



Understanding the Role of Spirituality in Adolescent Nonsuicidal Self-Injury: A Narrative Review

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Article Info	Abstract
Article history: Received 12 June 2026 Revised 03 July 2026 Accepted 11 July 2026 Available online 01 August 2026	Background: Nonsuicidal self-injury (NSSI) is an increasing concern among adolescents and is often linked to difficulties in emotional regulation and maladaptive coping strategies. As rates continue to rise, identifying protective factors is crucial. Spirituality has been proposed as a potential buffer against NSSI by enhancing emotional regulation, resilience, and impulse control.
Keywords: Adolescents; Emotional regulation; Nonsuicidal Self-Injury (NSSI); Psychospiritual intervention; Spirituality	Objective: This literature review examined studies to explore the relationship between spirituality and NSSI in adolescents.
Correspondence: psikiatri.fkkmk@ugm.ac.id andrian.fajar.k@ugm.ac.id	Methods: A literature search was conducted in July 2024 using the ScienceDirect database with the keywords “nonsuicidal self-injury”, “adolescent”, and “spirituality.” Inclusion criteria included full-text articles published in English or Indonesian between 2020 and 2025.
How to cite this article: Maya Aulya Saputri, Andrian Fajar Kusumadewi, Soewadi, Amarissa Alya Tsabita, A. Hutami Pratiwi, Teresa Lalita Wiryarini, Mustika Suci Mahardikaningrum, Ananti Wungudita. Understanding the Role of Spirituality in Adolescent Nonsuicidal Self-Injury: A Narrative Review. MAGNA MEDIKA Berk Ilm Kedokt dan Kesehat. 2026; 13(2): 118–128	Results: The findings suggest that higher levels of spirituality are associated with lower NSSI risk, while reduced spirituality may increase vulnerability. Spirituality appears to support emotional and behavioral regulation through its positive influence on prefrontal cortex functioning. Practices such as prayer and meditation may offer adaptive coping mechanisms that help adolescents manage distress without self-injury.
	Conclusion: Evidence suggests that spirituality enhances emotional regulation, resilience, and impulse control, potentially through its positive effects on prefrontal cortex functioning. Despite promising evidence, further research is needed to develop culturally appropriate psychospiritual interventions and evaluate their long-term effectiveness in preventing and reducing NSSI among adolescents.

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INTRODUCTION

Nonsuicidal Self-Injury (NSSI) involves deliberately causing harm to one's own body without the intention of ending one's life. Globally, approximately one in five adolescents has engaged in NSSI, with prevalence rates reported to be higher in Asian countries compared to Europe and North America. Recent evidence suggests a concerning upward trend in NSSI among adolescents, with prevalence estimates reaching as high as 44.8% between 2000 and 2023. However, reliable data regarding the prevalence of NSSI among adolescents in Indonesia and the broader Southeast Asian region remain limited.

NSSI is not merely a maladaptive behavior but a significant mental health concern that warrants special attention and targeted intervention, particularly during adolescence. The emergence of NSSI during adolescence may be related to increased independence and responsibilities that accompany greater exposure to decision-making, rewards, and stressful experiences. Although many adolescents are able to adopt positive coping strategies to manage these transitions, some turn to self-injury as a maladaptive coping strategy for managing emotional burden. Persistent engagement in NSSI can result in adverse psychological outcomes, including increased self-criticism, interpersonal difficulties, negative emotional experiences, and diminished self-control, thereby reinforcing a self-perpetuating cycle of distress. Furthermore, adolescents who engage in NSSI are approximately 4.8 times more likely to attempt suicide than their peers who do not engage in NSSI. Key indicators of increased suicide risk

among adolescents with NSSI include the tendency to use cutting as a method, along with emotional dysregulation and psychological distress that precede self-injurious behavior.

