusion criteria included: (a) incomplete questionnaires, (b) inaccurate or inconsistent responses, (c) self-reported severe psychiatric disorders, (d) use of psychiatric medications that could affect cognitive functioning, and (e) withdrawal from the study at any stage. Data were collected online via the Porsline platform. The questionnaire link was disseminated through social media and online groups related to individuals with multiple sclerosis in Tehran. At the beginning of the questionnaire, participants were provided with information regarding the purpose of the study, the confidentiality of the data, and how the collected information would be used. Participation was voluntary, and individuals proceeded to the survey after providing informed consent. Participants were assured that their information would remain confidential and that they could withdraw from the study at any time. No personally identifiable information was included in the final dataset or reports. Data were collected using a demographic questionnaire (age, gender, educational level, marital status, and duration of illness) along with standardized instruments, including the Posttraumatic Growth Questionnaire, the Intelligence Beliefs Scale, the Cognitive Biases Questionnaire, and the Mentalization Questionnaire.

Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996)

The Posttraumatic Growth Inventory (PTGI) was developed by [Tedeschi & Calhoun \(1996\)](#) to assess positive psychological changes experienced after exposure to highly stressful life events. The instrument consists of 21 items measuring five dimensions: new possibilities (5 items), relating to others (7 items), personal strength (4 items), appreciation of life (3 items), and spiritual change (2 items). All items are rated on a six-point Likert scale ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree). The total

score ranges from 0 to 105, with higher scores indicating greater levels of posttraumatic growth. [Tedeschi & Calhoun \(1996\)](#) confirmed the five-factor structure of the inventory using confirmatory factor analysis, supporting its construct validity. They reported high internal consistency with a Cronbach's alpha of 0.90 and a test-retest reliability of 0.71 over a two-month interval ([Tedeschi & Calhoun, 1996](#)). In Iran, [Mahmoudi et al., \(2013\)](#) reported a Cronbach's alpha of 0.91 for the scale, and the instrument's face and content validity were also confirmed.

Implicit Theories of Intelligence Scale (Abd-El-Fattah & Yates, 2006)

The Implicit Theories of Intelligence Scale was developed by [Abd-El-Fattah & Yates \(2006\)](#) to measure individuals' beliefs about the nature of intelligence based on the framework of implicit theories of intelligence. The scale consists of 14 items measuring two dimensions: entity (fixed) beliefs of intelligence and incremental beliefs of intelligence. The first seven items (items 1–7) assess entity beliefs, while the remaining seven items (items 8–14) measure incremental beliefs. All items are rated on a four-point Likert scale ranging from strongly disagree to strongly agree. Total scores range from 14 to 56, with higher scores indicating stronger endorsement of implicit beliefs about intelligence. Using confirmatory factor analysis, [Abd-El-Fattah & Yates \(2006\)](#) confirmed the two-factor structure of the scale, demonstrating satisfactory construct validity. The reliability of the instrument was reported with a Cronbach's alpha of 0.78 for the total scale, and 0.83 and 0.75 for the entity and incremental belief subscales, respectively ([Abd-El-Fattah & Yates, 2006](#)).

Cognitive Bias Questionnaire (Woody et al., 1997)

The Cognitive Bias Questionnaire was developed by [Woody et al. \(1997\)](#) to assess systematic patterns of selective attention and information processing in social situations. The instrument measures cognitive bias across two main components: self-focused bias and external-focused bias. The questionnaire includes 10 items, with the first five items assessing self-focused bias and the remaining five items assessing external-focused bias. Items are rated on a five-point Likert scale ranging from strongly disagree to strongly agree. Total scores range from 10 to 50, with higher scores indicating greater levels of cognitive bias. Within this framework, cognitive bias is conceptualized as a directional tendency

in attention and information processing in which individuals emphasize certain types of information while neglecting others. In self-focused bias, individuals tend to attribute events primarily to themselves and focus more on their own thoughts, emotions, and internal reactions. In contrast, external-focused bias involves attributing events mainly to environmental factors or the characteristics of others while minimizing one’s own role (Woody et al., 1997). Woody et al. (1997) reported satisfactory psychometric properties for this instrument. In the same study, the reliability of the scale was reported with a Cronbach’s alpha coefficient of 0.76, indicating acceptable internal consistency.

