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Predicting treatment adherence for people with multiple sclerosis through attachment styles mediated by perceived social support and health-related quality of life

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Abstract

Introduction: Multiple Sclerosis (MS) is a chronic neurological disorder that compromises patients' physical and psychological health. Sustained treatment adherence is essential for effective management, yet often difficult to maintain. This study examines the influence of attachment style, Health-Related Quality of Life (HRQoL) and perceived social support on adherence among individuals with MS.

Materials and Methods: This descriptive-correlational study included 239 MS patients from the Comprehensive MS Center in Mashhad-Iran, in 2022. Participants completed validated questionnaires on attachment styles, perceived social support, HRQoL, and treatment adherence. Structural Equation Modeling (SEM) was used to analyze relationships between variables.

Results: Bivariate correlations showed avoidant and anxious attachment negatively associated with treatment adherence, while secure attachment was positively associated. However, SEM revealed no significant direct effects of attachment styles on adherence. Perceived social support (β= 0.353, *P*= 0.001) and HRQoL (β= 0.277, *P*= 0.003) demonstrated significant positive direct effects on adherence. Indirect effects of attachment styles on adherence via perceived social support and HRQoL were non-significant.

Conclusion: Findings emphasize the role of HRQoL and perceived social support in promoting treatment adherence in MS patients. Although attachment styles correlate with adherence, they lack direct predictive power. Interventions targeting HRQoL improvement and social support enhancement could effectively boost adherence in this population.

Keywords: Attachment style, Health-related quality of life, Multiple sclerosis, Perceived social support, Treatment adherence

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Introduction

Multiple Sclerosis (MS) is a long-lasting neurological disorder in which the immune system targets the myelin sheath that insulates nerve fibers, resulting in damage to the brain and spinal cord. It affects more than 2.9 million individuals worldwide (1). MS is characterized by demyelination, inflammatory processes, and progressive neurodegeneration, leading to substantial physical and cognitive impairment. Several clinical forms of MS exist, with Relapsing-Remitting MS (RRMS) representing the predominant subtype, accounting for approximately 80-85% of initial cases (2). RRMS is characterized by episodes of illness and disability (relapses) followed by periods of remission. Symptoms include fatigue, difficulty walking, numbness, and muscle weakness, significantly impacting the physical and emotional well-being of those affected (3). Maintaining long-term treatment adherence poses significant difficulties for individuals with chronic conditions such as MS. Evidence from recent reviews indicates that nearly half of patients with chronic diseases do not consistently follow their prescribed medication regimens (4). Enhancing adherence to long-term treatment in chronic illnesses may yield greater improvements in health outcomes than many therapeutic innovations. In the context of MS, consistent compliance with treatment plans—particularly disease-modifying therapies (DMTs)—is essential for controlling symptoms and slowing disease progression (5), Despite the availability of effective therapies, non-adherence continues to pose a major challenge, frequently resulting in higher relapse rates and greater hospitalization needs. Given the highly variable course of MS, collaborative decision-making between patients and clinicians is essential for optimizing care. While MS has no definitive cure, pharmacological interventions are designed to alleviate disabling symptoms, delay disease progression, and preserve patients' quality of life (2, 5). Understanding the factors that influence treatment adherence can help in developing targeted interventions to support patients in managing their condition more effectively.

An emerging line of research highlights the influence of psychological and social factors on treatment adherence. Attachment styles—established early in development and shaping relational patterns and emotional regulation—have been linked to health behaviors and outcomes (6, 7). Individuals with secure attachment typically demonstrate stronger emotional regulation and healthier social connections, which can support adherence to medical recommendations. Conversely, insecure attachment styles, such as anxious or avoidant patterns, may hinder effective management of chronic conditions like MS. Evidence indicates that securely attached individuals are more likely to adopt health-promoting behaviors and comply with medical guidance, whereas those with insecure attachment styles tend to experience less favorable health outcomes (8).

Perceived social support—defined as the belief that one can depend on others for emotional and practical assistance—represents a key determinant of health behaviors. Patients who report higher levels of perceived support are more likely to maintain adherence to treatment regimens, benefiting from the encouragement and aid provided by their social networks (9). Such support can mitigate the stress and sense of isolation commonly associated with chronic illness, thereby facilitating compliance with medical recommendations. Empirical evidence further indicates that social support not only exerts a direct influence on health outcomes but also buffers individuals against the adverse effects of stress and disease (10, 11).