In recent years, spirituality has gained increasing attention as a potential protective factor against self-injurious behaviors among adolescents. It is commonly conceptualized as a fundamental aspect of human existence, encompassing the search for meaning and purpose in life and the ability to interpret personal experiences within a broader context. This process contributes to an individual's understanding of themselves, their relationships with others, and their connection to the surrounding world. Growing evidence suggests that spirituality plays a beneficial role in mental health by enhancing emotional regulation, fostering resilience to stress, and promoting adaptive coping mechanisms. Furthermore, several studies have reported an association between spirituality and increased activation of the prefrontal cortex (PFC), a brain region involved in impulse control and emotional regulation. Conversely, spiritual struggles have been linked to a greater likelihood of engaging in NSSI, alongside elevated symptoms of anxiety and depression.

Despite growing evidence on the relationship between spirituality and NSSI within the general population, research specifically investigating the role of spirituality among adolescents who engage in NSSI remains limited. Therefore, this review seeks to synthesize the existing literature to better understand the influence of spirituality on NSSI among adolescents. The findings of this review are expected to contribute to the theoretical foundation for developing more

holistic psychiatric interventions and to guide future studies exploring structured psycho-spiritual strategies aimed at supporting adolescents vulnerable to self-injurious behavior.

METHODS

A literature search was conducted in July 2024 using the ScienceDirect database (<https://sciencedirect.com/>). The search aimed to identify studies examining the relationship between spirituality and non-suicidal self-injury (NSSI) among adolescents. The search strategy employed the keywords “Nonsuicidal Self-Injury (NSSI)”, “Adolescent”, and “Spirituality”, combined using Boolean operators (AND/OR) where appropriate to optimize the retrieval of relevant articles.

Studies were considered eligible if they met the following inclusion criteria: (1) published in peer-reviewed journals; (2) available as full-text articles with free access; (3) written in English or Indonesian; and (4) published between 2020 and 2024. Articles were excluded if they were conference abstracts, editorials, commentaries, letters to the editor, or did not address the relationship between spirituality and NSSI in adolescent populations.

The study selection process consisted of an initial screening of titles and abstracts to identify potentially relevant articles, followed by a full-text review to determine eligibility based on the predefined inclusion and exclusion criteria. Relevant information from the inclusion studies, including study characteristics, population, methodology, and key findings, was extracted and summarized.

A critical appraisal of the included studies was conducted by evaluating their methodological quality, including the clarity of study objectives, the appropriateness of study design, participant characteristics, measurement methods, and the consistency of reported findings. The findings were subsequently synthesized using a narrative approach to summarize the current evidence regarding the role of spirituality in nonsuicidal self-injury among adolescents.

RESULTS

Nonsuicidal Self-Injury and Associated Risk Factors

Nonsuicidal self-injury (NSSI) is defined as the intentional infliction of harm on one's own body without the intention of ending one's life.^{1,2} Although NSSI is not currently recognized as a standalone psychiatric disorder, the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) Task Force and Work Groups have proposed six diagnostic criteria, highlighting its clinical relevance and the need for further investigation.³

Among adolescents, NSSI is commonly understood as a maladaptive strategy for coping with emotional distress. Repeated self-injury may be reinforced by the temporary relief it provides from negative emotions, particularly during periods of interpersonal or psychological conflict. However, when NSSI fails to provide sufficient relief, unresolved distress may accumulate and contribute to an increased risk of suicidal thoughts and behaviors.⁴

Research indicates that individuals with a history of NSSI are substantially more likely to continue engaging in self-injurious behaviors into adulthood (OR 5.95).⁵ Among adolescents, risk factors are multifaceted and include female gender (OR 2.89) and the presence of psychiatric disorders (OR 1.89). Furthermore, adverse childhood experiences—such as parental substance misuse, exposure to violence, sexual abuse, familial neglect, low socioeconomic status, peer suicide attempts, and a lack of religious or spiritual beliefs—further elevate the risk of engaging in NSSI (OR 2.49).⁶

Spirituality as a Protective Factor

Spirituality is commonly conceptualized as a fundamental dimension of human existence that encompasses the pursuit of meaning and purpose, influencing how individuals understand themselves, relate to others, and interpret their surrounding environment.^{7,8} Research has associated spirituality with a range of positive psychological outcomes, including greater self-regulation, more effective coping with loss and adversity, and enhanced overall well-being.⁷ These benefits may play an important role in reducing reliance on maladaptive coping behaviors, such as nonsuicidal self-injury (NSSI).