Mentalization Questionnaire MZQ; (Dimitrijević et al., 2018)

The Mentalization Questionnaire (MZQ) was developed by Dimitrijević et al. (2018) to assess individuals’ ability to understand and interpret their own and others’ mental states. The instrument consists of 28 items and includes three components: awareness of one’s own mental states (9 items), understanding others’ mental states (10 items), and psychic equivalence/reality stability (9 items). All items are rated on a five-point Likert scale ranging from completely incorrect to completely correct. The total score ranges from 28 to 140, with higher scores indicating a greater capacity for mentalization. Dimitrijević et al. (2018) reported Cronbach’s alpha coefficients ranging from 0.74 to 0.79, indicating satisfactory reliability. To examine validity, correlations between mentalization and constructs such as emotional intelligence, empathy, and the dimensions of the NEO personality model were assessed. The results demonstrated that mentalization showed significant positive correlations with cognitive and personality constructs, while negative associations were observed with avoidant and anxious attachment styles as well as neuroticism (Dimitrijević et al., 2018). In Iran, Safari Mousavi et al. (2020) standardized the instrument. In their study, Cronbach’s alpha coefficients for the total

scale and its subscales ranged from 0.73 to 0.86, indicating good reliability. The results of confirmatory factor analysis revealed satisfactory fit indices and appropriate factor loadings in the Iranian sample. Criterion validity also indicated that mentalization scores were positively correlated with mindfulness, secure attachment style, and social cognition (convergent validity) and negatively correlated with avoidant and anxious attachment styles (divergent validity) (Bazzi et al., 2024).

Findings and Results

Descriptive analyses were conducted to characterize the sample and examine the distribution of the study variables. Among the 274 participants included in the initial sample, 168 individuals (61.3%) were female and 106 (38.7%) were male. With respect to age distribution, 74 participants (27.0%) were between 25 and 30 years old, 96 (35.0%) were between 31 and 35 years, 63 (23.0%) were between 36 and 40 years, and 41 (15.0%) were between 41 and 45 years of age. In terms of educational attainment, 64 participants (23.4%) had completed lower secondary education, 89 (32.5%) held a high school diploma, 79 (28.8%) had obtained a bachelor’s degree, and 42 (15.3%) had postgraduate education. Regarding marital status, 158 participants (57.7%) were married, 89 (32.5%) were single, and 27 (9.8%) were divorced or widowed. Concerning the duration of illness, 82 participants (29.9%) had been diagnosed with multiple sclerosis for less than five years, 121 (44.2%) had lived with the disease for 5 to 10 years, and 71 (25.9%) had experienced the condition for more than 10 years. To describe the main study variables, descriptive statistical indices including the mean, standard deviation, skewness, and kurtosis were calculated. These indices were examined to assess central tendency, dispersion, and the normality of distribution prior to conducting path analysis. The results are presented in Table 1.

Table 1

Descriptive Statistics of the Study Variables (n = 274)

| Variable | Mean | SD | Skewness | Kurtosis |
|----------------------|-------|-------|----------|----------|
| Posttraumatic Growth | 71.84 | 12.36 | -0.42 | -0.31 |
| Intelligence Beliefs | 39.27 | 6.14 | -0.18 | -0.27 |
| Cognitive Biases | 27.53 | 5.72 | 0.36 | -0.22 |
| Mentalization | 94.68 | 10.85 | -0.29 | -0.34 |

Before testing the research hypotheses, the fundamental assumptions for path analysis were evaluated. First, missing data were examined; to maintain statistical power, missing values were addressed using the mean substitution method. Second, potential univariate outliers were identified using Z-scores. As no observations exceeded the threshold of ± 3 standard deviations, all data were retained for subsequent analysis. The normality of the data distribution was assessed using skewness and kurtosis indices, alongside the Kolmogorov–Smirnov (K–S) test. Skewness and kurtosis values for all variables were within the acceptable range (± 2), suggesting an approximately normal distribution. Furthermore, the K–S test confirmed non-significant deviations from normality (Posttraumatic Growth: $p = 0.12$; Intelligence

