

Explainable LightGBM Analysis of Adolescent Family Adjustment Based on Parenting Style, Family Communication, Emotional Security, and Self-Esteem


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1. Round 1

1.1. Reviewer 1

Reviewer:

In the Introduction, the paragraph beginning with “*Adolescence represents a critical developmental period characterized by substantial biological, cognitive, emotional, and social transformations*” provides a broad developmental overview; however, it lacks a more explicit conceptualization of family adjustment. The authors should incorporate a dedicated theoretical discussion defining family adjustment, distinguishing it from related constructs such as family functioning, cohesion, adaptability, and family resilience, and explaining why family adjustment was selected as the focal outcome variable.

The description of the Family Adjustment Scale in the Measures section is insufficiently detailed. The statement “*The scale consists of multiple items rated on a Likert-type response format*” should be expanded to include the exact number of items, response categories, score ranges, subscales (if applicable), and psychometric indices obtained in the current sample, including Cronbach’s alpha or McDonald’s omega.

Similarly, the paragraph beginning with “*Parenting style was measured using the Parenting Styles and Dimensions Questionnaire (PSDQ)*” should provide more precise methodological information. The authors should indicate whether the short or full version of the PSDQ was used, report reliability coefficients for each parenting dimension in the present sample, and clarify how parenting scores were aggregated for inclusion in the machine learning model.

The Data Analysis section indicates that *“Missing values representing less than 5% of the total data were imputed using median replacement methods.”* The authors should justify this decision and compare it with more robust imputation strategies such as multiple imputation or k-nearest-neighbor imputation. Median replacement may attenuate variability and potentially affect predictive performance.

Response: Revised and uploaded the manuscript.

1.2. Reviewer 2

Reviewer:

The paragraph stating *“Family systems theory suggests that family functioning emerges from complex interactions among parental behaviors, communication processes, emotional relationships, and individual psychological characteristics”* would benefit from a stronger theoretical framework. The authors should explicitly identify which version of family systems theory guides the study and explain how the selected predictors operationalize specific systemic processes within the theoretical model.

In the section discussing parenting style, the sentence *“Classic parenting models distinguish among authoritative, authoritarian, permissive, and neglectful styles”* introduces four parenting styles; however, only authoritative parenting appears in the predictive analyses and SHAP results. The authors should explain whether authoritarian and permissive parenting dimensions were excluded from the final model, removed during feature selection, or simply found to have negligible importance, and present corresponding results to avoid selective reporting.

The paragraph beginning with *“In addition to parenting style, family communication represents another critical dimension of healthy family functioning”* provides a literature-based rationale but does not address potential conceptual overlap between family communication and family adjustment. Since both constructs may share similar domains, the authors should discuss discriminant validity and demonstrate empirically that the predictive relationship is not inflated due to measurement redundancy.

The section introducing emotional security includes the statement *“Emotional security is fostered through consistent caregiving, supportive family interactions, and predictable relational environments.”* While theoretically sound, the manuscript should provide a more detailed justification for selecting emotional security over closely related constructs such as attachment security, family cohesion, or emotional climate. A discussion of construct distinctiveness would strengthen the conceptual foundation of the study.

The paragraph beginning with *“Although previous studies have examined parenting style, family communication, emotional security, and self-esteem independently”* identifies a research gap; however, the authors should elaborate more clearly on the specific limitations of previous statistical approaches. It would be valuable to explain why machine learning is expected to outperform conventional regression analyses in this context and whether nonlinear effects or higher-order interactions are theoretically anticipated.

In the Study Design and Participants section, the sentence *“The study was conducted in Colombia during the 2025–2026 academic year and focused on adolescents enrolled in public and private secondary schools across major urban regions”* lacks sufficient detail regarding geographic coverage. The authors should report the number of schools included, the sampling fractions within each city, response rates, and whether clustering effects associated with schools were considered during analysis.

The paragraph describing participant selection states that *“A total of 1,248 adolescents participated in the study.”* The manuscript would be strengthened by reporting a priori sample size estimation or power analysis. Given the use of machine learning methods, justification of sample adequacy relative to model complexity is essential for evaluating the reliability of predictive performance.

Response: Revised and uploaded the manuscript.

2. Revised

Editor's decision after revisions: Accepted.

Editor in Chief's decision: Accepted.