Growing evidence suggests that spirituality may serve as a protective factor against NSSI. Lower levels of spirituality have been linked to an increased vulnerability to various mental health problems, including post-traumatic stress disorder (PTSD), anxiety, depression, and self-injurious behavior.^{9,10,11,12} In contrast, higher levels of spirituality have been linked to lower depressive tendencies and greater resilience, particularly among adolescents with

a history of childhood trauma.¹³ These findings underscore the potential role of spirituality in promoting emotional regulation and resilience, which may help protect adolescents from engaging in NSSI.

Furthermore, spirituality-based interventions, such as mindfulness meditation and psycho-spiritual therapy, have been integrated into the management of personality disorders to enhance emotional regulation and promote a greater sense of psychological safety and self-awareness.¹⁴ By encouraging adaptive ways of coping with emotional distress, these interventions may help adolescents develop healthier strategies for managing difficult experiences, thereby decreasing the likelihood of engaging in NSSI. Collectively, these findings highlight the potential value of spirituality as a complementary component of mental health care, supporting the prevention of NSSI by enhancing emotional regulation and cultivating more effective coping mechanisms.

Emotional Regulation by the Prefrontal Cortex

Individuals who engage in NSSI frequently experience significant emotional distress and may use self-injurious behaviors as a maladaptive means of coping with overwhelming emotions. Therefore, identifying the underlying factors contributing to NSSI and providing appropriate interventions are essential for helping affected individuals develop healthier coping mechanisms and improve emotional regulation. Compared with individuals who do not engage in self-injury, those with NSSI tend to exhibit greater difficulties in regulating emotions, making them more susceptible to emotional distress.^{15,16}

A growing body of evidence suggests that emotional dysregulation in individuals with NSSI is closely linked to dysfunction in the prefrontal cortex (PFC), a region of the frontal lobe crucial for executive functioning, impulse control, and social cognition.^{17,18} The PFC serves as a central regulator of emotional responses by exerting cognitive control over emotions and impulsive behaviors, capacities that are often impaired among individuals with NSSI.^{19,20,21} Because the PFC continues to mature throughout adolescence, incomplete development of its neural circuits may contribute to heightened impulsivity and increase vulnerability to self-injurious behaviors. Furthermore, the PFC plays a key role in suppressing repetitive negative thinking, rumination, and excessive worry, all of which are commonly associated with emotional dysregulation and NSSI.^{22,23}

Previous studies have consistently linked PFC dysfunction to emotional dysregulation across various psychiatric conditions, including borderline personality disorder^{23,24,25}, anxiety disorders and major depressive disorder^{26,27,28,29,30,31}, post-traumatic stress disorder^{32,33,34}, and bipolar disorder.^{35,36,37} Reduced PFC activity has also been associated with elevated levels of aggression and impulsivity.^{38,39} In contrast, interventions that stimulate the PFC have demonstrated beneficial effects on emotional regulation and psychiatric symptoms by promoting both structural and functional neural changes. Among these interventions, spiritual practices such as meditation have been suggested to modulate PFC activity and enhance emotional regulation capacities.⁴⁰

The Role of Spirituality in Emotional Regulation and Prefrontal Cortex Function

Research suggests that spirituality can support emotional regulation by modulating prefrontal cortex (PFC) activity. Adolescents exposed to childhood adversity who demonstrate higher spirituality and resilience tend to report lower depressive symptoms.¹³ Longitudinal evidence also indicates a bidirectional link between spiritual struggles and engagement in non-suicidal self-injury (NSSI), implying that difficulties in spiritual beliefs may contribute to emotional distress and self-harming behaviors⁴¹.