Beliefs: $p = 0.19$; Cognitive Biases: $p = 0.15$; Mentalization: $p = 0.23$). Multicollinearity was assessed by calculating the tolerance and variance inflation factor (VIF) indices. Tolerance values ranged from 0.62 to 0.71, and VIF values ranged from 1.40 to 1.61, both of which indicate the absence of multicollinearity concerns ($VIF < 5$). Furthermore, the Durbin–Watson statistic (1.91) confirmed the independence of residuals. Collectively, these results indicate that the dataset satisfied all necessary assumptions for path analysis and inferential testing. To explore preliminary associations, Pearson’s correlation coefficients were computed. These results provided initial support for the hypothesized relationships among the variables, serving as a robust foundation for testing the proposed structural model.

Table 2

Pearson Correlation Matrix of the Study Variables (n = 274)

| Variables | 1 | 2 | 3 | 4 |
|-------------------------|---------|---------|---------|---|
| 1. Posttraumatic Growth | 1 | | | |
| 2. Intelligence Beliefs | 0.41** | 1 | | |
| 3. Cognitive Biases | -0.36** | -0.29** | 1 | |
| 4. Mentalization | 0.47** | 0.38** | -0.33** | 1 |

$p < 0.01$

As shown in *Table 2*, posttraumatic growth exhibited a significant positive correlation with intelligence beliefs ($r = 0.41, p < 0.01$) and with mentalization ($r = 0.47, p < 0.01$). Conversely, cognitive biases demonstrated a significant negative association with posttraumatic growth ($r = -0.36, p < 0.01$). Further analysis indicated that intelligence beliefs were positively correlated with mentalization ($r = 0.38, p < 0.01$) and negatively correlated with cognitive biases ($r = -0.29, p < 0.01$). Moreover, cognitive biases were negatively associated with mentalization ($r = -0.33, p < 0.01$). These findings collectively suggest an interrelated pattern among the constructs, consistent

with the study’s conceptual model. Overall, the correlation results confirm the presence of sufficient relationships among the key variables, thereby meeting the preliminary conditions for hypothesis testing using path analysis.

Table 3 presents the direct effects of the predictor variables on the mediator and criterion variables. As shown, intelligence beliefs had a significant positive direct effect on mentalization and posttraumatic growth, whereas cognitive biases exhibited significant negative direct effects on both variables. Additionally, mentalization showed a significant positive direct effect on posttraumatic growth.

Table 3

Direct Effects of the Study Variables in the Path Analysis Model

| Research Paths | B | β | S.E. | t | p |
|---|-------|---------|------|-------|-------|
| Intelligence Beliefs → Mentalization | 0.41 | 0.34 | 0.08 | 5.12 | 0.001 |
| Cognitive Biases → Mentalization | -0.36 | -0.28 | 0.07 | -4.87 | 0.001 |
| Intelligence Beliefs → Posttraumatic Growth | 0.38 | 0.27 | 0.09 | 4.29 | 0.001 |
| Cognitive Biases → Posttraumatic Growth | -0.33 | -0.22 | 0.08 | -3.96 | 0.001 |
| Mentalization → Posttraumatic Growth | 0.49 | 0.37 | 0.10 | 5.03 | 0.001 |

The path analysis results revealed that intelligence beliefs significantly and positively predicted mentalization ($\beta = 0.34, p < 0.001$) and posttraumatic growth ($\beta = 0.27, p < 0.001$). In contrast, cognitive biases exerted significant negative direct effects on both mentalization ($\beta = -0.28, p < 0.001$) and posttraumatic growth ($\beta = -0.22, p < 0.001$). Furthermore, mentalization demonstrated a significant positive direct effect on posttraumatic growth ($\beta = 0.37, p < 0.001$),

indicating that higher levels of mentalization are associated with greater posttraumatic growth in patients with multiple sclerosis.

