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A Neuropsychological Framework for Assessing Marital Conflict: Development of a Brain Systems–Based Conceptual Model

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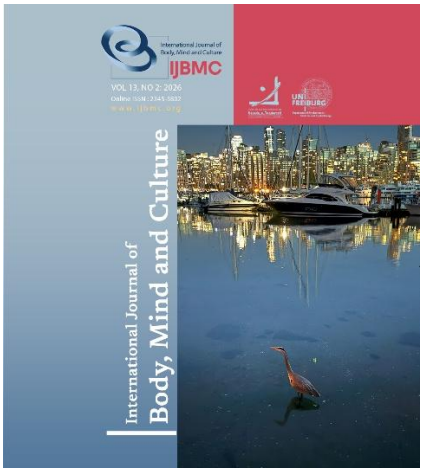

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ABSTRACT

Objective: This study aimed to identify neuropsychological pattern factors involved in marital conflict and develop a brain systems–based framework for assessment.

Methods and Materials: This applied mixed-methods study used an exploratory sequential design. In the qualitative phase, thematic network analysis, based on Attride-Stirling's approach, was conducted by reviewing scientific sources on neuropsychology, brain systems, and marital conflict. Initial codes were refined using Q-sort data from 30 men and women with moderate to severe marital conflict and expert evaluation by 9 psychiatrists. The extracted items were assessed for content validity using the content validity ratio and content validity index criteria.

Findings: The analysis identified five major neuropsychological domains associated with marital conflict: prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal cortex. Couples most frequently reported symptoms related to prefrontal dysfunction, including impulsivity, hasty decisions, poor planning, and weak empathy (25%), followed by deep limbic symptoms such as negativity, depression, rejection sensitivity, low sexual desire, and intense emotional reactions (22%). Anterior cingulate symptoms included inflexibility and fixation on past conflicts (20%), basal ganglia symptoms included chronic anxiety and conflict avoidance (18%), and temporal cortex symptoms included aggression, suspiciousness, and misinterpretation of the spouse's words (15%). Expert review confirmed acceptable content validity, with mean CVR values ranging from 0.80 to 0.87 and mean CVI values from 0.87 to 0.91.

Conclusion: Marital conflict can be conceptualized as a multidimensional outcome of interactions among executive, emotional, anxiety-related, cognitive-flexibility, and socio-emotional brain systems. This framework may support culturally adapted assessment tools and neuroscience-informed couple therapy.

Keywords: Marital conflicts, Neuropsychology, Cognitive processing, Network model, Couple therapy.

Introduction

Marital relationships, as the central core of the family system, play a decisive role in individuals' psychological, emotional, and social well-being. Within the context of shared life, spouses are in continuous interaction with one another, and this very continuity and closeness make marital relationships one of the most intense and sensitive contexts for the emergence of interpersonal conflicts (Almuhtaseb et al., 2021; Zhang et al., 2018). Although conflict in intimate relationships is considered a natural and unavoidable phenomenon, its persistence, intensity, and the way it is managed can have far-reaching consequences for relationship quality, marital satisfaction, and family stability (Ashrafi et al., 2025).

Research indicates that marital conflicts often stem from couples' inability to understand each other's individual, emotional, and cognitive differences, and ineffective responses to this inability contribute to the escalation of conflict (Charbonneau-Lefebvre et al., 2025). Conflicted couples typically exhibit patterns of cognitive errors, including emotional reasoning, selective attention to the spouse's negative behaviors, exaggeration of mistakes, and hostile interpretations of each other's words and actions; patterns that not only weaken the quality of marital interactions, but also create the conditions for secondary problems in individual and family functioning (Niam & Jadidian, 2024).

In this regard, numerous studies have attempted to explain marital conflicts in relation to various psychological variables. For example, findings indicate a significant relationship between cyclothymic temperament, anxiety sensitivity, sexual dissatisfaction, and marital conflicts (Razazan, 2025; Bakhshipour et al., 2024). In addition, the role of irrational beliefs, conflict resolution styles, and dysfunctional communication patterns in intensifying marital conflicts has been well documented (Bahramian et al., 2024). Despite the value of these studies, their predominant focus on self-report and cognitive-emotional variables provides a relatively incomplete picture of the underlying mechanisms of marital conflict.

In recent years, advances in cognitive neuroscience and neuropsychology have shown that interpersonal conflicts, including marital conflicts, are not merely psychological or social phenomena, but are also rooted in the functioning of brain systems involved in emotion regulation, cognitive processing, decision-making, and impulse control (Godfrey et al., 2021). Research suggests that the activity and coordination of multiple brain systems, including the prefrontal cortex, anterior cingulate gyrus, limbic system, amygdala, and basal ganglia, play a fundamental role in how marital conflicts are experienced, interpreted, and managed (Huang & Menon, 2025; Li et al., 2022).

More specifically, the prefrontal cortex plays a key role in impulse control, the regulation of emotional responses, and interpersonal decision-making, and its dysfunctional operation may lead to impulsive reactions and the intensification of conflict. The anterior cingulate gyrus is associated with conflict resolution processes, error monitoring, and cognitive flexibility, whereas the amygdala and other components of the limbic system are involved in processing emotions such as anger and fear, and their hyperactivity can produce intense and uncontrollable emotional responses in marital relationships. Likewise, dysfunction in the basal ganglia may lead to the reinforcement of maladaptive behavioral patterns in couples' interactions.

Despite this evidence, there are still few coherent models and valid instruments capable of assessing and explaining marital conflicts on the basis of brain systems within a neuropsychological framework, particularly in the cultural and social context of Iran. The lack of localized and valid instruments that can evaluate these systems in an applied and clinical manner is considered one of the major gaps in research in the field of neuroscience-based couple therapy.