The role of spirituality in personality disorder treatment has been explored as well. Psycho-spiritual interventions may enhance emotional stability in individuals with borderline personality disorder, particularly when integrated into Dialectical Behavior Therapy (DBT).¹⁴ Developing a connection with a transcendental entity may also foster a sense of security, potentially mitigating the emotional vulnerabilities seen in narcissistic personality disorder (NPD). Together, these findings highlight spirituality's protective role against NSSI by promoting emotional regulation.

Neuroimaging studies provide further support, showing that higher levels of spirituality are associated with increased cortical circuit activity and connectivity.^{42,43,44} Intensive spiritual practices, such as prayer and meditation, have been linked to heightened PFC activation, suggesting a neural basis for improved impulse control and emotional stability.^{45,46,47} Escalated PFC activity may play a role in inhibitory control over the thalamus and amygdala, reducing aggression and impulsivity, including self-injurious behaviors.⁴⁵ In addition, brain maturation in adolescence might shape

spirituality-related neural patterns supporting the role of spiritual engagement in the long-term development of emotional regulation.⁴⁸

DISCUSSION

The increasing prevalence of NSSI among adolescents represents a significant clinical concern because of its association with elevated mortality risk, enduring psychological consequences, and adverse social outcomes. NSSI is often linked to heightened psychological distress and difficulties in emotional regulation, which may contribute to the adoption of maladaptive coping strategies.^{49,50,51} Prior research has identified the association between low spirituality and PTSD, anxiety, depression, and particularly self-injurious behavior.^{9,10,11,12} In contrast, higher spirituality has been correlated with lower levels of depression and anxiety, which are significant risk factors for NSSI. Taken together, the available evidence suggests that higher levels of spirituality may be associated with a lower likelihood of NSSI, potentially through its relationship with better emotional regulation. However, the current evidence does not establish a causal relationship.

One possible explanation for the observed association between spirituality and lower NSSI is its potential link to neurobiological processes, particularly those involving the prefrontal cortex (PFC), which plays a key role in cognitive control, emotional regulation, and impulse inhibition. Given that the adolescent brain, particularly the PFC, continues to mature throughout this developmental period, engaging in spiritual practices may support the development of emotional maturity and

adaptive coping strategies.⁴⁸ Evidence suggests that engagement in spiritual practices such as prayer or meditation is associated with increased PFC activity, contributing to greater emotional stability and reduced impulsive tendencies.^{45,46,47} Perroud (2014) further proposed that enhanced PFC activation strengthens inhibitory control over the thalamus and amygdala, reducing emotional reactivity and aggressive behavior, both of which are commonly observed in adolescents with NSSI. Collectively, these findings suggest that spirituality may be associated with reduced aggression and impulsivity, which could contribute to a lower likelihood of NSSI. However, this proposed mechanism requires further empirical investigation.⁴⁵

The available evidence suggests that spirituality may be associated with lower levels of NSSI, indicating that consideration of patients' spiritual beliefs and practices may complement existing approaches to adolescent mental health care. Accordingly, a holistic, multi-dimensional approach that includes appropriate attention to spirituality may be considered as a complementary component of adolescent mental health care, alongside established psychiatric and psychological interventions. Nevertheless, further longitudinal studies and randomized controlled trials are needed to determine whether spirituality has a causal effect on reducing NSSI among adolescents.