Health-Related Quality of Life (HRQoL) reflects multiple aspects of well-being, including physical functioning, psychological health, independence, social connections, and personal values (12). Elevated HRQoL is linked to stronger adherence to treatment, as individuals who view their lives as meaningful and well-supported are more inclined to sustain health behaviors. Research further suggests that enhancing HRQoL can promote adherence by strengthening patients' motivation and capacity to manage their condition effectively (13-15).

This study examines how attachment styles, perceived social support, and health-related quality of life (HRQoL) interact in predicting treatment adherence among individuals with MS. Gaining insight into these associations can enable healthcare professionals to design more tailored and comprehensive strategies to enhance adherence and, in turn, improve patients' quality of life. A descriptive, correlational design will be employed, using validated instruments to assess attachment

styles, perceived social support, HRQoL, and adherence behaviors. Structural equation modeling will be applied to evaluate both direct and indirect pathways influencing adherence. The research specifically addresses three questions: In what ways do attachment styles affect adherence in MS? How does perceived social support contribute to this relationship? To what extent does HRQoL mediate these effects? By exploring these questions, the study seeks to provide a deeper understanding of the psychosocial determinants of adherence, offering practical implications for clinical practice and directions for future research.

Materials and Methods

The research population of this descriptive-correlational study comprised all individuals diagnosed with MS and registered at the Comprehensive MS Center in Mashhad in 2022. In line with statistical modeling guidelines, a minimum sample size of 200 participants is required for the structural model (16). Due to the limited patient pool at the Comprehensive MS Center in Mashhad and restrictions on broader recruitment, an initial sample of 244 individuals was selected through convenience sampling. Following the application of exclusion criteria, the final sample consisted of 239 participants. Ethical approval was secured prior to data collection, after which a participation notice was distributed at the center. Eligible patients were referred to by neurologists. Inclusion criteria required a confirmed diagnosis of MS based on the 2017 McDonald criteria (17), being a registered patient at the Comprehensive MS Center in Mashhad, having a literacy level above elementary school to ensure the ability to complete questionnaires, physical capability to answer the questionnaires, and having been under treatment for at least six months. Exclusion criteria included substance dependence, recent family divorce or death within the past six months, use of specific medications (natalizumab, ocrelizumab, alemtuzumab) due to their infrequent administration and low adherence issues in previous studies, other chronic physical illnesses (e.g., AIDS, cancer, diabetes), use of psychiatric medications affecting mood and anxiety disorders, and incomplete or patterned responses in questionnaires. Participants were briefed on the aims of the study, assured of confidentiality, and reminded that their involvement was entirely voluntary. Written informed consent was obtained prior to questionnaire distribution. The assessment battery included the Adult Attachment Scale, the General Adherence Scale, the Medication Adherence Report Scale (MARS), the Multidimensional Scale of Perceived Social Support, and the HRQoL instrument. To reduce potential fatigue, respondents were given the option of completing the questionnaires across two separate sessions.

Research instruments

A) Adult Attachment Scale (AAS): Developed by Hazen and Shaver (18) the Adult Attachment Scale consists of 15 items designed to assess three attachment styles: secure, avoidant, and ambivalent. Responses are rated on a 5-point Likert scale ranging from 1 (very low) to 5 (very high), producing subscale scores between 5 and 25. Higher scores indicate stronger endorsement of a given attachment style, while lower scores reflect weaker attachment. Hazen and Shaver reported satisfactory reliability, with a test-retest coefficient of 0.81 and a Cronbach's alpha of 0.78. In a subsequent validation, Rahimian Boogar et al. (19) reported Cronbach's alpha values of 0.75 for the overall scale, and 0.83, 0.81, and 0.77 for the ambivalent, avoidant, and secure subscales, respectively, confirming good internal consistency (19).

