Letter to Editor

Interpreting Neurocognitive Signals in Child Sexual Abuse Perpetrators: The Strengths and Limitations of a Multi-Modal Approach

Dear Editor

The research by Daneshvari and others[1] represents an ambitious and important endeavor to explore the neurocognitive and emotional profiles of child sexual abuse (CSA) perpetrators within an Iranian context. The study employed a multi-modal approach, utilizing self-report measures, cognitive tasks, and physiological assessments, such as functional near-infrared spectroscopy (fNIRS) and polygraphy. The attempts to identify objective biological and cognitive correlates of such behavior are of significant scientific interest, particularly at the intersection of brain function and deviant behavior. However, the study's methodology, interpretation of findings, and the inherent complexities of this research area warrant careful consideration and raise several points for discussion.

The authors report several key findings. First, the experimental group (EG) of CSA perpetrators demonstrated a greater tendency toward homosexuality (in terms of past, present, and ideal orientation) than the control group (CG). Second, using the mini-mental state examination (MMSE), cognitive distortions were found to be more common in the EG. Third, a history of being sexually abused between the ages of 12 and 16 was significantly associated with perpetrating CSA. Fourth, during the Stroop task, CSA perpetrators exhibited poorer cognitive performance, particularly in reaction time and the number of unanswered questions, in the condition without distracting images. They also displayed different patterns of hemodynamic changes in the frontal poles (Fp1 and Fp2), as measured by fNIRS. Specifically, the fNIRS data suggested reduced activity/blood supply in the Fp1 region of the EG during the cognitive task. Finally, polygraph data indicated less emotional control—reflected in higher skin conductance and heart rate—in the EG when viewing images of children.

The attempt to integrate subjective reports, cognitive performance, and physiological measures is a commendable strength, as it aims for a more holistic understanding. The use of fNIRS, a portable neuroimaging technique, is particularly innovative in this challenging research population.[2] Furthermore, the finding that a history of abuse was linked to perpetration aligned with existing literature on the cycle of abuse, a crucial point for preventative strategies.[3, 4]

However, several methodological and interpretative aspects warrant critical reflection. First, the sample sizes were very small (n=12 for EG, n=13 for CG), which severely limited statistical power and the generalizability of the findings. With such small groups, significant P values must be interpreted with extreme caution, as they might be susceptible to type I errors or reflect large but unstable effect sizes.

The interpretation of the fNIRS data[2] also requires a more nuanced discussion. The authors linked changes in oxyhemoglobin (HbO) and deoxyhemoglobin (HbR) directly to "blood supply and activity" and then to "cognitive control" or the "mitigation of disturbing stimuli". While fNIRS measures hemodynamic responses correlated with neural activity, the precise cognitive processes reflected by changes in Fp1/Fp2 regions during a Stroop task, particularly with emotionally charged distractor images, are highly complex. Attributing decreased HbO/HbR in Fp1 in the EG solely to "weaker performance" or "decrease in activity" was an oversimplification, especially without more detailed source localization or correlation with specific cognitive sub-processes (e.g., inhibition, emotional interference). The frontal pole is involved in a myriad of higher-order functions; the observed changes could reflect altered emotional processing, attentional bias, or the use of different cognitive strategies rather than a simple decrease in "cognitive efficiency".[5]

Furthermore, the use of the MMSE to assess "cognitive distortion" is highly unusual. The MMSE is a general cognitive screening tool designed primarily for dementia; it is not a validated instrument

for measuring offense-supportive cognitive distortions. While the authors might be referring to overall cognitive impairment, the term “cognitive distortion” in this context typically implies specific maladaptive thought patterns, which are more appropriately assessed with specialized questionnaires (such as the Bumby Molest Scale, which was also used in the study, though its correlation with MMSE was not detailed).

Regarding the polygraph findings, the observation of greater physiological arousal in the EG when viewing images of children was consistent with theories of deviant arousal.[6] However, it is critical to note that the polygraph measures physiological arousal—not “emotional control” or the veracity of statements.[7] Its application in forensic settings remains highly debated due to its susceptibility to countermeasures and the non-specificity of physiological signals it captures.[7] Therefore, interpreting polygraph data as a direct measure of emotional control is problematic.

Finally, the broad conclusion that CSA perpetrators “seem to have a poorer neurocognitive function” requires qualification. While the Stroop task data indicate performance differences in a specific cognitive domain, a more comprehensive neuropsychological battery assessing various domains supporting such a general conclusion would require a more comprehensive neuropsychological battery assessing various domains, executive functions, attention, memory, and processing speed.