CONCLUSION

In summary, existing evidence indicates that spirituality may be associated with better emotional regulation, resilience, and impulse

control, potentially through mechanisms involving prefrontal cortex (PFC) functioning. These findings indicate that spirituality may represent a valuable complementary consideration in adolescent mental health care and may have potential relevance for NSSI prevention and management. However, despite these promising insights, research in this area remains limited, with few studies directly examining the mechanisms by which spirituality influences self-injurious behaviors in adolescents. Future studies should focus on developing and rigorously evaluating culturally sensitive psychospiritual interventions, particularly through longitudinal and experimental designs, to clarify their effectiveness and the mechanisms underlying their association with NSSI.

REFERENCES

1. Klonsky ED. The functions of deliberate self-injury: a review of the evidence. *Clin Psychol Rev.* 2007;27(2):226–239. doi:10.1016/j.cpr.2006.08.002.
2. Nock MK. *Understanding nonsuicidal self-injury: Origins, assessment, and treatment.* Washington (DC): American Psychological Association; 2009.
3. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders: DSM-5-TR.* 5th ed. Washington (DC): American Psychiatric Association Publishing; 2022.
4. Xiao Q, Song X, Huang L, Hou D, Huang X. Global prevalence and characteristics of non-suicidal self-injury between 2010 and 2021 among a non-clinical sample of adolescents: A meta-analysis. *Front Psychiatry.* 2022;13:912441. doi:10.3389/fpsyt.2022.912441.
5. Fox KR, Franklin JC, Ribeiro JD, Kleiman EM, Bentley KH, Nock MK. Meta-analysis of risk factors for nonsuicidal self-injury. *Clin Psychol Rev.* 2015;42:156–167. doi:10.1016/j.cpr.2015.09.002.
6. Wang YJ, Li X, Chee HN, Xu DW, Hu SH, Yuan TF. Risk factors for non-suicidal self-injury (NSSI) in adolescent: A meta-analysis. *eClinicalMedicine.* 2022;46:101350. doi:10.1016/j.eclinm.2022.101350.
7. Soewadi. Dying in dignity. Presented at: Seminar Perhimpunan Dokter Spesialis Kedokteran Jiwa Indonesia Yogyakarta; 2022.
8. MacDonald DA. Theories of health and well-being germane to a positive psychology of religion and spirituality. In: Davis EB, Worthington EL, Schnitker SA, editors. *Handbook of positive psychology, religion, and spirituality.* Switzerland: Springer Nature; 2023. p. 69–82. doi:10.1007/978-3-031-10274-5.
9. Gibbel MR, Regueiro V, Pargament KI. A spiritually integrated intervention for spiritual struggles among adults with mental illness: Results of an initial evaluation. *Spiritual Clin Pract.* 2019;6(4):240–255. doi:10.1037/scp0000207.
10. Currier JM, Foster JD, Witvliet CVO, Abernethy AD, Luna LMR, Schnitker SA, VanHarn K, Carter J. Spiritual struggles and mental health outcomes in a spiritually integrated inpatient program. *J Affect*