Methods and Materials

Study Design

The present study was applied in terms of purpose and mixed-methods (qualitative–quantitative) in terms of methodology. The mixed-methods design employed was a two-phase exploratory–explanatory design. In this design, the qualitative phase was conducted first in order to identify the main concepts, dimensions, and components of the construct under study, and the findings obtained from this phase served as the basis for designing the measurement instrument. In the second phase, the developed instrument was quantitatively tested and its psychometric properties were examined.

The selection of this design was based on the rationale that "brain systems involved in marital conflicts" is a complex, interdisciplinary, and insufficiently localized concept in the domestic research literature and therefore requires in-depth conceptual exploration prior to quantitative measurement.

Qualitative Phase Method

In the first phase, with the aim of developing and preliminarily validating an instrument for assessing brain systems involved in marital conflicts, the study adopted a theory-driven qualitative method based on thematic network analysis following the approach of Attride-Stirling (2001) This phase was conducted within an exploratory–explanatory framework and was based on the assumption that, by drawing on neuroscientific foundations and library-based studies, it would be possible to identify and formulate a coherent set of key concepts related to dysfunction in brain systems, including the prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal region, within the context of marital conflicts. Accordingly, the five-stage thematic network analysis approach proposed by Attride-Stirling (2001) was employed. Below, each stage of this approach is introduced, and the procedures undertaken in the present study in relation to each stage are explained.

Stage One: Content Coding

In the first stage, content coding was carried out on the basis of theoretical foundations and library-based studies. In this process, a set of key concepts related to dysfunction in brain systems, including the prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal region, was extracted in the context of marital conflicts. Coding was performed with a focus on prior theoretical interests and concepts, reliance on latent meanings in scientific texts, and integration of the theoretical framework with semantic data derived from the texts. The main axis of coding consisted of neuropsychological mechanisms affecting couples' relationships and marital conflicts, which was considered the criterion for selecting and organizing the codes.

Stage Two: Theme Identification

In the second stage, themes or general statements were identified from the extracted codes. This stage involved the extraction of initial themes and their gradual refinement. Subthemes related to the two domains of "brain systems" and "marital conflicts" were extracted and refined, reviewed, and modified across three to five stages until they reached an acceptable level in terms of conceptual adequacy, internal coherence, and theoretical consistency.

Stage Three: Construction of the Thematic Network

In the third stage, the thematic network was created and organized. This stage involved arranging the themes extracted in the second stage, selecting the basic themes based on the content of the statements, reorganizing the basic themes into organizing themes, inferring the global theme, and drawing, reviewing, and refining the thematic network. The thematic network was mapped across the two domains of "brain systems" and "marital conflicts" and at the level of couples' communication strategies. Subsequently, the links among the basic, organizing, and global themes were reexamined, and the final network was revised and confirmed.

Stage Four: Description and Exploration of the Thematic Network

The fourth stage was devoted to the description and exploration of the thematic network. According to Attride-Stirling (2001), this stage may be carried out, depending on the research context and the researcher's creativity, through textual sources, expert opinions, or human sources involved in the phenomenon under study. In the present study, the description and exploration of the thematic network were conducted through thematic analysis of relevant scientific texts and the extraction of items for the instrument assessing brain systems in marital conflicts. Subsequently, the extracted items were presented to men and women experiencing marital conflict using the Q-sort method, and they were asked to rank the items based on the degree of similarity to their spouse.

Stage Five: Summarizing the Thematic Network

In the fifth stage, the thematic network was summarized. At this stage, using a thematic analysis table, the basic, organizing, and global themes were integrated with concrete and operational instances derived from the analysis of scientific texts. Ultimately, the final thematic network for each of the items in the instrument assessing brain systems in marital conflicts was finalized and summarized.

Summary of the Qualitative Phase and Instrument Development

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Overall, in the qualitative phase of the study, key concepts related to dysfunction in brain systems, including the prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal region, were first extracted in the context of marital conflicts through a careful review of theoretical foundations and library-based studies. The selected items were then presented to participants experiencing conflict through a questionnaire-sorting method so that they could rank them on a five-point scale consisting of "almost never," "rarely," "sometimes," "frequently," and "very much," based on the criterion ranging from "most similar to my spouse" to "least similar to my spouse." After frequency analysis and identification of the most representative items, the initial version of the questionnaire was developed. In the next step, the internal content validity of the questionnaire was evaluated in two rounds using the opinions of nine specialist psychiatrists. At this stage, the CVI and CVR indices were used to analyze the experts' judgments, and the questionnaire was revised and completed based on the results obtained. Accordingly, the overall framework of the process and method of the qualitative phase is presented in Figure 1.

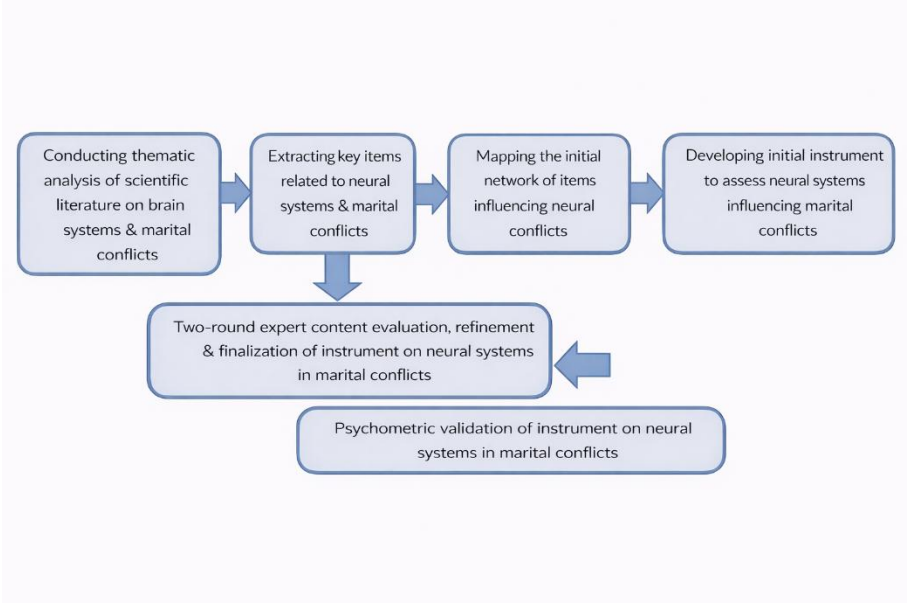

Figure 1

Six-stage process of the present study in the qualitative phase (first phase of the study)