Future research in this critical area, while ethically and logistically challenging, would benefit from several key improvements: larger, well-matched sample sizes; comprehensive, standardized neuropsychological testing; more sophisticated neuroimaging paradigms with careful task design to isolate specific cognitive and emotional processes; and longitudinal studies to understand developmental trajectories. The integration of genetic, neurodevelopmental, and detailed psychosocial histories would be invaluable.

In conclusion, Daneshvari and colleagues[1] conducted a commendable pilot study in a complex and sensitive research domain. Their pilot study offered preliminary, hypothesis-generating insights into potential neurocognitive and emotional differences in CSA perpetrators. However, the discussed methodological limitations, particularly the small sample size and the broad interpretation of some measures, necessitate that these findings be viewed as exploratory. They underscored the immense challenge and the critical need for continued, rigorous, and ethically sound multidisciplinary research to understand and ultimately prevent child sexual abuse.

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Declaration of AI

The authors declare that no AI tools were used in the preparation of this manuscript.

Conflict of Interest: None declared.

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References

1 Daneshvari M, Nami M, Ashrafi A, Najibi SH, Zahedian Nasb R, Moghimi Sarani E. Neurocognitive Insights into Child Sexual Abuse Perpetrators: Understanding Cognitive and Emotional Profiles: A Case-Control Study. Iran J Med Sci. 2025;50:304-15. doi: 10.30476/ijms.2024.103138.3633. PubMed PMID: 40433183; PubMed Central PMCID: PMCPMC12104540.
2 Doherty EJ, Spencer CA, Burnison J, Ceko M, Chin J, Eloy L, et al. Interdisciplinary views of fNIRS: Current advancements, equity challenges, and an agenda for future needs of a diverse fNIRS research community. Front Integr Neurosci. 2023;17:1059679. doi: 10.3389/fnint.2023.1059679. PubMed PMID: 36922983; PubMed Central PMCID: PMCPMC10010439.
3 Palini A. Stopping the Cycle of Abuse before It Starts: An Evaluation of Virginia's Domestic Violence Primary Prevention Model in Schools. Rich Pub Int L Rev. 2023;27:169.
4 Langevin R, Marshall C, Kingsland E. Intergenerational Cycles of Maltreatment: A Scoping Review of Psychosocial Risk and Protective Factors. Trauma Violence Abuse. 2021;22:672-88. doi: 10.1177/1524838019870917. PubMed PMID: 31455161.
5 Skau S, Jonsdottir IH, Sjors Dahlman A, Johansson B, Kuhn HG. Exhaustion disorder and altered brain activity in frontal cortex detected with fNIRS. Stress. 2021;24:64-75. doi: 10.1080/10253890.2020.1777972. PubMed PMID: 32510268.
6 Quayle E. Online sexual deviance and pedophilia. In: Craig LA, editors. Sexual Deviance: Understanding and Managing Deviant Sexual Interests and Paraphilic Disorders. New York: Wiley Online Library; 2021. p. 222-37. doi: 10.1002/9781119771401.ch14.
7 Iacono WG. Psychology and the lie detector industry: A fifty-year perspective. Biol Psychol. 2024;190:108808. doi: 10.1016/j.biopsycho.2024.108808. PubMed PMID: 38718884.

The Authors' Reply

Dear Editor

We sincerely appreciate the thoughtful and constructive feedback provided by the correspondent regarding our recent publication.[1] We welcome this opportunity to address the points raised concerning the study's strengths and limitations and to clarify our methodological and interpretive decisions.

Sample Size and Exploratory Nature

We fully acknowledge the constraints imposed by our small sample size (n=12 for the experimental group, n=13 for controls), which were necessitated by the profound challenges of accessing this sensitive population and the strict ethical considerations within the correctional and forensic context in Iran. As correctly noted by the correspondent, our study was exploratory and intended to be hypothesis-generating rather than definitive. Nevertheless, we believed the statistically significant and theoretically consistent patterns that emerged, which aligned with the existing literature on child sexual abuse (CSA) perpetration and neurocognitive functioning, could be valuable for guiding future research.

