

# The Relationships Between Affect, Psychache, and Suicidal Ideation: A Network Analysis in 3879 Young Adults

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**Background:** Suicide remains a critical public health challenge for young adults. Although affect and psychache are known correlates of suicidal ideation, research relying on sum scores of corresponding scales has limited fine-grained insights into their specific relationships. To address this gap, this study employed a novel joint network framework to move beyond traditional approaches and perform a dimension-level analysis of these constructs, aiming to elucidate their complex interrelationships and identify potential intervention targets.

**Methods:** A sample of 3879 young adults (mean age = 20.02 ± 1.05 years) completed self-report measures of positive and negative affect, psychache, and suicidal ideation (assessing pessimism, sleep, and despair). We estimated a regularized partial correlation network to examine the associations between dimensions and calculated expected influence (EI) and bridge expected influence (BEI) indices.

**Results:** The prevalence of suicidal ideation in young adults was 8.37%. The network revealed complex relationships between positive and negative affect, psychache, and the dimensions of suicidal ideation. Psychache, sleep, and positive affect were identified as the most central nodes, while psychache and positive affect were the key bridge nodes.

**Limitations:** The cross-sectional design precludes causal inference, and the reliance on self-report measures may be subject to bias.

**Conclusion:** This network analysis provides a fine-grained understanding of the interrelationships between affect, psychache, and suicidal ideation in young adults. The identified central and bridge nodes represent precise and promising targets for clinical intervention. In practice, alleviating psychache, fostering positive emotional experiences, and improving sleep quality are likely to effectively prevent and reduce suicidal ideation among young adults.

**Keywords:** network analysis, psychache, positive affect, negative affect, suicidal ideation, prevention, young adults

## Introduction

Suicide constitutes a major global public health issue and is a leading cause of death worldwide.<sup>1–3</sup> Annually, more than 720,000 individuals die by suicide, and it was the third leading cause of death globally among individuals aged 15–29 in 2021. In China, this burden disproportionately affects young people.<sup>4</sup> National data indicate that suicide is a leading cause of death among Chinese young people aged 15–29, and its incidence within the 10–24 age group exhibited a clear upward trend between 2017 and 2021.<sup>5</sup> The high prevalence of suicidal behaviors among adolescents is a global concern. In the United States, for instance, a large national epidemiological survey revealed that 12.1% of adolescents experience suicidal ideation, 4.0% make a suicide plan, and 4.1% attempt suicide, with the vast majority of these youth having pre-existing mental disorders.<sup>6</sup> Furthermore, a meta-analysis of 54 studies involving over 308,000 participants revealed that during the COVID-19 pandemic, the prevalence of suicidal ideation, suicide attempts, and self-harm increased relative to pre-pandemic levels, with younger individuals demonstrating heightened susceptibility to suicidal thoughts.<sup>7</sup>

Suicidal ideation has long been a central focus in suicide research due to its strong connection to suicidal behavior.<sup>8</sup> It encompasses a spectrum of thoughts, ranging from fleeting considerations of suicide to detailed plans to end one's life.<sup>9</sup> Research consistently shows that suicidal ideation constitutes a critical stage in the suicide process, as it is strongly linked to subsequent suicide attempts and completed suicide.<sup>10–12</sup> This relationship is further substantiated by specific empirical evidence. For instance, an 18-month follow-up study demonstrated a strong connection between persistent suicidal ideation and later suicide attempts and completions.<sup>13</sup> Furthermore, a meta-analysis of 365 studies spanning 50 years found that adolescents with recent suicidal ideation were 2.22 times more likely to die by suicide than those without such thoughts.<sup>14</sup> Given its established role as a significant risk factor for suicide mortality,<sup>15–17</sup> an in-depth exploration of the underlying mechanisms of suicidal ideation is essential to develop effective prevention strategies, particularly for this vulnerable age group (ie, adolescents and young adults).<sup>18</sup>

Psychache, defined by Shneidman as an intense and unbearable psychological pain distinct from physical pain, has been established as a pivotal precursor to suicidal ideation.<sup>19</sup> Substantial evidence indicates that psychache is not only closely associated with suicidal thoughts but also serves as a prominent predictor of their development.<sup>20–22</sup> Notably, this predictive power is uniquely robust, as demonstrated in a two-year prospective study of high-risk undergraduates, which identified psychache as the sole factor predicting changes in suicidal ideation over time, surpassing the contributions of depression and hopelessness.<sup>23</sup> This relationship is particularly pronounced among adolescents. For example, research has consistently reported that those with elevated psychache exhibit increased suicidal ideation,<sup>24,25</sup> with key sources of such pain including family dysfunction and academic pressure.<sup>26</sup> Furthermore, another longitudinal study of adolescents revealed that persistent psychache mediates the relationship between emotional abuse and suicidal ideation by profoundly diminishing self-worth and amplifying despair.<sup>27</sup> Overall, psychache represents a core psychological mechanism in the onset and maintenance of suicidal ideation among young people, underscoring the need for further research to inform targeted interventions.