The qualitative method of the present study was based on several principles. First, coherence was maintained through alignment of the data with the theoretical framework and key concepts. Second, validity was ensured through content evaluation by nine specialists, with CVI ≥ 0.80 and CVR ≥ 0.75. Third, replicability was supported through precise description of the stages of analysis and the refinement criteria. Fourth, transparency was maintained through adherence to ethical principles, including informed consent and protection of privacy. Finally, reproducibility was facilitated through the presentation of a structured process that can be replicated in future studies. This qualitative approach, through adherence to methodological principles, provided the necessary foundation for the trustworthiness and scientific validity of the research instrument.

Sampling in the qualitative phase was conducted based on the logic of qualitative research and the exploratory–developmental mixed-methods approach. The main purpose of this phase was to extract conceptual components, identify the hidden dimensions of the construct, and develop the initial items of the measurement instrument. Therefore, sampling was designed not on the basis of statistical generalizability, but on the basis of informational richness, theoretical adequacy, and conceptual saturation.

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In the first step, sampling was conducted from scientific sources in order to establish the theoretical framework of the study and the conceptual foundation of the measurement instrument. The sample size consisted of at least 25 valid scientific sources. These included specialized books, scientific research articles, master's theses, and doctoral dissertations in both Persian and English. The search databases included SID, Magiran, PubMed, and Scopus. The sampling method was purposive sampling based on theoretical criteria. The criteria for selecting sources included direct relevance to the concepts of brain systems and marital conflicts, scientific quality and peer-reviewed status, capacity for extracting theoretical components and items, and repetition and convergence of key concepts. Sampling of the sources continued until theoretical saturation was achieved; that is, review of new sources no longer resulted in the extraction of a new concept or dimension, and the conceptual framework of the study reached stability.

In the second step, sampling was conducted from participants with the aim of understanding the lived experience of marital conflicts, identifying emotional-cognitive patterns, and examining behavioral manifestations related to brain systems. The sample size was approximately 30 participants. The research setting included family counseling centers supervised by the State Welfare Organization and pre-divorce counseling centers affiliated with the Judiciary in the city of Isfahan. The sampling method was purposive. Inclusion criteria were a diagnosis of moderate to severe marital conflict by the center's counselor, active referral for counseling services, and informed consent to participate in in-depth interviews. The logic of sample selection was to ensure maximum variation in terms of conflict severity, age, duration of marriage, educational level, and socioeconomic status so that a wide range of marital experiences could be covered. Interviews continued until theoretical saturation was reached; that is, new data no longer led to the formation of a new category or theme.

In the third step of the qualitative phase, sampling was conducted from specialists with the aim of theoretical validation, conceptual refinement of the items, and implementation of the questionnaire-sorting method. The sample consisted of nine specialists. The sampling method was purposive and expertise-based. The criteria for selecting specialists included holding a specialist degree in psychiatry, having professional experience in the field of marital conflicts, and possessing theoretical or clinical familiarity with neuropsychological approaches. The role of the specialists in the study included participation in specialized interviews, conceptual evaluation of the items, and implementation of the questionnaire-sorting method. Their participation continued until theoretical consensus and stability in item categorization were achieved. The target population of the study consisted of participants experiencing serious marital conflicts.

Instruments

Semi-structured interviews with specialists were used to examine the content validity of the developed instrument. For this purpose, semi-structured interviews were conducted with nine psychiatrists. The interview structure focused on four main areas: the relevance of the items to the target brain structures, the clarity and simplicity of the items, the necessity of each item, and suggestions for deletion or revision.

In the qualitative phase, the items extracted from the theoretical literature were presented to participants experiencing conflict using the Q-sort method in order to identify the most representative items. Each couple evaluated the degree of similarity of each item to their spouse's behaviors using a five-point scale ranging from "almost never," "rarely," "sometimes," "frequently," to "very much." Items that received the highest frequency of high ratings were selected as inputs for the next stage.

Ethical Considerations

Observance of ethical principles was given serious attention in all stages of the design, implementation, and data analysis of the present study. These principles were applied not only in line with academic requirements, but also with greater sensitivity due to the nature of the research topic, namely marital conflicts and couples' relationships. For this study, an ethics code was issued by the National Committee for Ethics in Biomedical Research under the identifier IR.IAU.TNB.REC.1404.074.

Findings and Results

In the qualitative phase of the study, two main groups of participants were involved: participants experiencing marital conflict and psychiatric specialists. The group of participants experiencing marital conflict consisted of 30 individuals who had referred to counseling centers supervised by the State Welfare Organization and family counseling centers affiliated with the Judiciary in the city of Isfahan. The inclusion criteria were at least one year of marital life, experience of moderate to severe marital conflict based on the counselor's initial assessment, and willingness to participate in the study. The participants ranged in age from 19 to 57 years. Most participants had educational attainment ranging from a high school diploma to a bachelor's degree, and the reported duration of marriage ranged from 1 to 43 years. This group participated in the Q-sort procedure and, based on a five-point scale ranging from "never" to "very much," identified the degree of similarity between the proposed items and their spouse's behavior. The data obtained from this group formed the basis for identifying the salient symptoms of marital conflict arising from dysfunction in brain systems. This phase helped the researcher identify, from the perspective of lived experience, the items that had the greatest frequency and importance among participants.