- Disord.* 2019;249:127–135. doi:10.1016/j.jad.2019.02.012.
11. Whitaker RC, Wesley TD, Herman AN. The association of daily spiritual experiences with depression among Head Start staff. *Early Child Res Q.* 2021;56:65–77. doi:10.1016/j.ecresq.2021.03.001.
 12. Lucchetti G, Koenig HG, Lucchetti ALG. Spirituality, religiousness, and mental health: A review of the current scientific evidence. *World J Clin Cases.* 2021;9(26):7620–7631. doi:10.12998/wjcc.v9.i26.7620.
 13. Freeny J, Peskin M, Schick V, Cuccaro P, Addy R, Morgan R, Lopez KK, Baker KJ. Adverse childhood experiences, depression, resilience, & spirituality in African-American adolescents. *J Child Adolesc Trauma.* 2021;14:209–221. doi:10.1007/s40653-020-00335-9.
 14. Piedmont RL. Personality, spirituality, religiousness, and personality disorders: Predictive relations and treatment implications. In: Huguelet P, Koenig HG, editors. *Religion and spirituality in psychiatry.* Cambridge: Cambridge University Press; 2014. p. 173–189.
 15. Zetterqvist M. The DSM-5 diagnosis of nonsuicidal self-injury disorder: A review of the empirical literature. *Child Adolesc Psychiatry Ment Health.* 2015;9:31. doi:10.1186/s13034-015-0062-7.
 16. Wolff JC, Thompson E, Thomas SA, Nesi J, Bettis AH, Ransford B, et al. Emotion dysregulation and non-suicidal self-injury: A systematic review and meta-analysis. *Eur Psychiatry.* 2019;59:25–36. doi:10.1016/j.eurpsy.2019.03.004.
 17. Shafie M, Shahmohamadi E, Cattarinussi G, Moghaddam HS, Akhondzadeh S, Sambataro F, Moltrasio C, Delvecchio G. Resting-state functional magnetic resonance imaging alterations in borderline personality disorder: A systematic review. *J Affect Disord.* 2023;341:335–345. doi:10.1016/j.jad.2023.09.001.
 18. Melchitzky DS, Lewis DA. Functional neuroanatomy. In: Bolan R, Verduin ML, editors. *Kaplan & Sadock's comprehensive textbook of psychiatry.* 11th ed. Philadelphia: Lippincott Williams & Wilkins; 2024. p. 184–285.
 19. Arnone D, Wise T, Walker C, Cowen PJ, Howes O, Selvaraj S. The effects of serotonin modulation on medial prefrontal connectivity strength and stability: A pharmacological fMRI study with citalopram. *Prog Neuropsychopharmacol Biol Psychiatry.* 2018;84:152–159. doi:10.1016/j.pnpbp.2018.01.021.
 20. Baeken C, Wu G, Rogiers R, Remue J, Lemmens G, De Raedt R. Cognitive behavioral based group psychotherapy focusing on repetitive negative thinking: Decreased uncontrollability of rumination is related to brain perfusion increases in the left dorsolateral prefrontal cortex. *J Psychiatr Res.* 2021;136:281–287. doi:10.1016/j.jpsychires.2021.02.011.
 21. Zhu W, Chen X, Wu J, Li Z, Im H, Chen S, Deng K, Zhang B, Wei C, Feng J, Zhang M, Yang S, Wang H, Wang Q. Neuroanatomical and functional substrates of the hypomanic personality trait and its prediction on aggression. *Int J*