Use and Interpretation of fNIRS

We agree that interpreting functional near-infrared spectroscopy (fNIRS) data, particularly in relation to cognitive control and hemodynamic changes in the frontal poles (Fp1, Fp2), requires caution. While we described the reduced oxyhemoglobin (HbO) responses in Fp1 as suggestive of diminished prefrontal engagement during the Stroop task, we acknowledged that this interpretation might oversimplify the complex interplay of cognitive, emotional, and attentional processes involved. Our terminology was intended to reflect a functional interpretation consistent with the established literature on prefrontal hypoactivation in populations with impaired executive function.[2] We concur that future studies employing advanced source localization techniques (e.g., high-density fNIRS arrays or fMRI) alongside task designs that isolate specific cognitive subcomponents (e.g., inhibition, attentional shifting, emotional interference) are essential to enhance the specificity and precision of these findings.

MMSE and Cognitive Distortion

We thank the correspondent for their clarification regarding the mini-mental state examination (MMSE). We would like to clarify that in our study, the MMSE was used solely to screen for general cognitive impairments that could confound task performance; it was not intended to measure "cognitive distortion" in the clinical-criminological sense. Cognitive distortions specific to sexual offending were assessed exclusively using the Bumby molest scale. We acknowledge that the wording in our manuscript could have been clearer on this point and would ensure precise delineation of these constructs in future publications.

Polygraph Interpretation

We concur with the correspondent's observation that polygraphy measures general autonomic arousal and should not be equated with the specific construct of "emotional control". Our interpretation of elevated skin conductance and heart rate in the experimental group was grounded in their established correlation with heightened psychophysiological reactivity in the literature.[3] However, we wish to emphasize that these measures are not diagnostic and are not directly indicative of truthfulness or a specific emotional state. The polygraph data were included to contribute to a multi-modal psychophysiological profile and should be interpreted with a clear understanding of their non-specificity and susceptibility to individual variability.

Homosexuality and CSA

The observed differences in reported same-sex attraction between groups were presented as descriptive findings, with no intent to pathologize any sexual orientation. We wish to state unequivocally that sexual orientation, including homosexuality, is not a causal risk factor for CSA perpetration. As discussed in the article, this finding requires careful contextual interpretation, particularly considering potential reporting biases within a conservative sociocultural environment. No deterministic claims

were intended or implied. Future studies should employ more nuanced and validated tools to better distinguish between sexual orientation and paraphilic interests.

Cycle of Abuse and Historical Abuse

We agree with the correspondent that our finding of a higher prevalence of childhood sexual abuse among perpetrators aligned with the established literature on intergenerational trauma. However, we wish to emphasize that this association is a complex probabilistic risk factor. It is neither deterministic nor universally predictive of future offending. A deeper understanding of this pathway will require future research that includes more nuanced psychosocial and developmental variables in its analysis.

Conclusion and Future Directions

We value the correspondent's call for more comprehensive neuropsychological batteries, longitudinal designs, and multidimensional frameworks. Such approaches are indeed critical for elucidating the complex developmental, neurobiological, and psychosocial mechanisms underlying CSA perpetration. Our study represented an initial step toward integrating behavioral and neurophysiological data in a population that is often understudied due to significant ethical and logistical challenges.

In closing, we thank the correspondent for their insightful critique, which enriched the scientific discourse on this complex and urgent health issue. This constructive exchange underscored our shared commitment to advancing methodological rigor, ethical responsibility, and the translational impact of forensic neurocognitive research.

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References

1 Daneshvari M, Nami M, Ashrafi A, Najibi SH, Zahedian Nasb R, Moghimi Sarani E. Neurocognitive Insights into Child Sexual Abuse Perpetrators: Understanding Cognitive and Emotional Profiles: A Case-Control Study. Iran J Med Sci. 2025;50:304-15. doi: 10.30476/ijms.2024.103138.3633. PubMed PMID: 40433183; PubMed Central PMCID: PMCPMC12104540.

2 Doherty EJ, Spencer CA, Burnison J, Ceko M, Chin J, Eloy L, et al. Interdisciplinary views of fNIRS: Current advancements, equity challenges, and an agenda for future needs of a diverse fNIRS research community. Front Integr Neurosci. 2023;17:1059679. doi: 10.3389/fnint.2023.1059679. PubMed PMID: 36922983; PubMed Central PMCID: PMCPMC10010439.

3 Prochazkova E, Sjak-Shie E, Behrens F, Lindh D, Kret ME. Physiological synchrony is associated with attraction in a blind date setting. Nat Hum Behav. 2022;6:269-78. doi: 10.1038/s41562-021-01197-3. PubMed PMID: 34725513.