The group of psychiatric specialists consisted of nine psychiatrists. These individuals examined the necessity, clarity, appropriateness, and adequacy of the items through semi-structured interviews. They reviewed the preliminary questionnaire in two stages and, based on the indices of necessity, clarity, appropriateness, and relevance of each item, provided either confirmatory or corrective feedback. At this stage, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated to determine the adequacy and appropriateness of the items. This combination of participants enriched the qualitative data both from the perspective of the participants' lived experiences and from the clinical expertise of psychiatrists, thereby providing the necessary basis for designing a valid and culturally adapted questionnaire.

Composition of Participants

Table 1 presents the composition of participants in the qualitative phase.

Table 1

Composition of Participants in the Qualitative Phase

Participant Group	Number	Characteristics and Description
Participants with marital conflict	30	Referred to Welfare counseling centers and Judiciary-affiliated pre-divorce centers; selected purposively; participated in Q-sort
Specialists (psychiatrists)	9	Experienced in treating neuropsychological disorders; participated in CVI and CVR evaluation of the questionnaires

Coding Process and Extraction of Themes

To address the first research question, namely, what factors constitute the neuropsychological model for assessing marital conflicts, the process of qualitative data analysis was conducted with the aim of explaining the components of the neuropsychological model of marital conflicts. This process was based on Attride-Stirling (2001) thematic network analysis model and followed an integrated deductive–inductive approach. In other words, the conceptual framework of the study was first developed on the basis of theoretical literature and neuropsychological models, particularly Amen's model, and then the empirical data obtained from participants and specialists contributed to refining, enriching, and localizing this framework.

Qualitative data were collected from three main sources: scientific and theoretical texts, psychiatric specialists, and the implementation of the Q-sort method with men and women experiencing marital conflict. Data analysis was carried out through several stages of coding, organization, and conceptual abstraction, which are described below.

In the first step of qualitative analysis, initial coding was performed deductively and in a theory-driven manner based on a systematic review of scientific texts. At this stage, raw empirical data had not yet entered the analysis process, and the primary focus was on extracting behavioral indicators of marital conflicts related to the functioning of brain systems from the research literature and valid neuropsychological models,

especially Amen's functional brain model. The sources used at this stage included studies in clinical neuropsychology, brain imaging research, theories of emotion regulation, and literature related to marital conflicts and couple relationships. On this basis, behaviors and symptoms that had been attributed in previous studies to dysfunction in the prefrontal cortex, anterior cingulate gyrus, basal ganglia, limbic system, and temporal cortex were extracted and coded as meaning units. As a result of this process, approximately 124 initial theoretical codes were identified, each representing a behavioral, emotional, or cognitive pattern associated with marital conflicts within a neuropsychological framework. For example, in the area of the prefrontal cortex, codes such as "impulsive decision-making," "deficits in anticipating consequences," "weakness in planning marital interactions," and "reduced inhibition of emotional responses" were directly extracted from scientific texts. This stage played a concept-forming role in the study and provided the basis for the initial formulation of questionnaire items. In subsequent stages, the data obtained from the participants' Q-sort method and expert opinions were used not to generate new codes, but rather to refine, prioritize, localize, and empirically validate these theoretical codes.

After extracting the initial theoretical codes from the scientific texts, the second stage focused on refining and organizing these codes based on empirical data. At this stage, the extracted theoretical codes were subjected to empirical evaluation through the results of the Q-sort procedure with couples experiencing conflict and the preliminary feedback of specialists. The purpose of this stage was to assess the extent to which the theoretical codes corresponded to the lived experiences of couples within the cultural context of Iran and to eliminate or merge codes that lacked sufficient empirical frequency or clarity. Codes that were similar in content or referred to a single behavioral pattern were grouped into basic themes. For example, the codes "hasty decision-making," "quick reaction without thinking," and "inability to stop an emotional response" were merged into the basic theme of "impulsivity." Similarly, codes related to "rumination," "repeated return to past conflicts," and "inability to let go of previous mistakes" were organized under the basic theme of "being stuck in the past." This stage served as the point of connection between theory and experience and enabled the basic themes to acquire not only theoretical grounding but also phenomenological and cultural validity.

In the third step, the extracted basic themes were organized within the framework of the target brain systems of the study. At this stage, each set of basic themes referring to a common cognitive-emotional function was placed under an organizing theme. These organizing themes represented the principal dimensions of functional impairment in each brain system within marital relationships. For instance, in the area of the prefrontal cortex, basic themes such as "impulsivity," "hasty decisions," and "lack of planning" were grouped under the organizing theme of "deficits in problem-solving and decision-making." In the anterior cingulate gyrus, themes such as "being stuck in the past," "oppositionality," and "inflexibility" were placed under the organizing theme of "deficits in cognitive flexibility." This stage enabled the questionnaire structure to move beyond scattered behavioral symptoms and develop into a coherent system-based framework suitable for factor analysis and psychometric evaluation.

In the fourth stage, the organizing themes were analyzed at a broader level in order to identify the global patterns of marital conflict in connection with brain functioning. Global themes reflected the link between localized dysfunctions in brain systems and persistent patterns of conflict in couples' relationships. The results of this stage led to the identification of several overarching themes, each representing a major pathway of impairment in marital relationships, including dysfunction in cognitive-emotional regulation, associated with the prefrontal cortex and anterior cingulate gyrus; hyperactivity of the threat and anxiety system, associated with the basal ganglia and deep limbic structures; and dysfunction in social-emotional processing and empathy, associated with the deep limbic system and temporal cortex. These global themes formed the final conceptual framework of the study and provided the basis for the neuropsychological explanation of marital conflicts.

In the final step, the basic, organizing, and global themes were mapped within a coherent conceptual network. This network systematically illustrates the structural relationships among brain systems, impaired functions, and the behavioral manifestations of marital conflict. The thematic network was repeatedly compared

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with the couples' data and the experts' opinions and, after final revisions, was approved by the psychiatrists. The final thematic network served not only as the output of the qualitative phase of the study, but also as the direct basis for the development of the items in the neuropsychological questionnaire on marital conflicts. In this way, a systematic connection was established among theoretical data, empirical data, and the measurement instrument, thereby strengthening the content and construct validity of the questionnaire. For clarification, an example of this process is presented in the following table.