Affect, which comprises both positive (eg, happiness, confidence) and negative (eg, sadness, despair, anxiety) emotional dimensions,<sup>28</sup> also plays a critical role in suicidal ideation.<sup>18</sup> A well-documented pattern shows that high negative affect is associated with increased suicidal thoughts, whereas high positive affect correlates with reduced ideation.<sup>29–31</sup> For instance, one cross-sectional study found that suicidal ideation mediates the relationship between affect and suicide attempts in adolescents,<sup>32</sup> while a prospective study demonstrated that emotional intelligence can mitigate suicidal ideation by enhancing positive affect and reducing negative affect in university students.<sup>33</sup> Additionally, affect interacts dynamically with psychache: positive affect may buffer its intensity, while negative affect can exacerbate it.<sup>34,35</sup> This bidirectional relationship highlights the importance of considering affective processes when examining the pathways through which psychache influences suicidal risk in young people.

Although the associations between affect, psychache, and suicidal ideation in young people are well-established, prevailing research relies predominantly on traditional latent variable models that analyze aggregate scale scores.<sup>18,23,29,32–35</sup> This approach, however, obscures the fine-grained and dynamic interactions among the specific components of these constructs, which are crucial for a mechanistic understanding of suicide risk.<sup>36–38</sup> To address this critical gap, the present study employs network analysis. This methodology conceptualizes psychopathology as a complex system of directly interacting symptoms.<sup>39–41</sup> Within this network, key variables such as psychache, suicidal ideation, and positive and negative affect are represented as nodes.<sup>40</sup> The analysis estimates the unique conditional relationships, known as edges, between each pair of nodes after controlling for all other variables in the system.<sup>39,42</sup> In addition, a key advantage of this method is its capacity to identify not only central nodes that maintain the global stability of the network, but also bridge nodes that connect the distinct constructs of affect, psychache, and suicidal ideation.<sup>43,44</sup> It is noteworthy that the identification of these nodes can illuminate pathways for risk propagation and indicate precise targets for clinical intervention.<sup>39</sup>

Network analysis has been successfully applied to explore relationships between suicidal ideation and various psychological symptoms.<sup>38,44,45</sup> For example, Guo et al used network analysis to investigate affect, meaning in life, and suicidal ideation,<sup>46</sup> while Li et al examined the network structure of psychache, meaning in life, and suicidal ideation in a separate framework.<sup>47</sup> However, these prior studies have either focused on affect while overlooking the central role of psychache, or concentrated on psychache without situating it within the dynamic context of affect.<sup>46,47</sup> Therefore,

a significant research gap persists, as no investigation has adopted an integrated network framework to concurrently model psychache, positive and negative affect, and the structure of suicidal ideation. This limitation obstructs a mechanistic understanding of how these core risk factors interact as a synergistic system. The present study addresses this gap by focusing on Chinese young adults aged 18 to 24. This group is exposed to distinct sociocultural stressors that may configure risk in culturally specific ways. In particular, the psychological construct of “Neijuan” (involution)—characterized by perceived resource scarcity, coercive social norms, significant psychological pressure, and pervasive competition—creates a unique context for the development of psychache and dysregulated affect.<sup>48</sup> These acute pressures, set against a backdrop of rapid societal transformation associated with rising mental health burdens,<sup>49</sup> likely shape unique patterns of risk interaction. Emerging ecological models further support the complex, system-like configuration of suicide risk in this population.<sup>50</sup> Consequently, this research moves beyond a mere methodological application by constructing the first joint network model of psychache, the affective system, and suicidal ideation. This approach aims to elucidate the architecture of a culturally specific psychopathology and identify precise intervention targets within this high-risk group.