To examine the indirect effects of the study variables and determine the mediating role of mentalization in the relationships between intelligence beliefs, cognitive biases, and posttraumatic growth, the bootstrapping method was employed. The results are presented in Table 4.

Table 4

Indirect Effects Estimated Using the Bootstrap Method (95% CI)

| Path | Estimate | Lower CI | Upper CI | p |
|---|----------|----------|----------|-------|
| Intelligence Beliefs → Mentalization → Posttraumatic Growth | 0.15 | 0.08 | 0.23 | 0.001 |
| Cognitive Biases → Mentalization → Posttraumatic Growth | -0.13 | -0.21 | -0.06 | 0.001 |

The bootstrap results indicated that the indirect effect of intelligence beliefs on posttraumatic growth through mentalization was positive and significant ($\beta = 0.15; 95\% \text{ CI } [0.08, 0.23]$). Similarly, the indirect effect of cognitive biases on posttraumatic growth mediated by mentalization was found to be negative and significant ($\beta = -0.13; 95\% \text{ CI } [-0.21, -0.06]$). Given that the confidence intervals for both indirect paths excluded zero, it can be

concluded that mentalization serves as a significant mediator in the relationship between both cognitive-based predictors and posttraumatic growth among patients with multiple sclerosis.

To assess the adequacy of the conceptual model in representing the empirical data, several model fit indices were evaluated. The results are presented in Table 5.

Table 5

Model Fit Indices for the Proposed Research Model

| Fit Indices | χ^2 | df | χ^2/df | GFI | AGFI | CFI | RMSEA |
|----------------|----------|----|--------------------|------|------|------|-------|
| Research Model | 162.48 | 83 | 1.95 | 0.93 | 0.90 | 0.95 | 0.056 |

The results indicate that the model demonstrated an acceptable and satisfactory fit. The chi-square to degrees of freedom ratio ($\chi^2/\text{df} = 1.95$) was below the recommended threshold of 3, indicating good model fit. Additionally, the values of the Comparative Fit Index (CFI = 0.95), Goodness-of-Fit Index (GFI = 0.93), and Adjusted Goodness-of-Fit Index (AGFI = 0.90) were all at or above the acceptable level of 0.90. Moreover, the Root Mean Square Error of Approximation (RMSEA = 0.056) was

below 0.08, suggesting a satisfactory approximation of the model to the data. Overall, these findings indicate that the proposed conceptual model exhibits adequate fit and effectively explains the relationships among intelligence beliefs, cognitive biases, mentalization, and posttraumatic growth.

The standardized path coefficients of the research model are illustrated in Figure 1.

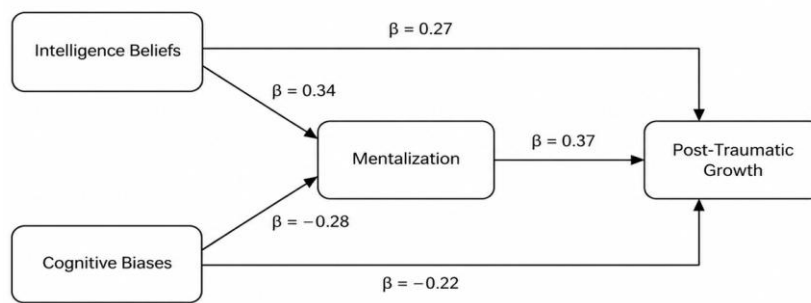


Figure 1

Structural model of posttraumatic growth with standardized path coefficients.

Discussion and Conclusion

The present study aimed to model posttraumatic growth based on intelligence beliefs and cognitive biases, with mentalization serving as a mediator in patients with multiple sclerosis. The findings provided support for the hypothesized relations and highlighted the cognitive and reflective mechanisms that may facilitate or hinder positive psychological transformation following chronic illness.