Table 2

Example of Data Organization in Thematic Analysis

Initial Coding	Basic Themes	Organizing Themes	Global Theme
Gets angry quickly	Weak emotion regulation	Dysfunctional prefrontal cortex functioning	Dysfunction of brain systems in marital conflicts
Interrupts spouse while speaking	Impulsive behaviors	Dysfunctional prefrontal cortex functioning	
Cannot let go of old issues	Being stuck in repetitive thoughts	Cognitive inflexibility	
Focuses on the negative side of things	Negative emotional bias	Deep limbic hyperactivity	
Is anxious and worried about being abandoned	Attachment anxiety	Basal ganglia dysfunction	
Shows verbal aggression	Problems in empathy and emotion processing	Temporal cortex dysfunction	

Findings from participants (Q-Sort Method)

In this section, the qualitative data obtained from the Q-sort method administered to couples experiencing conflict were analyzed. At this stage, the items that were selected by the couples in the preliminary questionnaire as the most prominent indicators of conflict in their relationships were extracted and categorized. The main purpose of this section was to identify behavioral symptoms related to the five brain systems: the prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal cortex. In the domain of the prefrontal cortex, couples showed the highest frequency for items such as impulsivity, hasty behavior, disregard for consequences, interrupting the spouse, lack of planning, overspending, and empathy problems. These symptoms reflect weakness in cognitive inhibition, emotional control, and executive planning, all of which play an important role in the emergence of marital conflicts.

With regard to the anterior cingulate gyrus, the reported symptoms included inflexibility, persistent opposition, fixation on past thoughts or issues, controlling behavior, repeated grievances, and prolonged silent treatment. These findings indicate that inability to shift attention and accept new perspectives contributes to intensifying conflict and reducing adaptation in marital life. In relation to the basal ganglia, couples most frequently referred to chronic anxiety, excessive worry, fear of abandonment, avoidance of confrontation with conflict, high dependency on the spouse, and somatic symptoms resulting from anxiety. These symptoms emphasize the central role of the basal ganglia in anxiety regulation, behavior initiation, and avoidance of stressful situations.

Findings concerning the deep limbic system showed that spouses involved in conflict more often reported negativity, depression, hypersensitivity to rejection, intense emotional reactions such as crying or withdrawal over minor issues, low sexual desire, persistent negative recollection, and chronic fatigue in their partner. These symptoms reflect the role of the limbic system in processing negative emotions and consolidating unpleasant memories. In the domain of the temporal cortex, couples reported behaviors such as verbal and physical aggression, misinterpretation of the spouse's words, difficulty identifying others' emotions, mood swings, suspiciousness, memory problems, and, at times, self-harming thoughts as prominent indicators. These findings demonstrate the role of the temporal cortex in social processing, empathy, and the interpretation of interpersonal emotions. To clarify the findings obtained from the Q-sort method based on the opinions of couples experiencing marital conflict, Table 3 presents the relative frequency of the selected items for each brain system.

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Table 3

Behavioral Symptoms Related to Brain Systems Based on Couples' Reports (Q-Sort Method)

Brain System	Most Important Behavioral Symptoms Reported by Couples	Relative Frequency (%)
Prefrontal cortex	Impulsivity, being hasty, disregard for consequences, lack of planning, overspending, empathy problems	25%
Anterior cingulate gyrus	Persistent opposition, inflexibility, fixation on issues, controlling behavior, prolonged silent treatment	20%
Basal ganglia	Chronic anxiety, excessive worry, fear of abandonment, conflict avoidance, high dependency	18%
Deep limbic system	Depression, negativity, sensitivity to rejection, low sexual desire, intense emotional reactions	22%
Temporal cortex	Verbal/physical aggression, verbal misinterpretation, suspiciousness, mood swings, memory problems	15%

In summary, the findings obtained from couples showed that the greatest behavioral problems were associated with the prefrontal cortex and the limbic system, and these two systems appeared to play the most prominent role in the emergence of marital conflicts. In contrast, symptoms related to the temporal cortex had the lowest frequency, although they were associated with more serious outcomes such as aggression and suspiciousness.

Findings from Specialists

After these codes had been refined and organized on the basis of the couples' empirical data, the questionnaire was presented to nine psychiatrists in order to assess its content validity. The purpose of this stage was to ensure the necessity, clarity, appropriateness, and relevance of the items to the domain of the study. The specialists were asked to evaluate each item according to the criteria of necessity, relevance, clarity and transparency, and ease of understanding for respondents using a multiple-choice scale. Thereafter, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated for each item.

The evaluations showed that the items related to the prefrontal cortex, such as impulsivity, hasty behavior, and overspending, obtained the highest average CVR because of their high necessity and relevance to marital conflicts. Psychiatrists emphasized that these items should remain fully in the questionnaire. In the area of the anterior cingulate gyrus, items such as "fixation on issues" and "inflexibility" were identified as the main indicators of dysfunction in the anterior cingulate cortex (ACC). However, some specialists suggested deleting or merging similar items, such as repeated grievances and persistent opposition, in order to prevent the questionnaire from becoming overly long.

Regarding the basal ganglia, most items were evaluated as relevant and necessary, but psychiatrists recommended that items related to somatic symptoms, such as shortness of breath or muscular pain, should be written more carefully in order to reduce the possibility of misinterpretation. For the deep limbic system, the specialists emphasized that items related to depression, sensitivity to rejection, and intense emotional reactions should be strengthened because these symptoms play a central role in intensifying marital conflicts.