In summary, this study is the first to employ network analysis within a joint framework that integrates psychache, suicidal ideation, and affect to examine their fine-grained relationships. We propose the following specific hypotheses: first, psychache will demonstrate the strongest direct connection with suicidal ideation; second, negative affect will act as a critical bridge node, positively connecting psychache with suicidal ideation, whereas positive affect will exhibit a protective bridging effect that weakens network connections. Accordingly, this study has three main aims: (1) to visualize and quantify the network structure; (2) to identify the most influential central nodes; and (3) to determine the key bridge nodes that connect the constructs of affect, psychache, and suicidal ideation. Ultimately, this network approach transcends traditional latent variable models by revealing how these core risk factors operate as an interactive system in Chinese young adults, thereby providing a scientific basis for precise interventions. Although the data are drawn from a Chinese context, the investigation focuses on fundamental psychological processes. Thus, the findings are expected to offer insights into the cross-cultural mechanisms of suicidal ideation.

## Materials and Methods

### Participants and Ethical Approval

Young adults in this study were defined as individuals aged 18–24 years. This age range was selected based on research indicating that the 10–24 age group better reflects the developmental characteristics of contemporary youth, with this population exhibiting a notably higher frequency of suicidal behavior compared to adults.<sup>51–53</sup>

Data collection was conducted via convenience sampling through the Wenjuanxing platform ([www.wjx.cn](http://www.wjx.cn)) between January 15 and May 15, 2024, with 5,000 participants aged 18 years and older initially recruited. Participants accessed the electronic questionnaire by scanning a QR code, reviewed and provided consent via an electronic informed consent form, and completed the survey based on their personal experiences. To ensure data quality, responses were excluded if participants were aged 25 years or older, completed the questionnaire in less than 150 seconds, or exhibited abnormal scores ( $\geq 4$ ) on the masking dimension of the suicidal ideation measure. After these exclusions, 3,879 valid datasets from young adults were included in the final analysis. It is important to note that this cross-sectional study design precludes causal inferences regarding the relationships between variables. Furthermore, the use of convenience sampling may limit the generalizability of our findings to the broader young adult population and could be subject to biases such as social desirability or under-reporting, despite our stringent data cleaning procedures. Finally, our study was reviewed and approved by the Ethics Committee of the Air Force Hangzhou Special Recreation Centre and strictly adhered to the principles of the Declaration of Helsinki.

## Measures

### Positive and Negative Affect Scale (PANAS)

The PANAS was developed by Watson et al to assess individuals' affect.<sup>54</sup> The present study utilized a revised version of the PANAS that includes 20 items.<sup>55</sup> Each item was rated on a 5-point Likert scale ranging from "almost none" (1) to "extremely much" (5). Higher scores indicate more severe affect experiences. In this study, the Cronbach's  $\alpha$  coefficients for positive affect and negative affect were 0.92 and 0.91, respectively, indicating that the scale has good internal consistency.

### Psychache Scale (PAS)

The Chinese version of PAS is a unidimensional questionnaire consisting of 13 items, specifically designed to evaluate psychological states.<sup>56,57</sup> Each item is rated on a 5-point Likert scale, ranging from 1 = "never" to 5 = "always", or alternatively from 1 = "strongly disagree" to 5 = "strongly agree". This scale assesses introspective experiences of negative affect such as guilt, despair, loss, and fear. Higher total scores on this scale indicate more severe perceived psychache. The Cronbach's  $\alpha$  coefficient for this scale is 0.96, indicating its strong reliability.

### Self-Rating Scale for Suicidal Ideation (SIOSS)

The SIOSS was used to assess suicidal ideation.<sup>58</sup> It consists of 26 items divided into four dimensions: despair, pessimism, sleep, and masking, with all items answered using a binary format (0 or 1). If the masking dimension score is  $\geq 4$ , the measurement is considered unreliable. A total score of  $\geq 12$  across the despair, pessimism, and sleep dimensions indicates the presence of suicidal ideation, with higher scores reflecting more severe suicidal ideation.<sup>58</sup> In this study, the scale demonstrated good internal consistency reliability with a Cronbach's  $\alpha$  coefficient of 0.80.

## Statistical Analysis

In this study, SPSS 25.0 was used to calculate the mean and standard deviation of the data. Additionally, a network model was constructed, and the expected influence (EI) and bridge expected influence (BEI) were calculated using R software (version 4.1.1).