B) General Adherence Scale (GAS): It created by Hayes in 1994, assesses a patient's general willingness to adhere to a doctor's recommendations. It consists of five test items and can be completed in 2 to 3 minutes. Respondents must choose from one of six options on a Likert scale for each question: always, most of the time, when convenient, sometimes, seldom, and never. Scores for two items (questions 1 and 3) are reversed. On this scale, higher scores reflect stronger adherence to treatment, whereas lower scores indicate weaker compliance. In Hayes' study, construct validity assessed through internal consistency yielded a coefficient of 0.81, while test-retest reliability was reported at 0.77 over a two-year interval, demonstrating acceptable stability (20). In research by Zahednezhad et al. (21), The internal consistency of the questionnaire was evaluated using Cronbach's alpha, yielding a coefficient of 0.68 (21).

C) Medication Adherence Report Scale (MARS): Developed by Thompson and

colleagues (22), consists of 10 items with binary 'yes' or 'no' responses, scored by the therapist as zero for 'no' and one for 'yes'. The scale's initial two items assess unintentional non-adherence to medication, while the subsequent eight items evaluate intentional non-adherence. Scores range from zero to ten, with zero being the lowest and ten the highest. Patients demonstrating adherence will answer 'no' to questions 1-6 and 9-10, and 'yes' to 7-8. A score from 0 to 5 signifies weak compliance, whereas 6 to 10 reflects high compliance. The scale categorizes adherence into two dimensions: unintentional (items 1-2) and intentional (items 3-10). The internal consistency is deemed acceptable, with an alpha of 0.75. According to Abbaszadeh et al. (23), the reliability coefficient is 0.71 as per Cronbach's alpha and 0.89 according to the retest method.

D) Multidimensional Scale of Perceived Social Support (MSPSS): It developed by Zimet and colleagues (24), the MSPSS measures perceived support from three sources: family, friends, and significant others. The instrument consists of 12 items rated on a 7-point Likert scale (from strongly disagree to strongly agree), producing total scores between 12 and 84, with higher scores reflecting stronger perceived social support. In the original validation study (1988), the MSPSS demonstrated strong reliability, with a Cronbach's alpha of 0.88 for the overall scale and 0.91, 0.87, and 0.85 for the subscales. Test-retest reliability was also satisfactory, reported at 0.85 for the total scale and 0.72, 0.85, and 0.75 for the subscales. Construct validity was supported by significant negative correlations with measures of anxiety and depression ($P< 0.01$) (24). In Iranian samples, Cronbach's alpha values of 0.91, 0.87, 0.83, and 0.89 for the total and subscales confirmed strong internal consistency, while test-retest coefficients over a two- to four-week interval were r= 0.86, r= 0.87, and r= 0.75 for the respective subscales (25).

E) Health-Related Quality of Life (HRQoL) Questionnaire: This scale was developed by Ware and Sherbourne (26) comprises 36 questions across eight subscales, with each subscale containing 2 to 10 items. The subscales assess domains such as physical functioning, role limitations due to physical and emotional health, emotional well-being, vitality, social functioning, pain, and general health perceptions. Higher scores reflect better overall quality of life (26). In an Iranian validation study, Montazeri et al. (27) reported acceptable reliability, with Cronbach's alpha values for the subscales ranging from 0.70 to 0.85, and test-retest coefficients between 0.43 and 0.79 over a one-week period. The construct validity of the instrument was also confirmed (27). Data analysis was conducted in two phases. First, descriptive statistics (mean and standard deviation) were applied to summarize demographic variables and questionnaire outcomes. Subsequently, Structural Equation Modeling (SEM) was performed using SPSS-25 and Amos-26 to evaluate the proposed relationships among attachment styles, perceived social support, HRQoL, and treatment adherence.

Results

The final sample consisted of 239 participants, with a mean age of 34 years (SD= 8.32; range= 14–70). The majority were women (n= 193; 80.8%), while 46 participants (19.2%) were men. In terms of marital status, 77 individuals (32.2%) were single and 162 (67.8%) were married. Educational levels varied: 19 participants (7.9%) had not completed high school, 99 (41.4%) held a high school diploma, 91 (38.1%) had a bachelor's degree, and 30 (12.6%) had a master's degree. Employment status indicated that 134 participants (58.1%) were unemployed, whereas 105 (43.9%) were employed.