In the temporal cortex section, items related to verbal aggression and misinterpretation of the spouse's messages received the greatest confirmation; however, psychiatrists suggested that items related to self-harming thoughts should be used with greater caution so as not to create undue sensitivity for participants. The CVR and CVI calculations showed that more than 80% of the items had CVR values above 0.79 and CVI values above 0.80. These values indicate acceptance and confirmation of the questionnaire's content validity. Items falling below these thresholds were either revised or removed from the questionnaire after expert consensus.

Examples of the revisions suggested by specialists included changing the statement "My spouse is wasteful" to "My spouse has difficulty with financial management" for greater clarity, merging the two items "Keeps reminding me of past grievances" and "Fixates on trivial matters" into a single item, and strengthening limbic items by emphasizing "intense emotional reactions to minor disagreements."

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Table 4

Sample of Specialists' Evaluation Results Based on CVR and CVI

Brain System	Number of Items Before Revision	Number of Deleted/Merged Items	Mean CVR	Mean CVI	Final Status
Prefrontal cortex	26	3	0.87	0.91	Approved with minor revision
Anterior cingulate gyrus	19	4	0.83	0.89	Approved with modification
Basal ganglia	19	2	0.80	0.87	Approved with wording revision
Deep limbic system	22	3	0.85	0.90	Items strengthened
Temporal cortex	14	1	0.82	0.88	Approved with desensitization

In summary, the specialists' findings showed that the designed questionnaire possessed desirable content validity. The revisions made it possible for the final version of the questionnaire to be both scientifically valid and practically understandable and appropriate for respondents.

Comparison of the Findings from Couples and Specialists

One of the strengths of the present study was the simultaneous comparison of the data obtained from couples experiencing conflict and from psychiatric specialists. The refined and organized empirical data from couples placed greater emphasis on lived experiences and concrete behavioral signs in everyday life, whereas the data obtained from specialists focused more on the clinical, diagnostic, and functional aspects of the brain. This comparison showed that, although there was substantial overlap in many cases, differences were also observed in the prioritization and interpretation of symptoms.

From the couples' perspective, the greatest conflicts stemmed from the spouses' overt behaviors. For example, in relation to the prefrontal cortex, impulsive behaviors, rapid anger, and inability to plan were repeatedly selected. Specialists, however, in addition to these symptoms, emphasized deeper problems such as deficits in cognitive inhibition, impaired logical decision-making, and weakness in evaluating consequences. In the anterior cingulate gyrus, couples focused more on inflexibility, stubbornness, and repeated arguments about the past, whereas specialists analyzed these symptoms in terms of "cognitive fixation" and "reduced flexibility in shifting mental sets."

In the domain of the basal ganglia, couples identified anxiety, constant worry, and avoidance of dealing with problems. Specialists confirmed these issues but also pointed to bodily symptoms resulting from anxiety, such as heart palpitations and breathing difficulties, as well as tendencies toward obsessive-compulsive behaviors. In the deep limbic system, couples referred more often to negativity, depression, and lack of motivation in their spouses. Specialists interpreted these findings in terms of "increased limbic activity" and emphasized its role in sensitivity to rejection, severe emotional fluctuations, and rumination. Finally, in the temporal cortex, couples' greatest complaints concerned verbal and physical aggression and misinterpretation of statements. Specialists, alongside these symptoms, pointed to problems in emotional processing, impairment in face recognition, and weakness in empathic ability.

This comparison demonstrated that couples' data were more focused on the behavioral and interpersonal level, whereas specialists' data were more focused on the neuropsychological and diagnostic level. The integration of these two levels of data ultimately led to the development of a questionnaire that is both rich in content validity and grounded in the real experiences of Iranian couples. This convergence enhanced the power of the final instrument for assessing marital conflicts based on brain functioning and turned it into a culturally adapted and practical model.

Table 5

Comparison of Couples' and Specialists' Findings on the Five Brain Systems in Marital Conflicts

Brain System	Couples' Findings (Behavioral-Experiential Level)	Specialists' Findings (Neuropsychological-Clinical Level)	Similarities and Differences
Prefrontal cortex	Impulsive behaviors, rapid anger, lack of planning, repetition of mistakes	Deficits in cognitive inhibition, weakness in logical decision-making, disregard for consequences	Similarity: impulsivity and decision-making problems. Difference: couples emphasized outward signs, specialists emphasized cognitive mechanisms.
Anterior cingulate gyrus	Inflexibility, stubbornness, repeated past arguments, persistent opposition	Cognitive fixation, reduced flexibility in shifting mental sets	Similarity: resistance to change. Difference: couples referred to stubborn behavior, specialists to difficulty in mental shifting.
Basal ganglia	Chronic anxiety, excessive worry, conflict avoidance, high dependency	Bodily symptoms of anxiety such as palpitations and shortness of breath, obsessive-compulsive behaviors	Similarity: anxiety and worry. Difference: couples expressed personal experience, specialists provided psychiatric explanation.
Deep limbic system	Negativity, depression, lack of motivation, severe sensitivity to rejection	Increased limbic activity, severe emotional fluctuations, rumination	Similarity: depressed mood and negative emotions. Difference: couples reported lack of motivation, specialists attributed it to increased limbic activity.
Temporal cortex	Verbal and physical aggression, misinterpretation of statements, mild suspiciousness	Impairment in emotional processing, face-recognition problems, weak empathic ability	Similarity: difficulty in emotional communication. Difference: couples described the behavioral level, specialists the neural-emotional processing level.

Final Thematic Network

After qualitative data analysis using Attride-Stirling (2001) thematic network analysis method, a set of basic themes extracted from couples and specialists was organized at three levels: basic themes, organizing themes, and global themes. The aim of this stage was to provide a conceptual model showing how dysfunction in brain systems contributes to the formation or intensification of marital conflicts. To demonstrate the relationship between brain systems and marital conflicts, a conceptual thematic network model was drawn in which the five brain systems were positioned as the main domains. Each system was linked to its corresponding basic and organizing themes, while at the center of the network stood the global theme, namely marital conflicts arising from dysfunction in brain functioning.