First, the results demonstrated that intelligence beliefs had a significant positive effect on posttraumatic growth. This finding is consistent with previous studies (Burnette et al., 2023; Schroder et al., 2017), which emphasized the role of incremental beliefs in promoting resilience and adaptive functioning in the context of health-related stressors. Individuals who endorse incremental beliefs tend to perceive illness not as a fixed and unchangeable condition but as a challenge that can be managed through learning and the acquisition of new coping strategies. Such a learning-oriented outlook encourages patients to reevaluate life goals, extract new meanings from their experiences, and engage in positive transformation and growth (Dweck, 2006).

The study also found that cognitive biases exerted a significant negative effect on posttraumatic growth. This finding aligns with the results of Savioni & Triberti (2020) and Eysenck (2022), who reported that negative attentional and interpretive biases interfere with adaptive information processing following adversity. According to the posttraumatic growth (PTG) model proposed by Tedeschi & Calhoun (1996), growth after

trauma requires cognitive restructuring and meaning reconstruction. However, cognitive biases—such as threat-focused attention and catastrophic interpretations—disrupt this reconstructive process. Instead of searching for potential opportunities or lessons embedded in difficult experiences, individuals become trapped in narrow, negative interpretations. This focus on negative aspects limits their ability to identify new meanings, deepen relational understanding, or foster a sense of personal strength, ultimately restricting opportunities for posttraumatic growth.

Furthermore, the present study revealed that intelligence beliefs had a significant positive influence on mentalization. This result is consistent with prior research (Burnette et al., 2023; Schroder et al., 2017), showing that incremental beliefs about personal abilities are associated with flexible cognitive processing and adaptive emotional regulation. Individuals who believe that cognitive abilities are malleable tend to adopt a more open and reflective attitude toward their own and others' internal experiences. This openness enables them to examine mental states rather than making rigid or premature judgments when confronted with complex emotions and thoughts related to illness. Consequently, incremental beliefs may support mentalization by promoting cognitive flexibility and enhancing the capacity to represent and interpret diverse mental states (Fonagy et al., 2018).

Additionally, the findings showed that cognitive biases had a significant negative effect on mentalization. Theoretically, mentalization requires cognitive flexibility, tolerance for ambiguity, and the ability to consider mental states from multiple perspectives. Cognitive biases, by contrast, are characterized by rapid, distorted, and threat-oriented information processing, which leads individuals toward one-sided conclusions. Under such circumstances, patients may struggle to understand their own and others' thoughts and emotions in a nuanced and reflective manner, weakening their mentalizing capacity. This is consistent with theoretical accounts suggesting that negative interpretive tendencies reduce opportunities for reflective functioning and impede the ability to evaluate the mental states underlying behaviors (Fonagy et al., 2018; Luyten & Fonagy, 2015).

The results further revealed that mentalization positively predicted posttraumatic growth. Consistent with the findings of Allen et al. (2008) and Joseph et al. (2012), mentalization appears to facilitate adaptive psychological functioning and positive transformation after stressful experiences. Mentalization assists individuals in processing complex illness-related emotions and thoughts at a reflective, rather than purely reactive, level. This reflective process helps them derive meaning from their illness and integrate it into a revised understanding of themselves and their lives. Within the PTG framework, such reflective meaning-making is considered a central mechanism for achieving positive psychological growth following crisis (Tedeschi & Calhoun, 2004).

Beyond direct effects, the study found that intelligence beliefs exerted a significant positive indirect effect on posttraumatic growth through mentalization. This finding aligns with research emphasizing the mediating role of reflective processes in converting cognitive attitudes into adaptive behavioral outcomes (Dweck & Yeager, 2019; Kuiken et al., 2021). While incremental beliefs encourage individuals to embrace change and search for meaning in adversity, these beliefs translate into growth only when the individual can reflectively examine internal states and the implications of illness. Mentalization thus acts as a *processing engine*, transforming incremental beliefs from abstract mindsets into cognitive-emotional mechanisms that support meaning reconstruction and growth (Liao, 2023).