First, the qgraph package (version 1.9.8) in R was used to construct and visualize a network of affect, psychache, and suicidal ideation.<sup>59</sup> The network was estimated using a Gaussian Graphical Model (GGM), which is an undirected network model.<sup>60</sup> In this model, each dimension from the scales (the PANAS, PAS, and SIOSS) was treated as a separate node. The unique association between two nodes, after statistically controlling for the influence of all other nodes in the network, was defined as an edge.<sup>60</sup> The estimation of the GGM was based on a nonparametric Spearman correlation analysis as the input.<sup>61,62</sup>

Furthermore, during the network construction process, the Least Absolute Shrinkage and Selection Operator (LASSO) regularization technique and the Extended Bayesian Information Criterion (EBIC) were jointly used to regularize the Gaussian Graphical Model, which helps to produce a more accurate and interpretable network structure.<sup>61,63</sup> Specifically, the hyperparameter gamma ( $\gamma$ ) for the EBIC was set to 0.5, which is the default setting in the qgraph package.<sup>61</sup> This value balances the fit of the model to the data with the desire for a simpler, more interpretable network.<sup>63</sup> In this process, by shrinking all edge weights and setting those with very small correlations to exactly zero, potentially spurious connections are removed, resulting in a more stable, sparse, and interpretable network.<sup>64</sup>

Second, the EI of each node was calculated using the qgraph package (version 1.9.8) to identify the most central nodes in the network.<sup>65</sup> The EI of a node is defined as the sum of the weights of all edges connecting that node to every other node in the network. A higher EI value indicates that the node has a greater overall impact on the network.<sup>65</sup> Similarly, the BEI of each node was calculated using the networktools package (version 1.4.0) to identify the key bridge nodes.<sup>66</sup> The BEI of a node is defined as the sum of the weights of all edges connecting that node to nodes belonging to a different theoretical community.<sup>66</sup> A higher BEI value indicates a greater capacity for that node to act as a pathway for risk propagation across different communities.<sup>66</sup> Before analysis, the nodes were pre-defined into three communities: the affect community, the psychache community, and the suicidal ideation community.

Finally, the accuracy and stability of the estimated edge weights and the centrality indices (EI and BEI) were assessed using the R bootnet package (version 1.5.3).<sup>41,66</sup> First, the accuracy of the edge weights was evaluated by calculating

95% confidence intervals (CI) through a nonparametric bootstrap method with 1,000 bootstrap samples. Narrower CI indicate more precise estimation of the edge weights.<sup>67</sup> Next, the stability of the EI and BEI indices was assessed using the correlation stability (CS) coefficient, which was calculated via a case-dropping bootstrap method (1,000 bootstrap samples). A CS coefficient above 0.5 is considered ideal, while a value above 0.25 is acceptable.<sup>41</sup> Additionally, bootstrap methods were used to test for significant differences between edge weights and between EI and BEI indices ( $\alpha = 0.05$ , 1000 bootstrap samples). Furthermore, we tested for significant gender differences in the overall network structure using the NetworkComparisonTest package.<sup>68</sup>

## Results

### Descriptive Statistics

For the 3879 participants, the average age was  $20.02 \pm 1.05$  years ( $M \pm SD$ , range: 18 to 24 years). A total of 1790 (46.15%) respondents were male, and 2089 (53.85%) were female. Additionally, 322 (8.37%) respondents met the screening criteria for suicidal ideation. The mean scores, standard deviations, EI (raw values), and BEI (raw values) for each variable are shown in [Table 1](#).

### Network Structure

The final network of affect, psychache, and suicidal ideation is shown in [Figure 1A](#). The network contained 14 non-zero edges (93.33% of possible edges) with weights ranging from  $-0.19$  to  $0.28$ . The strongest connections identified were cross-community edges: psychache (P) was positively linked to negative affect (A2; edge weight =  $0.28$ ), sleep (S2; edge weight =  $0.24$ ), and despair (S3; edge weight =  $0.21$ ). Conversely, positive affect (A1) was negatively associated with a negative outlook (S1; edge weight =  $-0.19$ ) and despair (S3; edge weight =  $-0.17$ ). Within communities, the strongest edges were between sleep and despair (S2-S3; edge weight =  $0.21$ ) in the suicidal ideation community, and between positive and negative affect (A1-A2; edge weight =  $-0.18$ ). All edge weights are detailed in [Table 2](#). The bootstrapped 95% CI was narrow, suggesting accurate estimation of edge weights (see [Supplementary Figure S1](#)). The bootstrapped difference test for edge weights is shown in [Supplementary Figure S2](#).