Table 6

Sample Organization of Qualitative Themes

Brain System	Organizing Themes	Basic Themes
Prefrontal cortex	Deficits in problem-solving and decision-making	Impulsivity, hasty decisions, lack of planning
Anterior cingulate gyrus	Deficits in cognitive flexibility	Being stuck in the past, oppositionality, inflexibility
Basal ganglia	Psychosomatic and anxiety symptoms	Anxiety, excessive worry, conflict avoidance
Limbic system	Deficits in emotion regulation	Sensitivity to rejection, depression, intense emotional reactions
Temporal cortex	Deficits in social-emotional processing	Verbal/physical aggression, misinterpretation of others' emotions

Figures 2 and 3 present the final thematic network of the study.

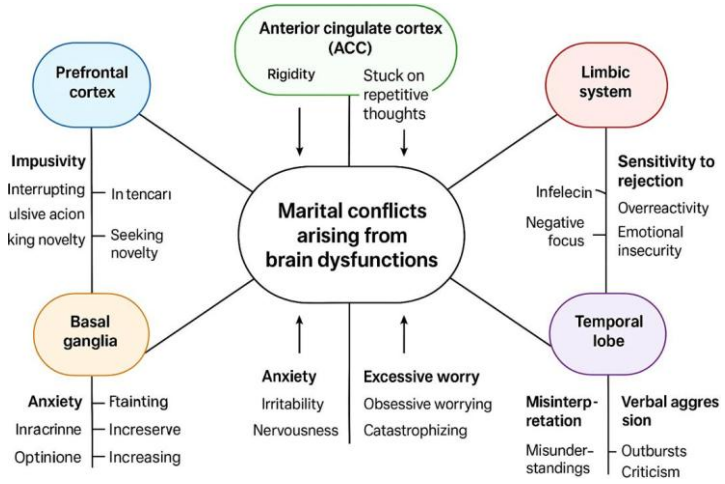

Figure 2

Qualitative thematic network model related to the five brain systems and marital conflicts

In summary, the qualitative phase of the study ultimately resulted in the presentation of a comprehensive thematic network showing how each of the five brain systems may, through its specific dysfunctions, contribute to the formation and persistence of marital conflicts. This model provided the foundation for the development of the final questionnaire and for the quantitative testing phase of the study.

Discussion and Conclusion

The findings of the qualitative phase of the present study showed that marital conflicts can be explained within the framework of a multidimensional, dynamic, and system-based neuropsychological model. This model is the product of the complex and nonlinear interaction of five key brain systems, namely the prefrontal cortex, anterior cingulate gyrus, basal ganglia, deep limbic system, and temporal cortex. The thematic network analysis of the data obtained from interviews with couples and specialists indicated that none of these systems alone is responsible for the emergence of conflict; rather, it is the pattern of their simultaneity, connectivity, and failure in functional integration that creates the conditions for the formation and persistence of marital conflicts. This finding is consistent with contemporary neuropsychological approaches that conceptualize interpersonal behaviors as emerging from brain networks (Nikrahan, 2023).

Within this model, the prefrontal cortex plays a central role as the regulatory core of executive functioning, decision-making, cognitive-emotional inhibition, and behavioral planning. The qualitative data showed that dysfunction in this system is manifested, at the level of couples' lived experience, in the form of impulsivity, hasty reactions, inability to manage conflictual conversations, emotionally driven decision-making, and failure to anticipate behavioral consequences. This finding is in line with neuroimaging evidence reporting reduced prefrontal cortex activity in situations involving interpersonal conflict and emotion regulation (Bloch et al., 2014; Nasiri et al., 2022). From a theoretical perspective, weakness in this system prevents the individual from creating a regulatory distance between emotional arousal and behavioral response, which in turn leads to the intensification of marital conflict cycles.

The anterior cingulate gyrus, as a system associated with cognitive flexibility, conflict monitoring, set shifting, and attentional regulation, also played a prominent role in the extracted model. The findings showed that dysfunction in this region was associated with symptoms such as fixation on past conflicts, rumination, stubbornness, oppositionality, and inability to accept the spouse's perspective. These results suggest that marital conflicts are not merely the consequence of disagreements in content, but are rooted in a neurocognitive inability to let go of conflict and shift mental frameworks. This explanation is consistent with

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findings from brain imaging studies on attachment and emotion regulation that have highlighted the role of the anterior cingulate gyrus in conflict resolution and inhibition of automatic responses (Vrtička et al., 2012; Zhang et al., 2018).

At the level of anxiety, avoidance, and safety-oriented behaviors, the basal ganglia were identified as one of the fundamental components of the neuropsychological model. Chronic anxiety, excessive worry, fear of rejection, avoidance of direct confrontation with conflict, and a tendency toward preventive control of the relationship were among the themes highlighted both in the couples' narratives and in the specialists' analyses. These findings suggest that hyperactivity in this system may contribute to the stabilization of avoidant patterns and the continuation of unresolved conflicts. In this respect, the results of the present study conceptually overlap with the findings of Kiani et al., (2022) on differences in alpha and beta wave patterns in the prefrontal and central regions of anxious couples, and they show how neurophysiological indicators may be transformed, at the level of lived experience, into cognitive anxiety and behavioral avoidance.

The deep limbic system, including structures such as the amygdala and hippocampus, emerged in the extracted model as playing a decisive role in negativity, sensitivity to rejection, depression, explosive anger, and emotional re-experiencing of past conflicts. The qualitative data showed that hyperactivity in this system traps couples in a cycle of emotional arousal, rumination, and defensive reactions that reduces the possibility of relational repair. These findings are consistent with trauma-related research showing that adverse experiences are associated with lasting changes in the amygdala, hippocampus, and prefrontal cortex and weaken the capacity for emotion regulation and empathy (Teicher et al., 2016; Tomoda et al., 2025).