Finally, the study showed that cognitive biases had a significant negative indirect effect on posttraumatic growth via mentalization. This result is coherent with the theoretical framework of Tedeschi & Calhoun (2004) and the mentalization-based perspectives of (Fonagy et al., 2018). Because posttraumatic growth requires cognitive reconstruction and reappraisal of threatening experiences, the presence of cognitive biases obstructs this process. When such biases simultaneously undermine mentalization, the individual becomes less capable of adopting a flexible understanding of mental states. As a result, they are less able to use the illness experience as a foundation for rethinking personal beliefs, strengthening relationships, or generating new meanings. Mentalization therefore operates as a protective mechanism that links cognitive vulnerabilities—stemming from biases—to diminished posttraumatic growth (Katz & Taubman-Ben-Ari, 2026; Mendonça et al., 2026; Zeng et al., 2026).

The findings of the present study indicated that intelligence beliefs and cognitive biases play significant roles in predicting posttraumatic growth among patients with multiple sclerosis, and that these relationships are partially explained through mentalization. Specifically, incremental intelligence beliefs were associated with higher levels of mentalization and, consequently, greater posttraumatic growth. In contrast, cognitive biases were linked to weakened mentalization capacity and reduced posttraumatic growth. Furthermore, the results demonstrated that mentalization functions as a mediating mechanism that transmits part of the direct effects of cognitive variables on posttraumatic growth.

By highlighting the role of cognitive and metacognitive processes in psychological adaptation to chronic illness, these findings suggest that the experience of multiple sclerosis is not inevitably confined to negative psychological outcomes. Rather, when individuals possess adaptive cognitive appraisals, cognitive flexibility, and the capacity to reflect upon internal states, the illness experience may serve as a catalyst for positive transformation and psychological growth.

Accordingly, the proposed model provides an explanatory framework for understanding some of the mechanisms underlying posttraumatic growth in patients with multiple sclerosis and underscores the importance of cognitive-metacognitive interventions in

this population. Interventions aimed at fostering incremental beliefs, reducing maladaptive cognitive biases, and strengthening mentalization capacity may enhance patients' potential for adaptive adjustment and growth in the context of chronic illness.

Limitations and Future Directions

The present study, despite its notable findings, has several limitations that should be considered when interpreting the results. First, the study employed a cross-sectional correlational design; therefore, causal relationships among the variables cannot be definitively inferred. Second, data were collected through self-report instruments, which may be susceptible to response biases or social desirability. Third, as the sample was selected purposively from patients with Multiple Sclerosis (MS) in Tehran, the generalizability of these findings to broader or culturally distinct populations should be approached with caution. Furthermore, potentially influential variables such as disease severity, specific MS subtype, treatment history, social support, and baseline levels of depression or anxiety were not included in the model. Finally, since certain inclusion criteria were based on self-reports rather than independent clinical evaluations, the accuracy of sample classification may be subject to limitations.

Given these constraints, future research is recommended to employ longitudinal and experimental designs to better examine the causal pathways among the variables and evaluate the efficacy of interventions aimed at modifying intelligence beliefs, reducing cognitive biases, and enhancing mentalization. Incorporating additional constructs such as resilience, emotion regulation, and meaning-in-life into future research models may provide a more comprehensive explanation of Posttraumatic Growth (PTG). Moreover, comparative studies involving patients with other chronic illnesses, as well as the use of mixed-methods approaches to explore patients' lived experiences, would further contribute to a deeper understanding of the PTG process.

From an applied perspective, the findings provide a robust basis for designing psychological interventions grounded in cognitive and metacognitive frameworks, specifically aimed at modifying maladaptive beliefs and strengthening reflective functioning in MS patients. It is recommended that, alongside medical treatment, a systematic assessment of psychological factors be

incorporated into the care provided within MS treatment centers. Finally, considering the vital role of interpersonal dynamics in developing mentalization, psychoeducational programs for families and caregivers could significantly improve emotional support and facilitate the path toward adaptation and growth for patients with multiple sclerosis.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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