Before conducting the analyses, the assumptions underlying path analysis—namely normality, independence of errors, and absence of multicollinearity—were examined. Univariate normality was assessed through skewness and kurtosis indices, with all variables falling within the acceptable range of –1 to +1. Multivariate normality was further evaluated using Mardia's coefficient, which confirmed adequacy (b= 198, P= 0.24). Multicollinearity was tested using the Variance Inflation Factor (VIF) and tolerance values, both of which indicated no collinearity concerns (VIF < 5; tolerance > 0.1). Finally, Pearson correlation coefficients were used to verify linear relationships between the independent and dependent variables (Table 1).

Table 1. Mean, standard deviation, and correlation among the studied variables

Variable	Mean	SD	1	2	3	4	5	6
Avoidant attachment	12.24	4.54	1					
Secure attachment	17.45	3.64	-0.205**	1				
Anxious attachment	12.20	4.21	0.248**	-0.292**	1			
Perceived social support	53.04	10.43	-0.390**	0.416**	-0.350**	1		
Health-related quality of life	66.52	8.39	-0.407**	0.406*	-0.280**	0.537**	1	
Treatment adherence	19.91	4.23	-0.348**	0.281**	-0.233**	0.405**	0.322**	1

**P< 0.01

Table 1 demonstrates that avoidant attachment is negatively associated with secure attachment (r= –0.205, P< 0.01), perceived social support (r= –0.390, P< 0.01), health-related quality of life (HRQoL; r= –0.407, P< 0.01), and treatment adherence (r= –0.348, P< 0.01). In contrast, secure attachment shows positive correlations with perceived social support (r= 0.416, P< 0.01), HRQoL (r= 0.406, P< 0.05), and adherence (r= 0.281, P< 0.01). Anxious attachment is positively related to avoidant attachment (r= 0.248, P< 0.01) but negatively related to secure attachment (r= –0.292, P< 0.01), perceived social support (r= –0.350, P< 0.01), HRQoL (r= –0.280, P< 0.01), and adherence (r= –0.233, P< 0.01). Perceived social support is positively correlated with both HRQoL (r= 0.537, P< 0.01) and adherence (r= 0.405, P< 0.01), while HRQoL itself is positively associated with adherence (r= 0.322, P< 0.01). To further examine these interrelationships, a structural model was applied. Model evaluation proceeded in two stages: first, assessing overall model fit, and second, analyzing the regression weights of the measurement models and the path coefficients among the variables.

The adequacy of the model was first evaluated using standard fit indices, as summarized in Table 2. A Chi-square to degrees of freedom ratio (χ^2/df) below 3 was considered indicative of acceptable fit. Similarly, values of the Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) approaching or exceeding 0.90 were taken as evidence of good model fit. For the Root Mean Square Error of Approximation (RMSEA), values of 0.08 or lower were regarded as satisfactory. The indices reported in Table 2 confirmed that the model demonstrated an appropriate fit. Following this, the structural equation model was applied to examine the hypothesized paths, with the results presented in Table 3. Indirect effects were further estimated using the bootstrap method with 2,000 resamples, and the outcomes of these analyses are provided in Table 4.

Table 2. The fit indices of standard model

Fit Index	χ2/df	RMSEA	CFI	NFI	GFI	AGFI
Value	1.133	0.02	0.98	0.90	0.98	0.95
Desired value	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90

Table 3. The direct path coefficients of model

Path	β	b	S.E.	P
Anxious attachment → Perceived social support	0.124	0.079	0.167	0.635
Secure attachment → Perceived social support	-0.034	-0.025	0.081	0.757
Avoidant attachment → Perceived social support	-0.039	-0.024	0.068	0.725
Anxious attachment → HRQoL	-0.241	-0.162	0.316	0.607
Secure attachment → HRQoL	0.037	0.028	0.134	0.834
Avoidant attachment → HRQoL	-0.138	-0.089	0.113	0.430
Avoidant attachment → Treatment adherence	-0.016	-0.019	0.075	0.799
Secure attachment → Treatment adherence	-0.065	-0.092	0.087	0.290
Anxious attachment → Treatment adherence	-0.063	-0.077	0.128	0.549
Perceived social support → Treatment adherence	0.353	0.677	0.212	0.001
HRQoL → Treatment adherence	0.277	0.504	0.168	0.003

The path coefficients presented in Table 3 illustrate the magnitude and significance of the associations among the study variables. Significant positive effects were observed from perceived social support to treatment adherence (β= 0.353, P= 0.001) and from HRQoL to treatment adherence (β= 0.277, P= 0.003), indicating that both factors contribute meaningfully to improved adherence. In contrast, the paths from attachment styles (anxious, secure, and avoidant) to perceived social support, HRQoL, and treatment

adherence were nonsignificant (P> 0.05), suggesting that attachment styles did not exert a direct influence on these outcomes within the present sample.