- Clin Health Psychol.* 2023;23:100397. doi:10.1016/j.jchp.2023.100397.
22. Zetsche U, Bürkner PC, Schulze L. Shedding light on the association between repetitive negative thinking and deficits in cognitive control – A meta-analysis. *Clin Psychol Rev.* 2018;63:56–65. doi:10.1016/j.cpr.2018.06.001.
 23. Sicorello M, Schmahl C. Emotion dysregulation in borderline personality disorder: A fronto–limbic imbalance? *Curr Opin Psychol.* 2021;37:114–120. doi:10.1016/j.copsyc.2020.12.002.
 24. Soloff PH, White R, Omari A, Ramaseshan K, Diwadkar VA. Affective context interferes with brain responses during cognitive processing in BPD: fMRI evidence. *Psychiatry Res Neuroimaging.* 2015;233:23–35. doi:10.1016/j.psychres.2015.04.006.
 25. Shafie M, Shahmohamadi E, Cattarinussi G, Moghaddam HS, Akhondzadeh S, Sambataro F, Moltrasio C, Delvecchio G. Resting-state functional magnetic resonance imaging alterations in borderline personality disorder: A systematic review. *J Affect Disord.* 2023;341:335–345. doi:10.1016/j.jad.2023.09.001.
 26. Liu X, Brown BK, Zhang R, Zhang J, Becker B. Distinct neurostructural signatures of anxiety-, fear-related and depressive disorders: A comparative voxel-based meta-analysis. *Transl Psychiatry.* 2022;12:405. doi:10.1038/s41398-022-02157-9.
 27. Xu X, Xin F, Liu C, Chen Y, Yao S, Zhou X, Zhou F, Huang Y, Dai J, Wang J, Zou Z, Kendrick KM, Zhou B, Becker B. Disorder- and cognitive demand-specific neurofunctional alterations during social emotional working memory in generalized anxiety disorder and major depressive disorder. *J Affect Disord.* 2022;308:98–105. doi:10.1016/j.jad.2022.04.023.
 28. Chen Y, Liu C, Xin F, Zou H, Huang Y, Wang J, Dai J, Zou Z, Ferraro S, Kendrick KM, Zhou B, Xu X, Becker B. Opposing and emotion-specific associations between frontal activation with depression and anxiety symptoms during facial emotion processing in generalized anxiety and depression. *Prog Neuropsychopharmacol Biol Psychiatry.* 2023;123:110716. doi:10.1016/j.pnpbp.2023.110716.
 29. Wang HY, You HL, Song CS, Zhou L, Wang SY, Li XL, Liang ZH, Zhang BW. Shared and distinct prefrontal cortex alterations of implicit emotion regulation in depression and anxiety: An fNIRS investigation. *J Affect Disord.* 2024;354:126–135. doi:10.1016/j.jad.2024.03.032.
 30. Wu H, Lu B, Zhang Y, Li T. Differences in prefrontal cortex activation in Chinese college students with different severities of depressive symptoms: A large sample of functional near-infrared spectroscopy (fNIRS) findings. *J Affect Disord.* 2024;350:521–530. doi:10.1016/j.jad.2024.01.044.
 31. Cichocki AC, Zinbarg RE, Craske MG, Chat IKY, Young KS, Bookheimer SY, Nusslock R. Transdiagnostic symptom of depression and anxiety associated with reduced gray matter volume in prefrontal

- cortex. *Psychiatry Res Neuroimaging*. 2024;339:111791.
doi:10.1016/j.psychresns.2024.111791.
32. Joshi SS, Duval ER, Sheynin J, King AP, Phan KL, Martis B, Porter KE, Liberzon I, Rauch SAM. Neural correlates of emotional reactivity and regulation associated with treatment response in a randomized clinical trial for PTSD. *Psychiatry Res Neuroimaging*. 2020;299:111062.
doi:10.1016/j.psychresns.2020.111062.
33. Balters S, Schlichting MR, Foland-Ross L, Brigadoi S, Miller JG, Kochenderfer MJ, et al. Towards assessing subcortical "deep brain" biomarkers of PTSD with functional near-infrared spectroscopy. *Cereb Cortex*. 2023;33(7):3969–3984.
doi:10.1093/cercor/bhac320
34. Popescu M, Popescu E, DeGraba TJ, Hughes JD. Altered long-range functional connectivity in PTSD: Role of cortical activity amplitude infrasonic oscillations. *Clin Neurophysiol*. 2024;163:22–36.
doi:10.1016/j.clinph.2024.03.036.
35. Favre P, Polosan M, Pichat C, Bougerol T, Baciuc M. Cerebral correlates of abnormal emotion conflict processing in euthymic bipolar patients: A functional MRI study. *PLoS One*. 2015;10(8):e0134961.
doi:10.1371/journal.pone.0134961.
36. Syan SK, Smith M, Frey BN, Remtulla R, Kapczynski F, Hall GBC, Minuzzi L. Resting-state functional connectivity in individuals with bipolar disorder during clinical remission: A systematic review. *J Psychiatry Neurosci*. 2018;43(5):298–316.
doi:10.1503/jpn.170175.
37. Kjaerstad HL, Damgaard V, Knudsen GM, Vinberg M, Kessing LV, Macoveanu J, Miskowiak KW. Neural underpinnings of emotion regulation subgroups in remitted patients with recently diagnosed bipolar disorder. *Eur Neuropsychopharmacol*. 2022;60:7–18.
doi:10.1016/j.euroneuro.2022.04.010.
38. Bertsch K, Florange J, Herpertz SC. Understanding brain mechanisms of reactive aggression. *Curr Psychiatry Rep*. 2020;22:81. doi:10.1007/s11920-020-01208-6.
39. Richard Y, Tazi N, Frydecka D, Hamid MS, Moustafa AA. A systematic review of neural, cognitive, and clinical studies of anger and aggression. *Curr Psychol*. 2023;42:17174–17186.
doi:10.1007/s12144-022-03143-6.
40. Barnby JM, Bailey NW, Chambers R, Fitzgerald PB. How similar are the changes in neural activity resulting from mindfulness practice in contrast to spiritual practice? *Conscious Cogn*. 2015;36:219–232.
doi:10.1016/j.concog.2015.07.002.
41. Good M, Hamza C, Willoughby T. A longitudinal investigation of the relation between nonsuicidal self-injury and spirituality/religiosity. *Psychiatry Res*. 2017;250:106–112.
doi:10.1016/j.psychres.2017.01.062.
42. Svob C, Wang Z, Weissman MM, Wickramaratne P. Religious and spiritual importance moderate relation between default mode network connectivity and familial risk for depression. *Neurosci Lett*.