### Central Symptoms

The EI for each node is shown in [Figure 1B](#). The nodes with the highest positive EI values were “psychache” (EI =  $0.77$ ) and “sleep” (EI =  $0.55$ ), identifying them as the most influential risk nodes in the network. In contrast, “positive affect” had the highest negative EI value (EI =  $-0.72$ ), indicating its role as a central protective node. The CS coefficient for EI was  $0.75$ , exceeding the recommended threshold of  $0.50$ , which signifies that the estimation of EI was ideally stable (see [Supplementary Figure S3](#)). The results of the bootstrapped difference test for node EI are provided in [Supplementary Figure S4](#).

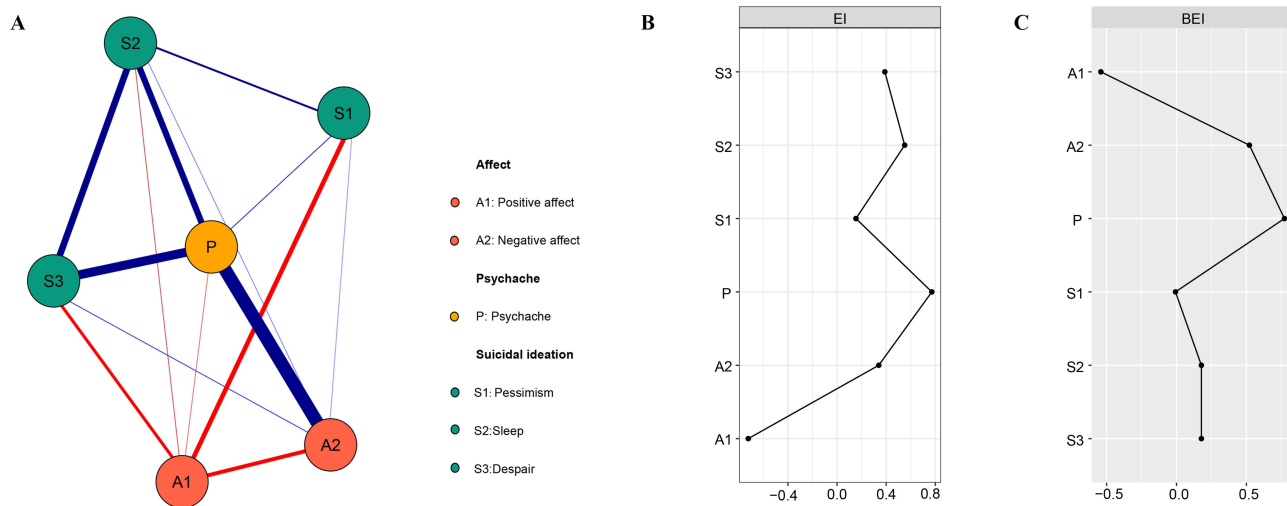
### Bridge Symptoms

The BEI for each node is shown in [Figure 1C](#). The node with the highest positive BEI value was “psychache” (BEI =  $0.57$ ), identifying it as the most critical risk bridge node that may actively spread activation to the suicidal ideation community.

**Table 1** The Means, SDs, EIs, and BEIs of Each Dimension

Variables	M	SD	EI	BEI
A1: Positive affect	35.29	7.76	-0.72	-0.46
A2: Negative affect	18.33	6.78	0.34	0.24
P: Psychache	15.80	6.50	0.77	0.57
S1: Pessimism	0.31	0.83	0.15	-0.01
S2: Sleep	0.58	0.97	0.55	0.18
S3: Despair	1.02	2.17	0.39	0.18

**Abbreviations:** M, mean; SD, standard deviation; EI, expected influence; BEI, bridge expected influence.



**Figure 1** Network structure of affect, psychache, and suicidal ideation and the EI and BEI of the nodes in the network. **(A)** Network structure of affect, psychache, and suicidal ideation. The blue edges represent positive relationships, whereas the red edges represent negative relationships. The thickness of an edge indicates the strength of the relationship. The weights of the edges are provided in [Table 2](#). **(B)** The EI indices of the nodes in the network (raw values). **(C)** The BEI indices of the nodes in the network (raw values).