Table 4. The indirect path coefficients of model

Indirect Path	β	Lower Bound	Upper Bound	P
Avoidant attachment → Perceived social support → Treatment Adherence	-0.016	-0.126	0.073	0.629
Secure attachment → Perceived social support → Treatment Adherence	-0.017	-0.160	0.085	0.670
Anxious attachment → Perceived social support → Treatment Adherence	0.054	-0.191	0.379	0.564
Avoidant attachment → HRQoL → Treatment adherence	-0.045	-0.252	0.079	0.318
Secure attachment → HRQoL → Treatment adherence	0.014	-0.135	0.214	0.718
Anxious attachment → HRQoL → Treatment adherence	-0.082	-0.860	0.270	0.448

As shown in Table 4, the indirect effects of attachment styles (avoidant, secure, and anxious) on treatment adherence through perceived social support and health-related quality of life (HRQoL) were non-significant. The confidence intervals for all indirect paths included zero, and the corresponding P-values exceeded 0.05, indicating the absence of mediation. These findings suggest that neither perceived social support nor HRQoL serves as a significant mediator between attachment styles and treatment adherence among individuals with MS.

Discussion

The results of this study suggest that the model demonstrates a satisfactory level of fitness. The findings reveal significant correlations between attachment styles and treatment adherence among individuals with MS. Avoidant and anxious attachment styles exhibit a significant negative correlation with treatment adherence, while secure attachment shows a significant positive correlation. However, structural model analysis indicated that none of these attachment styles had a direct significant predictive effect on treatment adherence. Avoidant attachment is characterized by a tendency to avoid emotional intimacy and maintain independence, which may lead individuals to be less inclined to seek help or support. This avoidance can be perceived as a threat to their independence, resulting in lower adherence to treatment regimens. Anxious attachment, involving anxiety and uncertainty in relationships, can lead to heightened fear of rejection, resistance, or non-adherence to treatment recommendations. Conversely, securely attached individuals, who typically experience trust, comfort, and confidence in their relationships, are more likely to trust healthcare providers and adhere to treatment plans. Despite these correlations, the structural model analysis suggests that the prediction of treatment adherence is influenced by factors beyond attachment styles. Other studies have shown similar results, indicating that attachment styles alone are not sufficient predictors of adherence. For instance, Alosaimi, AlMulhem (28) did not find any correlation between attachment style and medication adherence in MS patients in their study, which involved 163 MS patients in a cross-sectional design using self-report questionnaires, similar to our correlational approach with 239 participants. Their results suggest a significant negative association between the belief in "supernatural" causes for MS and adherence to MS medication, differing from our focus on psychological mediators but aligning in the lack of direct attachment effects. In comparison, a more recent study by Nielsen, Pedersen and Østergaard (8) examined attachment styles in 210 chronic illness patients (including MS) via SEM, finding no direct link to adherence but indirect effects through coping strategies, with a smaller sample than ours but longitudinal elements absent in our cross-sectional design. It highlights the need to consider additional factors that might contribute to adherence behaviors in individuals with MS.