- 2016;634:94–97.
doi:10.1016/j.neulet.2016.10.009.
43. Rim JI, Ojeda JC, Svob C, Kayser J, Drews E, Kim Y, Tenke CE, Skipper J, Weissman MM. Current understanding of religion, spirituality, and their neurobiological correlates. *Harv Rev Psychiatry*. 2019;27(5):303–316.
 44. Panier LYX, Bruder GE, Svob C, Wickramaratne P, Gameroff MJ, Weissman MM, Tenke CE, Kayser J. Predicting depression symptoms in families at risk for depression: Interrelations of posterior EEG alpha and religion/spirituality. *J Affect Disord*. 2020;274:969–976.
doi:10.1016/j.jad.2020.05.084.
 45. Perroud N. Religion/spirituality and neuropsychiatry. In: Huguelet P, Koenig HG, editors. *Religion and spirituality in psychiatry*. Cambridge: Cambridge University Press; 2014. p. 48–64.
 46. Mahdinejad J, Azemati H, Sadegi A, Matracchi P. Investigating the effect of age and gender of users on improving spirituality by using EEG. *Cogn Neurodyn*. 2021;15:637–647.
doi:10.1007/s11571-020-09654-x.
 47. Kapoor S. Psychiatry dan spirituality. In: Bolan R, Verduin ML, editors. *Kaplan & Sadock's comprehensive textbook of psychiatry*. 11th ed. Philadelphia: Lippincott Williams & Wilkins; 2024. p. 8653–8709.
 48. Riveros R, Immordino-Yang MH. Toward a neuropsychology of spiritual development in adolescence. *Adolesc Res Rev*. 2021;6:323–332. doi:10.1007/s40894-021-00158-1.
 49. Cook CC, White NH. Resilience and the role of spirituality. In: Bhugra D, Bhui K, Yeung S, Wong S, Gilman SE, editors. *Oxford textbook of public mental health*. Oxford: Oxford University Press; 2018. p. 513–520.
doi:10.1093/med/9780198792994.003.0054.
 50. Schwalm FD, Zandavalli RB, Filho ED, Lucchetti G. Is there an association between spirituality/religiosity and resilience: A systematic review and meta-analysis of observational studies. *J Health Psychol*. 2021;27(5):1218–1232.
doi:10.1177/1359105320984537.
 51. Kerkez M, Sanli ME. Mediating role of spirituality in the relationship of anxiety, stress and depression with resilience in individuals exposed to earthquakes in Türkiye. *Int J Disaster Risk Reduct*. 2024;104:104347.
doi:10.1016/j.ijdrr.2024.104347.