**Note:** A1: positive affect; A2: negative affect; P: psychache; S1: pessimism; S2: sleep; S3: despair.

Within the affect community, “positive affect” had the highest negative BEI value (BEI = -0.46), suggesting it serves as a primary protective bridge node that may inhibit the activation of symptoms in other communities. The CS coefficient for BEI was 0.75, exceeding the preferable threshold of 0.5, indicating ideal stability for the BEI estimation (see [Supplementary Figure S5](#)). [Supplementary Figure S6](#) shows the result of the bootstrapped difference test for node BEI.

### Gender Differences in Networks

There was no significant difference between males and females in terms of network invariance (network invariance  $M = 0.37$ ,  $p = 0.67$ ). There was also no significant difference between males and females in terms of overall strength invariance (overall strength invariance  $S = 0.08$ ,  $p = 0.89$ ). In terms of edge strength, we also found no significant difference between genders for most node pairs.

### Discussion

While substantial research has examined affect, psychache, and suicidal ideation in isolation, this study is the first to investigate their fine-grained relationships in a joint framework using network analysis. Our findings deepen the theoretical understanding of the specific psychopathological pathways underlying these constructs and identify central and bridge symptoms that point to precise targets for prevention and intervention strategies. The reliability of our measurements was robust, with Cronbach’s  $\alpha$  coefficients of 0.92 for positive affect and 0.91 for negative affect on the

**Table 2** The Edge Weights in the Network Model of Affect, Psychache and Suicidal Ideation

	A1	A2	P	S1	S2	S3
A1	0.00	-0.18	-0.08	-0.19	-0.10	-0.17
A2	-0.18	0.00	0.28	0.06	0.07	0.11
P	-0.08	0.28	0.00	0.13	0.21	0.24
S1	-0.19	0.06	0.13	0.00	0.16	0.00
S2	-0.10	0.07	0.21	0.16	0.00	0.21
S3	-0.17	0.11	0.24	0.00	0.21	0.00

**Abbreviations:** A1, positive affect; A2, negative affect; P, psychache; S1, pessimism; S2, sleep; S3, despair.

PANAS, 0.96 for the PAS, and 0.80 for the SIOSS. These high reliability estimates are strongly supported by both international and Chinese-specific studies. Internationally, our result for the PAS aligns exactly with the Spanish adaptation in young adults which reported an identical Cronbach's  $\alpha$  of 0.96,<sup>69</sup> and our PANAS reliabilities are consistent with its excellent internal consistency recently demonstrated in university student populations.<sup>70</sup> Within the Chinese context, the SIOSS has been established as a psychometrically sound tool for college students,<sup>71</sup> and psychache has been consistently identified as a central construct in suicide research,<sup>72</sup> thereby collectively reinforcing the transcultural stability and psychometric soundness of our assessment tools within our sample.

Building on this foundation of reliable measurement, our network model provided a fine-grained analysis of the relationships between these constructs. Within network theory, the edges bridging different communities are of particular interest, as they are thought to represent the psychopathological pathways that underlie comorbidity.<sup>73–75</sup> Guided by this perspective, we identified and examined the key bridging connections in our network. Our results indicated that positive affect was significantly and negatively correlated with dimensions of suicidal ideation such as pessimism, sleep, and despair, whereas negative affect exhibited a significant positive correlation with these same dimensions. These findings align with a previous network analysis by Guo et al,<sup>46</sup> yet they reveal a more complex picture than what is often found in studies using latent variable models based on total scores.<sup>23,27,32,33</sup> For instance, longitudinal studies have shown that negative affect can predict future suicidal ideation with a time lag,<sup>76</sup> while low positive affect independently predicts suicidal events.<sup>77,78</sup> Our network findings thus consolidate and extend previous work by illustrating the specific, contemporaneous connections between these affective states and distinct components of suicidal ideation.

In addition, our results demonstrated that psychache was positively related to both the sleep and despair dimensions of suicidal ideation. This finding is consistent with a recent web-based network analysis, which also identified psychache as being positively linked to despair and sleep problems.<sup>47</sup> The link between psychache and despair is conceptually coherent, as intolerable psychological pain often stems from a profound sense of hopelessness about one's situation or future.<sup>79</sup> This pathway is further corroborated by latent variable studies, which have similarly shown that deepening despair—often involving a loss of meaning in existence—significantly increases the risk of suicidal ideation.<sup>80–82</sup> Furthermore, the association between psychache and sleep disturbances can be understood through established evidence suggesting that sleep disorders are significantly associated with suicidal ideation and that psychache may mediate this relationship.<sup>83</sup> This implies a potential vicious cycle in which psychological pain disrupts sleep, which in turn may exacerbate the sense of despair and pain.