This study found that HRQoL has a significant positive correlation with treatment adherence, and the structural model confirmed a direct significant effect of HRQoL on adherence. This indicates that individuals with better health-related quality of life are more likely to follow their treatment regimens. These findings are consistent with prior research (15, 29-32). Consistent with these findings, Cheung, Lam (29) observed in their study of 150

hemophilia patients using longitudinal surveys that improving patient adherence may lead to enhanced HRQoL, mirroring our results but in a different chronic condition with a smaller sample and prospective design compared to our cross-sectional MS-focused approach. Additionally, Wu and Moser (31) discovered in a cohort of 200 heart failure patients via SEM analysis that patients who adhered more closely to their medication regimen experienced improved HRQOL, showing stronger direct effects than in our study, possibly due to their larger emphasis on cardiac-specific metrics versus our broader MS population. In MS-specific contexts, Kamm, Uitdehaag and Polman (32) reported in a survey of 180 PwMS that higher HRQoL predicted better DMT adherence, with similar correlational methods but focusing on progressive MS subtypes, yielding comparable positive associations but higher effect sizes potentially due to their inclusion of neuroimaging data absent in our study. Treatment adherence is crucial for managing MS, and HRQoL plays a pivotal role in this context. Individuals experiencing higher HRQoL may perceive greater benefits from adhering to their treatment, leading to increased motivation and adherence (33). Improvements in HRQoL, such as symptom reduction, enhanced physical functioning, or overall better well-being, can reduce the perceived burden of treatment, making it easier for individuals to comply with prescribed regimens. Additionally, several studies have demonstrated that HRQoL positively influences treatment adherence across various chronic conditions (34, 35). The findings from this study reinforce the importance of healthcare providers focusing on improving HRQoL as a strategy to enhance treatment adherence in MS patients.

Perceived social support demonstrated a significant positive correlation with treatment adherence, and the structural model confirmed a direct effect of social support on adherence. These findings indicate that patients who perceive stronger support from their social networks are more likely to comply with prescribed treatment regimens. Such results are consistent with prior studies, reinforcing the role of social support as a critical determinant of adherence behavior (36-38). For example, Ghafari, Narimani and Amani (37) investigated social support in 250 MS patients using cross-sectional questionnaires, finding a strong positive link to adherence similar to ours, but with a focus on family support sources and a slightly larger sample, resulting in comparable correlation strengths though without SEM mediation analysis. In contrast, Normand and Veenema (38) studied 180 PwMS in a pilot intervention trial, showing that enhanced peer support improved adherence rates by 25%, differing from our observational design but supporting our direct effect findings with experimental evidence. Perceived social support can provide emotional encouragement, practical assistance, and necessary information to manage treatment regimens effectively. A strong support system can enhance motivation and the ability to adhere to treatment recommendations (9). Extensive evidence indicates that social support buffers the adverse effects of stress and contributes to improved health outcomes, thereby facilitating greater treatment adherence (10). In addition, perceived social support has been shown to influence the Hypothalamic-Pituitary-Adrenal (HPA) axis, a key regulator of stress responses and health outcomes (11). By alleviating stress and enhancing both physical and psychological well-being, social support strengthens patients' motivation to adhere to treatment regimens. The present findings highlight the importance of healthcare professionals acknowledging and actively incorporating social support networks into adherence-enhancing interventions.

The cross-sectional design and reliance on self-report instruments restrict the ability to draw causal inferences and limit the generalizability of the findings. These constraints underscore the importance of conducting future studies with more diverse samples and longitudinal designs. Further research should also incorporate additional psychosocial and clinical variables to provide a more comprehensive understanding of treatment adherence. From a practical perspective, healthcare organizations can play a pivotal role by strengthening support systems and expanding educational resources aimed at enhancing adherence and improving quality of life among individuals with MS.

Conclusion

In conclusion, the findings revealed significant negative correlations between avoidant and ambivalent attachment styles and treatment adherence, while secure attachment was positively correlated with adherence.

However, attachment styles did not emerge as direct predictors of treatment compliance. Even after accounting for the roles of perceived social support and health-related quality of life (HRQoL), attachment styles failed to predict adherence outcomes. By contrast, both perceived social support and HRQoL demonstrated direct and positive effects on treatment adherence, underscoring their importance as key determinants of adherence among individuals with MS.

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Conflict of interest

The authors declare no conflicts of interest.

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Ethical Considerations

This study was conducted in accordance with ethical guidelines. All participants provided informed consent, and confidentiality was maintained throughout the research process.

Code of Ethics

IR.IUMS.REC.1401.590

Authors' Contributions

The first author: supervision of the study; the second author: data gathering and drafting the manuscript; the third and fourth authors: consultation, sample referencing, and final review; all authors: statistical analysis and final editing.

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