The temporal cortex, as a system associated with social-emotional processing, empathy, interpretation of nonverbal cues, and interpersonal meaning-making, was linked in the present model to symptoms such as misinterpretation of the spouse's intentions, suspiciousness, distortion of communicative messages, and, in some cases, verbal and physical aggression. Although the frequency of these symptoms was reported to be lower than that of the other systems, their severity and consequences, including erosion of trust and increased risk of acute conflict, were notable. This finding is consistent with studies in social neuroscience that associate dysfunction in the temporal cortex and mentalizing networks with deficits in empathy and increased interpersonal conflict (Liu & Vazsonyi, 2024; Schneider-Hassloff et al., 2015).

Overall, the answer to the first research question indicates that the neuropsychological model of marital conflict consists of a set of brain systems, each of which creates distinct but interconnected pathways for the emergence of conflict through its own specific dysfunctions. These findings support the view that marital conflict is not a linear or merely psychological reaction, but rather the outcome of a complex interaction among emotion regulation, cognitive control, social processing, and couples' lived experiences, all of which acquire meaning within a cultural context.

Consistent with Nikrahan (2023) network-based approach (2023), the present study demonstrates that focusing solely on a single brain region or one psychological variable is insufficient for explaining marital conflicts. For example, reduced prefrontal cortex activity leads to chronic conflict when it occurs simultaneously with the cognitive fixation associated with the anterior cingulate gyrus and the hyperactivity of the limbic system. This synergistic pattern explains why some couples, despite cognitive awareness, are unable to regulate emotion and resolve conflict effectively.

In comparison with the attachment literature, the findings of the present study are consistent with the results reported by Mikulincer & Shaver (2010), Knox et al., (2024), and neuroimaging studies on attachment, but they offer a deeper explanatory framework. From the perspective of this study, attachment style is not a static trait, but rather a reflection of the organizational pattern of brain systems. For instance, avoidant attachment style can be explained at the neural level by dysfunction in the social-emotional processing of the temporal cortex and avoidant prefrontal strategies, rather than merely as a personality tendency.

From a cultural perspective, the findings also showed that components such as family commitment, preservation of social reputation, and gender roles moderate the way dysfunctions in brain systems are manifested in marital conflicts. This result is consistent with the findings of Huang & Menon (2025), who

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demonstrated the effect of culture on prefrontal cortex activity in moral judgments and highlighted the necessity of localizing models and assessment instruments.

Ultimately, by presenting a network-based, dynamic, and culturally grounded model of marital conflict, the present study deepens existing knowledge. This model integrates neurophysiological data, psychological concepts, and couples' lived experiences into a coherent framework and may provide a theoretical basis for the design of neuropsychological assessment tools, the development of brain-based couple therapy interventions, and the formulation of targeted neurofeedback protocols within the cultural context of Iran.

Despite efforts to design a comprehensive model supported by both theoretical and empirical foundations, the present study, like other research in the human sciences, was subject to several limitations that should be considered for a more accurate interpretation of the results. The first limitation relates to the cross-sectional nature of the research design. The data were collected within a specific time period, which restricts the possibility of examining the dynamic and longitudinal changes of brain systems within the context of marital conflict. Because marital conflict is a processual and evolving phenomenon, it is not possible to draw definitive conclusions from the present findings regarding the causal direction of the relationships between brain functioning and marital conflict. In other words, it remains unclear whether dysfunction in brain systems is the cause of conflict or the consequence of the persistence of unresolved conflicts.

The data were collected from couples within a specific cultural context, and cultural beliefs, gender norms, communication patterns, and marital expectations may influence the manner in which conflict is experienced and reported. Therefore, caution is required in generalizing the findings to other cultures, social contexts, or value systems. Another limitation concerns the lack of precise differentiation of overlapping clinical variables. In this study, formal clinical diagnoses such as mood, anxiety, or personality disorders were not systematically controlled. Since some of the measured symptoms overlap with manifestations of such disorders, it is not possible to determine with certainty what proportion of score variance is attributable to marital conflict and what proportion to individual psychopathology. Finally, it should be noted that the complexity of marital relationships extends beyond neuropsychological variables. Factors such as economic pressures, attachment history, traumatic experiences, extended family structure, and socioeconomic conditions may also contribute to the development of conflict, yet these were not directly incorporated into the present model.

Based on the limitations noted above and the findings of the study, a number of recommendations may be offered for the advancement of knowledge and future research. First, future studies are encouraged to use longitudinal designs in order to examine the developmental trajectories of marital conflicts and the related changes in brain systems over time. Such designs would make it possible to investigate causal relationships and feedback cycles among conflict, emotion regulation, and cognitive functioning. Second, it is recommended that future studies employ multi-source data collection methods. Combining self-report questionnaires with clinical interviews, observation of couples' interactions, and therapists' reports could increase the accuracy and richness of the data and reduce single-source biases.

Third, the use of neuroimaging methods and objective neuropsychological tests could provide greater validation for the proposed model. Simultaneous examination of behavioral, emotional, and neural indicators would allow a more precise test of the neurobiological assumptions of the model. Fourth, it is suggested that the developed instrument be examined in specific clinical samples, such as couples referred to couple therapy centers, couples with psychiatric disorders, or couples in critical life stages such as childbirth or bereavement, so that its sensitivity and clinical applicability can be evaluated. Fifth, conducting cross-cultural studies could help clarify the role of cultural factors in the manifestation of brain systems associated with marital conflict and could provide a basis for further localization of the instrument.

At the applied level, it is recommended that the results of this study be used in designing brain-based couple therapy interventions. Identifying vulnerable brain systems in each couple may contribute to the development of targeted treatment programs, such as strengthening emotion regulation, increasing cognitive flexibility, or improving executive functioning. In

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addition, the developed instrument may be used as an initial screening tool in family counseling centers so that therapists can plan the course of intervention with a deeper understanding of the neuropsychological roots of marital conflicts.

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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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