Interestingly, beyond these direct connections, our network suggested an indirect pathway. The positive correlation between psychache and negative affect indicates that psychache may also influence suicidal ideation by amplifying negative emotional states. This proposed pathway is consistent with prior experimental research demonstrating that intense psychological pain is associated with a heightened motivation to avoid such pain, a state inherently characterized by negative affect.<sup>84</sup> This finding underscores the multifaceted role of psychache as a pivotal risk factor, an association robustly observed across different populations including adolescents and adults.<sup>85–88</sup> Furthermore, within the interpersonal theory of suicide, feelings of being a burden and thwarted belongingness are established as key precursors to suicidal ideation.<sup>89</sup> It is plausible that intense psychache contributes directly to the perception of being a burden, while also fueling the negative affect that characterizes a state of psychological pain, thereby creating a synergistic risk effect. This synergistic relationship is strongly supported by empirical models demonstrating a close, sequential pathway between perceived burdensomeness and psychache in the development of suicide risk.<sup>90</sup>

Regarding the most influential symptoms in the network, the EI indices identified psychache and sleep as the two most central risk nodes and positive affect as the central protective node. This indicates that these three symptoms had the greatest overall potential to activate or dampen the entire network of suicidal ideation. The centrality of sleep and positive affect is partially consistent with prior network studies on suicidal ideation.<sup>46,91</sup> However, discrepancies exist, as other studies have identified despair and loneliness as central.<sup>44,47</sup> We hypothesize that these differences likely stem from variations in study populations, measurement tools, other model-included variables, and potentially, cultural context. Indeed, the prominence of psychache and sleep problems may be particularly salient in our unique sample of Chinese youth grappling with the relentless pressures of “Neijuan”,<sup>48</sup> where chronic stress directly manifests as profound psychological pain and sleep disruption.<sup>71,92</sup> It is critical to interpret these identified nodes with caution; they represent

promising but exploratory intervention targets, as the cross-sectional design of our study precludes causal inference and necessitates validation through future longitudinal or experimental research. The BEI analysis further clarified how risk and protection might spread. Psychache emerged as the most critical bridge node, positively connecting its own community to suicidal ideation, whereas positive affect served as the primary protective bridge node, with negative connections weakening the pathway to suicidal ideation. This pattern suggests a dynamic where psychache acts as a potent conduit for risk propagation into suicidal thoughts, whereas positive affect functions as a crucial buffer, helping to insulate an individual from this escalation.

The current study carries significant theoretical and clinical implications. Theoretically, these findings offer foundational insights into potential pathological pathways linking psychache, affect, and suicidal ideation, thereby advancing understanding of the mechanisms underlying their relationships. They clarify the specific roles of affect dimensions (positive and negative) and the overarching construct of psychache in the development and maintenance of suicidal ideation. Specifically, this study identifies positive associations between psychache and the sleep disturbance and despair dimensions of suicidal ideation, which may elucidate how psychache contributes to suicidal ideation. It also suggests a potential pathway wherein positive affect mitigates suicidal ideation through its negative association with the despair or pessimism dimensions of suicidal ideation. Furthermore, the negative correlation between positive affect and psychache provides another indirect explanation for positive affect's protective role in reducing suicidal ideation.

Clinically, and consistent with the exploratory nature of our network model, these findings offer a valuable, hypothesis-generating foundation for developing targeted interventions. Central nodes are theorized to be promising intervention targets due to their potential for broad influence on the entire network.<sup>39,93–95</sup> In our study, this implies that interventions focusing on the central risk nodes of sleep disturbance and psychache could yield widespread benefits by reducing the overall network activity of suicidal ideation. Similarly, bridge nodes are critical for interrupting cross-construct interactions between different symptom clusters.<sup>66,96,97</sup> Our results indicate that mitigating psychache and enhancing positive affect, both of which serve dual roles as central and bridge nodes, could be particularly effective strategies for preventing the escalation of general psychological distress into active suicidal ideation.

To operationalize these targets, interventions can be precisely designed. For instance, to target the central node of sleep disturbance, digital Cognitive Behavioral Therapy for Insomnia (CBT-I) could be employed, which has direct evidence in not only improving sleep but also preventing and alleviating suicidal ideation.<sup>98</sup> This approach is highly feasible for young adults, as even email-delivered CBT-I has proven effective in university student populations.<sup>99</sup> For the central and bridge node of psychache, therapies focused on meaning-making, such as Acceptance and Commitment Therapy (ACT) or specific interventions grounded in psychache theory, could be deployed to alleviate mental pain, as demonstrated in suicidal patients with depression.<sup>100</sup> Similarly, to bolster the protective central and bridge node of positive affect, well-established positive psychology interventions (PPIs) could be integrated into treatment plans. These include techniques such as behavioral activation, mindfulness-based practices, which have been shown to systematically enhance momentary positive emotions,<sup>101,102</sup> and strength-based exercises, which aim to cultivate positive feelings like hope and optimism that are linked to reduced suicidal risk.<sup>103</sup> This multifaceted approach provides a robust framework for systematically enhancing positive affective experiences.

Beyond these individual-level clinical interventions, our findings also support the development of broader public health and policy initiatives. For example, school-based and university-based mental health programs that incorporate universal screening for sleep problems and psychache could facilitate early identification of at-risk youth.<sup>104</sup> Furthermore, the central role of sleep suggests that public health campaigns promoting sleep hygiene and later school start times could have a population-level impact on youth well-being.<sup>105</sup> Finally, the scalability of digital interventions (eg, app-based CBT-I) makes them particularly suitable for reaching the large and tech-savvy young adult population. This approach is strongly supported by evidence that digital cognitive behavioral therapy for insomnia not only improves sleep but also directly prevents and alleviates suicidal ideation,<sup>98</sup> thereby offering a potent and accessible strategy to address the critical issue of mental health service accessibility.

Despite its contributions, this study has inherent limitations. First, the cross-sectional design precludes any causal inference regarding the dynamic interactions among psychache, affect, and suicidal ideation in young adults. The observed network structure represents statistical associations at a single time point, and the directionality of influence

between nodes remains hypothetical. Future studies must adopt longitudinal or experience-sampling designs to track the temporal precedence and causal relationships among these variables. Second, reliance on self-report measures introduces potential social desirability bias, particularly in young adult populations, necessitating cautious interpretation of associations. Third, the use of convenience sampling, while practical, may restrict the generalizability of our findings to the broader population of young adults. The sample may over-represent certain demographics or individuals with specific characteristics, potentially limiting the external validity of the identified network structure. While the psychological processes investigated here represent fundamental mechanisms, the specific configuration and strength of network connections may vary across populations. Future research should employ rigorous, randomized sampling strategies and directly compare network structures across diverse cultural and demographic groups to disentangle universal mechanisms from culturally specific expressions of psychopathological risk. Finally, while central and bridge nodes were identified as promising intervention targets, the translational efficacy of therapies targeting these nodes requires empirical validation in young adult cohorts through randomized controlled trials.

## Conclusions

This study presents the first network analysis investigating the relationships between suicidal ideation, psychache, and affect in a joint framework. Our findings elucidate the specific interaction pathways among these constructs and identify psychache, sleep, and positive affect as pivotal central and bridge nodes. These exploratory insights highlight positive affect as a key protective factor, with negative affect and psychache emerging as significant risk factors within the network. While these findings pinpoint promising targets for clinical intervention, they are derived from a cross-sectional study with a convenience sampling strategy, and their causal efficacy and generalizability require validation through future longitudinal and experimental research. Clinically, this suggests that precisely tailored interventions, such as cognitive-behavioral therapy for insomnia to address sleep disturbances, psychache-focused therapies to alleviate psychological pain, and behavioral activation or mindfulness-based techniques to enhance positive affect, hold potential for effectively reducing suicidal ideation. Ultimately, this research elucidates the fine-grained structure and potential psychopathological pathways contributing to suicidal ideation in young adults, thereby providing a foundational model for future research and precision interventions.

## Data Sharing Statement

The datasets presented in this article are not readily available because they contain sensitive information on suicidal ideation. Requests to access the datasets should be directed to the corresponding author, Qingjun Guo. The R code supporting the network analysis is available from the corresponding author upon reasonable request.

## Ethical Approval Statement

The study strictly adhered to the Declaration of Helsinki and received approval from the Ethics Committee of the Air Force Hangzhou Special Recreation Centre (TLZX20241129-01). All participants have given their informed consent, and all methods were carried out in accordance with relevant guidelines and regulations.

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## Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

## Disclosure

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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